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About the Journal

CIET, NCERT has been a premier institution for development and dissemination of resources and techniques related to Educational Technology (ET) for better understanding of teaching-learning at school level. With renewed thrust on educational technology using digital platforms, the need for a quality journal on educational technology in India is felt more than ever. Keeping this in regard, Indian Journal of Educational Technology will be a medium for scholarly presentation and exchange of information between researchers, professionals and practitioners of technology related fields of education. The journal aims at covering disciplinary areas of educational technology (ET) for school education and teacher education. The specific objectives of this journal are: i) to provide an open access journal for sharing updated and peer reviewed research on Educational Technology for easy access and ii) to promote research on the integration of technology in school and teacher education, promote innovative practice, and inform policy debates on educational technology. This bi-annual open access online peer reviewed journal will be a platform for exchange of ideas and would also become a basis for further innovation in ET in school and teachers' education.

Notes to Contributors

Indian Journal of Educational Technology is a UGC listed (UGC CARE list, Group-1) peer reviewed bi-annual journal especially designed for scholarly discourse of use of various forms of technology in education. Some of the themes encompassed under its broad purview are: Education Technology (ET), Information and Communication Technology (ICT) in education, Distance education and technology, Technological integration into pedagogy and content, Open Educational Repositories (OER) and FOSS, Innovation in educational system, Computer-based learning, Audio-video and multimedia in education and issues thereof, Technology cognition and curriculum, Impact of technology in education, Nature of technology and learning, Mobile learning, Learning through social media, Technology assisted evaluation systems, Technology support for differently abled population, Flipped classroom, Virtual and Augmented Reality, Artificial Intelligence, robotics and education, Impact of technology on learning, Social media and children, Economics of technology and its impact on education system, Educational planning administration and technology and Online courses for school education and teacher education. We look forward to your contributions in the coming issues. Your feedback and suggestions are also welcome on the following address:

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“असतोमा सद्गमय। तमसोमा ज्योतिर् गमया। मृत्योर्मामृतं गमय॥”

(From ignorance, lead me to truth; From darkness, lead me to light; From death, lead me to immortality)

... Vhridaaranayak Upanishad

March 9, 2024, was a watershed moment in the history of school education in the country. Shri Dharmendra Pradhan, the Hon’ble Minister of Education, Government of India, launched 200 PM eVidya DTH TV channels for the country’s children. These channels broadcast video content based on textbooks or related materials from the foundational stage to the secondary level in children’s own languages. PM eVidya initiative was first announced by the Hon’ble Finance Minister, Government of India, on 17th May 2020 as part of Atma Nirbhar Bharat Abhiyaan (ANBA) or Self-Reliant India Movement announced by the Hon’ble Prime Minister on 12th May 2020 during the COVID pandemic times with an aim to impart education by using technology to minimise learning losses. Initially, as part of this initiative, 12 PM eVidya DTH TV Channels for school education were launched with one DTH TV channel earmarked for one class, under what was termed as one class, one channel. The 12 PM eVidya DTH TV channels for school education were carved out of 34 SWAYAM PRABHA DTH TV channels launched in 2016 by the Department of Higher Education, Ministry of Education, Government of India. The primary objective of PM eVidya DTH TV Channels for school education is to ensure easy access to education using television as a medium, which is an affordable and sustainable medium even in the remotest parts of the country. In a way it helps to bridge the digital divide. Later, the 12 PM eVidya DTH TV Channels were expanded to 200 DTH TV Channels in the Union Budget announcement of 2022-23 with a specific aim to enable all the states to provide supplementary education in various Indian languages and as per the State’s own curriculum.

The government of India has allocated these channels to States / Union Territories (UTs) / Autonomous Bodies (ABs) and others. Out of 200, 5 DTH TV channels have been allocated to each State (except Manipur, which has been allocated 10 DTH TV channels); 1 each to UT except Jammu & Kashmir and Ladakh, which have been allotted 5 channels each; 1 each to autonomous bodies under Department of School Education and Literacy (DoSE&L), Ministry of Education (MoE), Government of India (GoI) (viz., KVS, NVS and CBSE – 1 each; while NIOS has been allocated 4, NCERT 14 and Ministry of Skill Development and Entrepreneurship (MoSDE), Government of India 6. At present, out of 200 channels, a total of 184 channels among 28 States, 7 UTs and 6 ABs have been allotted. NCERT, under the aegis of DoSE&L, MoE, GoI has been designated as the national nodal agency for 200 PM eVidya DTH TV Channels. For technical facility and effective coordination, Bhaskaracharya National Institute for Space Applications and Geo-informatics (BISAG-N), Gandhinagar under the aegis of the Ministry of Electronics and Information Technology (MeitY), Government of India is acting as national technical coordinator for transmission and telecast of the channels, which in turn has entered into an understanding with Doordarshan (DD) for co-branding these channels as DD-eVidya channels. 200 PM eVidya DTH TV Channels are Free-to-Air (FTA) / Direct-To-Home (DTH) and can be accessed in every household using DD Free Dish. The programs shared by States / UTs / ABs for telecast on the respective channels cover 28 languages, including Indian Sign

Languages (ISL). The PM eVidya initiative also has a dedicated feedback mechanism to support the learners. This feedback mechanism currently includes an Interactive Voice Response System (IVRS) and class-wise-channel-wise email IDs for receiving queries and providing support to the learners.

Television transmission technology, the way it receives signals from a remote location, has undergone sea changes. In the 1930s and 40s, when TV was just invented, it used mechanical systems to scan images and transmit them. Later, when electronics came into being, the electronic analogue transmission was introduced. It improved TV viewing experiences. Colour TV made TV viewing more pleasant as transmission shifted from black and white to colour. The use of satellites to transmit TV signals over long distances has made broadcasting to a wider audience possible. In the 1980s and 90s, with the introduction of cable television, each household could receive more channels with better reception compared to over-the-air broadcasts. The shift from analogue to digital transmission, offering better picture and sound quality and more efficient use of bandwidth, has revolutionised TV viewing and has resulted in a significant increase in the number of viewers watching TV worldwide.

According to various reports, such as those from the International Telecommunication Union (ITU) and media research firms like Nielsen, global TV viewership has evolved significantly with the advent of new technologies. As of recent reports, approximately 4.1 billion people worldwide watch television regularly, including traditional broadcast TV and newer digital and streaming services. In India, as per the Broadcast Audience Research Council (BARC), India, there are around 197 million television households in India. India has one of the largest TV viewership bases globally, with about 835 million viewers. According to the Census 2011, Delhi had the highest percentage of households having television ownership (88 %), while Tamil Nadu stood second overall (and first among States) with 87 % of households having TV ownership. Bihar had the lowest percentage of households having TV ownership (14.5 %), while Dadra, Nagar and Haveli, with 47 % of households having TV ownership, had the lowest percentage among the Union Territories. The national percentage stood at 47.2 %. According to broadcast India's TV Universe Estimates by BARC, this figure stood at 66 per cent in 2018.

There is an increasing recognition that educational broadcasting, under optimal conditions, can reach dispersed geographical areas and large populations, thereby bringing high-quality teaching to underserved areas. However, the crucial step lies in identifying and implementing these ideal conditions effectively. (Television in Education by Padmaja Shaw, published online 20 May 2016 pages- 198-204 (https://doi.org/10.1080/01296612.2008.11726884). According to Bradford L. Yates (published on 1 February 2004, DOI: 10.3138/SIM.4.1.003, corpus ID: 144308392), media literacy helps students develop critical thinking skills to analyze and evaluate media messages, promoting a deeper understanding of information and fostering informed decision-making, besides helping students with the necessary skills to navigate the digital world effectively, including understanding digital citizenship, online safety, and media production. During COVID lockdowns, when schools were closed down for a long time, and learning shifted online, using television for education emerged as a significant alternative to digital ways of reaching out to students. This alternative emerged swiftly because SWAYAM PRABHA was already in place. Moreover, technology evolves along and after the socioeconomic conditions of society. If there is diversity in the learners' base, then the technology to reach out to them should also be diverse, and this was the primary driver for the launch of the PM eVidya initiative. The various stakeholders of this initiative should make these channels the second-best learning centres after the school classrooms.

In this issue of the journal, over 20 manuscripts have been accepted for publication across various categories that cover the educational technology related themes such as use of multimedia & eContent in social science studies, open schooling, universal design of learning (UDL), application of artificial intelligence (AI) in education, teacher education & ICT integration, mental health & tele-counselling, ICT & sustainable development, etc.

(ABHAY KUMAR)
Editor

Research Article

Attitude of College Teachers towards Virtual Classroom during COVID-19 Pandemic

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Abstract

Due to technological advancement important changes have been seen in the field of teaching and learning process. It is one of the tools that have emerged from information and communication technology, and during this pandemic, many schools, colleges and universities have been included in the teaching-learning process. In this paper, an attempt has been made to study the attitude of college teachers towards virtual classrooms during the COVID-19 pandemic. A self-constructed scale was administered to 206 college teachers via online mode. Item-wise analysis showed variations in attitudes towards virtual classrooms during the COVID-19 pandemic. However, both genders showed average attitudes, but in certain items, both genders showed highly positive attitudes towards virtual classrooms during the COVID-19 pandemic. The results also revealed that the teachers from different streams like sciences, social science, arts and commerce have not shown any significant differences in attitude towards virtual classrooms during the COVID-19 pandemic. The research outcomes can be used as input for framing virtual classroom learning platforms in an educational setting through teachers.

Keywords: Attitude; College Teachers; Virtual Classroom; COVID-19 Pandemic

Introduction

Today, the world is facing a pandemic as the Coronavirus (Jamrozik et al., 2020) is sweeping around the globe, and its effect is going on. The pandemic has led to many deaths; lakhs of people have been quarantined and has led to a serious situation of thinking towards a global health emergency. The COVID-19 pandemic has led to a total lockdown world over and India is no exception. During the lockdown, the education sector was impacted heavily and educational institutions had to move from the offline mode of teaching and learning to online mode.

Learning was rebooted during the Covid-19 pandemic. This Covid-19 was an ideal time to accept technological introduction and its latest offerings to make education delivery to students more efficient and make it more productive through online learning. The shutdown of educational institutions has led to many apprehensions among the students and teaching fraternity (Gupta & Goplani, 2020).

However, the teaching fraternity has been adapting innovative methods to interact with the students with a focus on the curriculum. Online learning also comes as an interesting and interactive additional resource as compared to the normal classroom. Undoubtedly, the spread of COVID-19 created huge challenges for the world’s educational systems.

All the educational institutions cancelled their classwork, examinations and other allied activities and it led to many negative impacts. During the COVID-19 pandemic educational institutions switched to a virtual mode of teaching, the body language and facial expressions are under restrictions as it is difficult to use these tools through online mode. However, the pandemic came with its own disadvantages and switching from traditional to modern methods of teaching and learning was not a simple task. Therefore, in virtual teaching, the teachers used different social networking and educational applications/platforms, like, zoom, Google Meet, Facebook, YouTube, Skype, etc., to restore their classwork and save the precious time of students. India was no exception to the global trend where every student is not well equipped with high-speed internet and digital gadgets. Numerous advanced educational institutions in India are also not equipped with digital facilities right now to cope with sudden changes from the educational setup to the virtual education system (Jena, 2020). Due to this sudden transition from physical classes to virtual classes, many teachers and students faced difficulties in order to operate the platform as they were not ready for this sudden transition. The problem was compounded in areas that already were underdeveloped like J&K, where accessibility of modern gadgets was a herculean task for students from low-income backgrounds.

Since the mode of teaching and learning during the pandemic changed, teachers had to adopt modern ways which were dominated by information and communication tools. This is a new area for both students and teachers, and assessments will probably have greater measurement errors than the normal teaching-learning process (Upoalkpajor & Upoalkpajor, 2020).

In this context, the present work tries to analyse the attitude of teachers in higher education, particularly college teachers towards, adapting to modern methods of ICT and virtual classrooms by using the questionnaire method distributed among 206 College teachers.

Relevant Prior Research

A number of studies have been conducted on the attitude of teachers towards E-Learning, learning through technologies, computers, the Internet, online learning, etc. For instance, a study was conducted by Panda & Mishra, (2007) in which they came to the conclusion that frequent usage of computers and email is strongly correlated with favourable attitudes towards e-learning. Similarly, Mahdizadeh et al. (2008) found that teachers' attitudes towards online learning may be affected by their perceptions of web-based activities, computer-assisted learning, and the additional value of online learning settings. However, Kutluca (2010) found in his study a significant difference in the scores of attitudes towards computers based on factors like experience using a computer, degree of computer use, taking computer classes, owning a computer, frequency of use, and class of the scores.

Bakr (2011), did a study on Egyptian public schools and found that teachers generally have a favourable attitude towards technology. In terms of gender and teaching experience, no significant differences were seen. Similarly, Suri & Sharma (2017) indicated that no significant effect of gender or faculty on teacher attitudes toward computers and e-learning whereas a significant effect of age was seen on teacher's attitudes towards computers &

e-learning. Nachimuthu (2020) found that normal classroom practice does not affect the attitude of students towards online learning and there is no significant difference between the male and female attitude scores of students and teachers toward online learning practice in Covid-19. Besides, Alhumaid et al. (2020) stated that there is a positive relationship between technology acceptance and e-learning during Covid-19.

To sum up, a number of studies have been conducted on the attitude of teachers, towards information and communication technology, computers, learning through technology, e-learning, computer competency, technology acceptance, etc., but none of the studies has been conducted on the attitude of teachers towards virtual classroom during COVID-19 pandemic. Therefore, the present work will be an addition to the already established knowledge of E-Learning by filling the suitable gap of attitudinal variations among the teaching community of colleges towards virtual classrooms. The present study holds much significance as it is done in such a study area where levels of development are very low and adaptation of modern methods of teaching and learning is very slow.

Objectives of the Study:

1. To study the attitude of male and female college teachers towards virtual classrooms during the Video-19 pandemic.
2. To find out whether a significant difference exists between the attitude of college teachers in different streams towards virtual classrooms during the COVID-19 pandemic.

Methodology

Descriptive survey research was used in the present study. The process of description as employed in this research study goes beyond mere gathering and tabulation of data. It involves an element of population/sampling procedure, tools for collecting the data, and interpretation of the meaning or significance of what is described.

Population of the Study

The population of the study consists of all the Assistant Professors of colleges of UT of Jammu and Kashmir.

Sample of the Study

In the present study, 206 College Assistant Professors currently posted in different Colleges of UT of Jammu and Kashmir filled out the questionnaire and were selected through simple random sampling. Out of the total 109 were male and 97 were female respondents. The researchers did not visit colleges personally due to the COVID-19 restrictions; the data was collected through the Google platform as the scale was distributed via mail and WhatsApp groups.

Tool Used

To know the attitude of college teachers towards virtual classrooms during the COVID-19 pandemic, a self-constructed scale was devised by the investigators to collect the information. The five-point scale consisting of 20 statements was developed to check the attitude of college teachers towards virtual classrooms. The response alternatives for each item were (1) Strongly disagree, (2) Disagree, (3) Neither Agree nor Disagree, (4) Agree and (5) Strongly agree.

Validity

To ensure the validity of the scale the researchers used two methods, face validity and construct validity. The face validity was evaluated by experts from the concerned field. Furthermore, to evaluate the construct validity of the scale, the researchers used the correlation method i.e., to correlate the score of each item & total score of the scale. The results are shown in table 1.

Table-1: Correlation between each item and total score

Items	'r' values	Sig.	Items	'r' values	Sig
1.	.720**	.000	11.	.709**	.000
2.	.710**	.000	12.	.491**	.000
3.	.448*	.045	13.	.399**	.000
4.	.289**	.000	14.	.245**	.000
5.	.725**	.000	15.	.419**	.000
6.	.689**	.000	16.	.529**	.000
7.	.265**	.000	17.	.401**	.000
8.	.389**	.000	18.	.397**	.000
9.	.165**	.043	19.	.345**	.000
10.	.307*	.032	20.	499**	.000

**Significant at 0.05 level

The values found to be are .720, .710, .448, .289, .725, .689, .265, .389, .165, .307, .709, .491, .399, .245, .419, .529, .401, 397, .345, .499 which are significant at 0.05 level.

Reliability

The reliability of the scale was calculated through Cronbach alpha and was found 0.72. The scores of the scale are categorized into three categories i.e., low attitude (below 50), average attitude (50-75), and high attitude (above 76).

Statistical Techniques Used

To analyse the data the researcher used Percentages, Descriptive statistics and One-way-ANOVA. The tabulation and analysis of data was done by using SPSS software version 20.

Analysis and Discussion of Data:

Objective 1: To study the attitude of male and female college teachers towards virtual classrooms during the Covid-19 pandemic.

To analyse the attitude of male and female college teachers towards virtual classroom, all the items in the scale were analysed by using percentage. The description of each item with respect to male and female is shown in Table-2.

Table-2: Item-wise Analysis of the attitude of male and female college teachers towards Virtual Classrooms during the COVID-19 pandemic

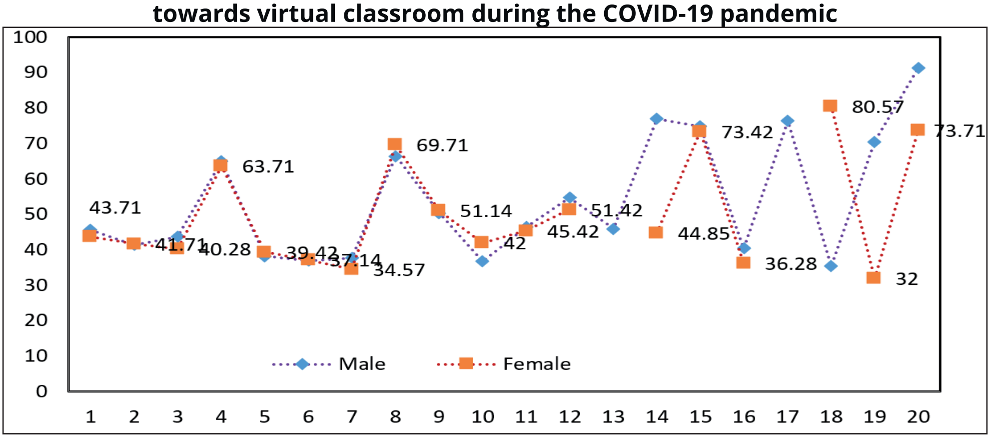
S.No.	Items	Percentage%	
		Male	Female
1.	All goals of teaching are fulfilled through virtual classrooms.	45.73	43.71
2.	Quality of teaching is much better through virtual classrooms than actual ones.	41.47	41.71
3.	Interaction between the students and teachers is not good in virtual classrooms.	43.82	40.28
4.	Virtual classrooms are more inexpensive in terms of cost and time than the actual classrooms.	65.00	63.71
5.	Virtual classrooms are effective for all the types of students.	38.23	39.42
6.	All students remain motivated throughout the session during online teaching.	37.05	37.14
7.	Individual attention is not paid to every student while teaching online.	37.79	34.57
8.	Virtual classrooms should be made as a part of curriculum.	66.47	69.71
9.	All teachers do not have competency to teach virtually.	50.44	51.14
10.	Online teaching should replace actual classroom teaching.	36.76	42.00
11.	Effective learning takes place through virtual classrooms.	46.47	45.42
12.	Teaching online is much easier than teaching in actual classrooms.	54.85	51.42
13.	Problems of students are not addressed through virtual teaching.	46.02	44.85
14.	Online teaching and learning help students to become aware about online learning strategies.	77.05	78.57
15	Virtual teaching help all the teachers to know the new ways of teaching.	74.85	73.42
16.	Performance of students are not assessed fairly in virtual classrooms.	40.44	36.28
17.	There is a lack of coordination between students and teachers in virtual classrooms.	76.47	80.57
18.	All the students do not attend the online classes.	35.44	32.00

S.No.	Items	Percentage%	
		Male	Female
19.	Online teaching has the advantage to attend the class again for those who miss it.	70.58	73.71
20.	Network issues on the part of teachers and students is big hurdle in Virtual teaching and learning.	91.32	97.14
	Total	53.81	53.84

The perusal of table-2 shows the attitude of both male and female teachers towards virtual classrooms against each item. Most of the teachers showed an average attitude towards all the questions which were asked to them using Questionnaire. Less than 50% of participants showed positive responses when asked about whether the overall goals of teaching were fully met using online education and tools. When asked about the quality of teaching, more than 50% replied negatively which indicated a decrease in the quality of education. Similarly, around 91% of males and 97% of females replied positively when they were asked about the issues, they faced on the part of internet connectivity for both teachers as well as students end. The overall attitude of male teachers is 53.81% and 53.84% of female teachers towards virtual classrooms during the COVID-19 pandemic. The overall attitude indicates that both male and female teachers have average attitudes towards virtual classrooms during the COVID-19 pandemic. The item-wise analysis also shows that in items 14, 17 and 20 both male and female teachers showed highly positive attitudes towards the virtual classroom and in items 4, 8, 9, 12, 15 and 19 both the male and female teachers showed average attitudes towards virtual classroom and in the rest of items 1, 2, 3, 5, 6, 7, 10, 11, 13, 16 and 18 both male and female teachers showed low attitude towards the virtual classroom.

Online learning is not a substitute for classroom teachers; the low attitude of teachers towards virtual classrooms may relate to the fact that teachers and students have no eye contact and sometimes students join for the sake of attendance. The graphical representation of each item with respect to male and female is shown in Figure-1

Figure-1: Item-wise graphical representation of male and female college teachers towards virtual classroom during the COVID-19 pandemic



Objective 2: To find out whether a significant difference exists between the attitude of college teachers K in different streams towards virtual classrooms during the COVID-19 pandemic.

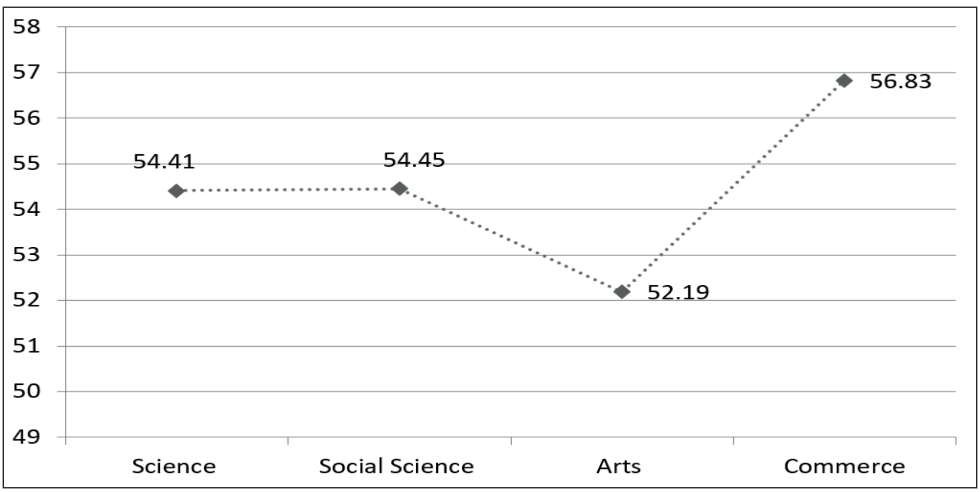
The researchers intended to measure the differences in the attitudes of college teachers towards virtual classrooms from different streams. To find out the differences within the groups and to interpret the results, the data was analysed with the help of One-way ANOVA. The result of 'f' ratio within groups in the attitude of teachers towards virtual classrooms from different streams is shown in Table-3.

Table-3: Mean difference in attitude towards virtual classroom of college teachers from different streams

Stream	N	SD	Mean	*F*	Sig
Sciences	78	6.77	54.51	1.25	.292
Social Science	86	7.89	54.45		
Arts	36	6.97	52.19		
commerce	6	5.91	56.83		

Table-3 depicts that, 'f' value (1.25) is not significant at the 0.05 level. Therefore, it can be concluded that there is no significant difference in attitude towards virtual classrooms of college teachers from different streams. The mean difference is shown in Figure 2.

Figure-2: Graphical presentation in attitude towards Virtual Classrooms of College teachers from different Streams



The results reveal that the teachers from different streams like sciences, social science, arts and commerce have not shown any significant differences in attitude towards virtual classrooms during the COVID-19 pandemic. The results indicate that all the teachers have the same attitude despite belonging to different streams.

Educational Implications of the Study

- Teachers used the virtual classroom to encourage students, enhance their mental health, and reduce stress throughout the epidemic.

- Students can look at course materials and revisit courses from online classroom folders, which is one of the major advantages of a virtual classroom. They can access pre-recorded videos and lectures.
- The flexibility of the virtual classroom enables both students and teachers to work and attend classes from anywhere.
- Virtual learning environments are cost-effective because they minimize the need for textbooks and travel.
- Teachers and students can both enhance their knowledge and skills by using a virtual classroom. It facilitates learning interactive online technologies like e-mail, online tests, homework drop boxes, collaboration tools, etc.
- Moreover, as information and communication technologies (ICT) rule the globe, a new paradigm in education will emerge as a result of the combination of online and offline teaching and learning techniques.

Conclusion

The perusal of results revealed that teachers of both genders showed average attitudes towards online teaching and learning, however, in certain items, both genders showed highly positive attitudes towards virtual classrooms during the COVID-19 pandemic. The results also revealed that the teachers from different streams like sciences, social science, arts and commerce have not shown any significant differences in attitude towards virtual classrooms during the COVID-19 pandemic.

(Acknowledgment: The authors are highly grateful to all participants (College Assistant Professor's) for their collaboration and contribution in giving the responses through Google form. The authors also acknowledge the support provided by their respective institutions.)

References

Alhumaid, K., Ali, S., Waheed, A., Zahid, E., & Habes, M. (2020). COVID-19 & eLearning: Perceptions & attitudes of teachers towards E-learning acceptance in the developing countries. *Multicultural Education*, *6*(2), 100-115.

Bakr, S. M. (2011). Attitudes of Egyptian teachers towards computers. *Contemporary Educational Technology*, *2*(4), 308-318.

Gupta, A., & Goplani, M. (2020). Impact of COVID-19 on Educational Institution in India. *Purakala*, 31 (21), 661-671.

Jamrozik, E., Littler, K., Bull, S., Emerson, C., Kang, G., Kapulu, M., & Selgelid, M. J. (2021). Key criteria for the ethical acceptability of COVID-19 human challenge studies: Report of a WHO Working Group. *Vaccine*, *39*(4), 633-640.

Jena, K. P. (2020). Impact of Pandemic COVID-19 on Education in India. International *Journal of Current Research*, 12 (07), 12582-12586.

Kutluca, T. (2010). Investigation of Teachers' Computer Usage Profiles and Attitudes toward Computers. *Online Submission*, *2*(1), 81-97.

Mahdizadeh, H., Biemans, H., & Mulder, M. (2008). Determining factors of the use of e-learning environments by university teachers. *Computers & education*, *51*(1), 142-154.

Nachimuthu, K. (2020). Student teacher's attitude towards online learning during Covid-19. *International Journal of Advanced Science and Technology*, *29*(6), 8745-8749.

Panda, S., & Mishra, S. (2007). ELearning in a Mega Open University: Faculty attitude, barriers and motivators. *Educational Media International*, *44*(4), 323-338.

Suri, G., & Sharma, S. (2017). Teachers' attitude towards computer and e-learning: An exploratory study of Panjab University, Chandigarh, India. *Pacific Business Review International*, *9*(8), 68-73.

Upoalkpajor, J. L. N., & Upoalkpajor, C. B. (2020). The impact of COVID-19 on education in Ghana. *Asian journal of education and social studies*, *9*(1), 23-3

Research Article

Investigating Socially Mediated Educational Communication through WhatsApp and Telegram: Perception and Preference of Students and Teachers

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Abstract

The COVID-19 pandemic has compelled the academic community to choose various social networking applications as an important avenue for interaction with students and teachers. WhatsApp and Telegram applications have emerged as efficient tools in the education process. With this background, the present study aimed to explore the perception and preferences of students and teachers towards the use of WhatsApp and Telegram as educational tools. The study used the descriptive quantitative method to collect data from 150 samples (100 UG students and 50 UG teachers) through a convenience sampling technique. A self-developed perception questionnaire with a Cronbach Alpha value of 0.917 was used to gather data. The percentage analysis indicated that the majority of the teachers have a favourable perception of the use of WhatsApp and Telegram as educational tools. However, the majority of the students have a favourable perception of the use of WhatsApp and a neutral perception of the Telegram application. The result found that both students and teachers mostly prefer WhatsApp as an effective tool in the education process.

Keywords: Perception, preference, social networking applications, WhatsApp, Telegram, educational tool

Introduction

The COVID-19 pandemic has led to internet-based communication as an important avenue for interaction with students and teachers. Various communication platforms like Facebook, WhatsApp, Telegram, and other applications are universally used in the world of education for interacting, sharing information and knowledge, networking and conducting research. The use of these applications is an innovative teaching and learning style in the 4.0 education era (Susilo & Amirullah, 2021). Social networking applications facilitate the creation of virtual communities for sharing common interests or exploring new ones. This allows for both real-time and asynchronous educational communication, promoting student collaboration, global knowledge exchange, and personalised learning. The rate of use of such platforms in education has increased significantly over the past few years. WhatsApp is the most used app in India, with over 53 crores of users and Instagram has 21 crores of users (Chakravarti, 2021). As reported by the Statista business data platform, "WhatsApp, with 2,000 million users, became the most popular messenger in the world as of January 2021 and Telegram with 500 million users" (STATISTA, 2021a) (as cited by Prokopyev, 2021). Hence, understanding the perceptions of students and teachers on educational communication platforms is a valuable source of information for educators and researchers.

Literature Review

The integration of WhatsApp into classroom learning can result in an easier, more fun and more useful way of learning (Susilo & Amirullah, 2021; Bansal & Joshi, 2014). Nitza and Roman (2016) elucidate that WhatsApp has a significant positive impact on students' learning outcomes and satisfaction with learning activities. Lazzam-Khraiwish, Bataineh, and Alzyod (2021) and Sari (2018) recommended the necessity of implementing WhatsApp as a strategy for improving students' English speaking skills. Gutierrez-Colon Plana, Gimeno, Appel, and Hopkins (2013) found that WhatsApp increases their satisfaction and willingness to learn resulting in positive impacts on students' reading habits, regularity and confidence. It simulates a socially constructive environment for learning (Naidoo & Kopung, 2016). Telegram can be an effective medium for sharing information and learning experiences for students and teachers (Mahdiuon, Salimi, & Raeisy, 2020). Ebrahimpour et al. (2016) found most students use and prefer Telegram for educational communication. Xodabande (2017) claimed that apart from using Telegram as an instant messaging application, it can also be used for improving language learning purposes and vocabulary learning (Alakrash, Razak and Bustan, 2020). Telegram promotes students' critical thinking skills and expands their knowledge with immediate feedback from the instructor turns out to be an important contributor to learning (Habibi et al., 2018).

Purpose of the Study

Earlier literature reviews identified that WhatsApp and Telegram applications emerged as efficient tools in the education process. With this view, the researcher believed that discovering teachers' and students' perceptions about the use of WhatsApp and Telegram as educational tools will help to make versed decisions for improving the educational potential and effectiveness. Based on this purpose, the following research questions were formulated:

RQ 1. What is the perception of the teachers teaching at the UG level about the use of WhatsApp and Telegram in the educational context?

RQ 2. What is the preference of the teachers teaching at the UG level regarding the use of WhatsApp and Telegram in the educational context?

RQ 3. What is the perception of undergraduate students about the use of WhatsApp and Telegram in the educational context?

RQ 4. What is the preference of undergraduate students regarding the use of WhatsApp and Telegram in the educational context?

Research Methodology

This study investigated teachers' teaching at the UG level and undergraduate students' perceptions and preferences towards the use of WhatsApp and Telegram applications. A descriptive quantitative research method was adopted to obtain the perceptions of the respondents. The study population included undergraduate students pursuing Bachelor of Arts (BA) and the teachers involved in the teaching of Bachelor of Arts (BA) at the college level. A total of 100 undergraduate students and 50 teachers teaching at the UG level from 3 different colleges in the Sonitpur district participated in the study.

Table-1: Demographic Profile of the Samples

S.No	No. of Students	No. of Teachers
1	40	23
2	35	15
3	25	12
Total	100	50

The researchers employed a convenience sampling technique for this study. The selection process for respondents involved choosing participants who willingly agreed to participate in the survey and subsequently completed the questionnaire using Google Forms. The data was gathered within the timeframe of the COVID-19 pandemic spanning from January to March 2021. The questionnaire was developed to collect the perceptions and preferences of both teachers and students regarding the use of WhatsApp and Telegram applications as educational tools. The questionnaire consists of 10 items that measure the use of the application within the context of teaching and learning, as well as the individual's communication skills, interpersonal relations, and any potential barriers encountered. The questionnaire underwent a process of validation conducted by experts specializing in the field of educational technologies. A pilot study was undertaken to assess the questionnaire's reliability and internal consistency. The Cronbach Alpha coefficient for the entire dataset was determined to be 0.917, as presented in Table 2. The data were systematically collected, recorded, and subsequently analysed using Excel Software.

Table-2: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.917	.919	10

Results

The results of the study are presented in tabulation and graphical representations in four sections as per the objectives.

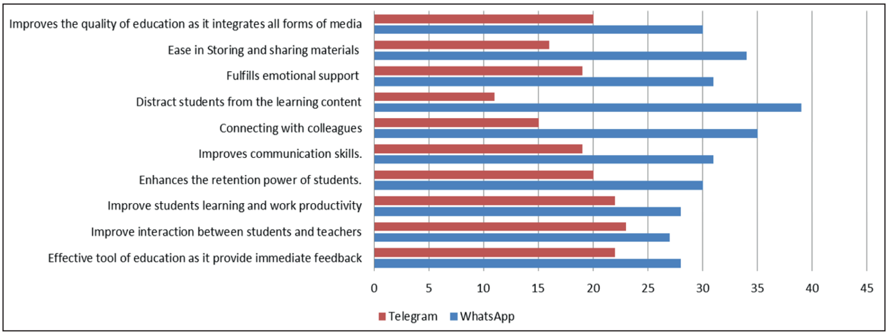
RQ 1. *Perceptions of Teachers about the use of WhatsApp and Telegram in the educational context*

Table-3: Frequencies and Percentage (N=50) of Perceptions of Teachers about the use of WhatsApp and Telegram in the educational context

Items	WhatsApp			Telegram		
	F	N	U	F	N	U
Effective tools of education as it provides immediate feedback	28 (56%)	13 (26%)	09 (18%)	22 (44%)	12 (24%)	16 (32%)
Improve interaction between students and teachers	27 (54%)	18 (36%)	05 (10%)	23 (46%)	14 (28%)	13 (26%)
Improve students learning and work productivity	28 (56%)	17 (34%)	05 (10%)	22 (44%)	13 (26%)	15 (30%)
Enhances the retention power of students.	30 (60%)	16 (32%)	04 (8%)	20 (40%)	16 (32%)	14 (28%)
Improves communication skills.	31 (62%)	12 (24%)	07 (14%)	19 (38%)	19 (38%)	12 (24%)
Connecting with colleagues	35 (70%)	06 (12%)	09 (18%)	15 (30%)	21 (42%)	14 (28%)
Distract students from the learning content	39 (78%)	06 (12%)	05 (10%)	11 (22%)	22 (44%)	17 (34%)
Fulfills emotional support	31 (62%)	15 (30%)	04 (8%)	19 (38%)	21 (42%)	10 (20%)
Ease in Storing and sharing materials	34 (68%)	08 (16%)	08 (16%)	16 (32%)	18 (36%)	16 (32%)
Improves the quality of education as it integrates all forms of media	30 (60%)	16 (32%)	04 (8%)	20 (40%)	19 (38%)	11 (22%)
Overall Total	63%	25%	12%	37%	35%	28%

*F= Favourable, N=Neutral, U=Unfavourable

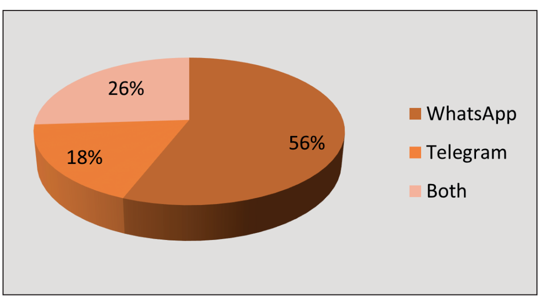
Figure-1: Perceptions of Teachers about the use of WhatsApp and Telegram in the educational context



The result of the data presented in Table 3 and Figure 1 revealed that the majority of the teachers have a favourable perception of the use of WhatsApp and Telegram in education. 63 per cent of teachers were in favour of WhatsApp and about 37 per cent were in favour of Telegram. 56 per cent and 44 per cent of teachers perceived that WhatsApp and Telegram are an effective tool for education as they provide immediate feedback. 54 per cent and 46 per cent agreed that both these applications improve the interaction between students and teachers. While 56 per cent and 44 per cent of teachers agreed with the statement that WhatsApp and Telegram improve students' learning and work productivity. 60 per cent and 40 per cent of teachers perceived that WhatsApp and Telegram enhance the retention power of students. 62 per cent and 38 per cent indicated that it improves communication skills. While the data showed that 70 per cent of teachers have a favourable perception of WhatsApp as a tool for interacting or connecting with their colleagues, whereas, teachers (42 per cent) have a neutral perception of Telegram as a medium of connection with colleagues. Similarly, a majority (78 per cent) of the teachers perceived that WhatsApp can distract students from the learning content and in terms of Telegram, they (44 per cent) have a neutral perception. 62 per cent of teachers found that WhatsApp can establish emotional support among students and colleagues, and only 42 per cent had a neutral view of Telegram. 68 per cent of respondents have shown a level of agreement on ease in storing and sharing materials on WhatsApp, while in terms of Telegram, 36 per cent of teachers have a neutral perception of it. Lastly, 60 per cent and 40 per cent of teachers were in favour of WhatsApp and Telegram as they improve the quality of education by integrating all forms of media.

RQ 2. *Preference of the teachers toward the use of WhatsApp and Telegram in the educational context*

Figure-2: presents the Preference of the teachers toward the use of WhatsApp and Telegram in an educational Context



In Figure 2, it has been presented that about 56 per cent of teachers mostly prefer the use of WhatsApp, again 26 per cent of teachers prefer both WhatsApp and Telegram and around 18 per cent of them prefer using Telegram in terms of educational context.

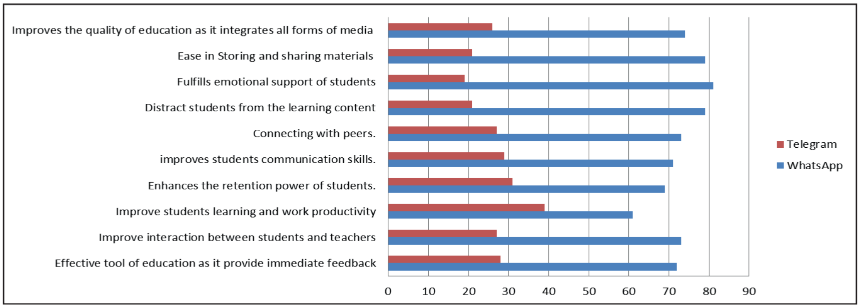
RQ 3. *Perceptions of students about the use of WhatsApp and Telegram in the educational context*

Table-4: Frequencies and Percentage (N=100) of Perceptions of students about the use of WhatsApp and Telegram in the educational context

Items	WhatsApp			Telegram		
	F	N	U	F	N	U
Effective tools of education as it provides immediate feedback	72 (72%)	19 (19%)	09 (9%)	28 (28%)	42 (42%)	30 (30%)
Improve interaction between students and teachers	73 (73%)	21 (21%)	06 (6%)	27 (27%)	41 (41%)	32 (32%)
Improve students learning and work productivity	61 (61%)	22 (22%)	17 (17%)	39 (39%)	47 (47%)	14 (14%)
Enhances the retention power of students	69 (69%)	18 (18%)	13 (13%)	31 (31%)	38 (38%)	31 (31%)
Improves communication skills	71 (71%)	22 (22%)	07 (7%)	29 (29%)	46 (46%)	25 (25%)
Connecting with peers	73 (73%)	23 (23%)	04 (4%)	27 (27%)	49 (49%)	24 (24%)
Distract students from the learning content	79 (79%)	17 (17%)	04 (4%)	21 (21%)	48 (48%)	31 (31%)
Fulfills emotional support	81 (81%)	15 (15%)	04 (4%)	19 (19%)	55 (55%)	26 (26%)
Ease in Storing and sharing materials	79 (79%)	18 (18%)	03 (3%)	21 (21%)	40 (40%)	39 (39%)
Improves the quality of education as it integrates all forms of media	74 (74%)	20 (20%)	06 (6%)	26 (26%)	52 (52%)	22 (22%)
Overall Total	73%	20%	7%	27%	46%	27%

*F= Favourable, N=Neutral, U=Unfavourable

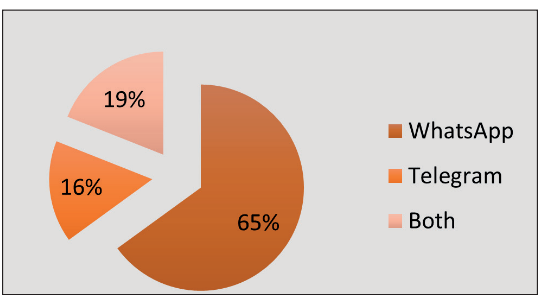
Figure-3: Perceptions of students about the use of WhatsApp and Telegram in the educational context



An analysis of the results related to the perceptions of students towards the use of WhatsApp and Telegram, as presented in Table 4 and Figure 3, showed that the majority of the students have a favourable perception of the use of WhatsApp. However, students have a neutral perception of the Telegram application. 73 per cent of students were highly in favour of WhatsApp, while 46 per cent were neutral to Telegram. In all, 72 and 42 out of the 100 students, representing 72 per cent and 42 per cent of students, perceived that WhatsApp and Telegram are effective tools for education as they provide immediate feedback. 73 per cent and 41 per cent agreed that both these applications improve the interaction between students and teachers. While 61 per cent and 47 per cent of students agreed with the statement that WhatsApp and Telegram improve their learning and work productivity. 69 per cent and 38 per cent agreed that this application enhances their retention power. 71 per cent and 46 per cent indicated that it improves communication skills. The data showed that 73 per cent of students have a favourable perception of WhatsApp as a tool for interacting or connecting with their peers, whereas, only 49 per cent of students have a neutral perception of Telegram as a medium of connection with peers. The majority (79 per cent) of the students agreed that WhatsApp distracts them from the learning content, and in terms of Telegram, 49 per cent of them have a neutral perception. 81 per cent of students find that WhatsApp can also establish emotional support between peers and teachers while only 55 per cent had a neutral view towards Telegram. 79 per cent of respondents have shown a level of agreement on ease in storing and sharing materials on WhatsApp, while in terms of Telegram, 40 per cent of them have a neutral perception of it. Lastly, 74 per cent and 52 per cent of students were in favour of WhatsApp and Telegram as they improve the quality of education by integrating all forms of media.

RQ 4. *Preference of the students toward the use of WhatsApp and Telegram in Educational Context*

Figure-4: presents the Preference of the students toward the use of WhatsApp and Telegram in an educational context



In Figure 4, it has been presented that about 65 per cent of students mostly prefer the use of WhatsApp, again 19 per cent of them prefer both WhatsApp and Telegram and around 16 per cent of them prefer using Telegram in terms of educational context.

Discussions

Perceptions of students and teachers about the use of WhatsApp and Telegram in the educational context

The results of the present study corroborate with the findings of Singh et al., (2020) Oteyola et al., (2021); Abubakar (2021) where it was found that teachers and students have a favourable perception towards using WhatsApp and Telegram in the teaching-learning process. In the studies of Wiranegara and Hairi (2020); Aghajani and Adloo (2018) it has been verified that WhatsApp and Telegram application provides us with immediate feedback. Aburezeq and Ishtaiwa (2013) and Durgungoz and Durgungoz (2021) concluded that WhatsApp and Telegram are effective tools for interaction between students and teachers. Hamad (2017) and Singh et al., (2020) remarked that using WhatsApp and Telegram in the teaching-learning process enhances students' learning, and retention (Kufre & Abe, 2017; Ashiyan & Salehi, 2016), communication skills (Kufre & Abe, 2017) and efficacious way of interacting with colleagues and peers (Shahkat Ali & Kootbodien, 2017). The present study found that the majority of teachers and students believed that although these applications are an effective tool in the education process, still there is a chance that they might distract students from the learning content. This is supported by the studies of Kushwaha and Jhawar (2018) Yeboah and Ewur (2014), where teachers and students felt that WhatsApp and Telegram could adversely affect their learning as students waste their time using it for other reasons as well. Maske et al. (2018) stated that messages such as wishes, prayers, and appreciation create discomfort and distraction among students and teachers while learning (as cited by Durgungoz and Durgungoz, 2021). A similar conclusion was drawn in the study of Cansoy (2017) Durgungoz and Durgungoz (2021), where it was asserted that social media applications develop a sense of belongingness among students and teachers, fulfilling their emotional needs. Even Derks, Fischer and Bos (2008) proclaimed that there is no such evidence that a digital media learning environment was less emotional than face-to-face classroom learning. These applications help in storing and sharing materials widely as supported by the findings of Munir, Erlinda and Afrinursalim (2021) and Mtega (2021). WhatsApp and Telegram have the potential to improve the quality of education as they integrate all forms of media (Alakloby, 2019).

Preference of the students and teachers toward the use of WhatsApp and Telegram in educational Context

The result of this study indicates that the majority of students and teachers mostly seem to prefer WhatsApp as an educational tool. Similar results have been addressed in the studies conducted by Reeves, Alkhalaf and Amasha (2019); Gasaymeh (2017) and Cetinkaya (2017). This is in line with the fact that WhatsApp is one of the most predominant social networking applications that enables users to send and share instant messages. Many researchers articulated that at present, WhatsApp has more advantages over other social networking applications employed by the education system. Gasaymeh (2017) reported that the integration of WhatsApp into education would enable students to access learning and educational material, assist student-teacher and student-student interaction, and facilitate collaborative learning. Reeves, Alkhalaf and Amasha (2019) posited that the accessibility, usability and relative simplicity of WhatsApp in comparison to other applications make it the most favoured application among students and teachers. These studies strengthened our research findings that WhatsApp is the most preferred and effective delivery of information-sharing applications.

Educational implication and limitations of the study

Based on the research findings, the present study suggests that educational institutions should consider incorporating platforms such as WhatsApp, Telegram, and other socially mediated educational communication channels into their curriculum and pedagogical strategies. The favourable perception of teachers towards these platforms suggests that educational institutions should prioritize the implementation of professional development programmes to guide teachers on the most effective strategies for incorporating these applications into their teaching methods. Consequently, our study proposed the need to educate students on digital literacy, promote appropriate online etiquette (netiquette), and cultivate responsible use of messaging platforms within the educational context. Educational institutions need to ensure robust guidelines for both teachers and students regarding data sharing and communication on these platforms. It is mandatory to establish a harmonious equilibrium between technology and pedagogy to effectively shape significant learning experiences for students.

While this research provides valuable insights into perceptions and preferences regarding the use of WhatsApp and Telegram in educational settings, it also has some limitations. The methodology of this study was significantly impacted by the constraints imposed by the Covid-19 pandemic. As the study was conducted between the time frame of January-March 2021, the researchers had to collect responses from the sample using Google Forms, which limited the sample size. Additionally, this study had a limited focus on the use of WhatsApp and Telegram, overlooking other platforms that may be used or preferred in academic settings. Thirdly, the study specifically focuses on undergraduate students who are pursuing a Bachelor of Arts (BA) degree, as well as the teachers who are involved in teaching the Bachelor of Arts (BA) programme at the college level. As a result, the findings of this study may not be generalized to other sectors such as universities or different academic disciplines. These limitations highlight the need for additional, more thorough research to build on these findings and provide a broader perspective.

Conclusions

In this study, we attempted to examine students' and teachers' perceptions and preferences regarding the use of WhatsApp and Telegram as educational tools. The study's outcome proposes that WhatsApp and Telegram were perceived positively by the teachers for educational communication with their students. However, students have a positive perception of the use of WhatsApp and a neutral perception of Telegram. In view of preferences, both students and teachers prefer WhatsApp as an educational tool. Although from the above discussion of the data and the previous literature on the use of WhatsApp and Telegram, we can see the strengths of using this social networking application in enhancing academic learning experiences, connecting with knowledge and information shared instantly by instructors and peers along with building rapport with students and teachers. In the coming years, due to the advent of the use of ICT in the 21st century, the influence of these applications in teaching-learning environments is welcomed substantially.

References

Abubakar, A. I. (2021). Perception on the Adoption of WhatsApp for Learning amongst University Students'. *International Journal of Research in STEM Education (IJRSE),* 3 (2), 28-36. DOI: https://doi.org/10.31098/ijrse.v3i2.680

Aburezeq, I. M., & Ishtaiwa, F. F. (2013). The impact of whatsapp on interaction in an Arabic language teaching course. *International Journal of Arts & Sciences, 6*(3), 165-180.

Aghajani, M., & Adloo, M. (2018). The effect of online cooperative learning on students' writing skills and attitudes through telegram application. *International Journal of Instruction, 11* (3), 433-448. https://doi.org/10.12973/iji.2018.11330a

Alakrash, H. M., Razak, N. A., & Bustan, E. S. ().The effectiveness of employing telegram application in teaching vocabulary: A quasai experimental study. *Multicultural Education, 6*(1), 151-159. DOI:10.5281/zenodo.3905099

Alakloby, S. S. (2019). Using whatsapp as a training tool for Arabic language teachers. *International Journal of Education, Learning and Development, 7*(5), 92-96.

Ashiyan, Z., & Salehi, H. (2016). Impact of whatsapp on learning and retention of collocation knowledge among Iranian EFL learners. *Advances in Language and Literary Studies, 7*(5), 112-127. Doi:10.7575/aiac.alls.v.7n.5p.112

Bansal, T., & Joshi, D. (2014). A study of students' experiences of mobile learning. *Global Journal of Human-Social Science interdisciplinary, 14*(4), 26-33.

Cansoy, R. (2017).Teachers' professional development: The case of whatsapp. *Journal of Education and Learning, 6*(4), 285-293. http://doi.org/10.5539/jel.v6n4p285

Cetinkaya, L. (2017). The impact of whatsapp use on success in education process. *The International Review of Research in Open and Distributed Learning*, *18*(7), 59-74. https://doi.org/10.19173/irrodl.v18i7.3279

Chakravarti, A. (2021, February 25). *Government reveals stats on social media users*, WhatsApp leads while YouTube beats Facebook, Instagram. *India Today*. https://www.indiatoday.in/technology/news/story/government-reveals-stats-on-social-media-users-whatsapp-leads-while-youtube-beats-facebook-instagram-1773021-2021-02-25

Derks, D., Fischer, A. H., & Bos, A. E. R. (2008). The role of emotion in computer-mediated communication: A review. *Computers in Human Behavior, 24*(3), 766–785. https://doi.org/10.1016/j.chb.2007.04.004

Durgungoz, A., & Durgungoz, F. C. (2021). "We are much closer here": Exploring the use of WhatsApp as a learning environment in a secondary school mathematics class. *Learning Environments Research*. https://doi.org/10.1007/s10984-021-09371-0

Ebrahimpour, A., Rajabali, F., Yazdanfar, F., Azarbad, R., Nodeh, M. R., Siamian, H., & Vahedi, M. (2016). Social Network Sites as Educational Factors. *Acta informatica medica :Journal of the Society for Medical Informatics of Bosnia & Herzegovina, 24*(2), 134–138. https://doi.org/10.5455/aim.2016.24.134-138

Gasaymeh, A. M. (2017). University students use of whatsapp and their perceptions regarding its possible integration into their education. *Global Journal Of Computer Science And Technology*, 17 (1), 1-10.

Gutierrez-Colon Plana, M., Gimeno, A., Appel, C., & Hopkins, J. E. (2013, July 10-13). *Improving learners' reading skills through instant short messages: A sample study using WhatsApp.* WorldCALL 2013 Global perspectives on Computer-Assisted Language Learning, Glasgow, 80-84.

Habibi, A., Mukminin, A., Riyanto, Y., Prasojo, L. D., Sulistiyo, U., Sofwan, M., & Saudagar, F. (2018). Building an online community: Student teachers' perceptions on the advantages of using social networking services in a teacher education program. *Turkish Online Journal of Distance Education-TOJDE 19*(1), 46-61.

Hamad, M. M. (2017). Using whatsapp to enhance students' learning of english language "experience to share". *Higher Education Studies,7* (4), 74-87. http://doi.org/10.5539/hes.v7n4p74

Kufre, A.P., & Abe, E.C. (2017). Effectiveness of Whatsapp as a collaborative tool for learning among undergraduate students in university of Uyo, Akwa Ibom state. *International Journal of Advanced Education and Research, 2*(5), 43-46.

Kushwaha, P. S. & Jhawar, N. (2018). Role of whatsapp as a teaching aid to enhance learning capabilities of management students. *Ushus-Journal of Business Management, 17* (1), 43-51.https://doi: 10.12725/ujbm.42.4

Lazzam-Khraiwish, A. A., Bataineh, A. M., & Alzyod, A. H. (2021). The effect of using whatsapp on the Jordanian 5th grade EFL students' speaking skill. *International Journal of Linguistics, 13*(4), 49. https://doi.org/10.5296/ijl.v13i4.18749

Mahdiuon, R., Salimi, G., & Raeisy, L. (2020). Effect of social media on academic engagement and performance: Perspective of graduate students. *Education and Information Technologies, 25*(4), 2427–2446. https://doi.org/10.1007/s10639-019-10032-2

Maske, S. S., Kamble, P. H., Kataria, S. K., Raichandani, L., & Dhankar, R. (2018). Feasibility, effectiveness, and students' attitude toward using WhatsApp in histology teaching and learning. *Journal of education and health promotion*, *7* (158). https://doi.org/10.4103/jehp.jehp_30_18

Mtega, W. P. (2021). Using whatsApp messenger for improving learners' engagement in teaching and learning: A case of undergraduate students at the Sokoine University of Agriculture, Tanzania. *Library Philosophy and Practice (e-journal),* 4809.

Munir, S., Erlinda, R., Afrinursalim, H. (2021). Students' views on the use of whatsapp during covid-19 pandemic: A study at IAIN Batusangkar. *Indonesian Journal of English Language Teaching and Applied Linguistics, 5*(2), 323-334. DOI: http://dx.doi.org/10.21093 /ijeltal.v5i2.740

Naidoo, J., & Kopung, K. J. (2016). Exploring the use of whatsapp in mathematics learning: A case study. *J Communication, 7*(2), 266-273.

Nitzal, D. & Roman, D. N. (2016). WhatsApp messaging: Achievements and success in academia. *International Journal of Higher Education, 5*(4), 255-261.

Oteyola, T., Oyeniran, O., Awopetu, E., & Bello, I. (2021). Students' acceptance of whatsapp/telegram for online classes: Osun State, Nigeria as a Pilot. *International Journal of Education and Development using Information and Communication Technology (IJEDICT),17*(3), 97-109.

Prokopyev, M.S., Kostikova, N. A., Kuzin, Z. S., Ilina, T. S., & Tyagulskaya, L.A. (2021).The technology of using telegram messenger as an elearning tool. *Laplage em Revista (International),7*, 229-238. DOI: https://doi.org/10.24115/S2446-622020217Extra-C1007p.229-238

Reeves, A. J., Alkhalaf, S., & Amasha, M. A. (2019). WhatsApp as an educational support tool in a Saudi University. *International Journal of Advanced Computer Science and Applications(IJACSA), 10*(8), 394-401. DOI: 10.14569/IJACSA.2019.0100853

Sari, F. M. (2018, November 30- December 1). *Undergraduate students' attitudes to the implementation of whatsapp group as their learning media in the EFL classroom*. International Conference on English Language Teaching and Learning, University of Lampung.

Shahkat Ali, M. S., & Kootbodien, A. (2017). The effectiveness of *whatsapp* as an interpersonal communication medium among Abu Dhabi university students. *International Journal of Media, Journalism and Mass Communications,3*(1), 11-19. doi:dx.doi.org/10.20431/2454-9479.0301002

Singh, C. K. S., Singh, T. S. M., Abdullah, N. Y., Moneyam, S., Ismail, M. R., Ong, E. T., Karupayah, T., Chenderan, K., Singh, M. K. R., & Singh, J. K. S. (2020) Rethinking english language teaching through Telegram, Whatsapp, Google Classroom and Zoom. *Systematic Reviews in Pharmacy*, 11 (11), 45-54. doi:10.31838/srp.2020.11.9

Susilo, S., & Amirullah, G. ().Student perception of the utilization of whatsapp in biological learning. Turkish Journal of Computer and Mathematics Education, 12(14), 842 – 850.

Wiranegara, D. A., & Hairi, S. (2020). Conducting english learning activities by implementing telegram group class during covid-19 pandemic. *Journal of English for Academic and Specific Purposes, 3*(2), 104-114. DOI:10.18860/jeasp.v3i2.11122

Xodabande, I. (2017). The effectiveness of social media network telegram in teaching english language pronunciation to Iranian EFL learners. *Cogent Education, 4*(1). https://doi.org/10.1080/2331186x.2017.1347081

Yeboah, J., & Ewur, G. D. (2014). The impact of whatsapp messenger usage on students performance in tertiary institutions in Ghana. *Journal of Education and Practice, 5* (6), 157-164.

Research Article

Exploring the Perceptions of K-12 Teachers towards Ed-Tech Tools

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Abstract

Technology has impacted nearly all facets of everyday life. Be it commerce or governance, technology is becoming an integral part of developing societies, and education is no exception to it. The necessity to include digital technologies in the educational system is growing due to their rapid development in contemporary practices. In the Indian context, the National Education Policy 2020 also emphasizes the importance of integrating technology at all levels of education. Further, it highlights facilitating teachers' preparation for technological integration. The present study aimed to explore the teachers' perceptions of technological integration in the teaching-learning process and awareness about emerging Ed-Tech tools. The sample consisted of N=50 in-service teachers of primary to higher secondary levels from government and private schools in eastern states of India. These teachers were under in-service training for the academic session 2022-23. The results showed that most educators are supportive of technology-integrated teaching and learning. Furthermore, more than half of teachers have received proper training related to the functioning and applications of different tools and technologies. The study also revealed that some teachers who have average technological skills also held positive attitudes towards technological integration in teaching and learning. It showed that some factors that interfere negatively, made many teachers skeptical about technology integration in educational practices. In this study, we have found that few teachers had never utilized technology in the classroom and were technologically inept. The present study can be a base for further research in order to explore why these teachers couldn't integrate technology into the teaching and learning process.

Keywords: Ed-Tech tools, technological proficiency, technological integration

Introduction

Technology has advanced significantly in the classroom since the 1980s. Today, technology is more than tools like interactive whiteboards, graphing calculators, laptop computers, iClickers and iPods. The pandemic has also added to the surge of different technologies amidst a slew of new challenges for education around the world. The question of how technological integration started in educational systems can be traced back to when the term "digital natives" was first brought to light by Prensky in 2001. The digital natives are referred to as "*the younger generations who grew up with technology-integrated lifestyles*." Since then, several researchers have started focusing on technology-integrated learning environments (Lei, 2009; Rainie, 2006; Stearns, 2006; Wood, 2006). In order to integrate technology in the classrooms, the role of teachers has been more emphasized. The prominent developments in the technologically integrated models for teaching and learning were made by several researchers over a certain period of time (Mishra & Koehler, 2006; Puentedura, 2006). The recent models which have gained attention are the Technological Pedagogical Content Knowledge (TPACK) and Substitution Augmentation Modification Redefinition (SAMR) models. In the Indian context, the Government of India's (2020) National Education Policy has recently highlighted the emerging need for technological integration at each level in the Indian education system. Further, it also has emphasized suitable training of teachers to enhance their technological skills. The policy also proposed to form the National Educational Technology Forum (NETF), for the free sharing of ideas among teachers and administrators. The present study was conducted in curiosity to understand whether the teachers in the present educational system are aware of recent trends, tools and policy recommendations. Further, if they are aware of whether they are effectively integrating technology in real classroom situations.

Objectives

- To study the perceptions of teachers towards technological integration.
- To study the teachers' perceptions about the different Ed-Tech tools in K-12 education.
- To identify the factors that affect the integration and utilization of the Ed-Tech tools in the teaching-learning process.

Review of related literature

Recently several studies have emphasized the need for technological proficiency among teachers (Guillén-Gámez et al., 2020; Rodriguez-Segura & Schueler, 2022). Gorder (2018) reported that in the last few years, the primary focus of many teachers is on making students aware of technology, but they themselves are unfamiliar with the abilities of integration and active learning utilizing technology. The teachers' opinions can influence successful technological integration and are the major determinant of whether they will employ technology in the classroom in the future. Although many factors influence how successfully technology is integrated, the most important is teachers' competency and aptitude to adapt instructional technology-based activities according to the needs of the learners (Hong, 2021). The other factors include the degree of cooperation, self-assurance and teamwork (Mundy et al., 2019). It was evident from the previous studies that the teachers who use technology in the classrooms were able to enhance learning and also bring out active learning among the learners (Marshall, 2016). However, there is very little emphasis given to teachers' preparation for technological integration both in the pre-service and in-service phases. Zhao et al. (2021) in their study has emphasized that there is still more work to be done in terms of practice and training of the teachers. Porter and Graham (2016), in their study, have tried to highlight a few issues that have affected technological inclusion recently in the classroom. The key issues that were discussed are lack of resources, lack of training and insufficient time. To completely comprehend how instructors in the modern world view technology in teaching and learning, further research in this area is still needed. In order to learn more, we must critically evaluate, consider and synthesize the data underlying teachers' perceptions of how to integrate technology into the classroom.

Methodology

The present study has utilized a mixed methods approach to explore the teachers' perceptions towards Ed-Tech tools in teaching and learning. The sample consisted of 50 teachers from government and private schools from mostly eastern states in India. The purposive sampling was followed for this study. The tool used was a self-made questionnaire which was prepared and validated with the help of experts. The questionnaire was designed to check the teachers' awareness and knowledge of Ed-Tech tools and included both close-ended and open-ended questions. The close-ended questions were on a dichotomous scale. It also consisted of a checklist of different Ed-Tech tools from various categories i.e. game-based tools, online discussion forums, learning management software, online meeting software, social media-based software and MOOCs. The questionnaire was distributed or forwarded to the teachers and responses were collected with the help of Google Forms. Approximately 10 days' duration was given to the teachers to reflect on the questions. The reminders related to deadlines were given to achieve the highest response rate from the participants considering their busy schedules. A total of one month has been taken to conduct this survey to cover different levels of teachers and types of schools. The data analysis was done at the end and results and major findings were listed. The data analysis followed a simple percentage distribution for the close-ended questions, and a descriptive overview of the major themes emerged on the basis of major transcriptions obtained for open-ended questions.

Results

Quantitative phase

The results showed that 46.20 per cent of private school teachers and 53.80 per cent of government school teachers participated in the study (Figure 1). Further, they were categorized into primary (4 per cent), secondary (50.8 per cent) and higher secondary (45.2 per cent) levels (Figure 2). More than half of the teachers (76.9 per cent) were aware of the Ed-Tech tools (Figure 3). Approximately 92per cent of teachers who were aware, had agreed to the point that they have used Ed-Tech tools in their classroom teaching (Figure 4). 69.20 per cent of the teachers participating in the study agreed that they have received training either in the pre-service or in-service stage related to technological tools and applications (Figure 5). Among the participants, mostly all of them were aware of online meeting applications such as Google Meet and Zoom and social media platforms such as Whatsapp, Youtube and Facebook. Nearly half of them knew about Indian MOOCs such as SWAYAM. It was seen in the study that teachers were less aware of different Learning Management Software such as Edmodo, Moodle, Docebo, Schoology etc. (Figure 6).

Figure-1: Percentage of teachers belonging to different schools

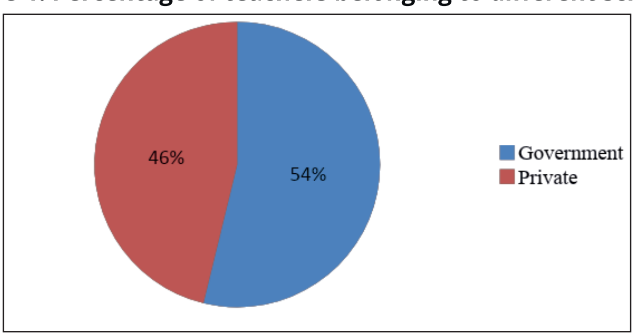


Figure-2: Percentage of teachers belonging to different school levels

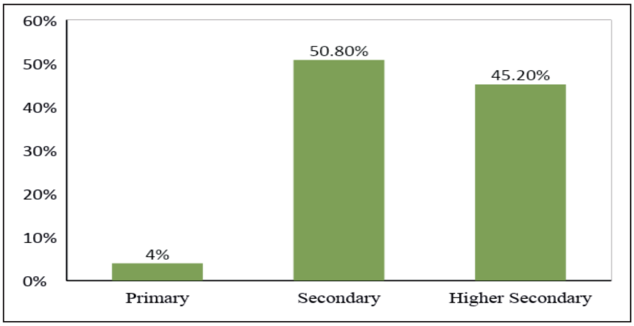


Figure-3: Percentage of teachers knowing about different Ed-Tech Tools

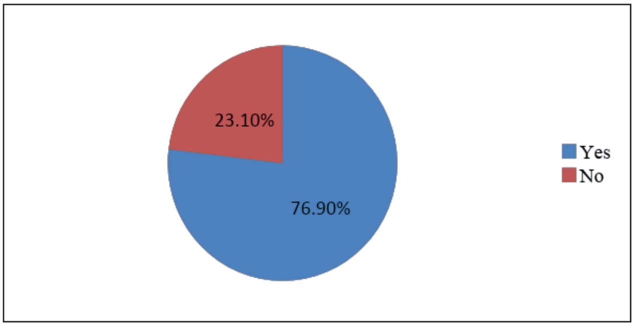


Figure-4: Percentage of teachers used Ed-Tech Tools while teaching

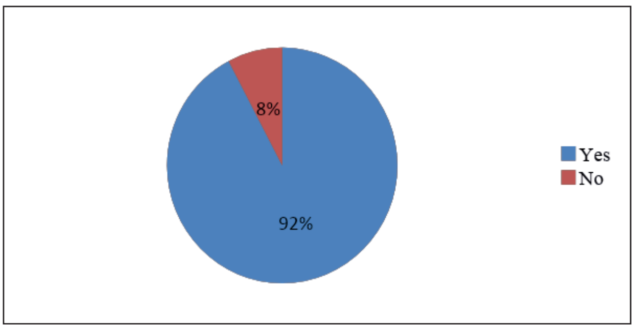


Figure-5: Percentage of teachers received pre-service or in-service training related to Ed-Tech Tools

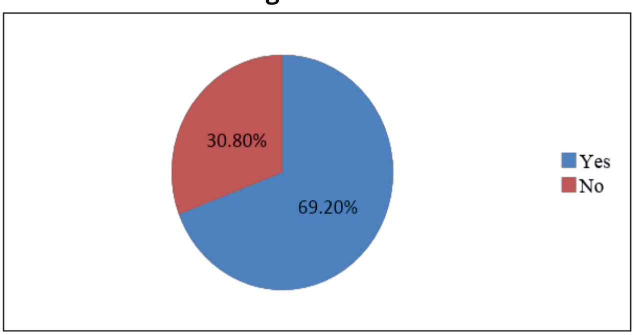
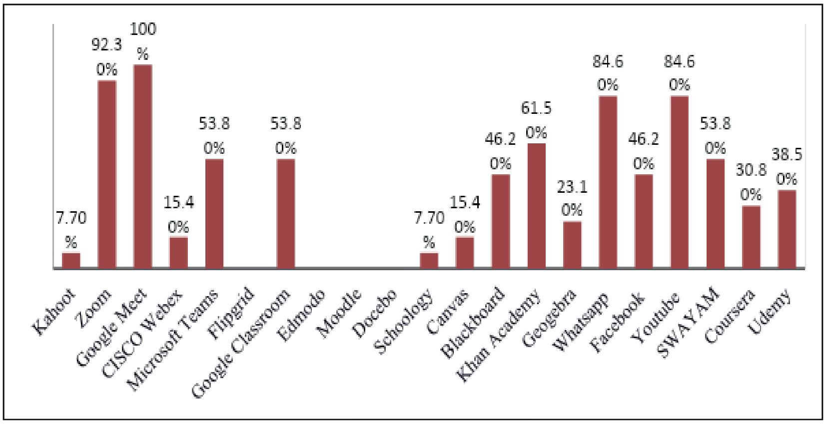


Figure-6: Percentage of teachers who are aware of recent Ed-Tech tools



Qualitative phase

The results of the open-ended questions revealed two prominent themes i.e. the major challenges and benefits of using the Ed-Tech tools that have been perceived by the teachers. The challenges which were largely stated by the teachers are summarized below:

- Need for revamping the teacher education curricula.
- Infrastructure and access-related issues.
- Most of the applications are proprietary licensing.
- Financial funds related issues.
- Technical difficulties and ethical problems.
- Economic affordability of learners.
- Parents' illiteracy.
- Cyber-crimes such as hacking of personal information.
- Distraction.

The major benefits of using Ed-Tech tools that were stated by the teachers are mentioned below:

Teacher 1: "It makes the teaching-learning process easier and makes the class more interactive because students not only learn by listening to the lectures of teachers but also can see related visuals in the form of videos of related topics."

Teacher 2: "As a Mathematics teacher, I feel that few diagrams, such as 3D shapes, are complicated to be represented on board. They require great visualization and it can be done by ICT tools."

Teacher 3: "It keeps children interested."

Teacher 4: "ICT helps in streamlining the transaction of curricular content."

Teacher 5: "Very much."

Teacher 6: "Better understanding and visualization."

Teacher 7: "Use of diagrams, videos and e-content."

Teacher 8: "It is student-friendly. Students find it more attractive to learn something new."

Teacher 9: "In Biology, it is easier to teach using animated videos of every cycle and process."

Teacher 10: "They make the delivery of concepts much easier and lively and help the students imagine the concepts better."

Major Findings and Discussion

Our findings showed that the teachers

have a positive attitude towards using the Ed-Tech tools in teaching and learning. Similar results have been shown in several research studies where the majority of the teachers have shown favourable attitudes towards technological integration in the classroom to improve learners' academic performance (Abel et al., 2022; Bilwani & Zehra, 2016; Ghavifekr & Rosdy, 2015; Munyengabe, 2017). Further, we also found that some of the teachers have highlighted the commonly used Ed-Tech tools and also listed some tools that were not mentioned in the questionnaire. The results also showed that most of the teachers were using Google Meet and Zoom for teaching purposes, Google Classroom and Google Forms for formative assessments (short tests including MCQs one-word answers), taking attendance and collecting assignments. Some of the previous studies also reported similar findings (Dantes et al., 2022; Timothy & Silva, 2022). These studies revealed the effective and majorly used online platforms such as Zoom, Google Meet etc. and their helpful features that support teaching and learning. Apart from these, our findings also reported that the teachers had used Scratch, animated GIFs, Youtube tutorials, Aveti Learning, power points, smart boards, projectors, interactive panels, Whatsapp and Telegram groups for teaching and learning. Ogbonnaya (2019), in his study, also highlighted the perceived usefulness of different social media platforms, as mentioned above, in the teaching-learning process. Recently the focus of research has been more shifted towards AI-based Ed-Tech tools in K-12 education. Chounta et al. (2022) in his study also reported the importance of AI based tools and the need for teachers' preparation regarding emerging technologies.

Implications

- The Ed-Tech is an emerging area of research therefore more emphasis should be given to new tools and technologies which have the potential to enhance the learning experiences
- This type of study can be a base for further research which can be extended by including certain interventions related to teachers' preparation and professional development in the context of particular regions

Limitations

Our study is a small scale pilot survey which has included few selected schools based on accessibility. We have considered limited Ed-Tech tools in each category. We have tried exploring the pre-conceived perceptions of the teachers towards the Ed-Tech tools rather than going for certain interventions and examine any change.

Conclusion

In this study the teacher perceptions of technological tools for pedagogic practices were analyzed, categorized and interpreted. Several challenges, issues, drawbacks, problems and interventions were investigated to learn more about how teachers view the use of technology in real classroom situations. This study will be helpful for different stakeholders involved in the teaching and learning process who will be able to understand the teachers' position and perceptions of integrating technology in real classrooms.

References

Abel, V. R., Tondeur, J., & Sang, G. (2022). Teacher perceptions about ICT integration into classroom instruction. *Education Sciences*, *12*(9), 609.

Bilwani, A., & Zehra, R. (2016). Perceptions of teachers regarding technology integration in classrooms: A comparative analysis of elite and mediocre schools. *Journal of Education and Educational Development*, *3*(1), 1-29.

Chounta, I. A., Bardone, E., Raudsep, A., & Pedaste, M. (2022). Exploring teachers' perceptions of Artificial Intelligence as a tool to support their practice in Estonian K-12 education. *International Journal of Artificial Intelligence in Education*, *32*(3), 725-755.

Dantes, G. R., Audina, I. P., Marsakawati, N. P. E., & Suwastini, N. K. A. (2022). Investigating The Zoom Application as A Video Conferencing Platform in The Online Learning Process Based on Teacher's Perception. *Journal Nasional Pendidikan Teknik Informatika: Janapati*, *11*(2), 133-144.

Government of India (2020). *National Education Policy*. Retrieved from https://www.mhrd.gov.in/sites/ upload_files/mhrd/files/NEP_Final_English_0.pdf

Gorder, L.(2018). A study of teacher perceptions of instructional technology integration in the classroom. *Delta Phi Epsil. J.*, *50*(2), 63-76.

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science*, *1*(2), 175-191.

Guillén-Gámez, F.D., Ruiz-Palmero, J., Sánchez-Rivas, E. & Colomo-Magaña, E. (2020). ICT resources for research: An ANOVA analysis on the digital research skills of higher education teachers comparing the areas of knowledge within each gender. *Educ. Inf. Technol*., *25*(5), 4575-4589.

Hong, X., Zhang, M., & Liu, Q. (2021). Preschool teachers' technology acceptance during the COVID-19: An adapted technology acceptance model. *Frontiers in Psychology*, *12,* 2113.

Lei, J. (2009). Digital natives as preservice teachers: What technology preparation is needed? *Journal of Computing in Teacher Education*, *25*, 87-97.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108,* 1017-1054.

Marshall, J. (2002). Learning with technology. *Evidence that technology can, and does, support learning*, *6*, 24-76.

Mundy, M. A., Kupczynski, L., & Kee, R. (2012). Teacher's perceptions of technology use in the schools. *Sage Open*, *2*(1), 2158244012440813.

Munyengabe, S., Yiyi, Z., Haiyan, H., & Hitimana, S. (2017). Primary teachers' perceptions on ICT integration for enhancing teaching and learning through the implementation of one laptop per child program in primary schools of Rwanda. *Eurasia Journal of Mathematics, Science and Technology Education*, *13*(11), 7193-7204.

Ogbonnaya, U. (2019). Adoption and perceived usefulness of social media by pre-service teachers in Nigeria. *iJIM, 13*(6), 52-67.

Porter, W. W., & Graham, C. R. (2016). Institutional drivers and barriers to faculty adoption of blended learning in higher education. *British Journal of Educational Technology*, *47*(4), 748-762.

Prensky, M. (2001). Digital Natives, Digital Immigrants. *On The Horizon*, *9*(5), 3-6. http://dx.doi.org/10.1108/10748120110424816

Puentedura, R. (2006). *Transformation, Technology, and Education. Presentation given August 18, 2006 as part of the Strengthening Your District Through Technology workshops*, Maine, US. Retrieved from http://hippasus.com/resources/tte/part1.html

Rainie, L. (2006). *Digital "natives" invade the workplace. Pew Internet & American Life Project.* Retrieved from http://pewresearch.org/pubs/70/digital-natives-invade-the-workplace">

Rodriguez-Segura, D., & Schueler, B. E. (2022). Can learning be measured by phone? Evidence from Kenya. *Economics of Education Review*, *90*, 102-309.

Stearns, J. (2006). Going pro: Schools embrace video production and videoconferencing. *Technology & Learning*, *26*(7), 32.

Timothy, T., & da Silva, A. M. (2022). Teachers' perception towards video conference for remote online teaching: The use of google meet in EFL elementary classrooms. *EDULANGUE*, *5*(1), 87-135.

Wood, G. (2006). Recognizing the generational divide: When X meets Y at the tribal college. *Tribal College Journal of American Indian Higher Education*, *17*(4), 24-25.

Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. L. (2002). Conditions for classroom technology innovations. *Teachers college record*, *104*(3), 482-515.

Research Article

Exploring the Potential of Educational Robots in India: A Study of Scope and Challenges

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Abstract

India's development is significantly influenced by education. The education system in India dates back to ancient times and has evolved substantially over the years. India has always encouraged innovative methods of instruction to raise the standard of education in the country. However, the education system had not undergone major structural shifts until the pandemic. Since the pandemic, innovative online tools and media have become an essential part of the education system, and the education system in India has gradually shifted from the traditional model to a hybrid mode of education. This gradual shift offers space to study the potential scope and challenges of introducing educational robots into the system. Studies in countries like the US demonstrate that learning with the help of educational robots from an early age can enable children to enhance multiple capabilities. This paper titled 'Exploring the Potential of Educational Robots in India: A Study of Scope and Challenges' aims to analyse the scope and challenges of using educational robots in India at various levels and attempts to expand the pedagogical possibilities of this field. Based on an analysis of existing literature on the benefits of educational robots and the socio-cultural background of education in India, the study looks at the various possibilities of incorporating educational robots in India and puts forth certain recommendations based on studies conducted in other countries to integrate educational robots into the education system in India effectively.

Keywords: Educational robots, challenges, new technology, pedagogical possibility, scope

Introduction

Technological advancements in robotics and artificial intelligence have accelerated in the past decade, leading to the development of humanoid robots with human-like features. From their humble beginnings as single-task machines, robots have evolved remarkably, inspiring great possibilities in their interaction with humans (Sisman et al., 2019). These advancements have led to the integration of humanoid robots, designed to interact with humans, in various sectors worldwide, including healthcare, business, and education.

Within the field of education, the emergence of educational robotics has gained significant traction in recent years. Educational robots emerged from the combination of electronics and mechanical toys in the 1980s, giving rise to simplified versions of commercial robots explicitly designed for educational purposes (Leoste & Heidmets, 2019). The potential of educational robots was first explored through the Logo Turtle project, initiated by Seymour Papert and Marvin Minsky at the MIT Artificial Intelligence Academy in 1967 (Leoste & Heidmets, 2019). This early endeavour laid the foundation for the development of educational robots, aiming to enhance the learning experiences of students. Further, Seymour Papert expanded the Logo computer language in 1969, introducing the first educational robot, the Turtle, to educate children. Notably, a study conducted in 1976 by MIT and Edinburgh University showcased the benefits of using a robot Turtle to assist a child with autism. According to the study, the interaction with the robot resulted in significant improvements in the child's communication skills and language development (Catlin & Blamires, 2019).

Today, various types of educational robots are available in the market, such as pre-assembled robots and robotics kits. While pre-assembled robots offer ease of use but limited customisation, robotics kits provide flexibility, allowing users to design and build robots tailored to specific tasks. The applications of educational robots extend to technical teaching, language studies, and science and technology, demonstrating their versatility and potential (Broadbent, 2017), and subsequent studies have shown the positive impacts of educational robots in various educational contexts. As a result, numerous countries, including the United States, have incorporated educational robots into their education systems to enrich teaching and learning experiences, fostering enhanced knowledge, cognitive skills, mathematical and computational thinking, and interactivity among students (Iberdrola, n.d.).

As a developing country embracing educational innovations, India presents a fertile ground for introducing educational robots. The Indus International School in Bengaluru has already introduced an Eagle 2.0 humanoid robot into its classroom on an experimental basis to unlock the potential of humanoids within the education sector. However, the adoption of educational robots in India faces challenges stemming from socio-cultural and economic factors. Overcoming these challenges requires supervised and efficient implementation, leading to the effective utilisation of educational robots, which can revolutionise the learning experience and drive technological advancements within the country.

Therefore, this article aims to analyse the scope of introducing educational robots into the Indian education system, with a focus on enhancing the education system in India. By reviewing existing studies on the use of educational robots and addressing the significant challenges that hinder the introduction of educational robots in India, this study seeks to provide recommendations for overcoming these obstacles and promoting the effective integration of educational robots in the Indian context.

Research Objectives

- To study the scope of incorporating educational robots into the Indian education system through a review of existing literature
- To trace the challenges of incorporating educational robots within the Indian education system.

Methodology

The data for this research paper was collected through an extensive review of available literature. A comprehensive search was conducted to identify relevant research articles, seminar papers, conference proceedings, reports, discussions, and website information pertaining to the use of educational robots and the challenges associated with their integration into the Indian education system. Keywords such as "educational robots," "robotics in education," "Indian education system," and "challenges" were used to ensure the inclusion of relevant studies. The review aimed to gather insights and expert opinions on the scope and challenges of using educational robots in the Indian education system. The data collected from the literature review was subjected to a thorough analysis and the findings below are supported by evidence and examples drawn from the reviewed literature.

Scope of Educational Robots: An International Perspective

Educational robots have gained significant popularity and have been widely utilised in classrooms and extracurricular activities in schools (Ben-Ari & Mondada, 2018). Many countries have incorporated educational robots within their education system as instructional tools (Lau et al., 1999; Wang, 2004), learning aids (Kory & Breazeal, 2014; Kory et al., 2013), and teaching companions (Han & Kim, 2009; You et al., 2006). For example, over the last decade, Spain has been using a Python-based Arduino robot called PYBOKIDS. Similarly, as studies suggested that educational robots facilitate learning and enable students to efficiently understand concepts, an educational framework using real and simulated robots was successfully used by more than 2000 real students in six schools (Vega & Canas, 2019). Similarly, the number of robots that are used in educational activities in kindergarten and primary school has increased exponentially over the decade (Papadakis, 2020). They were found to increase students' attention and involvement (Rubenstein et al., 2015), particularly in STEM subjects (Khanlari & Mansourkiaie, 2015; Zhong et al., 2020; Cetin & Demircan, 2020). The hands-on nature of educational robotics was found to engage students and spark their interest in the topic, leading to improved cognitive and social skills (Papadakis, 2020). As a result, the application of educational robots extended across various disciplines, including science, mathematics, and engineering. In these fields, robots played a crucial role in demystifying abstract concepts and improved essential skills such as spatial ability, selective attention, risk-taking, and decision-making (Papadakis, 2020).

Studies have also consistently shown that robots have the potential to inspire and engage students in the classroom while fostering the development of mathematical abilities (Leoste & Heidmets, 2019). Moreover, robots have been found to positively impact students' learning motivation (Leoste & Heidmets, 2019) and cognitive skills (Iberdrola, n.d.) and educational robotics have been found to be effective in promoting innovative thinking, successful teamwork, and effective communication among students. Participating in educational robotics environments allowed children to construct models of cognitive processes, fostering their problem-solving abilities and encouraging collaboration (Papadakis, 2020). For example, in the World Robot Olympiad, where participants were tasked with building robots using LEGO, students experienced enhanced communication skills, problem-solving capabilities, and overall knowledge of robotics (Chiang et al., 2020).

Internationally, educational robots were also found to play a crucial role in special education needs. They have been utilised for the intellectual growth and development of children and youth, offering new possibilities in the educational field (Mubin et al., 2013). Research indicates that educational robots increase the attention span and efficiency of students with poor concentration ability, providing them with additional support in their education (Sillanpaa, 2021). Thus, the findings of numerous studies emphasise the positive impact of educational robots on the educational landscape (Reich-Stiebert et al., 2019), and the wide acceptance and positive outcomes observed in different countries emphasise the transformative power of educational robots in enhancing education and knowledge transfer on an international scale.

Scope of Educational Robots in the Indian Context

India's education system has a long and esteemed history rooted in ancient traditions of knowledge dissemination. From the Gurukula system, where students learned through personal interactions with gurus, to the establishment of renowned centres of learning like Nalanda and Takshashila, education has always held a pivotal role in Indian society. The modern education system in India was introduced during the colonial era, heavily influenced by European college systems and printing. However, it was post-independence that India made significant strides towards providing universal access to education and enhancing the overall educational landscape. Recognising the importance of technological advancements, India integrated ICT into its education system in 2004, embracing the potential of digital tools to enhance learning experiences and knowledge dissemination. Today, India's educational system stands as the world's largest and most potent, with a literacy rate of 73 per cent as of 2011 and more than 315 million students (Talentedge Learning Series, n.d.).

In recent years, India has witnessed significant changes in the teaching-learning process, particularly due to the impact of the COVID-19 pandemic. The pandemic initially caused disruptions and chaos in the education system. However, it also presented an opportunity to accelerate the integration of technology and enhance the technological infrastructure in India's education sector (Jena, 2020a). As schools and institutions adapted to the new normal, a shift towards blended learning, the use of Learning Management Systems, online collaborative work, and enhanced digital literacy became prominent features of education in India (Jena, 2020b).

Looking ahead, India aims to restructure its education system by 2025, as outlined in the National Education Policy (NEP) 2020. The policy emphasises the equitable use of technology in education and calls for a change in the current pedagogical practices. In this context, introducing educational robots holds tremendous potential to facilitate the necessary pedagogical shifts envisioned by the NEP 2020. By leveraging the capabilities of educational robots, India can enhance the learning experience, foster student engagement, and promote innovative and interactive teaching methods that align with the evolving needs of students and the goals of the education system.

Primarily, educational robots can offer a viable solution for one of the significant challenges that persist within the Indian context, that is, the lack of necessary resources and teaching faculties, as well as a reduced number of children attending school, especially in rural areas. With an estimated 430 million children aged 0-18, a substantial portion of the population resides in rural areas where the rural-urban enrolment ratio stands at 7:5 (Barik et al., 2019). Alarming statistics from the Annual Status of Education Report (ASER) 2019 reveal that nearly 60 per cent of rural students up to the age of 10 struggle with reading, and even after completing higher classes, many lack the ability to solve basic mathematical problems or comprehend textbooks from lower grades (Barik et al., 2019). Thus, the introduction of humanoid robots holds tremendous promise, particularly in locations across India with a scarcity of teaching faculties. Humanoid robots offer superior performance, as they can teach anywhere without experiencing stress or fatigue. Unlike humans, robots can maintain high levels of consistency and accuracy for extended periods without breaks. Given the increasing shortage of teachers in rural areas, the introduction of a single humanoid robot can have a profound impact, surpassing the capacity and performance of human teachers in terms of numbers (Barik et al., 2019). Also, these robots have the potential to revolutionise the learning experience of students by providing consistent and quality education to students in remote areas. Deploying humanoid robots can also supplement the existing educational infrastructure, offering personalised instruction, interactive learning experiences, and continuous support. This innovative approach can play a pivotal role in bridging the educational gaps and empowering students with the necessary skills for a brighter future.

In line with the findings of Barik et al. (2019), the introduction of educational robots in India also holds the potential to increase literacy rates and facilitate error-free knowledge transfer significantly. Firstly, educational robots provide 24/7 accessibility to educational content. Students can engage with the robots' interactive lessons and materials at any time, allowing flexible learning opportunities catering to individual schedules and preferences. This accessibility promotes continuous learning and enables students to reinforce their understanding of concepts outside traditional classroom hours. The automatic updates and extensive databases of educational robots ensure that students receive the most up-to-date and accurate information. These robots can access a wealth of knowledge across various subjects and disciplines, providing comprehensive and interdisciplinary learning experiences. Also, educational robots simplify the testing and evaluation processes by utilising real-time data analysis and offer personalised instruction. They can track students' progress, identify areas of strengths and weaknesses, and provide immediate feedback. This enables students to track their own growth, address areas that require improvement, and engage in targeted practice and revision. By collecting and analysing data on individual student's performance and learning patterns, robots can tailor instruction to meet each student's specific needs. This personalised approach enhances engagement, promotes a profound understanding, and supports individualised learning pathways.

Moreover, educational robots offer cost-effectiveness in comparison to traditional teaching methods. Once the initial investment is made, these robots can simultaneously deliver instruction to numerous students, reducing the need for additional resources and personnel. This cost-effectiveness makes educational robots a viable solution for resource-constrained settings in India, such as in rural areas, where access to quality education is often limited. Additionally, the multilingual capabilities of humanoid robots are particularly valuable in a diverse country like India. These robots can communicate and interact with students in different languages, accommodating linguistic diversity and ensuring effective communication between the robot and students (Engwall & Lopes, 2022). This facilitates better comprehension and engagement, especially for students who may feel more comfortable expressing themselves in their native language.

Thus, the integration of educational robots within the Indian education system represents a transformative opportunity. By leveraging technology and embracing the potential of educational robots, India can enhance the accessibility, quality, and equity of education. These robots have the capacity to support personalised learning, bridge resource gaps, and cater to the diverse needs of students across the country. As India continues to navigate the changing landscape of education, educational robots offer immense potential to revolutionise teaching and learning practices, ensuring a brighter future for all students.

Major Challenges

Although the introduction of educational robots in India is promising, the process must address numerous challenges for successful implementation. One of the major challenges is the lack of resources, including infrastructure, funding, and technological support. Many schools in India, particularly those in rural areas, face significant resource constraints, making it difficult to integrate educational robots into their classrooms. The quality and infrastructure of educational institutions vary widely across India (Sankar, 2020). While some schools may be well-equipped to integrate educational robots, others may lack the necessary resources and support systems. Limited access to technology and inadequate facilities hinder the adoption of these advanced tools (Kumar, n.d.). Addressing these institutional differences and ensuring equal access to educational opportunities for all students is crucial to avoid exacerbating existing educational inequalities.

India's cultural diversity is another significant factor that must be considered. With a multitude of languages, customs, and traditions across different regions, adapting educational robots to suit the diverse cultural contexts of India becomes a complex task. It is essential to ensure that the content and instructional methods employed by educational robots are inclusive and sensitive to the cultural nuances of the country.

The digital divide within the country also poses a significant challenge in India (Laskar, 2023). While urban areas have witnessed advancements in technology, a significant portion of the population, particularly in rural and remote areas, still lacks access to reliable internet connectivity and basic technological infrastructure. Bridging this digital divide and ensuring equitable access to educational resources and opportunities are crucial for the successful integration of educational robots across the country. Technological illiteracy among educators and students is another hurdle. Many teachers and students may need to gain the necessary skills and familiarity with educational robots and their functionalities. Providing comprehensive training and support to educators is vital to enable them to utilise these tools in the teaching-learning process effectively. Simultaneously, students must be empowered with the digital literacy skills required to engage with educational robots and benefit from their use.

The level of education provided by educational robots is also a pressing concern specific to India (van Ewijk et al., 2020). While robots can deliver strategies and solutions, they may lack the deeper understanding required to foster critical thinking and conceptual understanding in students. Striking a balance between providing guidance and promoting independent thinking is essential for educational robots to complement and enhance the existing pedagogical approaches in India.

Moreover, the psychological well-being and emotional growth of students must be considered (van Ewijk et al., 2020). Human interaction and emotional connection play a crucial role in the Indian education system. The consistent and neutral responses of robots may pose challenges in fostering emotional development among students. Creating a supportive and nurturing learning environment alongside the use of educational robots is essential to address this concern.

Finally, privacy becomes a critical aspect when implementing educational robots in India. The collection of sensitive data, such as audio and video recordings, during interactions with students, raises concerns about privacy and data protection. Safeguarding student privacy through robust security measures, informed consent, and data anonymisation is essential to build trust and ensure the ethical use of educational robots (van Ewijk et al., 2020).

Thus, the integration of educational robots within the Indian education system encounters specific challenges, including resource constraints, cultural diversity, the digital divide, technological illiteracy, institutional differences, level of education provided, psychological well-being, and privacy concerns. Addressing these challenges within the Indian context requires a comprehensive approach, including adequate infrastructure, cultural adaptation, training programs, digital literacy initiatives, and privacy safeguards. By addressing these challenges, India can harness the potential of educational robots to enhance teaching and learning experiences and promote equitable access to quality education.

Recommendation

Based on the analysis of challenges that hinder the effective implementation of educational robots in India, several measures can be taken to ensure the proper integration of educational robots into the Indian education system. First and foremost, it is crucial to create awareness among the general population about the benefits and potential of educational robots. Generating a positive attitude towards the implementation of educational robots can be achieved by educating people about the positive impact they can have on learning outcomes. According to Reich-Stiebert et al. (2019), involving stakeholders, including educators, policymakers, and the general public, in the design and decision-making processes can foster a sense of ownership and acceptance of educational robots.

Likewise, introducing educational robots at the early stages of schooling can be challenging, as it requires technical requirements and a supportive environment. To overcome this, educators must develop methods and approaches that make robotics fun and interesting for students. Educators can engage students in the learning process by incorporating hands-on and interactive activities using educational robots, fostering a sense of curiosity and exploration. Furthermore, providing quality training to teachers is crucial to equip them with the necessary skills to integrate educational robots effectively into their teaching practices. This training should focus on creating an interactive and engaging learning environment that maximises the benefits of educational robots (Papadakis, 2020).

Privacy and ethical considerations should also be made essential when dealing with personal details and interactions of students. Establishing secure privacy settings and adhering to ethical guidelines are necessary to protect the confidentiality and privacy of students. It is crucial to maintain trust and confidence in the educational system by ensuring the responsible use of personal information and data (van Ewijk et al., 2020) collected by educational robots.

Additionally, efforts should be made to bridge the digital divide and ensure equal access to educational robots and technology. Introducing educational robots initially in rural areas, where the digital disparity is more pronounced, can help address this divide. While it may require additional investment, ensuring equal access to technology across rural and urban areas is vital for providing equitable educational opportunities to all students.

By implementing these measures and investing in comprehensive planning, the potential challenges associated with integrating educational robots into the Indian education system can be overcome. This will pave the way for the effective use of educational robots and significantly enhance the learning experiences of students across the country. With proper awareness, engaging teaching practices, privacy safeguards, and bridging the digital divide, educational robots can become a valuable tool in transforming the Indian education system.

Conclusion

The transition from the traditional education system to educational robots is gradually progressing around the globe. Further research and improvement in artificial intelligence might come up with humanoids that could create paradigm shifts in the global education scenario. As a country leaping towards becoming a global leader, the introduction of humanoids into multiple sectors in India, especially education, is prospective. This can not only diminish the educational disparity and digital divide within the country but also enable rapid technological and economic advancement. With up-to-date knowledge transmission and personal attention using educational robots, the Indian education system can ensure quality education for rural and urban populations. In the Indian context, the introduction of education robots has the scope to boost its technological advancements. Although the process of integrating educational robots into the current education system has to overcome socio-economic, cultural and geographical challenges, the gradual introduction of educational robots within the country, especially in areas that do not have access to quality education, and further large-scale implementation-based on effectiveness, can be helpful. Thus, with the proper integration of educational robots into the education system in India, both the students and teachers can enhance their skills and knowledge and add to the nation's development.

Reference

Barik, A., Khatua, S., Nikam, R. K., Pal, S., & Gohil, P. (2019). Scope of Implementing Humanoid Robots at Educational Institutes in India's Perspective. *5th International Conference On Computing, Communication, Control And Automation (ICCUBEA)*, 1–6. https://doi.org/10.1109/ICCUBEA47591.2019.9128886

Ben-Ari, M., & Mondada, F. (2018). Robots and Their Applications. In *Elements of Robotics* (pp. 1–20). Springer International Publishing. https://doi.org/10.1007/978-3-319-62533-1_1

Broadbent, E. (2017). Interactions with Robots: The Truths We Reveal about Ourselves. *Annual Review of Psychology*, *68*, 627–652. https://doi.org/10.1146/annurev-psych-010416-043958

Catlin, D., & Blamires, M. (2019). Designing Robots for Special Needs Education. *Technology, Knowledge and Learning*, *24*(2), 291–313. https://doi.org/10.1007/s10758-018-9378-8

Cetin, M., & Demircan, H. O. (2020). Empowering technology and engineering for STEM education through programming robots: a systematic literature review. *Early Child Development and Care*, *190*(9), 1323–1335. https://doi.org/10.1080/03004430.2018.1534844

Chiang, F. K., Liu, Y. qiu, Feng, X., Zhuang, Y., & Sun, Y. (2020). Effects of the world robot Olympiad on the students who participate: a qualitative study. *Interactive Learning Environments*. https://doi.org/10.1080/10494820.2020.1775097

Iberdola. (n.d.). *Educational Robotics: Definition, Advantages and Examples - Iberdrola*. Retrieved October 11, 2022, from https://www.iberdrola.com/innovation/educational-robots

Engwall, O., & Lopes, J. (2022). Interaction and collaboration in robot-assisted language learning for adults. *Computer Assisted Language Learning*, *35*(5–6), 1273–1309. https://doi.org/10.1080/09588221.2020.1799821

Talentedge Learning Series. (n.d.). *Evolution of Education in India (Post Independence) - Talentedge Learning Series.* Retrieved October 11, 2022, from https://talentedge.com/blog/evolution-education-india-post-independence/

Han, J., & Kim, D. (2009). r-Learning services for elementary school students with a teaching assistant robot. *Proceedings of the 4th ACM/IEEE International Conference on Human Robot Interaction - HRI '09*, 255. https://doi.org/10.1145/1514095.1514163

Jena, P. K. (2020a). Impact of Pandemic Covid-19 on Education in India. *International Journal of Current Research*, *12*(07), 12582–12586. https://doi.org/10.24941/ijcr.39209.07.2020

Jena, P. K. (2020b). Online Learning During Lockdown Period for COVID- 19 in India. *International Journal of Multidisciplinary Educational Research*, *9*(5), 82–92. www.ijmer.in

Khanlari, A., & Mansourkiaie, F. (2015). Using robotics for STEM education in primary/elementary schools: Teachers' perceptions. *2015 10th International Conference on Computer Science & Education (ICCSE)*, 3–7. https://doi.org/10.1109/ICCSE.2015.7250208

Kory, J., & Breazeal, C. (2014). Storytelling with robots: Learning companions for preschool children's language development. *The 23rd IEEE International Symposium on Robot and Human Interactive Communication*, 643–648. https://doi.org/10.1109/ROMAN.2014.6926325

Kory, J. M., Jeong, S., & Breazeal, C. L. (2013). Robotic learning companions for early language development. *Proceedings of the 15th ACM on International Conference on Multimodal Interaction - ICMI '13*, 71–72. https://doi.org/10.1145/2522848.2531750

Kumar, Indu. (n.d.). Technology in Education: NDEAR. *Ministry of Education*. Retrieved July 11, 2023, from https://www.education.gov.in/shikshakparv/docs/Technology_Education_Background_note.pdf

Laskar, M. H. (2023). Examining the emergence of digital society and the digital divide in India: A comparative evaluation between urban and rural areas. *Frontiers in Sociology*, *8*, 1145221. https://doi.org/10.3389/fsoc.2023.1145221

Lau, K. W., Heng Kiat Tan, Erwin, B. T., & Petrovic, P. (1999). Creative learning in school with LEGO(R) programmable robotics products. *FIE'99 Frontiers in Education. 29th Annual Frontiers in Education Conference. Designing the Future of Science and Engineering Education. Conference Proceedings (IEEE Cat. No.99CH37011*, 12D4/26-12D4/31. https://doi.org/10.1109/FIE.1999.841676

Leoste, J., & Heidmets, M. (2019). The impact of educational robots as learning tools on mathematics learning outcomes in basic education. In *Lecture Notes in Educational Technology* (pp. 203–217). Springer International Publishing. https://doi.org/10.1007/978-981-13-7361-9_14

Mubin, O., Stevens, C. J., Shahid, S., Mahmud, A. al, & Dong, J.-J. (2013). A Review of the Applicability of Robots in Education. *Technology for Education and Learning*, *1*(1). https://doi.org/10.2316/journal.209.2013.1.209-0015

Papadakis, S. (2020). Robots and Robotics Kits for Early Childhood and First School Age. *International Journal of Interactive Mobile Technologies*, *14*(18), 34–56. https://doi.org/10.3991/ijim.v14i18.16631

Reich-Stiebert, N., Eyssel, F., & Hohnemann, C. (2019). Involve the user! Changing attitudes toward robots by user participation in a robot prototyping process. *Computers in Human Behavior*, *91*, 290–296. https://doi.org/10.1016/j.chb.2018.09.041

Rubenstein, M., Cimino, B., Nagpal, R., & Werfel, J. (2015). AERobot: An affordable one-robot-per-student system for early robotics education. *2015 IEEE International Conference on Robotics and Automation (ICRA)*, 6107–6113. https://doi.org/10.1109/ICRA.2015.7140056

Sankar, A. (2022). A Low Benchmark: State of Infrastructure in our Schools. *The Bastion.* Retrieved July 11, 2023, from https://thebastion.co.in/politics-and/education/a-low-benchmark-the-state-of-infrastructure-in-our-schools/

Sillanpaa, H. (2021). *Educational Robots for Children in Primary Schools*. Tampere University.

Sisman, B., Gunay, D., & Kucuk, S. (2019). Development and validation of an educational robot attitude scale (ERAS) for secondary school students. *Interactive Learning Environments*, *27*(3), 377–388. https://doi.org/10.1080/10494820.2018.1474234

van Ewijk, G., Smakman, M., & Konijn, E. A. (2020). Teachers' Perspectives on Social Robots in Education: An Exploratory Case Study. *Proceedings of the Interaction Design and Children Conference*, 273–280. https://doi.org/10.1145/3392063.3394397

Vega, J., & Canas, J. M. (2019). Pybokids: An innovative python-based educational framework using real and simulated Arduino robots. *Electronics (Switzerland)*, *8*(8). https://doi.org/10.3390/electronics8080899

Wang, Y. (2004). Context awareness and adaptation in mobile learning. *The 2nd IEEE International Workshop on Wireless and Mobile Technologies in Education, 2004. Proceedings.*, 154–158. https://doi.org/10.1109/WMTE.2004.1281370

You, Z., Shen, C., Chang, C., Liu, B. & Chen, G. (2006). A Robot as a Teaching Assistant in an English Class. *Sixth IEEE International Conference on Advanced Learning Technologies (ICALT'06)*, 87–91. https://doi.org/10.1109/ICALT.2006.1652373

Zhong, B., Zheng, J., & Zhan, Z. (2020). An exploration of combining virtual and physical robots in robotics education. *Interactive Learning Environments*, 1–13. https://doi.org/10.1080/10494820.2020.1786409

Research Article

Academic Achievement Motivation: A Comparative Study of Government and Private Secondary School Students during Pandemic Online Classes

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Abstract

The unexpected situation of uncertainty caused by COVID-19 forced the Indian education system to switch to online teaching mode to fill the gap created by the suspended formal offline mode of teaching across the country. The Covid-19 pandemic had a significant impact on the secondary level school education. The present study is focused on the impact of online teaching on the academic achievement motivation of secondary level students during Covid-19. Academic achievement motivation reflects to the need for a student's academic achievement and his/her readiness to accomplish important and valuable tasks to achieve perfect results. The data collected through a self-constructed questionnaire of academic achievement motivation relates to online teaching and learning. The sample of 200 secondary-level students, including boys and girls of private and government schools, was chosen by purposive sampling method in the present study. The data collected was analyzed on the basis of statistical measures such as mean, standard deviation, frequency polygon, skewness, kurtosis and CR test. The study reveals that during the COVID-19 era, the academic achievement motivation of private school students was significantly higher than that of government school students at the secondary level. Further, the academic achievement of secondary-level female students was significantly higher than boy students.

Keywords: Covid-19, online teaching, offline mode of teaching, academic achievement motivation, secondary-level school education.

Introduction

In 2020, the Indian education system was switched to the online mode of education to alleviate the loss in studies of students because of the unintended situation caused by the COVID-19 pandemic. There were many factors during Covid-19 which affected student's academic achievement at the school level. Academic achievement motivation is the motivation attained by academic activities. Academic achievement motivation significantly influences academic performance (Pandey, S. et.al 2018). Students who are motivated are likely to excel in their academic activities.

In Mothibi, G.'s 2015 study, the focus was on examining the connection between e-learning and students' academic performance in higher education. The results of this research highlighted a notable and favorable influence of ICT (Information and Communication Technology) on students' overall academic achievements. Similarly, Rajaee Harandi, S. in 2015, delved into the realm of e-learning's impact on students' motivation within higher education. The outcomes of this investigation corroborated that e-learning serves as a pivotal factor influencing students' motivation levels. Amidst the pandemic, the primary avenue for education was through online teaching, which demanded students embrace qualities of independence, responsibility, and persistence. These requirements inevitably influenced the motivational dynamics among students. In a study by Elshareif et al. (2021), titled "Effects of E-Learning on Students' Motivation to Learn in Higher Education," notable findings emerged. The research showcased noteworthy and positive correlations between the fundamental facets of e-learning and the motivation of students of Ajman University to engage in learning.

This study, which was conducted soon after the COVID-19 pandemic lockdown aims to find out the impact of online teaching on academic achievement motivation among secondary-level school students during a pandemic.

Literature Review

The literature review of e-learning, achievement motivation and academic achievement is presented in the following two subsections.

Related work on e-learning & achievement motivation:

In recent years, after covid-19 the impact of online education at different levels of education has been the subject of many researches. Goswami, M. P. et.al. (2021) revealed in their study that student motivation (Attention, Relevance, Confidence, and Satisfaction) and student outcomes (knowledge, skills, and attitudes) are significantly affected by e-Learning systems (Technical and electronic requirements, personal requirements, perceived value, and credibility of e-Learning) during Covid-19 period. They also found that constraints of online education are associated with gender and caste. The quantitative findings of the study done by Yahiaoui F. et.al (2022) revealed that personal requirements and the perceived value of e-Learning have a significant effect on students' motivation and outcomes. They investigated that there is an indirect significant effect of the perceived value of e-learning on student outcomes through student motivation. Their qualitative findings validated the usefulness of e-learning systems in motivating students and increasing their outcomes, especially when used in conjunction with an in-person learning system. In a study done by Kumar & Bajpai ((2015) the factors of gender and Socio-Economic Status (SES) produce significant differences in achievement motivation of college students of Sikkim state in relation to e-learning. The interaction between Gender and SES indicates the difference in achievement motivation of the students. They observed that male students have greater achievement motivation than females; the students of the upper SES group have a greater achievement motivation compared to the students of the lower SES group. Harandi (2015) investigated that in higher education there is a significant relationship between e-learning and students' motivation. Her findings indicated that when teachers apply e-learning, more motivation is generated by students and vice versa.

Related work on achievement motivation & academic achievement:

Karlina et.al. (2021) studied the impact of achievement motivation (AM) on learning achievement in accounting courses. The results indicated that there is an influence of AM on achievement among Economic Education in accounting course students at the University of Lampung, Indonesia.

Sivrikaya, A.H. (2019) studied the relationship between AM and academic achievement of the students. They found that according to gender, there was no significant difference in academic motivation scores and sub-dimensions. Pandey, S. & Singh, P. (2018) studied the effect of academic achievement motivation (AAM) on academic performance of students. The study aimed to find out the effect of age, gender and AAM on the academic performance of students. Results revealed the effect of AAM on academic performance. It was found that highly motivated students performed very superior in academic performance. In spite of this, the effect of age and gender on academic performance was found to be partially significant. Arulmoly, C. & Branavan, A. (2017) examined the impact of AM on students' academic achievement and learning outcomes in Mathematics among secondary school students in Paddiruppu Educational Zone in the Batticaloa District, Sri Lanka. The findings of this study revealed the effect of gender difference when mathematics learning outcomes were compared and also the effect on AM. It was also examined that academic achievement in mathematics is affected by the degree of motivation. Kumar, A. & Yadav, D. (2015) studied the academic achievement motivation (AAM) of senior secondary students. They found that private school students had more AAM than government school students at the senior secondary level. It was also found that girls had more AAM than boys at senior secondary level.

Oyedotun (2020) suggested that during a pandemic, the rapid change to online pedagogy in developing countries created inequities in the education sector due to a lack of devices and internet access in rural areas and limited training among teachers to impart teaching on the online platform. In this study, the main aim is to examine the impact of online teaching on the academic achievement motivation of girls and boys students studying in government and private secondary-level schools.

Definition of the Term used

Extrinsic and intrinsic motivations stand as foundational pillars in the realm of achievement motivation. Extrinsic motivation encompasses engagement that stems from external stimuli, such as incentives and rewards. Conversely, intrinsic motivation involves undertaking activities driven by the inherent pleasure or satisfaction derived from the activities themselves. Extensive research consistently demonstrates that extrinsic rewards frequently erode intrinsic motivation. As posited by experts in the field, a paramount element within the landscape of achievement motivation is the sense of self-directed competence.

Students' academic success is heavily influenced by their academic achievement motivation. This motivation, encompassing cognitive, emotional, and behavioral aspects of their investment in education, plays a central role in academic engagement (Tucker, Zayco & Herman, 2002).

As stated by Kumar, S. (2017), within an academic setting, achievement motivation embodies the passion for learning and the keenness to gain knowledge while fostering personal development. This dynamic factor ignites within a child the aspiration to excel and accomplish their goals.

Operational Definition

In the context of online classes, academic achievement motivation can be understood as the internal drive to excel in various academic pursuits, encompassing demanding assignments, exhaustive homework, virtual classroom engagements, collaborative discussions, independent study, and online examinations. This motivation is rooted in one's self-determination to thrive across these academic endeavours.

Objectives of the Study

The objectives of the study are:

1. To compare the academic achievement motivation of government and private secondary level students during online classes.
2. To compare the academic achievement motivation among girls and boys of secondary level schools during online classes.

Methodology & Tool of the Study

The method used is a Descriptive survey based on an ex post facto approach. In this method, information is collected without changing the environment (i.e., nothing is manipulated). This information is collected by using a self-constructed questionnaire because there is no standardized tool available to measure the effect of online teaching on the AAM of secondary-level students. The scale consisted of 30 items. The scale was classified into six dimensions and tabulated in table-1–

Table-1: Dimensions of Academic Achievement Motivation Scale

S.No.	Dimensions
1.	Persistence & Engagement
2.	Eagerness
3.	Competitiveness
4.	Confidence in success
5.	Goal setting & status orientation
6.	Compensatory effort

The scores range from 0-30. The first draft of the questionnaire was developed through discussion with the supervisor. Item analysis and validation were done by the 7 experts in the field of psychology, education and language. The tool items rated by the experts on the preliminary draft helped in establishing the content validity. For establishing validity the researcher first calculated the Item Content validity Index (ICVI). Then, the SVI, that is, the Scale Validity Index was calculated and found to be 0.82.

The reliability of this tool was established by the test-retest method. The coefficient of the reliability of the full scale was determined by Karl Pearson correlation Coefficient and the coefficient of reliability was 0.92.

Sample

For this study, schools were selected on the basis of purposive sampling method whereas simple random sampling was adapted for selecting the students from government and private secondary schools. The survey was conducted just after the lockdown period when schools were re-opened. The sample size for analyzing the responses of the students was 200, in which 100 students (50 boys+50 girls) were taken from government schools and 100 (50 boys+50 girls) from private schools. To calculate the data for finding out the effect of online teaching on the academic achievement of students, the sample was selected from the secondary level irrespective of their streams.

Results

On the basis of statistical analysis of the collected data the following analysis and interpretation was drawn with reference to the objectives of the study.

Academic Achievement motivation of secondary level students

One of the objectives of the study was to investigate the academic achievement motivation of secondary-level students. In relation to this objective, the analysis carried out is detailed under the following headings

Nature of Distribution of Academic Achievement Motivation Scores

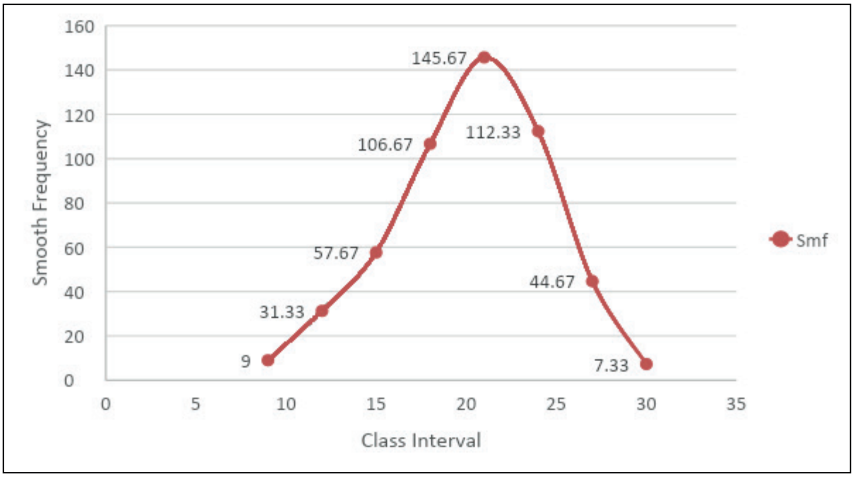
In order to scrutinize the nature of Academic achievement motivation scores in the selected population of government & private secondary school girls and boys, the scores procured on the self-constructed Academic achievement motivation scale were assorted in a tabular form. A frequency distribution of the scores was prepared, which is given in the table below:

Table-2: Frequency distribution of Academic Achievement Motivation Scores

Class Interval	Frequency	Smooth Frequency
29-31	0	7.33
26-28	22	44.67
23-25	68	112.33
20-22	67	145.67
17-19	32	106.67
14-16	23	57.67
11-13	8	31.33
8-10	1	9
Total	200	

The above table-2 reveals that the scores of academic achievement motivation are normally distributed, as most of the frequencies are concentrated at the centre and gradually decrease towards both ends of the distribution. To further ensure the representativeness of the sample frequency a polygon curve of the obtained score was prepared and studied (vide figure-1). The pictorial representation of the obtained scores on the academic achievement motivation scale confirmed the normal distribution of the sample.

Figure-1: Frequency distribution of Academic achievement motivation scores



Further to see the distribution divergence the values of mean, median, standard deviation, skewness and kurtosis were also computed which are shown in the table given below:

Table-3: Descriptive Statistical measures of Academic Achievement Motivation scores

Statistical Measure Variable	N	Mean	Median	Std. Dev.	Skewness	Kurtosis
Academic Achievement Motivation	200	21.09	22	3.94	-0.66	-0.35

Table 3 reaffirms the fact that the scores of total samples are accumulated at the centre of the distribution, besides the slight and insignificant negative skewness and slight platykurtosis in the distribution of scores of Academic Achievement Motivation. The value of skewness of achievement motivation scores was -0.66, which means the distribution was left/negatively skewed and the value of kurtosis was 0.03, which indicates the slight platykurtic nature of the distribution. Though there is a slight skewness and platy kurtosis in the scores of academic achievement motivation, this can be considered negligible, as these are very low which might be due to sample fluctuation and size of the sample overall. It is evident from the above mentioned statistical facts that scores of the study are almost normally distributed in the population.

The values for asymmetry and kurtosis between -2 and +2 are considered acceptable in order to prove normal univariate distribution (George & Mallery, 2010). Hair et al. (2010) and Bryne (2010) argued that data is considered to be normal if skewness is between -2 to +2 and kurtosis is between -7 to +7.

Comparison of the academic achievement motivation of government and private secondary school students

Hypothesis: 1

There is no significant impact of online teaching on the academic achievement motivation of government and private school secondary school students.

Table-4: Academic Achievement Motivation of Government and Private Secondary School Students

Category	N	Mean	Mean Difference	S_{ED}	CR	df	P	Interpretation
Government School	100	19.06	3.32	0.499	6.658	198	>.05	H_0 Rejected
Private School	100	22.38						

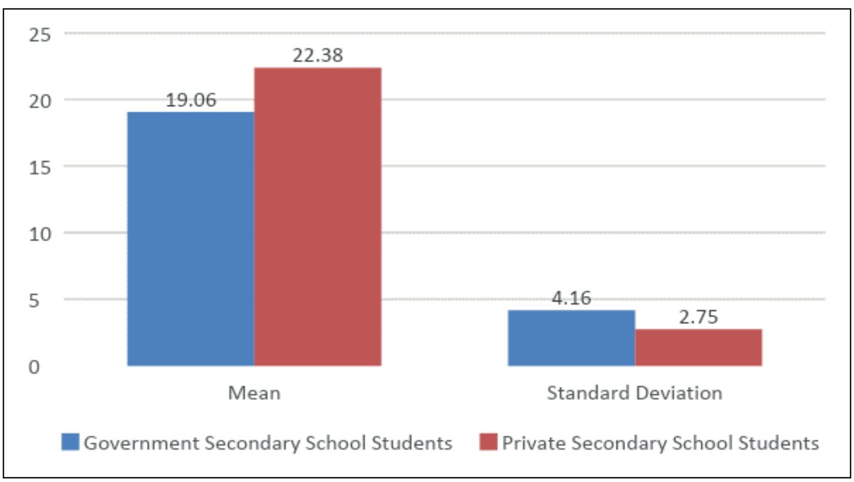
The above table-4 shows that the obtained t value, i.e. 6.658, is more than the table value with df 198 at .05 level i.e. 1.96 and .01 level, i.e. 2.59. This means that students of government and private secondary schools differ significantly in academic achievement motivation. Hence, Hypothesis No. 1, "There will be no significant impact of online teaching on the academic achievement motivation among government and private schools secondary level students" is rejected.

Table-5: Mean and Standard Deviation Values of Academic Achievement Motivation of Government and Private Secondary School Students

Categories	Mean	Standard Deviation
Government Secondary School Students	19.06	4.16
Private Secondary School Students	22.38	2.75

The mean value of achievement motivation scores obtained by government school students and private school students were found to be 19.06 and 22.38 respectively. It is clear from the above table-5 and figure-2 that government school students have a lower mean value than private school students. The standard deviation of both types of school were 4.16 and 2.75 which indicates more deviation in government school students than the private school students from their mean value.

Figure-2: Academic Achievement Motivation of Government and Private Secondary School Students



It has been found that there is a significant impact of online teaching on academic achievement motivation among government and private schools secondary level students. It can be concluded that students of government and private secondary schools differ significantly in their academic achievement motivation. This result is inconsistent with the findings of Pandey, S & Singh, P (2018) who found that the significant effect of AAM on academic performance and the findings of Kumar, A. & Yadav, D. (2015) who found that private school students had more AAM than government school students at senior secondary level.

Comparison of the academic achievement motivation among girls and boys of secondary level schools

Hypothesis: 2

There is no significant impact of online teaching on the academic achievement motivation of secondary level girls and boys.

Table-6: Academic Achievement Motivation among Girls and Boys of Secondary School

	N	Mean	Mean Diff.	SED	CR	df	P	Interpretation
Boys	100	19.85	1.79	0.532	3.36	198	>.05	HO Rejected
Girls	100	21.64						

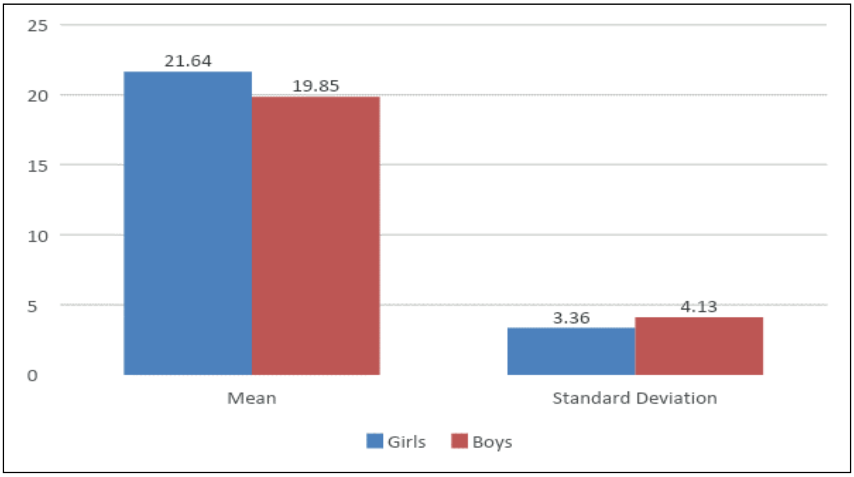
The above table-6 shows that the obtained t value i.e. 3.36 is more than the table value with df 198 at .05 level i.e. 1.96 and .01 level i.e. 2.59. It means boys and girls students of secondary school differ significantly in academic achievement motivation. Hence, Hypotheses No. 2, "There will be no significant impact of online teaching on the academic achievement motivation among boys and girls students of secondary schools" is rejected.

Table-7: Mean and Standard Deviation Values of Academic Achievement Motivation of Boys and Girls of Secondary Schools

	Mean	Standard Deviation
Girls	21.64	3.36
Boys	19.85	4.13

The mean value of achievement motivation scores obtained by girls and boys were 21.64 and 19.85, respectively. It is clear from the above table-7 and figure-3 that girls have a higher mean value than the boys group. The standard deviations of girls and boys were 3.36 and 4.13 which indicates more deviation in boys' group from their mean value.

Figure-3: Academic Achievement Motivation among boys and girls of Secondary School



It has been found that there is a significant impact of online teaching on academic achievement motivation among boys and girls of secondary schools. It can be concluded that male and female secondary school students differ significantly in their motivation for academic achievement. This result is consistent with the findings of Arulmoly & Branavan (2017) who revealed a significant gender difference when mathematics learning outcomes were compared and accounted for a significant effect on academic motivation and the findings of Kumar, A. & Yadav, D. (2015) who revealed that girls had more AAM than boys in senior secondary schools. The following findings are contrary to the findings of Sivrikaya, A. H. (2019), who revealed that there was no significant difference according to gender in academic motivation scale scores. Whereas Kumar, N. & Bajpai, R. P. ((2015) concluded that the factors of gender and SES produce significant differences in achievement motivation. The interaction between gender and SES being significant indicated that the difference in achievement motivation of the students was there due to the interaction effect of gender and SES. They observed that the achievement motivation of males was greater than that of females; the students of the upper SES group had a greater achievement motivation compared to the students of the lower SES group.

Limitations and Future Research

The present study has some limitations which could not be overcome due to a lack of time and resources that can provide direction for future studies. This study is delimited to the pandemic period. The finding of this study cannot be generalized to the entire population, but it does provide an overview of how students were managed with online teaching during the COVID-19 period. Future studies can be conducted on a broader scale to generalize the findings of the study. Future researchers should also consider other variables.

Discussion & Conclusion

The result of this study reveals that private secondary school students showed higher academic achievement motivation than government school students during the covid-19 lockdown period when online teaching was the only option to continue the education of the students. This might be due to the better facilities available to the students studying in private schools in comparison to the students studying in government schools. The availability of devices and internet access and training among teachers of private schools to impart teaching on the online platform as compared to government schools are the factors responsible for the difference in academic achievement motivation.

The result also shows that girls have more academic achievement for motivation than boys. This might be because girls are more concerned about their studies as compared to boys.

On the basis of the analysis of interpreted data, this conclusion has been drawn that online teaching was an effective and most important factor that affected the academic achievement motivation level of students during covid-19 lockdown.

Educational Implications of the Study

Teachers and students are the basic and essential units of the educational system whereas modes of teaching are fundamental spare parts. Furthermore, no teaching mode works until students and teachers are willing to receive that knowledge, this would happen only if motivation is there. Findings of the present study have a number of implications for stakeholders.

- After Covid-19 situation, there is need that the government should facilitate the alternatives of offline mode of teaching and learning in government schools.
- Teachers should use the appropriate teaching tools and soft skills in order to meet the needs, desires and requirements of the students. Moreover, they should be well-oriented towards the use of various digital tools and techniques of imparting information to the students. Teachers should provide opportunities for learning with alternative sources or other materials.
- Teacher's competencies and skills should be increased through teacher training programmes regarding the use of new technological methods of teaching so that they can be capable of catering for the needs of today's learners. This incorporation of digital tools in teacher training programmes can enhance the teaching skills, knowledge and abilities of pre-service teachers.
- Furthermore, in-service teachers should be more oriented towards the use of the latest tools and technology of teaching and learning by extension lectures by proficient educationist and other technical experts. They should be arranged frequently to impart upgraded knowledge about the new technological developments that can help the in-service teachers to enhance their teaching- learning strategies.
- Learners should be motivated to use computers and other digital tools for their basic requirements, for preparing assignments and projects, etc. This will enable them to understand the new technology in a better way.

References

Arulmoly, C., & Branavan, A. (2017). The Impact of Academic Motivation on Students' Academic Achievement and Learning Outcomes in Mathematics among Secondary School Students in Paddiruppu Educational Zone in the Batticaloa District, Sri Lanka. *International Journal of Scientific and Research Publications, 7(5)*. Retrieved from http://www.ijsrp.org/research-paper-0517.php?rp=P656380

Elshareif, E., & Mohamed, E. (2021). The effects of e-learning on students' motivation to learn in higher education. *Online Learning, 25(3)*, 128-143. Available at: https://doi.org/10.24059/olj.v25i3.2336

Goswami, M. P., Thanvi, J., & Padhi, S. R. (2021). Impact of Online Learning in India: A Survey of University Students during the COVID-19 Crisis. *Asian Journal for Public Opinion Research, 9(4),* 331–351. Available at: https://doi.org/10.15206/ajpor.2021.9.4.331

Karlina, R., Rizal, Y., Pujiati, P., & Maydiantoro, A. (2021). The influence of achievement motivation on learning achievement of Introduction to Accounting course. *International Journal of Educational Studies in Social Sciences, 1(1)*, 7–15. Available at: https://doi.org/10.53402/ijesss.v1i1.2

Kumar, N., & Bajpai, R.P. (2015). Impact of E-learning on Achievement Motivation and Academic Performance - A Case Study of College Students in Sikkim. 10th International CALIBER 2015, 370-382. Retrieved from https://ir.inflibnet.ac.in/bitstream/1944/1877/1/38.pdf

Kumar, S., (2017). Academic Achievement Motivation: Concept and Theory. *Global Journal for Research Analysis, 6(9)*, 572-573. Retrieved from https://www.worldwidejournals.com/global-journal-for-research-analysis-GJRA/recent_issues_pdf/2017/September/September_2017_1505391276__104.pdf

Kumar, A., & Yadav, D. (2015). A Comparative Study of Academic Achievement Motivation of Secondary Students. *Bhartiyam International Journal of Education & Research, 4(3)*, 33-39. Retrieved from http://www.gangainstituteofeducation.com/june/5.pdf

Mothibi, G. (2015). A Meta-Analysis of the Relationship between E-Learning and Students' Academic Achievement in Higher Education. *Journal of Education and Practice, 6,* 6-9. Retrieved from https://files.eric.ed.gov/fulltext/EJ1082408.pdf

Oyedotun, T. D. (2020). Sudden change of pedagogy in education driven by COVID-19: Perspectives and evaluation from a developing country. *Research in Globalization, 2*, 100029. Available at: https://doi.org/10.1016/j.resglo.2020.100029

Pandey, S., & Singh, P. (2018). Effect of Academic Achievement Motivation on Academic Performance of Students. *International Journal of Indian Psychology, 6(4)*, 42-56. Available at: https://doi.org/10.25215/0604.086

Rajaee Harandi, S. (2015). Effects of e-learning on Students' Motivation. *Procedia - Social and Behavioral Sciences*, 181. Available at: https://doi.org/10.1016/j.sbspro.2015.04.905

Sivrikaya, A. H. (2019). The Relationship between Academic Motivation and Academic Achievement of the Students. *Asian Journal of Education and Training, 5(2),* 309–315. Available at: https://doi.org/10.20448/journal.522.2019.52.309.315

Yahiaoui, F., Aichouche, R., Chergui, K., Brika, S. K. M., Almezher, M., Musa, A. A., & Lamari, I. A. (2022). The Impact of e-Learning Systems on Motivating Students and Enhancing Their Outcomes during COVID-19: A Mixed-Method Approach. *Frontiers in Psychology, 13*, 874181. Available at: https://doi.org/10.3389/fpsyg.2022.874181

Research Article

An Empirical Study Analyzing Selected Strategies for School Education in New Normal

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Abstract

In the present time, the education system has faced several disruptions and challenges due to the pandemic, but coped with the assistance of advancing Internet technology. To repair the damage and deterioration brought in education due to this largest disruption in the working of educational institutions all over the world, different strategies of learning and teaching were adopted by different countries. The present research work undertakes a systematic review of contemporary literature focusing on the major practices and strategies adopted by the different nations, during this challenging time of the new normal. It empirically explores and identifies the possible effective education strategies, which could be implemented by the Indian education systems in the new normal. The findings of this study will be fruitful for educators, policy-makers and other stakeholders in the field of education, especially in coping with the challenges imposed on primary and secondary education systems and designing future courses of action adequately and aptly.

Keywords: Learning strategies, Teaching strategies, Institutional strategies. New normal. Teachers' perception. Students' perception.

Introduction

The COVID-19 disease outbreak has led to the largest disruption in the working of educational institutions all over the world. It has adversely influenced roughly 1.6 billion students in more than 200 nations, irrevocably affecting 95 per cent of the world's student population, by the closure of educational institutions and other learning spaces. The imposed social separation has resulted in some substantial legislative reforms in education that are geared toward an "online pivot" (George, 2020). There has been a movement from a face-to-face teaching paradigm to a wholly online one, for the first time in the history of the Indian education system (Zimmerman, 2020). At the same time, the Global pandemic has brought tremendous changes in the educational system by introducing digitalization of educational practices, such as the introduction of several e-platforms like WebEx, Zoom, Google etc. During this span of the global pandemic, the education system in all the countries struggled and strove in different ways to deal with the inevitable challenges of the new normal like by incorporating virtual learning and by adopting innovative practices for educating their people. This research work has investigated numerous online research papers, newspaper reports, published documents and available literature by doing a systematic review of the selected published works and analysing distinct practices and innovative strategies adopted by different countries for education during this period of new normal. In order to find out the suitability of these innovative strategies, the current study empirically examined these commonly used educational strategies in the Indian scenario. The research suggests certain educational strategies which can be effectively implemented in this time of new normal in Indian schools.

Review of related Literature

In recent years, increasing attention has been paid to the use of learning strategies, learning attitudes, learners' emotions etc. to enhance learning satisfaction, which is a significant factor in evaluating the quality of learning (Ahmed et al. 2013; Mariza et al. 2015; Obergriesser and Stoeger, 2020), as learning strategies have been methods to produce, arrange or transform knowledge (Alexander et al. 1998). The present research explores strategies to enhance educational achievement and learning satisfaction in times of crisis caused by COVID-19. It studies by classifying learning strategies into three categories, i. e., learners-based strategies, educators-based strategies and institutional strategies, regarding the perception of learners and educators about the effectiveness of these strategies in the post-pandemic era. The pandemic wreaked havoc on the educational system, particularly among schoolchildren (Vegas, 2020). Children spent about half of their time on homework at home compared to what they would have spent in a classroom setting at regular times (Thorn & Vincent-Lancrin, 2021).Though Indian learners find technology and social networking tools useful for learning and are inclined to use them (Alvi, 2021), the biggest problem for Indian teachers and learners was adapting technology in a short period of time during pandemic. Several previous studies established that classroom dynamics and social activities lead to more successful, productive, and meaningful learning (Hurst et al . 2013; Carini et al . 2006), whereas online classes lack co-curricular activities (Lall and Singh 2020). Furthermore, studies reveal that characteristics such as age, gender, learners' computer skills and technology tolerance, learning habits, lack of awareness, interest, personal touch, and interaction, as well as connectivity challenges, have a significant impact on students' perceptions of online learning (Keller and Cernerud 2002; Arora and Srinivasan 2020). Studies also identified major issues in developing countries like India due to digital gap and infrastructural dimensions for online education platforms (Mishra, 2020); Many researchers have investigated and identified problems faced by teachers like their willingness to teach online and their resistance to change (Gratz and Looney, 2020); network troubles, a lack of training, a lack of awareness, a lack of enthusiasm, reduced student participation (Arora and Srinivasan, 2020; Kaup et al., 2020); external interruptions and family disruptions, a lack of training, a lack of technical support, ambiguity related to direction, an inadequate infrastructure, limited knowledge and understanding of online teaching platforms and security concerns, lack of course integration with technology, and low motivation (Joshi, A. et al, 2021); inappropriate behaviour of learners' including playing music, making noise, writing derogatory remarks, eating, and playing games in many windows (Punit and Qz.com, 2020). Despite all these challenges associated with online learning, Indian educational institutions began using web-assisted online classes to provide students with learning opportunities (Jain and Ruby 2020; Nandakumar 2020). Several other research studies have suggested different strategies and development in education system to cope with the challenges including and appropriate interface for learning and engagement, need of new paradigm, efforts for effective blended learning, enhancement of student teacher virtual communication (Chaturvedi, et al, 2021); development of new learning infrastructure experimentation and micro innovations (Schleicher, 2021a)); develop resilience perseverance collaboration, responsiveness and adaptability in the face of rapid changes and disruptions (Png. and Goh, 2021); health education, maintaining good hygiene, academic catch-up, remedial activities, parental engagement, developing essential skills and supporting social and emotional development (Rigall et al., 2021); online and remote learning, developing teachers and students for online and remote learning (OECD, 2021c); investing for the development of educators (Carver-Thomas, et al. 2021) close the digital divide, strengthen distance and blended learning, supporting social and emotional learning (Darling-Hammond, et al. 2020); designing an appropriate policy for schools; identifying the contextual factors that matter, developing new strategies to face the crisis (Goh & Tuga 2021). Considering all this previous research knowledge, this paper explores and analyzes the need to update and upgrade the education system towards online pivots and the digital mindset to cope with the problems presented before it in the recent time i. e. the post-pandemic new normal situation.

Objectives of the Study

The main objectives of a research paper are as follows:

1. To identify the challenges faced by learners and educators in the new normal.
2. To explore effective teaching strategies to be followed in the new normal.
3. To explore learning strategies that can be adopted in the new normal.
4. To analyse the difference between the perception of learners and educators about the selected teaching and learning strategies in the new normal.

Based on these objectives following hypothesis was formulated:

H0: There is no significant difference between the perception of learners and educators about the select education strategies in the new normal.

Research Methodology

The present study aims to analyse strategies to impart education effectively in the new normal. It is an empirical study, which tries to understand different challenges faced by educators and learners in the new normal. Through the review of contemporary literature, the researchers have identified various psychological and social problems, which are being faced by learners and educators in the present scenario. It studies by classifying learning strategies into three categories i. e., learners-based strategies, educators-based strategies and institutional strategies, with the perception of learners and educators about the effectiveness of these strategies in the post-pandemic era. The Research Design for the current study was exploratory research design that investigates the areas of research which have been under-researched earlier (Mason, 2002). The researchers used a non-probability convenience sampling method and took a sample of 102 respondents associated with school education. The research was conducted on a sample consisting of 78 teachers of primary and secondary education institutions and 24 students, belonging to two different schools in western India. The data was gathered using an online questionnaire, during the month of February - March 2022. It was the time when educators and learners were struggling to cope with the fear and challenges of reopening schools in the new normal. To enable the ease of data analysis the selected strategies were pre-coded. The statistical package (spss 23.0) was used to analyse the data obtained using a questionnaire. The selected strategies were pre-coded to facilitate the ease of data analysis. Data were analyzed using descriptive statistics mean, standard deviation and z-test.

Data Analysis and Interpretation

An overview of the demographic variables related to the gender, profession, income and domicile of the respondents participating in the present research study, is depicted in the table no. 1. The table shows the distribution of respondent according to gender is 34.3 per cent male and 65.7 per cent female, and so female respondents dominated the study.

The sample consists of 78 (76.5 per cent) educators and 24 (23.5 per cent) learners, which clearly indicates that the educators are keen to take part and adopt challenges imposed on the education system in the new normal. The distribution of the sample on the basis of family income per month, as shown in the table, depicts that among the respondents70 (68.6 per cent) are from the lower income group, whereas 32 (31.4 per cent) are from the higher income group. Thus the lower income group dominates the sample. The distribution of rural and urban respondents was 30 (29.4 per cent) and. 72 (70.6 per cent) respectively. It is clearly exhibited that most of the respondents belonged to urban areas as the selected educational institutions were from urban areas.

Table-1: Demographic Profile of the Respondents

Description	Distribution	Total	Percentage
Gender	Male	35	34.3
	Female	67	65.7
Category	Educators	78	76.5
	Learners	24	23.5
Family Income (per month)	Lower Income Group	70	68.6
	Higher Income Group	32	31.4
Domicile	Rural	30	29.4
	Urban	72	70.6

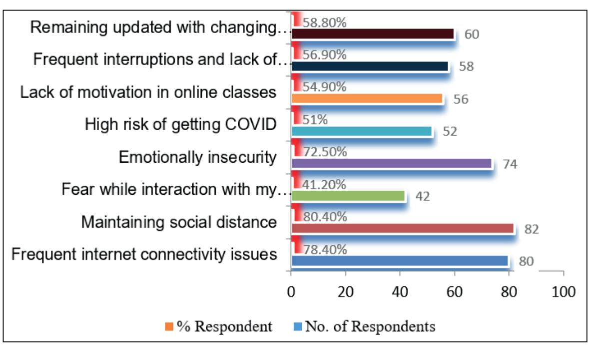
The present study aims to analyse strategies for effective education in the new normal. The study primarily tries to explore and identify the major challenges faced by educators and learners in the new normal. They have mentioned problems such as frequent issues related to internet connectivity, maintaining social distance while coming to the Institution, fear while interacting with colleagues and friends in the new normal, emotional insecurity, risk of getting COVID while coming to an educational institution, lack of motivation, frequent interruption and lack of attention in online classes and keeping pace with the changing policies and technology during new normal. In the present research, it is found that most of the respondents faced these challenges; the highly affecting issues are maintaining social distance in the new normal (80.4 per cent) and frequent internet connectivity issues (78.4 per cent), as depicted in table no. 2. Another challenge which is faced by most educators and learners is emotional insecurity (72.5 per cent) during times of crisis and in new normal situations. The challenge which has the least impact on the respondents in the new normal, is fear while interacting with colleagues and friends (42 per cent). It is probably on account of the long absence of social interactions during severe pandemic times that the respondents welcomed getting an opportunity to interact with their colleagues and friends. It is believed that if they follow guidelines, maintain hygiene and take precautions, there is no fear while interaction with colleagues and friends.

Table-2: Challenges faced in New Normal

Challenges	No. of Respondents	% Respondent
Frequent internet connectivity issues	80	78.4
Maintaining social distance	82	80.4
Fear while interacting with colleagues and friends	42	41.2
Emotionally insecurity	74	72.5
High risk of getting COVID	52	51.0
Lack of motivation in online classes	56	54.9
Frequent interruptions and lack of attention in online classes	58	56.9
Remaining updated with changing technology and policies	60	58.8

Figure 1 also demonstrates that approximately 75 per cent of respondents faced challenges of emotional insecurity, maintaining social distance, and internet connectivity issues and more than 50 per cent of respondents feared a high risk of getting COVID, lack of motivation, frequent interruptions and lack of attention in online classes as well as keeping updated with changing technology and government policies related to education system in new normal.

Figure-1: Challenges Faced in New Normal



The study also explores the perception of educators and learners regarding a few feasible selected strategies which were based on an extensive review of recent research on this pandemic situation and strategies adopted by different countries to cope with challenges in imparting education. For the present research study, from the review of the previous literature, 11 educational strategies have been selected and studied for their appropriateness in the new normal for school education. These studied strategies for better adaptability and effective education in the new normal, include three learning (SL-1, SL-2, SL-3), two educators-related strategies (SE-1, SE-2) and six strategies related to institutional effectiveness (SI-1, SI-2, SI-3, SI-4, SI-5, SI-6). The respondents were asked to indicate their perception of the effectiveness and possible implementation of these studied strategies i.e. 'Dividing the learners into groups based on their accessibility to the Internet'(SL-1), 'Dividing the learners on the basis of their approachability to the educational institution with low risk of exposure due to transportation etc.'(SL-2), 'Dividing the learners on the basis of their level of learning and ease of learning in online classes'(SL-3), 'By categorizing educators on the basis of their ease of using technology for teaching'(SE-1), 'By categorizing educators on the basis of their willingness to be trained for adopting new methods of teaching'(SE-2), 'By providing online learning education more effectively and increasing the quality'(SI-1), 'By providing Sports day, Activity day etc. for learners to make deal with social learning and emotional development issues'(SI-2), 'By adopting continuous classroom evaluation methods for substituting exams'(SI-3), 'By adopting oral exams more effectively as a substitute of final examination'(SI-4), 'By developing technology for better proctoring of online exams'(SI-5), 'By emphasizing qualitative assessment instead of quantitative evaluation'(SI-6).

To enable the ease of data analysis the selected strategies were pre-coded. Data were analyzed using descriptive statistics and the results of the descriptive statistical analysis of the perception of educators and learners regarding selected strategies are presented in table no. 3. The table exhibits the mean and standard deviation of different selected strategies. The mean scores of most of the selected strategies are above 3 and near 4, which explains that the respondents find these educational strategies highly significant in dealing with challenges faced in imparting education in the new normal. It may be inferred from the analyzed data that SL-1, i.e. Dividing the learner on the basis of their accessibility to the internet, is the least significant of these strategies with a mean score of 2.77. it is also evident that SI-2, with a mean score of 3.79, SI-5, with a mean value of 3.78 and SI-6 with a mean of 3.73, are considered the most appropriate strategies by both educators and learners.

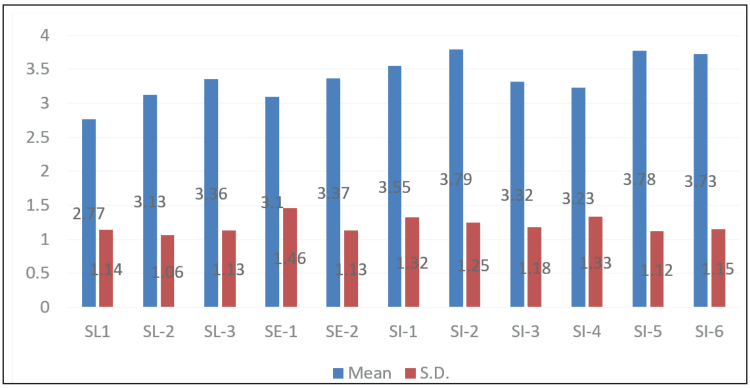
Table-3: Descriptive Analysis of the Perception of Educators and Learners

Strategies	Mean	S.D.
SL1	2.77	1.14
SL-2	3.13	1.06
SL-3	3.36	1.13
SE-1	3.1	1.46

Strategies	Mean	S.D.
SE-2	3.37	1.13
SI-1	3.55	1.32
SI-2	3.79	1.25
SI-3	3.32	1.18
SI-4	3.23	1.33
SI-5	3.78	1.12
SI-6	3.73	1.15

The figure 2 also depicts the descriptive statistics related to the respondents' perception about the studies strategies, which could be effectively implemented, to face the challenges in new normal in school education. And it is definitely clear that educators and learners both find all the selected strategies significant as the have mean score higher than 3, except SL-1.

Figure-2: Mean & S.D. of the Perception of Educators and Learners



Analysis of the difference in Perception regarding the Studied Strategies

H0: There is no significant difference between the perception of learners and educators about the select education strategies in the new normal.

The research study statistically tested the difference between the perception of educators and learners, with regard to different selected strategies, using the test of difference of means i.e. Z-test. The outline of each test is provided below in the table no. 3. The null hypothesis that H0: There is no significant difference between the perception of educators and learners with regard to different selected strategies, is statistically tested, whether the value of Z-test is higher than 1.96 and lesser than 2.58, it is significant at 5 per cent level. If the value is greater than 2.58, it is significant at the 1 per cent level, and the significant value indicates that the null hypothesis is not accepted. The test result given below shows clearly that there is a significantly high difference in the perception of educators and learners regarding SE-1 with ($Z=2.74$, $p<0.001$). It means that educators and learners perceive differently about categorizing educators on the basis of their ease of using technology for teaching. Similarly, for SI-1 i. e. providing online learning education more effectively and increasing the quality, the Z-test value is 1.99 ($p<0.05$), and for SI-3, i.e. adopting continuous classroom evaluation methods for substituting exams, the score is Z =1.99 ($p<0.05$). Therefore, it is evident that i.e. there is a significant difference in the perception of educators and learners regarding these strategies.

Contrary to the difference in the perception of educators and learners regarding strategies, the results of SL-1 with ($Z=0.05$, $p<0.05$), SL-2 with ($Z=0.67$. $p<0.05$) and SL-3 with ($Z=0.73$, $p<0.05$), show that there is no significant difference in the perception of educators and learners regarding these strategies. Similarly, the Z-test scores of SE-2 with ($Z=0.42$, $p<0.05$), SI-2 with ($Z=0.09$. $p<0.05$), SI-4 with ($Z=0.04$, $p<0.05$), SI-5 with ($Z=0.52$. $p<0.05$) and SI-6 with ($Z=0.08$, $p<0.05$) aptly depict that the perceptions of educators and learners regarding these other strategies do not differ significantly. Therefore, it can be concluded that both, educators and learners find all the studied strategies significant for coping with the challenges of the new normal in school education.

Table-4: Descriptive Analysis of the Perception of Educators and Learners

Strategy	Category	Mean	S.D.	Z-value	(2 tailed)
SL-1	Educator	2.65	1.11	0.05	NS
	Learner	3.17	1.17		
SL -2	Educator	3.10	0.97	0.67	NS
	Learner	3.21	1.32		
SL-3	Educator	3.38	1.01	0.73	NS
	Learner	3.29	1.49		
SE-1	Educator	3.54	1.34	2.74*	S
	Learner	1.67	0.76		
SE-2	Educator	3.42	1.18	0.42	NS
	Learner	3.21	0.98		
SI-1	Educator	3.33	1.33	1.99*	S
	Learner	4.25	1.03		
SI-2	Educator	3.68	1.27	0.09	NS
	Learner	4.17	1.09		
SI-3	Educator	3.73	0.89	1.99*	S
	Learner	2.00	1.02		
SI-4	Educator	3.08	1.29	0.04	NS
	Learner	3.71	1.40		

Strategy	Category	Mean	S.D.	Z-value	(2 tailed)
SI-5	Educator	3.74	1.11	0.52	NS
	Learner	3.92	1.18		
SI-6	Educator	3.62	1.15	0.08	NS
	Learner	4.08	1.10		

Discussion and Conclusions

The study aims to understand different learning strategies based on learners, educators, and institutions, which could be effective in the new normal. In order to explore, the effectiveness of selected educational strategies and how educators and learners perceive them, by using the structured instrument, the data was collected. the collected data was analyzed using descriptive statistics. The result of this study provides a clear understanding that there is a significant difference between the perception of educators and learners about these strategies. The research was carried out by adopting a descriptive quantitative, that used a questionnaire for data gathering. From the study, it can be safely concluded that the issues which have a greater impact and impose major challenges on all the educators and learners in the new normal, are mainly related to social distancing, managing emotional insecurity and dealing with internet connectivity issues.

The present study also establishes that most of the studied strategies are found significant by both learners and educators for coping with the challenges of the new normal. Both educators and learners are in favour of the adoption of the studied institutional strategies, to deal with the challenges of the new normal. Among the selected strategies, learners based strategy i.e. 'dividing the learners on the basis of their approachability to educational institutions with lower risk to exposure due to transportation' and 'dividing the learner on the basis of their level of learning and ease of learning in online classes' was found more appropriate and acceptable, than 'dividing the learner into groups based on their accessibility to internet'. It is established that both learners and educators believe that all learners should get better access to the Internet. The outcomes of this study support the conclusions that students prefer mixed-mode learning to e-learning (Tagoe, 2012), and students found blended e-learning, as suggested through some of the strategies in the current research, to be more appealing than web-assisted learning (Sharma and Alvi, 2021) adopted during a pandemic.

The present study also establishes that educators and learners are growing more adaptable to innovative educational strategies. The result throws light that imparting education in the new normal requires immediate attention from educational institutions to cope with the challenges of the new normal. From the current study it can also be concluded that educational institutions need to immediately deal with the rapidly changing needs of educational services. The research revealed that in the new normal, educational institutions should implement the studied strategies as per the needs of the environment and should help in curbing the anxiety and fear of the learners and become more effective as well as efficient in delivering educational services.

Recommendations and Suggestion

In uncertain times appropriate

measures are needed to be undertaken by Educational Institute to promote the development of an effective education system. Educational institutions should encourage for implementation of innovative learning Strategies and assist in making them more successful. Effective implementation of these learning strategies would help in filling the learning gaps created by the COVID-19 situation and also assist in coping with the challenges imposed on the education system by the Pandemic crisis. It is recommended that educational institution should empower their educators to take the initiative for the effective implementation of innovative learning strategies. A developed and effective education system is not only, needed to enhance knowledge and prepare learners mentally and professionally, but it is also required to maintain economic sustainability and global advancement. Educational institutions and educators must undergo training programs to maintain the quality of education.

De-limitations

There are some restrictions of this study that need to be acknowledged. One significant constraint of the research is the limited number of respondents in the sample. The study requires further empirical analysis with a larger number of respondents for generalization of the inferences drawn from the study. Secondly, the present research uses a self-rating questionnaire as measuring instrument, which might result in response bias as participants have a tendency to share socially appropriate responses instead of giving genuine responses. The study studies selected strategies to cope with the challenges in the new normal, but it did not throw much light on the other possible strategies which could be adopted and be a success. The study focuses on the challenges faced by Indian schools which are struggling to provide quality education in the new normal. However, considering the Indian scenario, all the educational institutions might not have suitable resources and infrastructure to implement these studied strategies.

Educational Implications

The present study will be advantageous for initiating successful learning strategies for students and educators as they are experiencing several challenges in the new. Learners and educators need to attain educational goals for which they require a face-to-face class schedule to learn, teach and effectively practice, but are unable to achieve so due to the pandemic crisis. Very few studies have empirically investigated the learning strategies, which can be successfully used by learners, educators, and institutions to deal with challenges imposed on the education system in the new normal. The present study aims to close this gap in the literature by taking a look at the use of these learning strategies and their impact on the perception of educators and learners. The finding of the current research would help in improving educational practices, as the basic objective of the study was to recognise successful learning strategies in copying these challenges. The study results will be useful to academicians, policymakers, teachers, psychologists, and research scholars in enhancing the educational achievements of learners in the present times of uncertainty due to this crisis. It will be beneficial in being prepared for such an unpredictable situation and in the effective implementation of innovative learning strategies for different types of learners. The study might well be helpful to schools and teachers in identifying effective teaching and learning practices by providing a better understanding of the challenges of learners and educators.

References

Ahmed, W., Greetje, V. D. W., Kuyper, H., and Minnaert, A. (2013). Emotions, self-regulated learning, and achievement in mathematics: a growth curve analysis. *Journal of Educational Psychology*, 105, 150–161. doi: 10.1037/a0030160.

Alexander, P. A., Graham, S., and Harris, K. R. (1998). A perspective on strategy research: progress and prospects. *Educational Psychology Review*, 10, 129–154. doi: 10.1023/A:1022185502996.

Alvi, I. (2021). College students' reception of social networking tools for learning in India: an extended UTAUT model. *Smart Learning Environments, 8(1).*https://doi.org/ 10.1186/ s40561-021-00164-9

Arora, A. K. and Srinivasan, R. (2020). Impact of pandemic COVID-19 on the teaching–learning process: a study of higher education teachers. *Prabandhan:Indian Journal of Management, 13(4),* 43-56. doi: 10.17010/pijom /2020/ v13i4/151825.

Carini, R. Kuh, .G. and Klein, S. (2006). Student engagement and student learning: Testing the linkages. *Research in Higher Education, 1,*1–32.

Carver-thomas, D., Leung, M. and Burns, D. (2021). California Teachers and COVID-19: How the Pandemic is Impacting the Teacher Workforce. *Learning Policy Institute*, Palo Alto, CA.https://learningpolicyinstitute.org/sites/default/files/product-files/California_ COVID_ Teacher_Workforce_REPORT.pdf

Chaturvedi, S. Purohit, S. and Verma, M. (2021). Effective teaching practices for success during covid 19 pandemic: Towards phygital learning. *Front. Educ.* 6:646557. doi: 10.3389/feduc.2021.646557

Darling-hammond, L. Schachner, A. and Edgerton, A.K. (2020). Restarting and reinventing school learning in the time of COVID and beyond. *Learning Policy Institute,* Palo Alto, CA. https://learningpolicyinstitute.org/sites/default/files/product- files/Restart_ Reinvent_ Schools _COVID_REPORT.pdf

George, M. L. (2020). Effective teaching and examination strategies for undergraduate learning during COVID-19 school restrictions. *Journal of Educational Technology Systems, 49(1),* 23–48. doi:10.1177/0047239520934017

Goh, C. C. M. and Tuga, B. J. (2021). Education in the time of COVID-19 and beyond: Lessons from six ASEAN teacher education institutions. *ASTEN Journal of Teacher Education, 1,* 1-3. https://po.pnuresearchportal.org/ejournal /index.php/asten/article/ view/1713/487

Gratz, E. and Looney, L. (2020). Faculty resistance to change: an examination of motivators and barriers to teaching online in higher education. *International Journal of Online Pedagogy and Course Design (Design), 10(1),* 1-14.

Hurst, B. Wallace, R. and Nixon, S. (2013). The impact of social interaction on student learning. *Reading Horizons, 52(4),* 375-398.

Jain, E. and Ruby, A. (2020). *Can India achieve its enrolment target post-pandemic?* www. universityworldnews.com /post.php?story=20200725092411819. Accessed 10 April 2022.

Joshi, A. Vinay, M. and Bhaskar, P. (2021). Impact of coronavirus pandemic on the Indian education sector: perspectives of teachers on online teaching and assessments. *Interactive Technology and Smart Education, 18(2),* 205-226. https://doi.org/ 10.1108/ ITSE-06-2020-0087

Kaup, S., Jain, R., Shivalli, S. and Pandey, S. (2020). Sustaining academics during COVID-19 pandemic: the role of remote teaching-learning. *Indian Journal of Ophthalmology, 68(6),* 1220-26.

Keller, C. and Cernerud, L. (2002). Students' perception of e-learning in university education. *Learning, Media and Technology, 27,* 55-67

Lall, S. and Singh, N. (2020). COVID-19: unmasking the new face of education. *International Journal of Research in Pharmaceutical Sciences, 11(1),* 48-53. doi.org/ 10.26452/ijrps. v11iSPL1.2122

Mariza, C., Irini, D., Anastasia, E., and Aggeliki, L. (2015). Motivational and affective determinants of self-regulatory strategy use in elementary school mathematics. *Educational Psychology*, 35(7), 835–850. doi: 10.1080/01443410.2013.822960.

Mason, J. (2002). *Qualitative researching* (2nd ed.). London: Sage.

Mishra, S. V. (2020). *COVID-19, online teaching, and deepening digital divide in India*. https://doi.org/10.31235/osf.io/wzrak

Nandakumar, P. (2020). *Startups redefine online medical education during COVID crisis*. https://www.theweek.in/news/india/2020/06/27/startups-redefine-online-medical-education-during-covidcrisis.html. Accessed 12 April 2022.

Obergriesser, S., and Stoeger, H. (2020). Students' emotions of enjoyment and boredom and their use of cognitive learning strategies–How do they affect one another? *Learning and Instructions*. 66, 101285. https://doi.org/10.1016/j.learninstruc.2019.101285.

OECD. (2021). The state of school education - one year into the COVID pandemic. *OECD Publishing*, Paris.

Png, J. L. H. and Goh, C. C. M. (2021). The impact of the COVID-19 pandemic on teacher education in Singapore. *ASTEN Journal of Teacher Education Spl. Issue 1*, 14- 17. https://po.pnuresearchportalorg/ejournal/index.php/asten/article/view/ 1708/482

Punit, I. S. and QZ.COM. (2020). *For many of India's teachers, online classes amid lockdown have been an awful experience* [Web log post]. https://scroll.in/article/961738/ formany-of-indias-teachers-online-classes-amid-lockdown-have-been-an-awful-experience.

Riggall, A., Kashefpakdel, E., Mullan, J., Rajagopalan, K., Sutoris, P. and Korin, A. (2021). *Covid-19 and the non-state education sector. Education Development Trust, Reading,* UK. https://www.educationdevelopmenttrust.com/our-research-and-insights/research/covid-19-and-the-non-stateeducation-sector

Schleicher, A. 2021. The state of global education - 18 months into the pandemic. *OECD,* Paris. www.oecd.org/education/the-state-of-global-education-1a23bb23-en.htm

Sharma, A. and Alvi, I. (2021). Evaluating pre and post COVID 19 learning: An empirical study of learners' perception in higher education. *Education and Information Technologies*. https://doi.org/10.1007/s10639-021-10521-3

Tagoe, M. (2012). Students' perceptions on incorporating e-learning into teaching and learning at the University of Ghana. *International Journal of Education and Development using Information and Communication Technology, 8(1),* 91-103.

Thorn, W. and Vincent-lancrin, S. (2021). Schooling during a pandemic: The experience and outcomes of schoolchildren during the first round of covid-19 lockdowns. *OECD Publishing*, Paris. https://doi.org/10.1787/1c78681e-en

Vegas, E. (2020). *Reopening schools: Insights from Denmark and Finland*. In Allen, J. R. and West, D. M. (Eds.), Reopening the World: How to Save Lives and Livelihoods, 92-95. Brookings Institution, Washington, DC. https://www.brookings.edu/wp-content/ uploads/ 2020/06/ Brookings-Reopening-the-World-FINAL.pdf

Zimmerman, J. (2020). *Coronavirus and the great online-learning experiment. the chronicle of higher education.* Available at: https://www.chronicle.com/article/ coronavirus-and-the-great-online-learning-experiment/ (accessed on April 2022).

Research Article

A conscientious literature review of Flipped learning strategy as a means of enhancing student engagement

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Abstract

Researchers and educators have often searched for alternative strategies and methods to teach students according to the needs of the 21st century. Developing higher-order skills among learners has become the need of the hour and new pedagogical approaches are required for the same. Among such approaches, the inverted classroom strategy, popularly known as the "Flipped classroom" is one such innovative pedagogical strategy where learning is student-centered. Under this inductive approach, classroom instruction is done at home with the help of videos and interactive lessons, and work done outside the class is now done in class with the teacher as a guide. Since flipped classroom aims at providing higher-order skills to students which is possible when students engage in activities that include interaction between students and staff and between students - thus related to the concept of student engagement. Student's participation in active learning and conditions favorable for higher-order skills is recognized as student engagement by Coates (2008).

In order to gain a deeper understanding of how flipped classroom learning strategy affects students, a need was felt to review different studies and steer through comprehensive quantitative and qualitative data.

Keywords: Flipped classroom approach, innovative pedagogical strategy, student engagement, higher-order skills, active learning.

Introduction

"We need technology in every classroom and every student and teacher's hand, because it is the pen and paper of our time, and it is the lens through which we experience much of our world."

- David Warlick (2015)

For ages, our education system has been based on the central pillar of the traditional teacher-centred approach to learning. The entire focus is on establishing the expertise of teachers in embedding the essential pedagogical skills and methods. This historical lecture method is being questioned nowadays by educationists because they are of the opinion that through this, the students are less attentive, mere passive learners and moreover, the courses are not delivered according to the individual learning needs. Also, it becomes difficult to teach higher-order thinking skills such as application and analysis using this age-old practice. Students often cram up before exams which results in attaining just the superficial knowledge rather than understanding the grass-root level.

Recent educationists have advocated a change in the teaching-learning process using technology to provide active learning and holistic engagement, which is the essence of the constructivism theory of learning. This has led to a push to discover new student-centred teaching and learning methods where the teachers and students have new roles. Flipped learning strategy is one of such methods which provides an active learning environment for both the teachers and the learners (Sharma & Chowdhry, 2021). This technological strategy includes a large variety of activities both inside and outside the class, also may embrace a wide range of approaches, such as debates, discussions, quizzes, and presentations. The flipped classroom model seems to cater to the challenges faced by the traditional learning methods and does the groundwork for using classroom time for engaging in higher levels of skills as mentioned in Bloom's taxonomy.

Flipped learning-an active learning strategy, tends to engage and encourage students to enhance their knowledge and advance their skills (Prince, 2004). Student engagement has often been associated with improving the learning environment as it enables the students to actively participate in classroom activities. It broadly refers to student's engagement in various inside and outside classroom activities that contribute to their learning achievements and their sense of belonging in the academic community. Here Flipped classroom strategy plays a significant role. Keeping this in view, it becomes invariably essential to study the effects of the flipped learning strategy on student engagement and how it helps the learner develop higher-order thinking skills.

Outlining the Flipped Learning Strategy

The flipped learning strategy is often referred to as a type of blended learning which makes use of both the traditional and modern technological aspects of education. In this type of strategy, the students have to watch videos or listen to audio lessons at home and then have to respond actively to the discussions, quizzes, and brainstorming sessions in the class (Sharma & Chowdhry, 2018). Munir, Baroutian, Young, and Carter (2018) state that "Students can watch from mobile devices at any time and come back to class with questions for the teacher, so they have more flexibility and the opportunity to learn independently. Keeping up with the class is no longer an issue for students who process ideas slowly while faster-thinking students can avoid boredom". A flipped classroom enables students to be pre-prepared for the class by already going through the topic before class and then utilizing the face-to-face interaction time in the class for discussions, problem-solving, application, and analysis of the content learned. Here, the students can start doing the exercises as soon as the class starts, and the lecturer supervises their progress and addresses their queries. As a result, students get more engaged and are less likely to give up due to frustration.

Outlining Student Engagement

Student engagement is the extent of engrossment, eagerness, certainty, interest, and devotion that students exhibit in the process of teaching and learning. Kuh, Kinzie, Buckley, Bridges & Hayek (2007) defined engagement as a form of partaking in educationally effective practices to result in several assessable outcomes. Student engagement is primarily associated with the student's interest, attention, and zeal during the learning process. They are highly motivated to learn when they are curious, interested, and engrossed in the learning process.

According to Blumenfeld, Phyllis & Paris, Alison. (2004), "Student engagement is a multidimensional (multifaceted) construct that can be measured with all the dimensions dynamically interrelated. Its major three dimensions are:

- Behavioral engagement refers to students' participation in class, such as their attendance and concentration levels, along with their participation in social aspects of learning and whether or not they participate in extracurricular activities, all fall under the category of behavioural engagement.
- Emotional engagement refers to the feelings that students have, particularly in relation to the topic or class that they are currently enrolled in, their instructor, their classmates, and their entire academic experience.
- Cognitive engagement refers to the enthusiasm and effort that students put into their own education. It also includes how much they take responsibility for their own learning, how well they can regulate themselves, and how much effort they exert to reach their own educational goals.

The involvement of educational technology has established a favorable environment for the students to learn and attain higher-level skills, thus giving them more opportunities to engage themselves in other learning processes. Various studies like Danuri, Dwee, Jamari, and Samad (2017) and Gilboy, Heinerichs, and Pazzaglia (2014) have advocated that teachers must apply flipped learning strategies to enhance student engagement in the learning process.

Engaging in the flipped classroom

The flipped classroom strategy makes use of an active learning and problem-solving approach where the learners familiarise themselves with the course being taught beforehand to facilitate discussions in the classroom. Mason, Rutar, Teodora, and Cook (2013) in their studies found flipped classrooms an effective approach and performed better in their academics. Studies have shown that a positive and supportive relationship with the lecturers can lead to better behavioral, emotional, and cognitive engagement. White et al. (2017) have also suggested a preference for flipped classroom instruction in their studies. Students have shown a synergistic relationship between preparation for class and in-class learning, which is visible in the higher results after student assessment. Flipped classroom learning connects both the previous and current learning experiences and keeps students mentally engaged in the topics. This is an essential element of student engagement that the flipped classroom strategy depicts. The flipped classroom proved a boon in the current pandemic situation. Therefore, it becomes essential to study further its effect and relationship with various aspects of education. Keeping all this in mind and to gain insight into the impact of flipped classroom strategy on multiple dimensions, the related studies were surveyed to analyse the relationship between student engagement and flipped classroom instruction. The variables of research are Flipped classroom instruction and student engagement.

Rationale of the study

In the midst of a pandemic, the flipped classroom proved invaluable. As a result, it is critical to better investigate its impact and link with many components of schooling. With this in mind, and in order to obtain insight into the influence of the flipped classroom method on several dimensions, various associated research were surveyed in order to examine the relationship between student engagement and flipped classroom instruction. Students in a flipped classroom have more opportunities to interact with course materials outside of class, which improves their active learning and, in turn, their ability to retain and apply what they've learned. By analyzing the impact of this approach on student engagement, teachers can better cater their lessons to students' unique requirements and interests, ultimately improving the quality of their students' educational experiences. Educators can create a stimulating and interactive classroom where students can think critically and have a deeper understanding of the material if they have a firm grasp of the effect this method has on student engagement. By analyzing the impact of the flipped classroom strategy, educators can evaluate its efficacy and make the necessary adjustments to improve student engagement and learning outcomes. This assessment will facilitate the continuous development of instructional practices, ensuring that students receive the most effective and engaging learning opportunities possible.

Objectives of the study

- To assess whether the flipped classroom approach enhances students' intrinsic motivation to learn and participate actively in the learning process thereby leading to improved student engagement in the class.
- To determine if the flipped classroom strategy leads to improved academic performance in terms of grades, test scores, or mastery of key concepts.
- To determine if the flipped classroom method promotes increased student collaboration, peer-to-peer interaction, and cooperative learning experiences.
- To identify whether the flipped classroom approach increases students' active engagement in class discussions, group activities, and other interactive learning experiences.
- To analyse whether the flipped classroom method enhances students' ability to take responsibility for their own learning, self-regulate their study habits, and develop lifelong learning skills.
- To examine the effectiveness of the flipped classroom strategy in promoting critical thinking and problem-solving skills among students.

Review of related literature

The research done in the past 17 years (2023-2007) was collected in order to survey the literature on the variables i.e. Flipped Classroom Learning Strategy, Student Engagement. For this study, the researcher gathered related study reports, various periodicals, published reviews and research abstracts. The researcher mainly focused on the studies that established a relationship or analysed the effect of the Flipped learning strategy on student engagement and academic achievement. Obtaining pertinent data, categorising, and evaluating it took a lot of time. An extensive review of the Flipped learning strategy was done in order to gain more insight into the topic. Some of the shortlisted comprehensive reviews have been discussed here for reference. The following inclusion criteria were applied during the study's selection process:

- Research published in academic journals.
- Academic research (in schools, colleges, and universities).
- Studies examining the influence of Flipped classroom strategy on student performance.
- Studies with measurable outcomes of student performance (e.g., academic achievement, test scores, grades).
- Scholarly works that are published in English.

Naik (2023) assessed the effectiveness of the flipped classroom strategy on student performance. This literature research suggested that the flipped classroom approach improves student achievement. The flipped classroom paradigm improves students' academic achievement, involvement, critical thinking, and retention. Moreover, it also encourages active involvement, collaboration, and self-guided learning, which improves subject understanding. The study also suggested that the flipped classroom model has the potential to improve educational equity, foster a more welcoming learning environment, and better equip students for the challenges of the modern workplace.

The effectiveness of the Flipped classroom strategy in improving the student's learning outcomes was assessed by Paramita (2023). The main aim was to determine whether the Flipped Classroom learning method was able to effectively improve student learning outcomes, especially in English lectures. The research was quantitative descriptive research with a quasi-experimental design. There was a significant difference in the average mean gain scores of the control and experimental groups showing the positive effectiveness of the Flipped classroom strategy in improving the English skills of students.

Sarker, Pramath; Siddique, Md; Sultana, Sabina; and Pal, Subrata. (2023) conducted a study to examine the impact of the reversed classroom learning environment on student engagement and satisfaction relative to the traditional classroom. Using a 5-point Likert-scale questionnaire, a cross-sectional study was conducted to measure student engagement and satisfaction with both the traditional classroom and the reversed classroom. Data were received from 79 participants in the traditional classroom and 61 participants in the flipped classroom. The study revealed a significant difference between traditional and flexible classrooms in terms of student engagement and satisfaction. Students were more engaged and satisfied with flipped classrooms than with traditional classrooms, according to the results.

In a quasi-equivalent, non-randomized factorial design, Nja and Anari (2022) assessed flipped classroom students' chemistry and academic performance attitudes. The study of 100 students employed a 30-item chemistry attitude questionnaire. Pretests were given to controls and experiments. The control group was taught traditionally, whereas the experimental group was flipped. Experimental group students took a post-attitude test. The post-attitude score was much higher than the pre-attitude score. Academically, students outperformed the average. These findings imply that flipping the classroom may improve students' chemistry attitudes and performance. The Flipped classroom strategy enabled students to review lecture videos at home in order to fully comprehend the material.

Rehman (2022) conducted a pilot study

at a local secondary school to determine the efficacy of digital literacy in terms of Flipped classroom instruction. A seventh-grade science class was inadvertently flipped and compared to a traditional classroom setting to evaluate the student's academic achievement. The study population consists of all 259 male and female pupils in seventh grade during the first semester of the 2019-2020 academic year. The results indicated that there is a statistically significant difference between the achievement scores of students in the Flipped classroom and those of students in the traditional classroom. Students in flipped classrooms performed better than those in traditional classrooms. In a Flipped classroom environment, student responses to a Likert scale survey revealed increased engagement, interaction, and depth of learning.

The impacts of the flipped classroom on 4th-grade students' academic progress and motivation were examined by Erbil and Kocabas (2020). To conduct the study, they used three experimental groups and one control group. They look at the results of using both flipped classrooms and cooperative learning at the same time and separately. The experimental method of research was adopted by forming four groups- three experimental and one control group. The findings of the study revealed that the flipped classroom approach, collaborative learning method, and both methods together have a positive impact on students' academic performance.

Hakimzade (2020) carried out a study to see the effect of the flipped classroom method on student engagement and academic performance of high school students. Traditional lectures and flipped classroom training were used to teach 56 randomly selected students for experimental research for a period of 20 weeks. The results of the experiment show that the experimental group's academic performance improved significantly, and student involvement across all four dimensions, i.e., behavioural, cognitive, emotional, and factor engagement, was higher than average, demonstrating the beneficial effects of flipped classroom education.

Stratton, Chitiyo, Mathende, and Davis (2020) compared flipped classrooms versus one-to-one classrooms in middle school scientific accomplishment and student perspective. During the study, 7th-grade students' academic performance and attitudes toward flipped classrooms were evaluated. Eighty-one students were taught in the traditional manner, while the remaining 73 were taught using a flipped learning model. In terms of academics, there wasn't much difference between the two groups. A surge in student engagement and motivation in the flipped classroom was observed.

Alamri's (2019) carried out research on students' academic success, performance, and satisfaction in a flipped classroom environment. Mixed-method research was employed to obtain data through surveys, interviews, and achievement assessments. The findings showed that nearly all students improved their academic standing and overall happiness as a result of the research. Online resources, peer group conversations, and the teacher's role all led to better levels of learning and active participation.

A research study by Soler et al. (2019) described the implementation and results of applying a flipped classroom strategy for teaching-learning. A sample of around 3000 students was taken in 17 different subjects at the university level. Their results revealed an increase in students' motivation and class attendance. Also, a comparison of final exam results of traditional and flipped classrooms revealed a decline in students' failure rate, proving that flipped classrooms improve students' learning.

Sun, Hu, Wan, Fu, and Wu did research in 2019 "to find out how pre-service teachers' ideas about engagement change in the flipped classroom." The study was done with 53 teachers-to-be in China who were taking classes on curriculum development. It was concluded that the flipped classroom could help students become more interested. The t-test results demonstrated that flipped learning had a positive effect on student performance regardless of the student's cognitive style. The study is regarded as a reliable resource for anyone interested in implementing the flipped classroom method in their courses.

"A qualitative study of student engagement in a flipped classroom" was done by Utheim and Foldnes in 2018. Twelve students were asked in-depth questions about how they learned with and without flipped classrooms. The first semester, they taught by flipping the classroom, and the second semester, they taught by giving lectures. The results showed that the flipped classroom had a strong effect on the emotional side of student engagement, in addition to improving the cognitive and behavioural sides.

In their 2017 study on Exploring students' engagement in writing using the flipped classroom approach was conducted by Danuri, Dwee, Jamari, and Samad. The study was conducted on 118 student volunteers with the help of a self-made questionnaire. Most of the students agreed that the flipped classroom approach forced them more likely to use the online platform as a source of information and helped them to do their assignments in a more interactive way. Respondents were of the opinion that the flipped classroom method made their learning easy and engaged them on all three levels: behavioural, emotional, and cognitive.

Rani and Muniandy's (2017) studied the effect of flipped classroom strategy on student engagement. The sample of the study comprised of 43 computer science students chosen through "purposive sampling" and given a "quasi-experimental" test. The results showed that the experimental group, i.e., the students who were taught in the flipped classroom, were more engaged and were able to apply academic concepts to a real-world situation.

Smallhorn (2017) studied flipped classrooms to boost student participation. To gauge student participation, 110 university students took part in a flipped classroom session. The entire course was on moodle. Students prepared for class by watching internet videos and resources. For analysis, surveys, student attendance, learning data records, and formative outcomes before and after flipped classroom methods were employed. Results showed a surge in positive attitude and student engagement. 95 per cent of kids found flipped classrooms positive and lively.

In an experiment involving 57 junior high school students, Mian (2016) examined the impact of student involvement on the flipped classroom. Flipped classroom education was also part of their research. To better understand student engagement, they looked at how students behaved as well as how they thought. According to the research, flipping the classroom increased both the behavioural and general levels of student involvement. An increase in the amount of time spent interacting between students and teachers, as well as between students in the same peer group, was discovered to be associated with a positive outcome in the study's findings.

Mohanty (2016) conducted a study on the efficacy and applicability of Flipped Classroom Instruction by comparing 8th graders' learning outcomes in History and Science under flipped versus regular education. 90 Odisha primary school children were divided into control (conventional) and experimental (flipped) groups. After one month, post-test scores were compared to study instructional treatments. The resulting "t" values of both groups' post-test scores were significant at p 0.01 and confirmed the difference between control and experimental groups. The significant difference between flipped and traditional instructional groups' mean scores proved the favourable influence of the flipped model on History and Science learning outcomes.

In a secondary mathematics classroom, the effects of the flipped model of instruction on student engagement and performance were researched by Clark (2015). Pre and post-surveys, unit tests, interviews, and focus group sessions were used to assess the changes in students' perceptions. Results revealed that students were more engaged and involved in the flipped classroom as it allowed for optimum utilization of class time and used hands-on activities and project-based learning strategies. In comparison, there weren't any significant changes in the academic performance of students.

Jamaluddin, Md Osman & MD Osman (2014) investigated the use of the Flipped Classroom approach to enhance engagement and promote active learning." A quantitative descriptive survey was conducted on 24 undergraduate students. The results showed the effect of Flipped Classroom on engagement in the following sequence, with emotional engagement being the highest, followed by behavioural, cognitive, and agentic engagement. The results showed that flipped classrooms helped lecturers achieve their goals and helped in making the teaching-learning process more engaging, active, and student-centred. The study also revealed that flipped classroom learning improved active learning both inside and outside the class.

Tsimerman (2014) did a conference paper on the Flipped-Classroom Approach to analyze its effect on future learning. The study investigated students' assessments of the flipped classroom approach in an undergraduate course at the College for Academic Studies in Israel. The learners prepared for classes by watching videos in out-class activities, allowing the classroom to focus on discussion, exercises, and dialogue. The students stated that watching videos between lessons aroused interest, lessened boredom, and improved learning. They also reported that it increased their participation in learning, understanding of the learning material, and confidence in their capability to understand it.

Bishop and Verleger (2013) conducted a survey on flipped classrooms to analyze student perception of the same. The results of the survey showed that students had a positive perception of the flipped classroom. But as far as video lectures are concerned, they preferred in-person lectures, whereas they preferred interactive classroom activities over lectures. Evidence suggests an improvement in learning for the flipped classroom as compared to a traditional class. They recommend carrying out controlled experimental research to analyze the learning outcomes of the flipped classroom.

Another study, namely," The Flipped Classroom: Cultivating Student Engagement" by Tetreault (2013), examined the research on the flipped-classroom approach to education. Here, three case studies were reviewed, which served as exemplars of the flipped classroom approach. In conclusion, the benefits of flipped classrooms as evident in these three case studies, included increased engagement, individualized education, enhanced higher-order thinking skills, and active and supportive learning by sharing of resources. They insisted that the flipped classroom approach should make use of simple, accessible, and familiar technology to be beneficial for both learners and educators.

Marlowe (2012) investigated the effect of the flipped classroom on student achievement and stress. Students were made to watch their lectures outside the class and were asked to do their second-year college assessment in the class. Students showed improvement in their semester results and reported lower stress levels. Students found this approach exciting and displayed positive feelings towards the treatment.

A study, namely," Flipping the Classroom to explore active learning in a large undergraduate course," was conducted by Zappe, Leicht, Messner, Litzginer, and Lee (2009). The traditional lecture was replaced by watching online videos so that more active learning, such as problem-solving, happens in the class. Assessment data were collected to examine students' perceptions of the flipped classroom for active learning and better understanding. They only preferred that half-course should be taught through a flipped classroom and half through the traditional classroom.

A research to study the effects of classroom flip on the learning environment was conducted by Owens and Strayer (2007). The study was conducted in the statistics class at the college level to compare traditional lecture/homework structure to the flipped classroom approach. The study suggested that though students felt more engaged in the flipped classroom, they were somehow less satisfied and showed unsettledness. It was advised not to implement a flipped classroom in any introductory class session.

Significant understanding gained from the scrutiny of the literature

- Several investigations have led researchers to the conclusion that the flipped classroom model is directly responsible for the rise in the level of student engagement; furthermore, this model and the rise in student engagement are closely interrelated. Research has indicated that using a flipped classroom method can make students more engaged in the material being presented in class.
- At both the secondary school and the senior secondary level, there is a continuing demand for psychometrically sound instruments that are both valid and reliable in order to quantify the level of student engagement.
- The process of digitalization and deciding on active learning methodologies can take a significant amount of time. For efficient implementation, adequate assistance is required, and this assistance must come from educational technology centres and technical instructional designers.
- Stimulation of affective dimension in the flipped classroom leads to a pleasant learning experience, which may be attributed to a feeling of being involved and of being noticed. This may be the case because the student feels like they are being acknowledged.
- Blended learning strategies, such as flipped classrooms, can be used in the medical and computer science fields to captivate students, encourage them to actively participate in problem-based learning sessions, and improve the quality of learning through the use of videos, flashcards, and many other similar aids. This can help students learn more effectively.

- Students' writing abilities can also be strengthened by engaging them in the flipped classroom model, in which videos and assignments are kept to the point, and students are aware of the specific learning goals they are working towards.
- Learners' motivation and interest can be piqued through the use of short and relevant videos, interactive sessions, and conversations. Students may have the opportunity to engage in meaningful learning with the implementation of the flipped classroom approach, especially the virtual flipped classroom approach (Sharma & Chowdhry, 2020).
- For enhanced student learning, teachers need to reflect on technical resources, professional needs, email accessibility, and students-focused pedagogy.
- Many studies have been conducted at the university and higher level. There still needs a lot of work to be done at the school level at high, middle, and elementary levels. The effect of the flipped classroom at the school level still needs to be explored.
- A number of studies have shown that students of the millennial generation have a preference for teaching methods such as the flipped classroom and that they are aware of the advantages of being presented with a variety of visual inputs, as well as more hands-on and practical approaches.

Conclusion

In conclusion, the Flipped learning strategy has indeed shown positive effects on student engagement. By flipping the traditional model of instruction students become more actively involved in their learning process. One of the main advantages of Flipped Classroom Learning is that it promotes active engagement and participation among students. By allowing students to review the lecture materials at their own pace and ability, they can deepen their understanding of the content and come prepared to engage in meaningful discussions and activities during class time. This not only encourages critical thinking and problem-solving skills but also fosters a sense of ownership in their own learning journey.

Moreover, the Flipped learning strategy enables students to personalize their learning experience. They can adjust their learning to their individual needs and preferences. This autonomy and flexibility in learning create a more inclusive and engaging environment for students, as their unique strengths and learning styles are taken into account. Another positive effect of the Flipped learning strategy is the enhanced teacher-student interaction. Teachers can dedicate more time to providing individualized support and guidance to their students. This personalized attention helps build stronger relationships between teachers and students, leading to increased student motivation, confidence, and overall academic performance. Furthermore, it encourages collaborative learning and communication skills. By engaging in group discussions, problem-solving activities, and project-based tasks during class time, students learn how to effectively communicate, collaborate, and negotiate with their peers.

Overall, the Flipped learning strategy has proven to be an effective way to boost student engagement. By promoting active learning, personalization, teacher-student interaction, and collaborative skills, it empowers students to take ownership of their education and prepares them for success in a constantly evolving world.

References

Alamri, Mahdi. (2019). Students' academic achievement performance and satisfaction in a flipped classroom in Saudi Arabia. *International Journal of Technology Enhanced Learning.* 11. 103. 10.1504/IJTEL.2019.096786.

Anna Therese Steen-Utheim & Njål Foldnes (2018) A qualitative investigation of student engagement in a flipped classroom, *Teaching in Higher Education*, 23:3, 307-324, DOI:10.1080/13562517.2017.1379481

Bahmani, & Javadipour, Mohammad & Hakimzadeh, Rezvan & Salehi, Keyvan & Alavimoghadam, Seyed. (2020). *Evaluating the rate of engagement and academic Achievement of high school students by using flipped classroom instruction* . 8. 35-49.

Bishop, J.L. & Verleger, Matthew. (2013). The flipped classroom: A survey of the research. *ASEE Annual Conference and Exposition*, Conference Proceedings.

Blumenfeld, Phyllis & Paris, Alison. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research* - REV EDUC RES. 74. 59-109. 10.3102/00346543074001059.

Clark, Kevin. (2015). The Effects of the Flipped Model of Instruction on Student Engagement and Performance in the Secondary Mathematics Classroom. *The Journal of Educators Online.* 12. 10.9743/JEO.2015.1.5.

Coates, H. (2008). *Attracting, Engaging and Retaining: New Conversations about Learning. Australasian Student Engagement Report. Camberwell: Australian Council for Educational Research.* Retrieved from http://research.acer. edu.au/ausse/16

Danuri, Norazmi & Dwee, Chiew & Jamari, Suzilla & Samad, Nurzarina. (2017). Exploring Student Engagement in Writing using the Flipped Classroom Approach. *Pertanika Journal of Social Science and Humanities*. 25. 663-674.

David Warlick. (n.d.). AZQuotes.com. Retrieved July 14, 2020, from AZQuotes.com Website: https://www.azquotes.com/quote/668464

Erbil, Deniz Gökçe & Kocabaş, Ayfer. (2020). Flipping the 4th-grade social studies course in a cooperative Way: Effects on academic achievement and motivation. *Studies In Educational Evaluation*. 66. 10.1016/j.stueduc.2020.100878.

Gilboy, Mary & Heinerichs, Scott & Pazzaglia, Gina. (2014). Enhancing Student Engagement Using the Flipped Classroom. *Journal of nutrition education and behavior.* 47.10.1016/j.jneb.2014.08.008.

Jamaludin, Rozinah & Md Osman, Siti Zuraidah & md osman, Siti. (2014). *The Use of a Flipped Classroom to Enhance Engagement and Promote Active Learning*. 5.

Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. K., & Hayek, J. C. (2007). Piecing Together the Student Success Puzzle: Research, Propositions, and Recommendations. *ASHE Higher Education Report*, 32(5), 1-182.

Marlowe, C. A. (2012). The effect of the flipped classroom on student achievement and stress (Unpublished master's thesis). *Montana State University, Bozeman*, MT.

Mason, Greg & Rutar Shuman, Teodora & Cook, K.E. (2013). Comparing the Effectiveness of an Inverted Classroom to a Traditional Classroom in an Upper-Division Engineering Course. Education, IEEE Transactions on. 56. 430-435.10.1109/TE.2013.2249066.

Mian, Chen. (2016). Design and Application of Teaching Model of Flipped Classroom on Information Technology Course. *International Journal of Multimedia and Ubiquitous Engineering.* 11. 285-294. 10.14257/ijmue.2016.11.12.26.

Mohanty, Atasi. (2016). Exploring the Efficacy & Suitability of Flipped Classroom Instruction at School Level in India: A Pilot Study. *Creative Education*. 7. 768-776. 10.4236/ce.2016.75079.

Munir, Muhammad & Baroutian, Saeid & Young, Brent & Carter, Susan. (2018). Flipped Classroom with Cooperative Learning as a Cornerstone. *Education for Chemical Engineers*. 23. 10.1016/j.ece.2018.05.001.

Naik, Mahesh. (2023). Assessing the effectiveness of Flipped Classroom Strategy on student performance. *European Chemical Bulletin*. 12. 2883-2896.

Nja, Cecilia & Orim, Richard & Neji, Hope & Ukwetang, John & Uwe, Uduak & Anari, Mary. (2022). Students' attitude and academic achievement in a flipped classroom. *Heliyon*. 8. e08792. 10.1016/j.heliyon.2022.e08792.

Owens, D.T., & Strayer, J.F. (2007). The effects of the classroom flip on the learning environment: a comparison of learning activity in a traditional classroom and a flip classroom that used an intelligent tutoring system.

Paramita, I. (2023). The Effectiveness of Flipped Classroom in Improving Students' Learning Outcomes. *Soshum: Jurnal Sosial dan Humaniora*. 13. 193-203. 10.31940/soshum.v13i2.193-203.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93*(3), 223-231. Retrieved from http://onlinelibrary.wiley.com/DOI/10.1002/j.2168-9830.2004.tb00809.x/ abstract

Rani, Suwarna & Muniandy, Balakrishnan. (2017).The Effect of Flipped Classroom on Students' Engagement. *Technology, Knowledge, and Learning.* 24. 10.1007 / 10758-017-9343-y.

Rehman, Hameed. (2022). Effect of the Flipped Science Classroom on Academic Achievement of Grade Seven students. *Journal of Applied Research and Multidisciplinary Studies.* 1. 10.32350/jarms.12.01.

Sarker, Pramath & Siddique, Md & Sultana, Sabina & Pal, Subrata. (2023). Comparison between Traditional Classroom and Flipped Classroom on Student's Engagement and Satisfaction. *International Journal of Multidisciplinary: Applied Business and Education Research.* 4. 624-635. 10.11594/ijmaber.04.02.29.

Sharma, Hemant & Chowdhry, Mansi. (2018). Empowering Millennial Learners through Flipped Classroom Learning Pedagogy. *International Journal of Research in Engineering, IT and Social Sciences*, UGC Approved Journal No-42301. 8. 250-253.

Sharma, Hemant & Chowdhry, Mansi. (2020). Virtual Flipped Classroom: The Ultimate Blend Of Classic Lecture With More Self-Directed Learning During The Covid Pandemic. 19. 6095-6100.

Sharma, Hemant & Chowdhry, Mansi. (2021). Employing flipped classroom approach as a means to improve students' overall positivity and achieve a greater level of self-confidence. 10.13140/RG.2.2.20874.80322.

Smallhorn, Masha. (2017). The flipped classroom: A learning model to increase student engagement, not academic achievement. *Student Success*. 8. 43. 10.5204/ssj. v8i2.381.

Soler, Mariano & Bentabol, M. & Lopes, Ana Paula & Caña, Rocío & Bentabol, Amparo & Munoz, Maria & Esteban, Ana & Luna, María & Cortés, Luis. (2018). LOOKING FOR STUDENTS' ENTHUSIASM: FLIPPED CLASSROOM. 888-895. 10.21125/iceri.2018.1209.

Stratton, E., Chitiyo, G., Mathende, A. M., & Davis, K. M. (2020). Evaluating Flipped Versus Face-to-face Classrooms in Middle School on Science Achievement and Student Perceptions. *Contemporary Educational Technology, 11*(1), 131 142. https://doi.org/10.30935/cet.646888

Sun, Fu-Rong & Hu, Hong-Zhen & Wan, Rong-Gen & Fu, Xiao & Wu, Shu-Jing. (2019). A learning analytics approach to investigating pre-service teachers' change of the concept of engagement in the flipped classroom. *Interactive Learning Environments*. 1-17. 10.1080/10494820.2019.1660996.

Tétreault, L. P. 2006, "The Flipped Classroom: Cultivating Student Engagement." A Project Submitted in Partial Fulfillment of the Requirements for the Degree of Master Thesis, Simon Fraser University, Canada.

Tétreault, P.L. (2013). The Flipped Classroom: Cultivating Student Engagement.

Tsimerman, Alexandr. (2014). The Flipped-Classroom Approach: The Answer to Future Learning?. *European Journal of Open, Distance, and E-Learning*. 17. 171-181. 10.2478/euro del-2014-0027.

White, P. J., Naidu, S., Yuriev, E., Short, J. L., McLaughlin, J. E., & Larson, I. C. (2017). Student engagement with a flipped classroom teaching design affects Pharmacology examination performance in a manner dependent on question type. *American Journal of Pharmaceutical Education,* 81. https://doi.org/10.5688/ajpe5931

Zappe, Sarah & Leicht, Robert & Messner, John & Litzginer, Thomas & Lee, Hyeon Woo. (2009). "Flipping" the classroom to explore active learning in a large undergraduate course. *Proc Am Soc Eng Educ Ann Conference Exhibition*.

Research Article

Technological Anxiety in the Post-Pandemic Era: A Study among Higher Secondary Students of Kerala

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Abstract

We live in a world where technology is making a mark in every niche and corner. The educational sector is also evolving along with the changing technological advancements for the sake of betterment. Online education has become an integral part of the educational system. Online courses, online exams, digital textbooks and learning resources have taken over the teaching-learning process. Though this new phase sounds interesting, effective and efficient in strengthening the quality of education, there are still some challenges that need to be addressed. The present paper throws light on these aspects and the technological anxiety of students with respect to online learning, Internet and social media usage, devices and gadgets, general problems and in total. It also attempts to find out if demographic variables influence technological anxiety. A descriptive survey was conducted on a sample of 300 higher-secondary students. It was found that 15.3 per cent of students have a low level, 69.4 per cent have a moderate level, and 15.3 per cent have a high level of technological anxiety.

Keywords: Technological Anxiety, Online Education, Post-Pandemic and Higher Secondary Students

Introduction

Modern Technology has helped people achieve great things in just a short period by making their lives easier. It is simply impossible to ignore the tremendous impact that modern technologies have on the new generation of students. Students start using mobile phones, laptops, tablets, and other digital gadgets from a very young age. They have to use technology to learn and complete their academic tasks. In short, technology has become an integral part of the teaching-learning process. The educational sector has also completely adapted and adjusted to digitising all its activities, especially teaching and learning. However, there are some dark sides of technology too, and one such aspect is the anxiety associated with it, especially among children.

Technology-related anxiety occurs when a person feels fear and anxiety while interacting with a computer, any technology source or gadget that may not be a real threat. It is a person's discomfort or aversion to any technological device or app, especially computers. Technological anxiety is common because everyone experiences tension, fear or anxiety while confronted with new technology or digital devices. It's natural for all to initially feel discomfort or uneasiness while getting introduced to new things. It's just that the levels of this tension, fear, or anxiety might vary. Some might feel higher levels of anxiety, while some might feel less. It is said that approximately one-third of our population is affected by some degree of technological anxiety. Though this term might sound familiar to many, it gained significance in the 1960s when the information age gained momentum and is now inclining up at a breakneck pace. This anxiety does not just affect the technology-related aspects of learners. Still, learners' overall scholastic and co-scholastic achievements will be negatively affected, so it needs to be addressed with utmost care. According to Bozionelos (2001), the negative emotional state or negative cognition encountered by a person while they use technology or technology devices is what we define as technological anxiety. Hasan & Ahmed (2010) define technological anxiety as a negative emotional response, which can be the fear or discomfort they face or experience while they think about using technology.

Review of Literature

Though technological anxiety is a growing concern, few studies have been conducted explicitly on technological anxiety among school students. A perusal of related studies reveals the following. Kjerulff *et al.* (1992) compared nurses with the highest and lowest technology anxiety. It was found that job satisfaction was lower among nurses with high technology anxiety and more work stress than others. High anxiety also leads to lower adaptability and autonomy and develops a less positive attitude towards computers. It also made them older than those with less anxiety and less favourable towards the people they were working with. Alkhawaja, Halim & Afthanorhan (2021) studied technology anxiety, the instructor's self-efficacy and the e-learning system's actual use in problem-solving. It was found that technology anxiety moderated the relationship. People with low levels of technological anxiety used e-learning systems on a higher basis than those with higher levels of technology anxiety. Bolliger & Halupa (2012) conducted a study on eighty-four online health education doctoral program students. Their anxiety concerning computers, the Internet, and online courses and overall satisfaction were studied. It was found that there was a significant negative correlation between anxiety and student satisfaction with their course.

According to Fuller et al. (2006), computer anxiety plays a substantial role in learning. People with high computer anxiety will mainly continue to be in the same state in the future, which may lead to a higher state of anxiety if they are continuously exposed to computers. There is a chance for such people to develop repellence towards using computer technology and will be unable to gain learning benefits from an e-learning environment. Studies have found that demographic variables, personality and situational variables, along with the cognitive style of learners, influence their computer anxiety. This also affects their attitudes toward computers (Igbaria & Chakrabarti,1990; Igbaria & Nachman, 1990). However, a study by Suryanto et al. (2022) found that only a few lecturers at the NIPA School of Administration felt worried, uncomfortable or doubtful while using technology in distance learning activities. The reason for this was mentioned as the familiarity of lecturers in using technology in work tasks and also because of their technology socialisation and availability of the IT team to assist them always. Studies also show that ICT anxiety will affect individual productivity, welfare, and social relationships (Saadé & Kira, (2009); Bai, 2019).

It can be seen from literature perusal that studies directly related to the variable of the present study are very limited. It was mainly in the health sector and with respect to the work sector. Studies specifically on technological anxiety in schools and its relation to demographic variables like gender in the Indian context could not be spotted by the investigators. Most of the studies are done at higher levels and abroad. However, existing studies from different sectors and countries indicate that anxiety concerning all aspects of technology affects the productivity and potential of people and enhances their stress. Serious contemplation on the relevant subject and a requirement to engage in research endeavours, particularly at the school level, are necessary. This is crucial due to the dominance of technology in our education system, which has become more pronounced following the advent of the pandemic.

Need & Significance of the Study

The educational sector is one such area that has been under the influence and impact of this rapidly changing technology, especially since the pandemic times. It was pivotal in supporting the educational system during the pandemic and helped carry out all educational activities online. Though people embraced this new change in education, there persist some problems concerning the same. Not all students are well equipped and adapted with the skills to handle technology and its devices. Many have apprehensions and fear towards technology and its instruments, preventing them from giving their best output. It results in poor academic performance and behavioural changes. Adapting to technology is not simple. ICT anxiety is an umbrella term, and technological anxiety studied in the present paper is a part of ICT anxiety. Increased ICT anxiety can increase work disorders since the lack of individual self-confidence and increased fear and discomfort when using technology can hinder work activities (Celik and Yesilyurt, 2013; Meuter et al., 2003). Saadé and Kira (2009) also explain that ICT anxiety will affect individual productivity, welfare, and social relationships. An individual with high ICT anxiety can cause problems in daily work productivity due to ineffective and inefficient performance (Bai, 2019). Therefore, it is essential to understand learners' apprehensions and help them overcome them. The present study is a step taken in this regard and studies the technological anxiety of students with respect to online learning, Internet and social media usage, devices and gadgets and general problems. The variable in the present study forms a part of the umbrella term of ICT anxiety. This study will provide information about the anxiety students face while using technology with respect to its dimensions. It will pave the way for finding measures and remedies for tackling technological anxiety among learners.

Objectives of the Study

The following are the objectives of the study.

1. To study the level of technological anxiety among higher secondary students with respect to dimensions like online learning, Internet and social media usage, devices and gadgets, general problems and in total.
2. To study the statement-wise anxiety level among higher secondary students.
3. To study the significant difference in the mean scores of technological anxieties among higher secondary students with respect to gender.

Research Questions

1. What is the level of technological anxiety among higher secondary students with respect to dimensions like online learning, Internet and social media usage,

devices and gadgets, general problems, and in total?

2. What is the statement-wise anxiety level among higher secondary students?
3. Is there any significant difference in the mean scores of technological anxieties among higher secondary students with respect to gender?

Operational Definition

Technological Anxiety: In the context of this study, technological anxiety refers to the emotional and physiological responses experienced by students when interacting with various technological tools and platforms. It encompasses feelings of tension, fear, and physical uneasiness arising from the use of technology in both educational and personal contexts. The present study focuses on the technological anxiety of students with respect to online learning, Internet and social media usage, devices and gadgets and general problems.

Methodology

A descriptive survey method was used to fulfil the objectives of the study. In this study, all the Higher Secondary students of Kasaragod district form the population for the study. 300 Higher secondary students were selected as the sample from the Kasaragod district through a simple random sampling technique.

Tool of the Study

Technological Anxiety Scale was the tool used for this study. It was developed based on the technological anxiety of students with respect to the six dimensions like online learning, Internet and social media usage, devices and gadgets and general problems. The tool was constructed and validated by the investigator. In the present study, the investigator employed Cronbach's Alpha method to establish the reliability of the tools. Cronbach's Alpha value was 0.82. The tool was validated for its content by various subject experts. The scores were 3 for always, 2 for sometimes and 1 for never. Data was analysed using mean, standard deviation, percentage analysis and t-test.

Analysis and Interpretation of Data

Research Question 1: What is the level of technological anxiety among higher secondary students with respect to dimensions like online learning, Internet and social media usage, devices and gadgets, general problems, and in total?

Table-1: Level of Technological Anxiety with respect to dimensions

Dimensions	Low	Moderate	High
	f(%)	f(%)	f(%)
Tech Anxiety - Online Learning	59 (19.7)	194 (64.7)	47 (15.6)
Tech Anxiety - Internet & Social Media	49 (16.2)	198 (66)	53 (17.7)
Tech Anxiety - Devices & Gadgets	59 (19.7)	181 (60.3)	60 (20)
Tech Anxiety - General Problems	50 (16.7)	196 (65.3)	54 (18)
Tech Anxiety - Total	46 (15.3)	208 (69.4)	46 (15.3)

The above table shows the level of Technological Anxiety with respect to online learning. From the table, it is clear that 19.7 per cent of students offer a low level of Technological Anxiety regarding online learning. About 67.7 per cent of students have shown a moderate level, and 15.7 per cent have demonstrated a high level. The data describes that most students have moderate levels of technological anxiety concerning online learning.

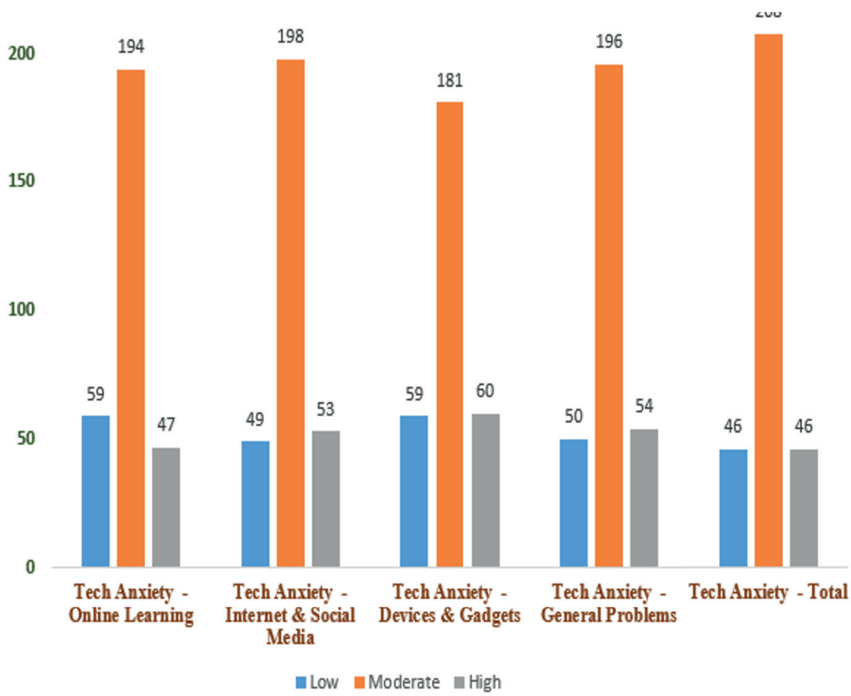
From the above table, it is clear that 16.3 per cent of students have a low level of Technological Anxiety with respect to Internet and Social Media usage. Around 63 per cent of students have a moderate level, and 17.7 per cent have a high level with respect to the same. The above data indicates that most students show moderate levels of Technological Anxiety regarding Internet and social media usage.

From the above table, it is clear that 19.7 per cent of students have shown a low level of Technological Anxiety concerning devices and gadgets, 60.3 per cent of students have a moderate level, and 20 per cent have a high level. The above data indicates that most students show moderate levels of Technological Anxiety concerning devices and gadgets.

From the above table, it is clear that 16.7 per cent of students have a low level of technological anxiety concerning general problems, 65.3 per cent of students have a moderate level, and around 18 per cent have a high level. From the data, it is clear that most students have shown mild technological anxiety concerning general problems.

Table 1.5 and Fig.1 show the level of technological anxiety with respect to all dimensions. From the table, it is clear that 15.3 per cent of students offer a low level of technological anxiety, 69.4 per cent show a moderate level, and 15.3 per cent show a high level of technological anxiety. This indicates that most students have demonstrated moderate technical concern in total.

Figure-1: Pictorial representation of the level of Technological Anxiety



Research Question 2: What is the statement-wise anxiety level among higher secondary students?

Table-2: Statement-wise anxiety level among higher secondary students.

No.	Statement	Never		Always		Sometimes	
		F	%	F	%	F	%
1.	I feel compelled to use online learning platforms.	116	38.7	40	13.3	144	48
2.	I am scared when I use online learning platforms.	232	77.3	12	4	56	18.7
3.	I feel reluctant to turn on the camera in online classes.	16	5.3	208	69.4	76	25.3
4.	My voice does not come out when the teachers ask me to turn on the audio and talk during online classes.	116	38.8	42	14	141	47.2
5.	I am not able to speak during group discussions while working online	91	30.4	44	14.8	164	54.8
6.	I am more comfortable in offline classes.	13	4.3	262	87.4	25	8.3
7.	It is difficult for me to learn from online learning applications and websites.	44	14.7	98	32.6	158	52.7
8.	I find it challenging to take seminars online	64	21.3	152	50.7	84	28
9.	I am unable to submit my school works in online platforms on time.	222	74	7	2.3	71	23.7
10.	I feel discomfort when teachers tell me to submit an assignment online.	111	37	25	8.3	164	54.7
11.	I often neglect reading privacy policies and terms while installing online applications due to fear.	61	20.3	73	24.3	166	55.4
12.	I feel that my friends will avoid me if I stay away from using online gaming apps.	78	26	52	17.3	170	56.7
13.	I am afraid to use the Internet.	61	20.3	91	30.3	148	49.4
14.	I am worried about the complicated form of the Internet.	80	26.7	74	24.6	146	48.7

No.	Statement	Never		Always		Sometimes	
		F	%	F	%	F	%
15.	I am afraid that the use of the Internet could have a negative impact on my academic achievement.	89	29.6	101	33.7	110	36.7
16.	I get a sinking feeling when I think of trying to use ITs.	153	51	27	9	120	40
17.	I fear the genuineness of the content I access through the Internet.	200	66.7	29	9.6	71	23.7
18.	While making internet searches, pop-up links related to pornography, gambling and gaming worry me.	59	19.7	43	14.3	198	66
19.	Cyber-crime news haunts me when I use the Internet.	136	45.3	69	23	95	31.7
20.	I worry about becoming an internet addict and wasting most of my time.	109	36.3	44	14.7	147	49
21.	I have difficulty finding the exact information for academics via search engines.	69	23	103	34.3	128	42.7
22.	I feel that life would be more happy and joyful without the internet and technology devices.	99	33	68	22.7	133	44.3
23.	It's difficult for me to use email as the primary communication tool with my teachers and classmates.	51	17	119	39.7	130	43.3
24.	I get happy when I use the computer.	81	27	110	36.7	109	36.3
25.	I prefer face-to-face communication to communicating with mobile phones.	116	38.7	64	21.3	120	40
26.	I find it challenging to learn how to operate new gadgets.	48	16	85	28.3	167	55.7
27.	I get the feeling that life would be more peaceful without ICT.	49	16.3	144	48	107	35.7
28.	I get scared when I use the computer in front of my parents	169	56.3	22	7.3	109	36.3

No.	Statement	Never		Always		Sometimes	
		F	%	F	%	F	%
29.	I fear sitting alone in front of the computer while the teacher takes IT practical classes.	156	52.2	19	6.4	124	41.5
30.	I am worried about what to do if something goes wrong while using the computer.	150	50	68	22.7	82	27.3
31.	Friends often mock me for not knowing how to use the new game application / social media.	64	21.3	43	14.3	193	64.3
32.	I worry about my family time due to the overuse of social media.	146	48.7	61	20.3	93	31
33.	Internet access attracts me more towards social media usage.	37	12.3	101	33.7	162	54
34.	I am unaware of the privacy terms and conditions of social media and online applications.	45	15	107	35.7	148	49.3
35.	I do not know enough about the technologies to handle it satisfactorily.	21	7	220	73.3	59	19.7
36.	I feel others know more about the technology than I do	144	48	13	4.3	143	47.7
37.	I feel inferior when my friends talk about online games.	31	10.3	137	45.7	132	44
38.	It's difficult for me to communicate using online platforms.	97	32.3	76	25.3	127	42.3
39.	I am afraid about the new technologies emerging every day.	251	83.7	6	2	43	14.3
40.	I often find myself outside the digital world.	211	70.3	28	9.3	61	20.3
41.	I am worried that getting carried away by technology will cause problems in my social relations.	160	53.3	57	19	83	27.7
42.	I feel I need to update my technology skills.	191	63.9	23	7.7	85	28.4

No.	Statement	Never		Always		Sometimes	
		F	%	F	%	F	%
43.	I feel that life would be more stress-free without technological devices.	239	79.7	6	2	55	18.3
44.	I often feel that the use of technology has drained my skills and confidence	52	17.3	50	16.7	198	66
45.	When friends talk about new technologies, I feel like escaping from there.	121	40.3	34	11.3	145	48.3

The above statements comprehensively overview students' perceptions, emotions, and attitudes towards technology across multiple dimensions. These findings shed light on students' complex relationship with technology, revealing both areas of comfort and concern. We can better understand how students navigate the digital landscape and their underlying emotions by investigating these findings. The following factors-based results are discussed below.

Online Learning and Engagement: A sizable proportion of students appear to be drawn to online learning platforms in varying degrees. A moderate majority admits to feeling compelled to use them, while a smaller percentage admits to having a consistent aversion or fear of using these platforms. This reflects the changing dynamics of education in the digital age, with some students welcoming the change while others grappling with it.

Privacy and Security Concerns: Concerns about privacy and security emerge as recurring themes throughout the statements. Students are concerned about turning on cameras during online classes, navigating complicated internet forms, and accessing content of questionable authenticity. This suggests a greater need for increased awareness and education about online privacy, digital literacy, and responsible technology use.

Communication and Interaction: The findings highlight students' preferences for face-to-face communication and offline classes, indicating a desire for more direct and personal interactions. Many students also report having difficulty using digital communication tools such as email and online platforms. This suggests a potential gap in digital communication skills, which may limit their ability to participate effectively in the digital world.

Peer Influence and Social Relations: The data show students' emotions related to peer influence and social acceptance. Some students feel compelled to participate in online games and applications due to fears of social exclusion or ridicule. This highlights the impact of peers on their technology choices and behaviours and the possibility of technology-related anxiety caused by social dynamics.

Balancing Technology Use: The findings show that technology is deeply embedded in students' lives. Despite various concerns, most people do not want to abandon technology entirely, recognising its benefits in communication, information access, and learning. This tension between embracing technology and retaining control suggests that students attempt to achieve equilibrium in their digital experiences.

Implications and Next Steps: Incorporating these findings into educational strategies is critical. Educators and policymakers must address the identified issues while encouraging positive technological engagement. This includes providing comprehensive digital literacy education to students so they can navigate online spaces safely and confidently. Awareness campaigns can alleviate students' privacy and security concerns, allowing them to use technology responsibly.

Efforts should also be made to create an environment where students feel comfortable discussing their concerns and seeking help. This can aid in the prevention of technology-related stress and the promotion of mental well-being. Encouraging face-to-face interactions in addition to technological interactions can assist students in developing a more comprehensive set of communication skills.

The findings highlight the importance of recognising and responding to students' complex emotions and perceptions of technology. Educators and policymakers can work together to create a digital landscape that empowers students while addressing their concerns, resulting in a generation that can navigate the digital world confidently and resiliently.

Research Question 3: Is there any significant difference in the mean scores of technological anxieties among higher secondary students with respect to gender?

Table-3: t-table of Technological Anxieties among the higher secondary students with respect to Gender

Gender	N	Mean	SD	Df	t	p-value	Remarks
Female	187	88.93	9.858	298	4.714	0.000	Significant
Male	113	83.41	9.795				

The analysis revealed that female students' mean technological anxiety score was88.93, with a standard deviation of 9.858. In comparison, male students had a mean score of 83.41, with a standard deviation of 9.795. The t-value calculated to compare the difference in means was 4.714. The corresponding p-value was found to be 0.00, less than the predetermined significance level of 0.05. The results indicate a statistically significant difference in the mean technological anxiety scores between male and female students. The obtained p-value (0.00) is well below the significance threshold of 0.05, suggesting strong evidence for rejecting the null hypothesis. Therefore, the research question is answered positively: There is indeed a significant difference in the technological anxiety experienced by male and female students.

The findings suggest that female students exhibit higher levels of technological anxiety compared to their male counterparts. This insight has implications for educational institutions and policymakers aiming to create a supportive and inclusive learning environment. Addressing this gender-based disparity in technological anxiety could involve targeted interventions such as providing additional resources, workshops, or counselling to female students to enhance their confidence and comfort with technology.

Major Findings and Discussions of the Study

The study investigated the level of technological anxiety among 300 higher-secondary students across various dimensions. The results revealed notable trends in the distribution of technological anxiety levels within each dimension.

Online Learning Anxiety: In terms of online learning, 19.7 per cent of students exhibited low levels of technological anxiety, while the majority (67.7 per cent) fell within the moderate range. A smaller percentage (15.7 per cent) showed high levels of anxiety related to online learning. This indicates that the majority of students experience moderate levels of anxiety in the context of online learning environments.

Internet and Social Media Usage Anxiety: Regarding internet and social media usage, 16.3 per cent of students reported low levels of technological anxiety, while a significant portion (63.0 per cent) demonstrated moderate anxiety levels. A notable proportion (17.7 per cent) exhibited high levels of anxiety concerning internet and social media usage. This suggests that a substantial number of students experience moderate technological anxiety in their online interactions and activities.

Devices and Gadgets: Concerning devices and gadgets, 19.7 per cent of students indicated low levels of technological anxiety, while a majority (60.3 per cent) reported moderate levels. A notable 20 per cent of students expressed high levels of anxiety related to devices and gadgets. This implies that a considerable portion of students feel moderately anxious when dealing with various technological tools.

General Problems: In the dimension of general problems, 16.7 per cent of students displayed low levels of technological anxiety, while a significant majority (65.3 per cent) fell within the moderate range. Around 18 per cent of students exhibited high levels of anxiety when confronted with general technological challenges. This suggests that a substantial proportion of students experience moderate levels of anxiety when dealing with various technological issues.

Total Technological Anxiety: When considering the overall technological anxiety, 15.3 per cent of students showcased low levels, 69.4 per cent had moderate levels, and 15.3 per cent exhibited high levels of anxiety. The cumulative data indicates that a majority of students experience moderate levels of technological anxiety across various dimensions.

Furthermore, the study identified a significant difference in the mean scores of technological anxieties based on gender. Female students were found to exhibit higher levels of technological anxiety compared to their male counterparts. This finding underscores the need to address gender-related disparities in technology-induced emotions, potentially leading to more inclusive and supportive technological environments.

The study's findings underscore the prevalence of moderate technological anxiety levels among higher secondary students across dimensions such as online learning, internet and social media usage, devices and gadgets, and general problems. The research further highlights the significance of gender in influencing technological anxiety levels. These insights can inform educational strategies and interventions aimed at fostering more confident and well-adjusted technology users, particularly in the context of online learning and digital interactions.

Clark (1997) conducted a study on Computer anxiety and the nursing informatics needs of graduate nursing students. It was found that these students have mild computer anxiety. Another survey of computer anxiety in e-learning conducted by Saadé & Kira (2009) reported that nearly fifty per cent of adults have computer-related fear. The present study found that most students have a moderate level of technological anxiety with respect to online learning, social media usage, devices and gadgets. Tuncer, Dogan & Tanas (2013) conducted a study on the computer anxiety of Vocational High-School Students. It was found that gender did not make any meaningful difference in computer anxiety. However, their grade, type of education received, prior computer education and having personal computers make meaningful differences in computer anxiety. According to the findings obtained in the present study, there is a significant difference in the mean scores of technological anxiety with respect to gender.

Conclusion

The findings of this study reveal that among higher secondary students, technological anxiety is a nuanced phenomenon influenced by various dimensions of technology use. Across the dimensions of online learning, internet and social media usage, devices and gadgets, and general problems, a consistent pattern emerged. The majority of students displayed moderate levels of technological anxiety, indicating that they experience a certain degree of tension and unease when interacting with technology.

Specifically, within the context of online learning, a significant proportion of students exhibited moderate levels of anxiety, suggesting that adapting to digital learning platforms and tools might evoke mixed emotions. Similarly, internet and social media usage evoked moderate levels of anxiety, underscoring the complexities of navigating the online realm. Concerns related to devices and gadgets, as well as general technological challenges, contributed to similar moderate levels of anxiety among students.

Notably, a gender-based difference in technological anxiety levels was evident. Female students reported higher levels of technological anxiety compared to their male counterparts. This gender discrepancy calls for targeted interventions to create a more inclusive technological environment that supports both genders in their interactions with technology.

In conclusion, this study sheds light on the diverse technological anxieties experienced by higher secondary students. The prevalence of moderate anxiety levels across dimensions underscores the need for educational institutions to address and alleviate these concerns. By implementing strategies that promote digital literacy, provide guidance on technology use, and foster a supportive technological culture, educators and policymakers can empower students to navigate the digital landscape with greater confidence and ease. Additionally, addressing gender-based differences in technological anxiety is crucial for cultivating an equitable and positive technology experience for all students.

Technology has become part and parcel of our lives, so we need to develop a technological anxiety-free environment for our students. Using technology without proper preparation, evaluation and digital skills and the advent of other technology use disorders will cause barriers to implementing online learning systems (Oliveira et al., 2021). In conclusion, this study contributes valuable insights into the prevalence of moderate-level technological anxiety among students and underscores the importance of recognising and addressing this phenomenon within educational contexts. The predominance of moderate anxiety levels implies academic institutions and policymakers need to design strategies that foster a healthier and more confident relationship with technology. According to Rosen et al. (2018), metacognition in using technology in the classrooms and taking tech breaks will help reduce technological anxiety among students and professors. Furthermore, the gender-based differences in technological anxiety necessitate a more nuanced approach to support and intervention, accounting for diverse perspectives and experiences. Ultimately, this study is a stepping stone for future research and initiatives to cultivate a more harmonious coexistence between students and technology.

References

Alkhawaja, M. I., Halim, M. S. A., & Afthanorhan, A. (2021). Technology Anxiety and Its Impact on E-Learning System Actual Use in Jordan Public Universities during the Coronavirus Disease Pandemic. *European Journal of Educational Research*, *10*(4), 1639-1647.

Bai, J. (2019). The Spectrum of the Divine Order: Goodness, Beauty, and Harmony. *Soundings: An Interdisciplinary Journal*, *102*(1), 1-30.

Bozionelos, Nick. (2001). Computer anxiety: Relationship with computer experience and prevalence. *Computers in Human Behavior*. 17. 213-224. 10.1016/S0747-5632(00)00039-X.

Bolliger, Doris & Halupa, Colleen. (2012). Student perceptions of satisfaction and anxiety in an online doctoral program. *Distance Education - DISTANCE EDUC*. 33. 81-98. 10.1080/01587919.2012.667961.

Celik, V., & Yesilyurt, E. (2013). Attitudes to technology perceived computer self-efficacy and computer anxiety as predictors of computer-supported education. *Computers & Education*, *60*(1), 148-158.

Clark, M.E. (1997). “Computer anxiety and nursing informatics needs of graduate nursing students”.*FIU Electronic Theses and Dissertations*. 2374.

Cochran, J. D., Campbell, S. M., Baker, H. M., & Leeds, E. M. (2014). The role of student characteristics in predicting retention in online courses. *Research in Higher Education*, *55*, 27-48.

Fuller, R. M., Vician, C., & Brown, S. A. (2006). E-learning and individual characteristics: The role of computer anxiety and communication apprehension. *Journal of Computer Information Systems*, *46*(4), 103-115.

Hasan, B., & Ahmed, M. U. (2010). A path analysis of the impact of application-specific perceptions of computer self-efficacy and anxiety on technology acceptance. *Journal of Organizational and End User Computing (JOEUC)*, *22*(3), 82-95.

Igbaria, M., & Chakrabarti, A. (1990). Computer anxiety and attitudes towards microcomputer use. *Behaviour & Information Technology*, *9*(3), 229-241.

Igbaria, M., & Nachman, S. A. (1990). Correlates of user satisfaction with end-user computing: an exploratory study. *Information & Management*, *19*(2), 73-82.

Kjerulff, K. H., Pillar, B., Mills, M. E., & Lanigan, J. (1992). Technology anxiety is a potential mediating factor in response to medical technology. *Journal of Medical Systems*, *16*, 7-13.

Meuter, M. L., Ostrom, A. L., Bitner, M. J., & Roundtree, R. (2003). The influence of technology anxiety on consumer use and experiences with self-service technologies. *Journal of Business Research*, *56*(11), 899-906.

Oliveira, G., Grenha Teixeira, J., Torres, A., & Morais, C. (2021). An exploratory study on the emergency remote education experience of higher education students and teachers during the COVID-19 pandemic. *British Journal of Educational Technology*, *52*(4), 1357-1376.

Rosen, L. D., Carrier, L. M., Pedroza, J. A., Elias, S., O'Brien, K. M., Lozano, J., Kim, K., Cheever, N. A., Bentley, J., & Ruiz, A. (2018). The Role of Executive Functioning and Technological Anxiety (FOMO) in College Course Performance as Mediated by Technology Usage and Multitasking Habits. *Psicologia Educativa*, *24*(1), 14–25. https://doi.org/10.5093/psed2018a3

Saadé, R. G., & Kira, D. (2009). Computer anxiety in e-learning: The effect of computer self-efficacy. *Journal of Information Technology Education: Research*, *8*(1), 177-191.

Suryanto, A., Fitriati, R., Natalia, S. I., Oktariani, A., Munawaroh, M., Nurdin, N., & Ahn, Y. H. (2022). Study of working from home: the impact of ICT anxiety and smartphone addiction on lecturers at NIPA School of Administration on job performance. *Heliyon*, *8*(12), e11980.

Tuncer, M., Dogan, Y., & Tanas, R. (2013). Investigation of Vocational High-School Students' Computer Anxiety. *Turkish Online Journal of Educational Technology-TOJET*, *12*(4), 90-95.

Research Article

Training In-service teachers in designing Online Lesson Plans using Instructional techniques based on learning theories

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Abstract

This study draws on the authors' first-hand experience of the pilot study focused on delivering a 6 weeks online training programme on 'Designing lesson plans' in an online mode education for in-service teachers to improve their teaching competencies. The study aimed to evaluate the lesson plans designed by the participants using the innovative instructional elements based on the combined ideas and principles of three learning theories- behaviourism, cognitivism and constructivism in an online teaching-learning process. Twenty-six Indian school teachers participated in the study. The data was collected using the mixed method- both quantitative and qualitative. The Demographic profile of the participants was collected through the Google Form. A focused group interview form was used to determine the teachers' perception of writing lesson plans in online teaching and possible concerns and needs while teaching. A self-developed 16-item, 3-point rating scale was used to evaluate the online lesson plans drafted by the participants both at the pre- and post-training programme to determine the overall impact of the online training programme. Against this backdrop, the study presents the findings of the in-service training programme conducted to improve the competencies of the teachers in designing lesson plans using the combined ideas of the three learning theories in an online learning environment in school education and its relevance in implementing NEP 2020.

Keywords: In-service training, online education, learning theories, instructional elements, lesson planning, NEP 2020

Introduction

The COVID-19 pandemic has disrupted education and affected learners and teachers worldwide leading to adversely affecting the teaching-learning process (UNESCO, 2022). Resources, money, and time are always restricted in the real world (Mittal et al., 2021), and it is evident in the education system, too, where we have a shortage of trained and skilled teachers to meet the ever-changing demands of the school system. Due to the abrupt shift from F2F teaching to online teaching, several difficulties faced by school teachers in creating an effective online learning environment and fulfilling the learning outcomes. In-service training programmes to enhance the competencies of the teachers in an online learning environment are essential due to the pandemic situation; therefore, many national and local educational bodies conducted numerous workshops and capacity-building programmes under the professional development of the teachers. Resources, money, and time are always restricted in the real world, and this is applicable in the education sector, too, where there is a shortage of teachers capable of providing effective digital education to students.

In India, with the release of the New Education policy (2020), much attention is given to the learning outcomes of the students, and this aroused interest in the instructional elements and the approaches used by school teachers in designing lesson plans in online teaching. Lesson Planning serves as an instrument for effective instruction, and enhancing the engagement level is an aspect of practice that serves as a lever for instructional improvement and engagement of the teachers in lesson planning may influence the quality of their instruction (Bieda et al., 2020). Specifically, knowledge of designing lesson plans with innovative instructional activities and elements using the blend of learning theories in online teaching is much required for optimum learning and achieving the desirable outcomes for the students. Though the lesson plan is essential for successful teaching and learning, its practice and implementation have hardly been found after the outbreak of the COVID-19 pandemic. Learning theories, with their instructional techniques and strategies, are essentially important to address the needs of the learners. Planning lessons in a variety of ways using interactive activities enhances the students' satisfaction, learning needs and educational achievement (Jamalia & Heidari 2014; Pang, 2016; Chen 2019). Educational psychologists have developed theories of learning based on three main paradigms – behaviourism, cognitivism and constructivism. To ensure a successful teaching and learning environment, it is vital to design a theory-based lesson plan and follow the instructional elements with a blend of three learning theories.

Theories-driven Instructional strategies

In Behaviorism Theory, Villalba and Romiszowski, 2001 stated, "Instruction is designed to promote individual pacing and progress using a task analysis which breaks down the behaviour into a sequence of observable actions". Emphasis is to be given to selecting the reinforcements which are most effective to facilitate the learning and performances of the students. In online learning, lessons with explicit objectives in behavioural terms shall be shared with the students breaking the learning tasks into small chunks. Proper feedback shall be provided to the learners so that they can monitor how they are performing and take corrective actions if required. For example, the teacher introduces the lessons with the structured objectives defined in behavioural terms, teaches the lesson, and monitors the students' learning through formative assessment with proper feedback to examine the gaps where remediation is required. Activities reminders, dashboards depicting deadlines for assignments, word cloud features, digital stickers and emoticons, and small breakout forums are some of the activities teachers can use in their teaching to reinforce the learning behaviour of the learners in an online setting.

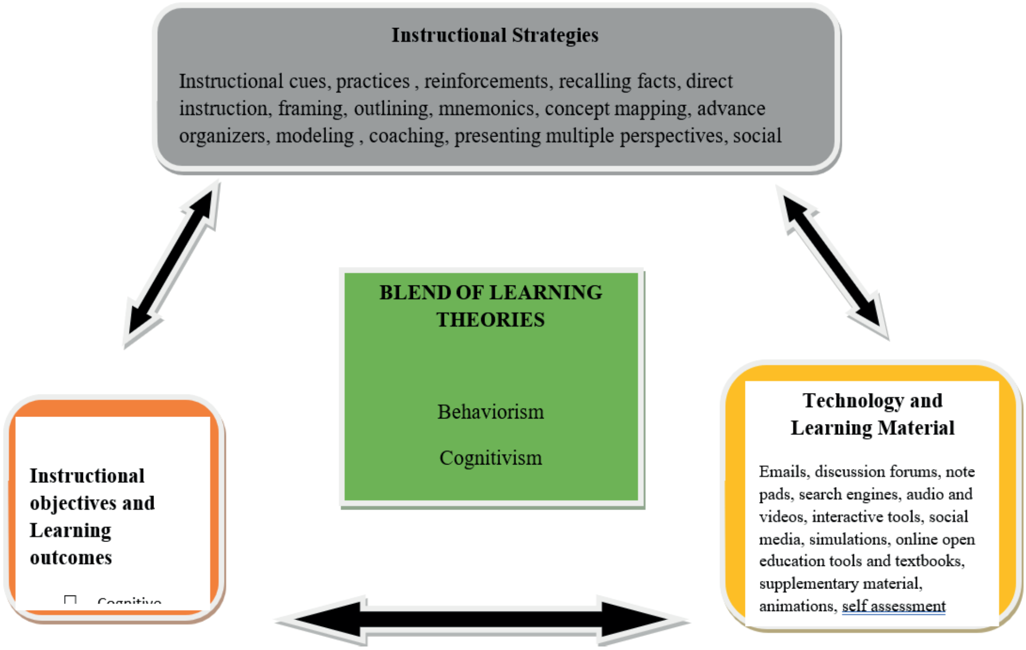
Cognitivists emphasize the students and their abilities to make them engage actively to organize their knowledge. It focuses on the different learning styles and allows the students to incorporate new learning with the prior learning and reproduce the new learning through connections and associations. Students are taught to think independently and analyse problems; the teacher acts as a facilitator and enables the learners to discover new knowledge by assimilation and accommodation. Graphic organizers and concept mapping can be used as introductory material to activate the previous knowledge of the learners, which enables them to recall and enable a linkage between prior and new knowledge. Various instructional strategies such as framing, outlining, mnemonics, concept mapping and advance organizers can be used to activate the prior knowledge which enables the learners to make connections between existing and new knowledge To activate the prerequisite knowledge of the learners, pre-instructional questions and test questions can be included while teaching online. Annotation and note taking skills, peer-assessment of learning and search engines promote the processing activities to teach the learners so as to acquire information or solve problems.

Jonassen et al., 1995 viewed, "Constructivist principles provide ideas to help instructors create learner-centered and collaborative environments that support critical reflection and experiential processes". Constructivists believe that the purpose of education is to provide learning in a meaningful way to integrate knowledge with real-life settings and situations, which allows the learners to construct their own knowledge. Provision for social activities on the net through participation in discussion forums and chats provides personal and meaningful learning experiences to the learners. Cooperative and collaborative learning encourages reflective awareness and provides real-world experiences to the learners.

Marfuah, M., et al., 2022 analyzed the three learning theories closely. Overlapping in the ideas and principles of the three theories - – behaviourism, cognitivism and constructivism become apparent. Hence the instructional strategies can include the principles from all three learning theories. To teach 'What to learn' (facts) – behaviourists' strategies can be used, 'How to learn' (processes and Principles) – Cognitivists' strategies can be used and 'Why to Learn (deriving personal meaning) – Constructivists' strategies can be used.

From the above discussion and literature it is clear that incorporating the ideas and principles of learning theories in instructions with the connected instructional strategies and activities can support the learning of the students effectively. For this, first and foremost, the teacher shall be professionally capable of designing the lesson plan to enhance the student's learning with the prime focus on virtual classrooms. However, none of the research to date addresses the instructional perspectives of facilitating teachers to design theory-based lessons incorporating innovative instructional approaches in online educational environments. There is a paucity of research on lesson planning by school teachers in digital learning. Due to the lack of literature and research on this area, the author has taken the initiative to assess the effectiveness of the training programmes in developing competencies of the existing school teachers in designing lesson plans based on the learning theories-driven instructional strategies and techniques in an online classroom environment.

Figure-1: Theories-driven instruction components for online teaching-learning process



Objectives of the Study

The study was aimed at assessing the effectiveness of training programme executed in developing competencies of the existing school teachers in designing lesson plans based on the learning theories driven instructional strategies and techniques in online classroom environment.

The main objectives of the study are as follows:

1. To explore the perception of school teachers about their knowledge of lesson planning in online teaching and possible concerns and needs while online teaching.

2. To evaluate the impact of the online training programme on the lesson plans designed by the participants using the innovative instructional elements based on the combined ideas and principles of three learning theories- behaviourism, cognitivism and constructivism in an online teaching-learning process.

Research Design

To improve the teaching competencies of the school teachers in digital teaching, an online in-service training was conducted. The combination of quantitative and qualitative measures was designed to examine and evaluate the competencies of the participants in planning online lessons using instructional approaches based on a combination of three learning theories. The design employed for this research work was a Pre-Post-test experimental design. Descriptive statistics – percentages and frequency were used to examine the impact of a training programme on the online lesson plans designed by the participants.

Participants

A Google Form was created and shared among the school principals of Chandigarh and Punjab, India, through WhatsApp and school mail IDs in which the clear purpose of the project was declared along with the consent of the participants who were asked to participate in the project. From 48 respondents, 26 teachers were the final part of the project. Participants had agreed to attend the workshop session in a group twice a week as per the mutual time agreed by everyone. The participants were 26 school teachers (general and special educators) and principals of CBSE-affiliated private schools situated in Chandigarh and Punjab, India. 65.3 per cent (17) were general teachers, 11.5 per cent (3) were special educators and 23 per cent (6) were coordinators of the schools. The participants were mixed groups teaching from elementary to higher classes, teaching different subjects (see table 1). All the participants had experience of teaching in the schools and taking classes in blended mode during the post pandemic. 46.15 per cent (12) of the participants had more than 15 years of experience, 15.38 per cent (4) had experience between 13-15, 11.5 per cent (3) between 10-12, 7.6 per cent(2) between 7-9, 15.38 per cent (4) between 4-6 years 3.8 per cent (1) between 0-3years.

Table-1: Presents the demographic details of the participants

No.	Designation	Subjects taken	Classes	Experience
	General Teacher	English	6-12	10-12 years
	General Teacher	Mathematics	6-8	More than 15 years
	General Teacher	Science	8 to 10	More than 15 years
	Special Educator	School Counselor	6-12	0-3 years
	Coordinator	EVS and Science	4-7	7-9 years
	Coordinator	English Science SSt EVS	1-5	More than 15 years
	General Teacher	Punjabi	8-10	More than 15 years
	General Teacher	Math, Hindi	2nd	4-6 years
	General Teacher	Biology, Science, Primary Mathematics	4th -8th	10-12 years
	General Teacher	English, Evs, Maths	1st-2nd	More than 15 years
	General Teacher	Life skill &Hindi	4th	More than 15 years
	Special Educator	Economics	10th -12th	13-15 years
	Special Educator	Psychology, Social Science	3-7th	7-9 years
	General Teacher	Physical education	11-12	13-15 years
	Coordinator	English	5	More than 15 years

No.	Designation	Subjects taken	Classes	Experience
	General Teacher	Mathematics	7th -8th	More than 15 years
	General Teacher	Teacher	I to 8th	10-12 years
	General Teacher	English	3rd,4th,5th	More than 15 years
	General Teacher	Computer	1-5	4-6 years
	General Teacher	Sanskrit and hindi	Tenth (10)	More than 15 years
	Coordinator	English,math. evs,hindi	1st-2nd	13-15 years
	General Teacher	social science	9 -10	13-15 years
	Coordinator	Mathematics, Computer	8th -10th	More than 15 years
	General Teacher	Science and Maths	6th	4-6 years
	General Teacher	Science n Maths	6th	4-6 years
	Coordinator	mathematics, computer	8th -10th	More than 15 years

Tools and data collection

The qualitative data was collected through a Semi-structured focused group interview which was conducted to explore the perception of school teachers about their knowledge of writing lesson plans in an online teaching and possible concerns and needs while online teaching. The interviews were conducted on google meet and were recorded with their prior consent. The narratives were coded and then categories with themes were devised.

The 16-item rubric was designed to compare the components included in the online lesson plans drafted by the participants prior to and after the training programme. One lesson of each participant was scored on a three-point scale – 3 points for Adequate/ Meets Expectations, 2 points for need improvement and 1 for absent of that item in the lesson plan. Relevant literature was reviewed to prepare the interview schedule and rubric. The data was analyzed with the content and descriptive analysis.

Ethical consideration

Ethical principles were considered by informing the respondents about the purpose of the study with their consent on the Google Form.

Procedure

Initial Meeting: Before data collection, an initial introductory meeting was conducted with the participants in one group on Google Meet for an analysis of the training programme to design online lesson plans. Focused group interviews were conducted with the participants on the Google Meet platform due to post-pandemic fear and limited mobility. In a focused group interview, participants were asked questions like "Do you prepare an online lesson plan? If yes, what approach do you use?, "Are you aware of the online teaching-learning tools? "Which tools do you use often during online classes?" What specific learning outcomes do you address in your lesson?", "How do you engage students during online teaching?", "How do you provide support and facilitate students in online classes to address their needs/ learning problems?", "What major challenges do you face during online classes?" and "Are you aware of the learning theories? How do you use it in your teaching?"

Google classroom was created to share the material, resources and discussions with the participants. The participants were asked to share the online Lesson plan drafted by them before the training. The pre-drafted lesson plans were rated by using the 3 point scale rating scale covering components of instructional activities and strategies using the combination of three learning theories.

Development of training programme: A 6-week online training workshop (see table 2) was planned and designed by the researcher to make the in-service teachers competent in drafting and designing online lesson plans on instructional activities and strategies using the combined ideas and principles of three learning theories- behaviourism, cognitivism and constructivism in an online teaching-learning process. With the vast experience of conducting training programmes with school teachers for more than a decade under the capacity building programmes organized by the CBSE board, India both in person and online along with experience as a head of teacher training programme, the researcher planned and designed a series of online in-service training programme for the school teachers. The researcher herself instructed the participants and conducted 16 sessions that lasted one to one and half hours at noon time between 3:00 to 4:30 IST (Wednesday and Friday) for one and half months, excluding ice-breaking and follow-up sessions. The training was conducted in both synchronous and asynchronous modes. Google Meet, Google Classroom, OER Common Group, Google features (drive, jam board), and online tools (paddles, Meeting Pulse, slide, thing link, Book Creator, wallet, TED-Ed, Edpuzzle, Kahoot) were created to offer the sessions to the participants. The training was facilitated with case studies, hands-on activities through self-reflection exercises, visual presentations, questioning, assignments, supplementary material (available open educational resources), and discussion opportunities for the teacher participants to promote critical and collaborative skills in their subject domain. Participants had enough time to practice learned skills during the workshop. The training was offered to the in-service teachers on writing lesson plans using the instructional strategies/ activities based on the combination of three learnings in their online teaching. Reiser (1994) viewed that with the appropriate training, teachers can employ effective approaches and techniques in their instructional planning.

Table-2: Online teacher training sessions

S.No.	Topic	Hours
1.	Conceptual framework of learning theories: Behaviorism, cognitivism and Constructivism	1.5
2.	Bloom's Taxonomy: Writing Learning outcomes using cognitive, affective and psychomotor domains	1.5
3.	Instructional strategies and techniques in Behaviorism, cognitivism and Constructivism	1.5

S.No.	Topic	Hours
4.	OERs in teaching learning and How to form OER common group	1.5
5.	Using free mind software	1
6.	Using white boards/ jam board for online teaching	1
7.	Sharing documents with the students through google drive, interactive tools (padlet, book creator, waklet, meeting pulse, slido, tedEd)	2
8.	Creating videos with freecam and slideator	1
9.	Graphic organizers/ concept mapping/ Mnemonics in online teaching	1
10.	Diversity in classrooms and ways to accommodate in online classrooms	1
11.	Competency based assessment (focus on designing rubrics)	1.5
12.	Online lesson elements/ components	1.5

Post Training: After the completion of the training progrmme, teachers were given the time from week 1 to week 2 to write one lesson plan from the subject taken and submit it on the google classroom. The post training lesson plans submitted by the participants were evaluated on the 3 points rating scale which was compared with the lesson plan submitted by the participants before the training.

Results and Discussions

Objective 1: To explore the perception of school teachers about their knowledge of lesson planning in online teaching and possible concerns and needs while online teaching, the following results were drawn from the focused group interviews conducted with the participants:

- Majority of the teachers did not design any lesson plan for online classes. Only an outline comprising the learning objectives covering the remembering and understanding component was included in the lesson plan. During online teaching, less significance was given to evaluation and creating skills. The affective domain was been ignored in the online classes.
- Participants showed concern in planning online lessons from moderate to very difficulty/ challenging with much need for the training in online lesson planning. They perceived themselves as less competent in planning online lessons than in face-to-face teaching.
- Teachers have heard about the blended and flipped approach to teaching but could not differentiate or imply it in their online classrooms. The majority of the teachers relied on the YouTube videos, textbook exercises and Google forms prepared by them.
- Majority of the lessons were teachers, and little evidence was noticed for the activities conducted online for students' engagement, especially in secondary classes.

- Majority of the teachers had formed WhatsApp groups of the students to interact and facilitate in clearing doubts related to learning needs.
- Majority of the teachers sent soft copy of the question papers for assessing the learning performances of the students. However few have created google form in an open ended question (paragraph/ short questions) for evaluation.
- Little evidence/ responses have been gathered from the participants on their awareness of learning theories. Though they know about the theories in general their application in online lessons was not much evident during the interview and from the lesson plans.
- Lack of students engagement, limited peer interaction, Insufficient digital literacy on the part of the teacher and infrastructural barriers were the major challenges that they encountered during the online instructions

For example one of the teachers viewed:

Students are not interested in online classes; they simply complete the formality to get attendance done. Students have list of excuses... Students lack necessary digital devices like laptops as well as high-speed internet facilities, due to which many of them cannot attend the class.

The above results indicated that overall, all 26 participants agreed that student engagement is an important part of online teaching, and they faced challenges in engaging them virtually. While participants seemed to be unfamiliar with the instructional activities and techniques online using the learning theories principles and ideas, they still generally understood the main ideas of constructivism theory and few instructional activities. But how it can be implemented in online teaching was they needed to learn through planning the instruction.

Objective 2: To evaluate the impact of the online training programme on the lesson plans designed by the participants using the innovative instructional elements based on the combined ideas and principles of three learning theories- behaviourism, cognitivism and constructivism in an online teaching-learning process, the descriptive statistics i.e. percentage and frequency were employed. Results of the pre- and post-training programmes are depicted in Table 3.

Table-3: Percentage and frequency of the pre and post-training lesson plan designed by the participants evaluated on 3 point rating scale (adequate/ Meets expectations=3 to Absent=1)

		Pre-training			Post-training		
S.No.	Statement	Adequate/ Meets Expectations	Needs Improvement	Absent	Adequate/ Meets Expectations	Needs Improvement	Absent
1	The lesson plan clearly describes the explicit goals and objectives with expected learning outcomes	15.3% (4)	65.38% (17)	19.32% (5)	76.9% (20)	23.0% (6)	0% (0)

		Pre-training			Post-training		
S.No.	Statement	Adequate/ Meets Expectations	Needs Improvement	Absent	Adequate/ Meets Expectations	Needs Improvement	Absent
2	Use of interactive activities for self learning	11.5% (3)	46.15% (12)	42.30% (11)	34.6% (9)	57.6% (15)	7.6% (2)
3	Presenting the information in steps	84.6% (22)	11.5% (3)	3.8% (1)	96.1% (25)	3.8% (1)	0% (0)
4	Provide a scope for the students to seek information through search engines	34.6% (9)	57.6% (15)	7.6% (2)	88.4% (23)	11.5% (3)	3.8% (1)
5	Use of discussion forums and chats	19.2% (5)	69.2% (18)	11.5% (3)	76.9% (20)	19.2% (5)	3.8% (1)
6	Provision of emails/ social media to transfer their ideas amongst learners	7.6% (2)	34.6% (9)	57.6% (15)	30.7% (8)	50% (13)	19.2% (5)
7	Use of appropriate technology to address the learning goals	11.5% (3)	42.3% (11)	46.15% (12)	26.9% (7)	57.6% (15)	15.3% (4)
8	Use of Open educational resources including e-books, web page links, reference materials and other open sources	11.5% (3)	46.15% (12)	42.30% (11)	76.9% (20)	23.0% (6)	0% (0)
9	Use of instructional strategies and techniques	7.6% (2)	42.3% (11)	50% (13)	88.4% (23)	11.5% (3)	0% (0)
10	Varied opportunities for the students to engage in the online learning	11.5% (3)	50% (13)	42.30% (11)	42.3% (11)	38.4% (10)	19.2% (5)

		Pre-training			Post-training		
S.No.	Statement	Adequate/ Meets Expectations	Needs Improvement	Absent	Adequate/ Meets Expectations	Needs Improvement	Absent
11	Teacher provides full support during online classes	30.7% (8)	42.3% (11)	26.9% (7)	46.1% (12)	34.6% (9)	19.2% (5)
12	Connecting the concept/ topic of one subject area to other area	7.6% (2)	34.6% (9)	57.6% (15	11.5% (3)	57.6% (15)	30.7% (8)
13	Make connections of the concept/ topic to real world situation	11.5% (3)	38.4% (10)	50% (13)	53.8% (14)	23.0% (6)	23.0% (6)
14	Integration of arts in the concept/ topic	7.6% (2)	34.6% (9)	57.6% (15)	15.3% (4)	34.0% (9)	50% (13)
15	Use of alternative assessments so as the students able to demonstrate their knowledge of concept/ skills	3.8% (1)	26.9% (7)	69.2% (18)	38.4% (10)	46.1% (12)	15.3% (4)
16	Students able to self- evaluate their progress and knowledge	0% (0)	7.6% (2)	92.3% (24)	19.2% (5)	38.4% (10)	42.3% (11)

The results demonstrate in Table 3 reveal an increase in the participants' usage of various theories driven instructional strategies in designing lesson plans for virtual classes. Post-test sample lesson plan is given in Appendix-A.

1. Goals and objectives with expected learning outcomes

   The learning outcomes related to the content are the expectations, competencies, and skills which learners need to acquire in achieving holistic which cannot be achieved by focusing on the cognitive, affective and psychomotor domains. While writing the online lesson plans, the teachers shall answer the following questions connected with the learning Goal and objectives with expected learning outcomes answers the questions:

- What will students experience and be able to do as a result of this lesson or project? What instructional goals would students need to achieve to demonstrate their understanding?
- What specific curriculum learning outcomes will be addressed in the lesson or project?

Hence, by understanding the characteristics of the learners and their learning needs, the teachers can define instructional goals and objectives in the cognitive, psychomotor and affective domains, keeping in view the topic to be taught.

In the pre-training evaluation, among 26 participants, only 4 (15.3 per cent) of the participants described the goals and objectives with expected learning outcomes from the students, 17 (65.38 per cent) defined the goals however need improvement, and 5 (19.32 per cent) of the participants did not describe the goals and objectives with expected outcomes. However, after conducting sessions on Bloom's Taxonony: Writing Learning outcomes using cognitive, affective and psychomotor domains during the training programme, the post-training evaluation of lesson plans results indicated the majority of the participants wrote the goals and objectives representing the three domains i.e 20 (76.9 per cent) of 26 participants lesson plan scored under adequate/ meets expectation category, 6 (23 per cent) participants with needs improvement and interestingly, all the lesson plans had this component, and no one (0 per cent) scored under absent category.

Sample of the goals and objectives with learning outcomes defined by the participant after training

Class	Lesson No. & Name Of Lesson	A. Learning Objectives B. Learning Outcomes C. Skills Enhanced
9A,B,C,D	Lesson 4 Working of Institutions (Political science)	***Students will:*** • ***Identify the need to accommodate social and cultural diversity in a democracy.*** • ***Understand how a democracy promotes acceptance of diversity.*** • ***Appreciate that democracy forms a legal basis for equality and dignity of all citizens.*** ***Learning outcomes*** ***Students will be able to:*** ***Appreciate that democracy by its very nature works towards being socially and culturally inclusive thereby accommodating and accepting diversity.*** ***Skills Enhanced:*** ***Thinking,Empathy,Understanding.***

2. Use of interactive activities for self-learning

Self-assessment is a process in which students criticize their own work according to clearly stated expectations, usually provided in the form of goals or criteria, and then revise their work (Andrade & Valtcheva, 2009). It helps students participate directly in learning objective activities (Ozan, C., & Kıncal, R. Y. (2018) and check their own understanding of the lesson/ topic. It can be evaluated by the teachers by answering the question given question while lesson planning: What and how will I add interactive activities in my lesson components which support the learners in reflecting on what they have learned?

Students who can self-assess are poised to be life-long learners and use self-regulatory skills effectively. They are able to ask focused questions when they don't understand or when they're stuck (Brookhart, S. M. (2016) in an online class as well. Cognitivism theory focuses on making knowledge meaningful and helping learners to be able to relate new information to existing knowledge. Instructional activities that encourage the students to self-reflect on their learning assist the students in evaluating their learning. In online teaching, with the use of interactive activities

Almaiah (2020) study emphasized in online classes, "the content is either less or no opportunities are provided in terms of interactivity" and hence it leaves no scope for self-assessment of the learning. From the pre-training evaluation data, only 3 (11.5 per cent) of the participants mentioned self-assessment questions as interactive activities in their lesson plans, with 12 (46.15 per cent) of the participants needing improvement in this item, and 11(42.30 per cent) of the participants did not include any self-assessment questions. The post training data showed improvement in the lesson planning on using interactive activities (brainstorming) for the self-assessment. A session on various interactive activities in the learning material eg: using google drive, padlet, kahoot, waklet etc were conducted which supports in self-assessment. 9 (34.6 per cent) lesson plans were rated adequate, 15 (57.6 per cent) needed improvement, and only 2 (7.6 per cent) of the lesson plans did not mention this component.

3. Presenting the information in steps

The goal of instruction for the behaviorist is to elicit the desired response from the learner who is presented with a target stimulus. Therefore, instruction is structured around the presentation of the target stimulus and the provision of opportunities for the learner to practice making the proper response (Ertmer, 2013). From the pre-training data, it is evident Out of 26, the majority of the participants (n=22 with 84.6 per cent) had mentioned the step-by-step description of learning materials in small chunks, 3 (11.5 per cent) lessons need improvement, with 1 (3.8 per cent) absent of this component. The post-training lesson plan showed an increase in this component, i.e. 25 (96.1 per cent) out of 26 participants' lesson plans indicated detailed descriptions of learning materials in small chunks,1 (3.8 per cent) need improvement, which showed they break down the tasks into small elements and teach one by one each element in online teaching.

4. Scope for students to seek information through search engines

Seeking and collecting information independently allows the learners to develop their own knowledge and meaning. If the teachers provide scope to the students to seek information from the search engines, it will facilitate the learning that is based on task-based and hands-on activities. Through this, the ideas and principles of constructivism theories are applied in online teaching.

Pre-training lesson plans indicated out of 26, only 9 (34.6 per cent) of the teachers scored with adequate, 15 (57.6 per cent) needed improvement and 2 (7.6 per cent) were absent. There was an improvement in the lesson plans of the participants submitted after the training programme, which is indicated by the post-training data. Out of 26 participants, 23 (88.4 per cent) of the participants scored with adequate 23 indicated the use of search engines in their lesson plans and, 3 (11.5 per cent) with need improvement and 1 (3.8 per cent) absent in this component.

5. **Use of discussion forums and chats**

The pre-training data showed only 5 (19.2 per cent) of the participants mentioned the use of discussion forums and chats in their lesson plan, 18 (69.2 per cent) of the participants thought mentioned but again it was not been reflected in the presentation part of the lesson and 3 (11.5 per cent) of the participants did not mention the discussion forum at all. However, post-training data successfully extended the use of discussion forums in online lesson planning, which is evident from the data with an increase in the rating to 20 (76.9 per cent) under adequate 5 (19.2 per cent) need improvement, and only 1 (3.8 per cent) lesson plan did not use the discussion forum.

6. **Provision of emails/ social media to transfer the ideas**

This component is the extension of the previous component related to the discussion forum which facilitates the ideas of constructivism learning theory. The use of social media and emails for teaching facilitates the learning activities for the students and enhances communication, participation and meaning. The pre-training data showed only 2 (7.6 per cent) of the participants mentioned a provision of emails and social media to transfer ideas among learners, 9 (34.6 per cent) participants needed improvement in this item, and 15 (57.6 per cent) did not mention this in their lesson plans. Post-training showed a positive impact; out of 26, 8 (30.7 per cent) lesson plans were rated adequate, 13 (50 per cent) needed improvement, and 1(3.8 per cent) lesson plan did not mention social media for learning.

7. **Use of appropriate technology to address the learning goals**

The training programme benefitted the participants in planning and using technology in online lessons. The increase in the number of post-training lesson plans indicating the use of appropriate technology to address the learning goals indicated the participants have additional skills to teach in remote classrooms. Data revealed only 3 (11.5 per cent) of the participants had used the appropriate technology to address the learning goals in their lesson plans, with 11 (42.3 per cent) needing improvement and 12 (46.15 per cent) not mentioning this in the pre-training lesson plans. The post-training showed 7 (26.9 per cent) lesson plans rated at adequate/ meet expectation, 15 (57.6 per cent) had mentioned the technology used but not in very clear terms, and 4 (15.3 per cent) did not refer to the technology.

8. **Use of open educational resources (OERs)**

OERs in the online learning environment can offer learning opportunities that are independent and self-directed and encourage lifelong learning (Sommer et al., 2022). Open educational resources include an extensive array of online formats, including YouTube clips, online textbooks, video recorded lectures, web-based textual materials designed for independent study, animations and simulations, digital diagrams and graphics, some MOOCs etc.

Pre-training data showed only 3 (11.5 per cent) of the participants used open educational resources in their lesson plan, 11 (42.3 per cent) mentioned the other materials used from the internet, but sources were not cleared, and 12 (46.15 per cent) did not mention it. The post-training lesson plan indicated an increase in the use of OERs in online teaching which is evident from the increase in number to 20 (76.9 per cent) rated at an adequate level, surprisingly all lesson plans used OER with 6 (23 per cent) need improvement as it was mentioned in the lesson plan beginning as the teaching aid but its usage was not evident much in the further presentation part of the lesson plan.

9. Use of Instructional strategies

Incorporating effective visual, written, and animated content in a relevant and realistic context has a positive impact on students' online learning experiences. Pre-test data showed only out of 26 only 2 (7.6 per cent) participants mentioned the use of instructional materials such as mnemonics, concept mapping and advance organizers, 11 (42.3 per cent) mentioned but not very clear with 13 (50 per cent) of the teachers did not use any such instructional strategies in their online lesson plans. Substantial increase in the use of mnemonics, advance organizers, videos, and note taking evident from the post-training workshop; out of 26, 23 (88.4 per cent) lesson plans included these strategies and rated them as adequate and only 3 (11.5 per cent) needed few improvements.

10. Varied opportunities for the students to engage in online learning

Successful pedagogical practices help teachers actively engage online students synchronously and asynchronously. The online training programme included sessions in which the participants were taught engaging strategies. Pre-training workshop lesson plans showed only 3 (11.5 per cent) of the participants mentioned such activities in the form of group projects or cooperative learning, 13 (50 per cent) of the participants needed improvement of such element in their lesson plans, and 11 (42.30 per cent) did not mention this in their lesson plans. The Post training lesson plan was written by the participants adequately i.e. 11 (42.3 per cent) lessons covered the engaging activities for ex: in one of the lesson plans, a teacher added an activity to engage the students in which the students are required to post the their understanding about the topic in between the short breaks along with few questions are created. 10 (38.4 per cent) lesson plans needed improvement, and 5 (19.2 per cent) lesson plans did not mention any activities.

11. Teachers' support during online classroom

Regarding full support by the teachers during online classes, Korhonen et al. (2019) viewed that teachers act not only as instructors but play various roles, including planners, facilitators, guides, supervisors, coaches and evaluators, to effectively enhance students learning in online learning. Pre-training data showed only 8 (30.7) participants' lesson plans mentioned this in the way of observing the progress of learners, 11 (42.3 per cent) of the lesson plans mentioned an outline only and rated as improvement needed, and 7 did not include references to ways of observing or checking the progress of individual students. Post-training results showed 12 (46.1 per cent) lesson plans adequately indicated the support of the teachers, e.g., teachers mentioned clarifying the doubts/ queries, answering questions, providing learning materials, use of illustrations and addressing diversity, e.g. students with specific learning needs, conducting informative demonstrations, and providing valuable analogies. , 9 (34.6 per cent) lessons need improvement, and 5 (19.2 per cent) lesson plans did not mention the teachers' support during online classes.

Example: Topic on Working of Institutions (Political science)

Gifted learners- will be guided to collect more information regarding the powers and functions of the President and the Prime Minister.

Struggling learners- Chapter will be made easier for them with the help of the worksheet and the flow charts.

12. Connecting the concept/ topic of one subject area to other areas

Research suggests that students connect knowledge most effectively in active social classrooms, where they negotiate understanding through interaction and varied approaches. Pre-training data revealed only 2 (7.6 per cent) of the participant's lesson plan lesson-related topics in another content area. For ex, one of the lesson plans on parliament prepared by the teacher in social science was related to the language for article writing. 9 (34.6 per cent) of the participant's lesson plans included the integration but were not clearly indicated in the presentation part of the lesson plan. 7 (26.9 per cent) of the participants did not include the connections of the topic with other topics. The post-training results showed only 3 (11.5 per cent) of the lesson plans had adequately connected the concepts with other content /subject areas, with 15 (57.6 per cent) needing improvement, and 8 (30.7 per cent) did not mention this. It seemed the participants did not benefit much from this component.

13. Making content or the topic connected with real-life/ world situations

Pre-training data showed, that only 3 (11.5 per cent) of the lesson plans related the content to life for ex: one of the teachers prepared a lesson plan on pollution, that was connected with real life by giving an example of climate change and its affect on the lifestyle of people, out of 26 participants, 10 (38.4 per cent) of the participants mentioned about the connections but not clearly indicated in their lesson plan methodology. , 13 (50 per cent) of the participant's lesson plans did not include it. Post-test results showed 14 (53.8 per cent) out of 26 lesson plans made the connection of the topic with real life, with 6 (23 per cent) lessons needing improvement, and the remaining 6(23 per cent) did not mention the connecting of knowledge to real life-situation.

14. Integration of arts in the concept/ topic

NEP (2020) emphasized the integration of art in the pedagogical approaches for immediate and long-lasting learning experiences. The training program covered sessions on online tools, e.g., book creator and thing links to add art to the lessons in the form of stories. The pre-training data showed only 2 (7.6 per cent) of the lesson plans included art in the way of pictures, 9 (34.6 per cent) lesson plans needed improvement, and 15 (57.6 per cent) did not mention it. The post-training data showed little improvement in the lesson plans on art integration. Only 4 (15.3 per cent) of the lesson plans mentioned art integration, with 9 (34 per cent) needing improvement and 13 (50 per cent) did not include any form of art. It revealed the teachers need intensive training on the integration of art in their teachings in an online education.

15. Alternative assessments

To assess the learning of the students in online teaching, various free technologies may be chosen by the teachers. For ex, Kahoot may be used for formative assessment and review of the learning with fun activities, Padlet for open responses, meeting pulse and Slido for poll, open answers and objective question-based assessment, and Book Creator can used for presentation. Pre-training data showed only 1 (3.8 per cent) of the participants lesson plans used informal and formal assessment in which both the student and teacher are involved, with 7 (26.9 per cent) incomplete on this item and 18 (69.2 per cent) participants' online lesson plans did not indicate the use of alternative assessments.

Post training data revealed improvement in using the alternative assessments by the teachers in their lessons. 10 (38.4 per cent) lesson plans adequately included variety in assessment in the form of creating videos, posters , presentation, writing article , 12 (46.1 per cent) lesson plans mentioned but not clearly indicate the types of assessment to be utilized with 4 (15.3 per cent) lesson planned did not indicate the alternative assessments.

16. Self-evaluate the progress and Knowledge

Castro and Tumibay (2019) viewed that "students should be encouraged to work independently in an environment that provides proper guidance and ample support". Pre-training lesson plans written by the participants did not adequately mention the self-evaluation techniques, 2 (7.6 per cent) mentioned the idea of self-evaluation in general in the lesson plan but did not clearly indicate it at a point in the lesson, and 24 (92.3 per cent) of the participant's lesson plan did not mention about self-evaluation. The training session covered the topic of creating a rubric for the evaluation along with online tools. Five lesson plans (19.2 per cent) adequately mentioned creating a rubric for self-evaluation along with self-regulatory strategies, 10 (38.4 per cent) lessons mentioned a few strategies, e.g. questioning, but how to use not clearly indicated, with 11 (42.3 per cent) lesson plans did not give any evidence of self-evaluation.

Participants' feedback on the Training Programme

Post-training feedback also showed positive responses from the participants. The majority of the participants expressed gain in their capacities and skills – "learnt teaching pedagogies and strategies for effective teaching-learning process in virtual classes", "improving teaching style in digital mode"," being more competent in designing the online lesson plan", "new ideas of integration and inclusion were interesting part to teach online", "making teaching-learning process more innovative and interesting", "effective lesson plan to teach online", "understanding students needs", " Knowing about OER was something new", " designing a rubric for evaluation ", " freemind software for graphic organizer was new and really interesting" were the emerging themes. Overall, the training programme enhanced the teachers' competencies to design their lessons, keeping in view the evidence-based practices and phases of lesson plans based on life-based experiences, hands and mind activities, task-based, learner-centred, and hence making learning more meaningful.

Conclusion

The goal of this study was to train school teachers in planning online lessons by embedding instructional strategies based on the blend of all the best features of three learning theories. In-service training is one of the elements of professional development (Seffer & Demirel, 2022). The data analysis results showed the training programme has the potential to equip teachers in using innovative instructional elements with ideas and principles of learning theories which can increase student engagement and their learning outcomes in the digital era.

The ultimate goal of teaching is to foster critical thinking and skills acquisition—even to bring about a change in attitudes. Strengthening teachers' capacities to develop online lessons and awareness of innovative instructional strategies are highlighted and emphasized in the New Education Policy 2020.

The author developed the connection between instructional approaches and learning theories in the light of available literature. Keeping in view the time and scope of the study, it aimed to develop competencies among the teachers in designing online lessons however, the author left the scope for further research in this area. It would be beneficial and advantageous to explore the effectiveness of the designed lesson plan on student engagement and learning outcomes. The results of the study have the potential to empower in-service and pre-service teachers to plan and implement integrated theories-based instructional approaches in both online/ blended/hybrid and F2F classes as envisioned in NEP2020.

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References

Almaiah, M.A., Al-Khasawneh, A. & Althunibat, A. Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic. *Educ Inf Technol* 25, 5261–5280 (2020). https://doi.org/10.1007/s10639-020-10219-y

Andrade, H., & Valtcheva, A. (2009) Promoting learning and achievement through self-assessment. *Theory into Practice*, 48(1), 12–19. http://dx.doi.org/10.1080/00405840802577544

Bieda, K. N., Lane, J., Evert, K., Hu, S., Opperman, A., &Ellefson, N. (2020). A large-scale study of how districts' curriculum policies and practices shape teachers' mathematics lesson planning. *Journal of Curriculum Studies*, 52(6), 770–799. https://doi.org/10.1080/00220272.2020.1754921

Brookhart, S. M. (2016). START WITH Higher-Order Thinking. *Educational Leadership*, 74(2), 10–15.

Bye, L., Smith, S., & Rallis, H. M. (2009). Reflection Using an Online Discussion Forum: Impact on Student Learning and Satisfaction. *Social Work Education*, 28(8), 841–855. https://doi.org/10.1080/02615470802641322

Castro, M.D.B. and Tumibay, G.M. (2019) A Literature Review: Efficacy of Online Learning Courses for Higher Education Institution Using Meta-Analysis. *Education and Information Technologies*.

Chen, Suanrong& Zhang, Bo. (2019). Improving Prospective Teachers' Lesson Planning Knowledge and Skills through Lesson Study. 10.1007/978-3-030-04031-4_27.

Ertmer, P. A., & Newby, T. J. (2013). *Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. Performance Improvement Quarterly*, 26(2), 43-71.https://edtechbooks.org/lidtfoundations/behaviorism_cognitivism_constructivism.

Huang, H. (2002). Toward constructivism for adult learners in online learning environments. *British Journal of Educational Technology*, 33(1), 27–37. https://doi.org/10.1111/1467-8535.00236.

JamaliNesari, A., &Heidari, M. (2014). The important role of lesson plan on educational achievement of Iranian EFL teachers' attitudes. *International Journal of Foreign Language Teaching and Research*, 2(5), 27-34.

Jonassen D, Davidson M, Collins M, Campbell J and Haag B B (1995) Constructivism and Computer-Mediated Communication in distance education *The American Journal of Distance Education* 9 (2) 7–23.

Korhonen, Anne-Maria & Ruhalahti, Sanna & Veermans, M.. (2019). The online learning process and scaffolding in student teachers' personal learning environments. *Education and Information Technologies*. 24. 1-25. 10.1007/s10639-018-9793-4.

Marfuah, M., et al (2022). Providing Online Learning Situations for In-Service Mathematics Teachers' External Transposition Knowledge During COVID-19 Pandemic: Case of Indonesia. *The Electronic Journal of e-Learning*, 20(1), pp. 69-84, available online at www.ejel.org

Mittal, N., Garg, A., Singh, P., Singh, S., & Singh, H. (2021). Improvement in learning enthusiasm-based TLBO algorithm with enhanced exploration and exploitation properties. *Natural Computing*, 20(3), 577–609. https://doi.org/10.1007/s11047-020-09811-5

Ozan, C., & Kıncal, R. Y. (2018). The Effects of Formative Assessment on Academic Achievement, Attitudes toward the Lesson and Self-Regulation Skills. *Educational Sciences: Theory & Practice*, 18(1), 85–118. https://doi.org/10.12738/estp.2018.1.0216

Pang, M. (2016). Pedagogical Reasoning in EFL/ESL Teaching: Revisiting the Importance of Teaching Lesson Planning in Second Language Teacher Education. *TESOL Quarterly*, 50(1), 246–263. http://www.jstor.org/stable/43893814).

Sefer, A., & Demirel, M. V. (2022). Online In-service Teacher Training: Perspectives of Turkish L2 Lecturers. *International Online Journal of Educational Sciences*, 14(2), 419–431. https://doi.org/10.15345/iojes.2022.02.010

Sommer, M., Ritzhaupt, A. D., Kohnen, A., & Hampton, J. (2022). Instructional elements in an online information literacy Open Educational Resource (OER) and their influence on learner achievement, satisfaction and self-efficacy. *Journal of Information Literacy*, 16(1), 70–90. https://doi.org/10.11645/16.1.3113

UNESCO (2022). *Education: From disruption to recovery*. Retrieved 22 November, 2022 from https://www.unesco.org/en/covid-19/education-disruption-recovery.

Villablba C and Romiszowski A j (2001). Current and ideal practice in designing, developing and delievering web-based training in Khan B H (ed) *Web-based Training ETP*, Englewood Cliff, NJ, 325-342.

Appendix-A

Post Training Lesson Plan Desinged by the Particpant

Teacher:- ABC	**School:-1234**
Subject Area(s):English	Grade Level/ Class:VII
Lesson Title/Topic: FIGHT MANJU FIGHT (Lesson 4- English Literature)	Estimated Duration:4 Periods
Lesson Goals/ Objectives:	After completion of this lesson, the students will be able to: • understand the message/ theme of the story. • know the importance of setting goals. • Be more sensitive towards inclusion
Curriculum Addressed:	After completing the lesson, students will be able to: • develop reading and comprehension skills. • learn right values of being human first before being anything else. • Students will be able to recognise and apply new words and frame sentences
Technology Addressed:	The blended learning initiative will: • extend students' learning beyond the classroom. • provide students with the tools to understand the concept on a higher level.
Technology Required:	• MS Teams • YouTube video based on text • Whiteboard • Google forms • Laptop/ Mobile phone/Tab/ Desktop
Other Materials/ Resources:	• You tube video : https://www.youtube.com/watch?v=A3ogm6StETU • Textbook • Notebook • Pen/ pencil • Textbook • YouTube video • Notebook • Pencil/Eraser
Student Engagement	• Students will be asked about their future plans in the class. • They will also be asked if they have ever changed their mind in context of their choices. • Students will be encouraged to look around them and apply inclusion as part of life

Student Exploration	• Students ask for clarity of meaning when they come across new words. • They share their own similar experiences. • Students will put up a role play to understand the plot and characters with clarity
Explanation	• Various questions based on the story will be asked during the course of explanation to engage students and make them understand the lesson. • The lesson will be taught with emphasis on Value education. • Discussion and exploration about SDG 6,REDUCE INEQUALITY, will be taken up to provide the students with a global perspective
Elaboration	• Students share their own experience in the context of the chapter. • They understand the importance of mutual respect and dignity of living
Evaluation	• Students participating actively in brainstorming round taken with the help of Whiteboard fi. • Students assess themselves by means of test conducted through Google forms.
Teacher Self-Assessment:	• Students understood the lesson well. • The learning outcomes were fully achieved.

Research Article

Exploring the Use of Technology and Online Resources in Commerce and Management Education: A Study of NEP Curriculum Implementation in Karnataka

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Abstract

The National Education Policy (NEP) in India emphasizes the importance of integrating technology and online resources in education to enhance the quality of teaching and learning outcomes. This study aims to explore the extent to which faculty in Commerce and Management departments in Karnataka are incorporating technology and online resources in their teaching methods as per the NEP guidelines. The study also aims to identify the barriers and challenges faced by the faculty in the adoption of technology and online resources for NEP curriculum implementation, examine the perceptions and attitudes of faculty towards the use of technology and online resources, and suggest strategies and best practices for effective integration of technology and online resources in Commerce and Management education in Karnataka. The study will employ a mixed-methods approach, including a survey questionnaire and interviews with faculty members. The findings of the study are expected to contribute to the effective implementation of NEP guidelines in Commerce and Management education and provide insights into best practices for the integration of technology and online resources.

Keywords: Technology, Online resources, Commerce education, Management education, National Education Policy (NEP), Curriculum implementation

Introduction

The National Education Policy (NEP) 2020, introduced by the Government of India, aims to revolutionize the education system in the country by making it more flexible, inclusive, and technology-driven. The NEP has emphasized the importance of incorporating technology and online resources in education to enhance the quality of teaching and learning. In particular, the NEP encourages the use of technology and online resources for Commerce and Management education, which is vital for the growth of the economy.

Karnataka, a southern state of India, is a hub of Commerce and Management education with numerous colleges and universities offering various courses. With the introduction of NEP, it becomes imperative for the Commerce and Management faculties in Karnataka to integrate technology and online resources in their teaching methods as per the guidelines of NEP. This study aims to assess the extent of the use of technology and online resources for NEP curriculum implementation by the Commerce and Management faculties in Karnataka.

The integration of technology and online resources in education has been shown to have a positive impact on student learning outcomes (Al-Busaidi, 2019). Studies have demonstrated that technology-based teaching methods such as online quizzes, video lectures, and virtual simulations can enhance students' understanding and engagement in learning (Chen et al., 2020; Almahasees Z et al., 2021; Almusaed, A, et al, 2023).

However, the adoption of technology in education is not without challenges. A study by Al-Busaidi (2019) identified the lack of technical support, inadequate training for teachers, and the digital divide as significant challenges in implementing technology in education. Therefore, it is essential to assess the challenges faced by the Commerce and Management faculties in Karnataka in the adoption of technology and online resources for NEP curriculum implementation.

Moreover, the perceptions and attitudes of faculty and students towards the use of technology and online resources are crucial for the successful implementation of NEP in Commerce and Management education. The study by Almahasees Z et al, (2021) found that students had positive perceptions of technology-based teaching methods, while faculty members had mixed perceptions. Therefore, it is essential to examine the perceptions and attitudes of both faculty and students towards the use of technology and online resources in Commerce and Management education in Karnataka.

This study aims to explore the use of technology and online resources for NEP curriculum implementation by the Commerce and Management faculties in Karnataka. The study will assess the challenges faced by faculty in the adoption of technology, evaluate the effectiveness of technology-based teaching methods, and examine the perceptions and attitudes of both faculty and students towards the use of technology in education. Based on the findings, the study will suggest strategies and best practices for the effective integration of technology and online resources in Commerce and Management education in Karnataka.

Literature review

Technology and online resources have become essential tools for effective and efficient teaching and learning in today's digital age. The National Education Policy (NEP) of India emphasizes the integration of technology in education for improving the quality of learning outcomes. This policy encourages the use of technology and online resources for teaching and learning to create a more interactive and engaging learning environment for students.

Several studies have explored the use of technology and online resources in higher education and have shown positive outcomes for student learning. For instance, a study by Ramesh and Rani (2017) found that the use of multimedia and online resources significantly improved the academic performance of students in a management course. Similarly, a study by Sahai and Thakkar (2018) showed that the use of technology-enhanced teaching methods improved students' engagement, motivation, and critical thinking skills in a commerce course.

However, despite the numerous benefits of using technology and online resources in education, several challenges hinder their effective implementation. A study by Agarwal and Purohit (2019) identified factors such as lack of infrastructure, inadequate training, and resistance to change among faculty as significant barriers to the adoption of technology in education.

To address these challenges, several strategies and best practices have been recommended for the effective integration of technology and online resources in higher education. For example, a study by Yildirim and Ozmaden (2017) suggested that faculty should be provided with adequate training and support for incorporating technology in their teaching methods. Another study by Kaur and Singh (2018) recommended the use of a blended learning approach, which combines face-to-face instruction with online learning to provide a more personalized and engaging learning experience for students.

Moreover, research by Al-Amin et al. (2021) underscores the importance of assessing preparedness and participation when transitioning to online classes, emphasizing the need to consider the perspectives of both students and faculty.

Yureva et al. (2020) offer insights into how faculty perceptions may influence technology integration efforts, highlighting the significance of understanding the attitudes of teachers toward digital transformation in higher education.

In the context of unexpected challenges, such as the COVID-19 pandemic, Zhu (2022) emphasizes the importance of adaptable teaching models supported by digital technology in higher education. The study conducted by Danchikov et al. (2021) provides a further understanding of the possibilities and limitations of online learning, aligning with the concept of integrating online resources into education.

Cohen et al. (2022) offer a broader perspective on student attitudes toward technology through an international comparison of students' technology use and perceptions, which can be valuable when assessing the effectiveness of technology integration in different contexts. Pandit and Agrawal's exploration of challenges in online education during COVID-19 (2022) underscores the significance of technology integration during crisis situations, acknowledging its role in ensuring continuity in education.

Lastly, the conceptual framework for secure online exams presented by Ngqondi et al. (2021) contributes to discussions on technology's role in evaluations and assessments, a crucial aspect of technology integration in education.

In summary, while the integration of technology and online resources in Commerce and Management education has shown significant potential for improving student learning outcomes, several challenges need to be addressed for their effective implementation. The literature suggests that strategies such as providing adequate training and support, adopting a blended learning approach, and addressing institutional policies and regulations can help overcome these challenges and promote the effective integration of technology in higher education. The findings from the mentioned studies will be instrumental in informing and contextualizing this research endeavor.

Research Gap

There is a lack of research on the extent to which faculty in Commerce and

Management departments in Karnataka are incorporating technology and online resources in their teaching methods, as well as their perceptions and attitudes towards the use of technology for NEP curriculum implementation. While previous studies have explored the benefits and challenges of technology integration in higher education, there is a need for more context-specific research in Karnataka to identify the barriers and challenges faced by faculty in the adoption of technology and online resources for NEP curriculum implementation, and to suggest strategies for their effective integration. Therefore, this study aims to fill this research gap and contribute to the literature on technology integration in Commerce and Management education in Karnataka.

Research Questions

What is the current level of technology and online resource integration in Commerce and Management education in Karnataka?

What are the barriers and challenges faced by the faculty in the adoption of technology and online resources for NEP curriculum implementation?

What are the perceptions and attitudes of faculty towards the use of technology and online resources for NEP curriculum implementation?

What are the strategies and best practices that can be suggested for the effective integration of technology and online resources in Commerce and Management education in Karnataka, based on the findings of the study?

Objectives of the study

To assess the extent to which the faculty in Commerce and Management departments in Karnataka are incorporating technology and online resources in their teaching methods as per the guidelines of the National Education Policy (NEP).

To identify the barriers and challenges faced by the faculty in the adoption of technology and online resources for NEP curriculum implementation.

To examine the perceptions and attitudes of faculty towards the use of technology and online resources for NEP curriculum implementation.

To suggest strategies and best practices for the effective integration of technology and online resources in Commerce and Management education in Karnataka based on the findings of the study.

Methodology

This study employs a mixed-methods research design that includes both quantitative and qualitative data collection and analysis techniques. The study was conducted among faculty members of Commerce and Management departments in Karnataka.

Research design: The research design for this study, a concurrent mixed-methods approach, combines both quantitative and qualitative data collection and analysis methods to offer a comprehensive examination of technology integration in Commerce and Management education in Karnataka.

Sample size

The formula for calculating the sample

size for a study with a single population proportion is:

$n = (z^2 * p * q) / E^2$

Where: n = required sample size

z = z-score for the desired level of confidence

p = estimated proportion of the population with the characteristic of interest, q = 1 – p,

E = desired margin of error

Assuming a conservative estimated proportion of 0.5 (i.e., p = q) and a desired margin of error of 0.05, and a confidence level to 90% (i.e., z = 1.645), the sample size can be calculated as:

$n = (1.645^2 * 0.5 * 0.5) / 0.05^2 / (1 + ((1.645^2 * 0.5 * 0.5) / 0.05^2 * infinity))$

n = 267.8

Therefore, a sample size is 285 participants to achieve the desired level of precision and confidence in this study.

Sampling Technique

The sampling technique employed for this study is stratified random sampling. Stratified sampling was chosen because it allows for the division of the population of faculty members in the Commerce and Management departments in Karnataka into distinct strata based on specific characteristics, such as years of teaching experience and academic rank.

Reliability and Validity of the Questionnaire

Pre-Testing: Before administering the questionnaire to the larger sample, a pre-test was conducted with a small sample of faculty members. This pre-test aimed to identify any ambiguous or unclear items in the questionnaire and assess the overall comprehensibility and relevance of the questions.

Expert Review: The questionnaire was reviewed by experts in the field of Commerce and Management education to ensure that the questions aligned with the research objectives and were appropriately framed.

Data Collection

The study used a self-administered online questionnaire to collect quantitative data from the faculty members. The questionnaire was designed to collect data on the extent of technology and online resource integration, barriers and challenges faced, and attitudes towards the use of technology and online resources for NEP curriculum implementation. The questionnaire was pre-tested with a small sample of faculty members before being administered to the larger sample.

Data Analysis:

The quantitative data collected through the questionnaire was analyzed using descriptive statistics such as mean, standard deviation, and frequency distribution.

Ethical Considerations:

Informed consent was obtained from all participants before they participated in the study. The study will ensure the confidentiality and anonymity of the participants

Data Analysis

Table-1: Demographic Profile of Respondents

Particulars		Responses	Percentage
Age	Under 25	15	5.26
	25-34	101	35.44
	35-44	111	38.95
	45-54	44	15.44
	55 or older	14	4.91
Total		285	100
Gender	Female	121	42.46
	Male	164	57.54
Total		285	100
Highest degree	Master's degree	235	82.5
	Doctoral degree	50	17.5
Total		285	100
Teaching experience	0-2 years	22	7.72
	3-5 years	29	10.18
	6-10 years	139	48.77
	11-15 years	65	22.81
	16 or more years	30	10.52
Total		285	100
Institution	Govt College	108	37.89
	Private College	21	7.37
	Public University	112	39.3
	Private University	44	15.44
Total		285	100
Specilzation	Accounting	53	18.60
	Finance	128	44.91
	Human Resources	43	15.09
	marketing	39	13.68
	taxation	22	7.72
Total		285	100

Particulars		Responses	Percentage
Designation	lecturer	132	46.316
	Assistant professor	100	35.088
	Associate Professor	35	12.281
	Professor	18	6.316
Total		285	100
Students strength	Less than 20 students	15	5.26
	20-40 students	74	5.26
	41-60 students	94	5.26
	61-80 students	72	5.26
	More than 80 students	30	5.26
Total		285	100

The majority of respondents in the study of NEP curriculum implementation in Karnataka were between the ages of 25 and 44 years old, comprising 74.39 per cent of the total sample. The largest age group was 35-44 years old, at 38.95 per cent, while the smallest age group was 55 or older, at 4.91 per cent.

Gender-wise, the majority of respondents were male, at 57.54 per cent. Female respondents comprised 42.46 per cent of the total sample.

The majority of respondents held a Master's degree, at 82.5 per cent, while respondents with a Doctoral degree made up 17.5 per cent of the sample.

In terms of teaching experience, the largest group of respondents had 6-10 years of experience, at 48.77 per cent. The smallest group had 0-2 years of experience, at 7.72 per cent.

Regarding institution, the majority of respondents were from public universities, at 39.3 per cent. Respondents from government colleges made up 37.89 per cent of the sample, while those from private universities comprised 15.44 per cent. The smallest group was from private colleges, at 7.37 per cent.

Finance was the most common specialization, with 44.91 per cent of respondents indicating this as their area of expertise. Accounting and human resources were the next most common specializations, at 18.60 per cent and 15.09 per cent, respectively. Taxation was the least common specialization, at 7.72 per cent.

The largest group of respondents were lecturers, at 46.316 per cent, while the smallest group were professors, at 6.316 per cent.

In terms of student strength, the largest group of respondents had 41-60 students in their classes, at 33.33 per cent. The smallest group had less than 20 students, at 5.26 per cent.

Table-2: Technology Integration and Its Impact on Commerce and Management Education

Table 2		
Use of Technology in teaching		
Never	07	2.46
Rarely	42	14.74
Sometimes	99	34.74
Often	86	30.18
Always	51	17.89
Total	285	100
Types of technology or online resources used in teaching methods		
Interactive whiteboards or projectors	100	35.09
Learning management systems (e.g. Moodle, Blackboard)	90	31.58
Multimedia content (e.g. videos, audio recordings)	80	28.07
Online assessments or quizzes	08	2.81
Online discussion forums or chat rooms	07	2.46
Total	285	100
Incorporation of technology or online resources into lesson plans		
As primary means of delivering course content	44	15.44
As supplemental materials for in-person lectures	174	61.05
As tools for collaborative or group work	43	15.09
As tools for formative or summative assessment	24	8.42
Total	285	100
Familiarity with the guidelines of NEP regarding the use of technology and online resources in education		
Not very familiar	72	25.26
Somewhat familiar	98	34.39
Yes, very familiar	115	40.35
Total	285	100

Extent in use of technology or online resources enhances student learning in Commerce and Management education		
Not at all	07	2.46
To a small extent	73	25.61
To a moderate extent	52	18.25
To a large extent	139	48.77
To a very large extent	14	4.91
Total	285	100

Refer table 2, Based on the data, it can be inferred that the majority of the respondents (89.26 per cent) use technology or online resources in their teaching methods, with 30.18 per cent using it often and 35.09 per cent using interactive whiteboards or projectors. Learning management systems and multimedia content were also commonly used. However, the use of online assessments or quizzes and online discussion forums or chat rooms were less frequent.

Incorporation of technology or online resources into lesson plans was mostly used as supplemental materials for in-person lectures (61.05 per cent). It was also used as the primary means of delivering course content (15.44 per cent) and as tools for collaborative or group work (15.09 per cent). Only a small percentage of respondents used technology or online resources as tools for formative or summative assessment.

Most of the respondents were at least somewhat familiar with the guidelines of NEP regarding the use of technology and online resources in education (74.74 per cent). Among them, 40.35 per cent were very familiar.

Regarding the extent to which the use of technology or online resources enhances student learning in Commerce and Management education, the majority of respondents (53.68 per cent) believed that it enhances learning to a large or very large extent. Only a small percentage (2.46 per cent) believed that it does not enhance learning at all.

Table-3: Impact and Effectiveness of Technology in Commerce and Management Education

Table 3		
Use of technology or online resources enhances student engagement in learning		
Yes, significantly	131	45.96
Yes, to some extent	154	54.04
No, not significantly	00	00
I am not sure	00	00
total	285	100

Use of technology or online resources impact student achievement in Commerce and Management education		
Significant improvement in student achievement	165	57.89
Some improvement in student achievement	120	42.11
No significant impact on student achievement	00	00
Negative impact on student achievement	00	00
I am not sure	00	00
total	285	100
Use of technology or online resources improves the quality of teaching in Commerce and Management education		
Yes, significantly	129	45.26
Yes, to some extent	149	52.28
No, not significantly	00	00
I am not sure	07	2.46
total	285	100
Specific technology or online resources found to be most effective in enhancing student learning outcomes		
Learning management system (LMS)	203	71.23
Online tutorials or videos	190	54.04
Web-based discussion forums	144	70.94
Online quizzes or assessments	124	65.26
Social media platforms	66	45.83
N= 285, Responses Recorded 666. Therefore MRR 2.5509		
Measuring the effectiveness of technology or online resources in teaching methods		
Student performance on assessments	138	48.42
Student engagement in class	203	71.23
Student feedback on technology use	138	48.42
Teacher observations of student engagement	74	25.96
N= 285, Responses Recorded 666. Therefore MRR 1.9404		

Use of technology or online resources enhances student engagement in learning:

54.04 per cent of the respondents believe that technology or online resources enhance student engagement to some extent, while 45.96 per cent believe it does so significantly.

Use of technology or online resources impact student achievement in Commerce and Management education:

57.89 per cent of the respondents believe that technology or online resources have a significant impact on student achievement, while 42.11 per cent believe that it has some improvement.

Use of technology or online resources improves the quality of teaching in Commerce and Management education:

45.26 per cent of the respondents believe that technology or online resources improve the quality of teaching significantly, while 52.28 per cent believe it does so to some extent.

Specific technology or online resources found to be most effective in enhancing student learning outcomes:

The Learning Management System (LMS) is considered the most effective technology or online resource for enhancing student learning outcomes with 71.23 per cent of respondents selecting it. Online tutorials or videos were selected by 54.04 per cent of respondents, web-based discussion forums by 70.94 per cent, online quizzes or assessments by 65.26 per cent, and social media platforms by 45.83 per cent of respondents.

Measuring the effectiveness of technology or online resources in teaching methods:

71.23 per cent of respondents believe that student engagement in class is the best way to measure the effectiveness of technology or online resources in teaching methods, followed by student performance on assessments at 48.42 per cent. Student feedback on technology use and teacher observations of student engagement were also identified as effective measures.

Thus, the data suggests that the use of technology or online resources is seen as beneficial for Commerce and Management education in Karnataka, with respondents believing it enhances student engagement, impacts student achievement, and improve the quality of teaching. The LMS is seen as the most effective technology or online resource for enhancing student learning outcomes, and student engagement in class is the most effective way to measure the effectiveness of technology or online resources in teaching methods.

Table-4: Attitudes, Comfort, and Concerns Regarding Technology Use in Commerce and Management Education

Table 4		
Attitude towards the use of technology or online resources in Commerce and Management education		
Very positive	160	56.14
Somewhat positive	118	41.40
Neutral	07	2.46
Somewhat negative	00	00

Very negative	00	00
Total	285	100
Use of technology or online resources impacts student learning outcomes in Commerce and Management education		
Significantly improves student learning outcomes	114	40.00
Improves student learning outcomes to some extent	164	57.54
No significant impact on student learning outcomes	00	00
Negatively impacts student learning outcomes	00	00
I am not sure	07	2.46
Total	285	100
Comfortable with using technology or online resources in your learning or teaching		
Yes, very comfortable	131	45.96
Somewhat comfortable	116	40.70
Neutral	38	13.33
Somewhat uncomfortable	00	00
Very uncomfortable	00	00
Total	285	100
Specific technology or online resources found most beneficial for your learning or teaching		
Learning management system (LMS)	188	65.96
Online tutorials or videos	196	68.77
Web-based discussion forums	108	37.89
Online quizzes or assessments	123	43.16
Social media platforms	51	17.89
N= 285, Responses Recorded 666. Therefore MRR 2.3368		
Concerns or reservations regarding the use of technology or online resources in Commerce and Management education		
Concerns about student engagement or motivation	136	47.72
Concerns about accessibility for all students	189	66.32

Concerns about reliability or technical issues	125	43.86
Concerns about privacy or security	60	21.05
N= 285, Responses Recorded 510. Therefore MRR 1.7895		

The results suggest that the majority of respondents (97.54 per cent) believed that technology or online resources have a positive impact on student engagement in learning. Furthermore, 57.89 per cent of respondents felt that technology or online resources have a significant improvement on student achievement, while 42.11 per cent believe that it has some improvement.

Regarding attitude towards the use of technology or online resources, 97.54 per cent of respondents had a positive attitude, with 56.14 per cent stating that their attitude was very positive. Similarly, 98.94 per cent of respondents felt comfortable using technology or online resources in their learning or teaching, with 45.96 per cent feeling very comfortable.

When asked about the most effective technology or online resources for enhancing student learning outcomes, 71.23 per cent of respondents believed that Learning Management System (LMS) was the most effective, followed by online tutorials or videos (54.04 per cent).

However, there were also concerns about technology or online resources, with 66.32 per cent of respondents having concerns about accessibility for all students. Additionally, 47.72 per cent of respondents had concerns about student engagement or motivation.

Thus, the study suggests that the use of technology and online resources is seen as a positive development in Commerce and Management education in Karnataka. However, there are also concerns about accessibility, reliability, and privacy that need to be addressed.

Discussion

Based on the findings of the study exploring the use of technology and online resources in commerce and management education in Karnataka, the following discussion can be made:

Encourage the use of technology and online resources: The majority of respondents believed that the use of technology and online resources enhances student engagement, impacts student achievement, and improves the quality of teaching. Therefore, institutions should encourage and provide support for faculty members to incorporate technology and online resources in their teaching methods.(Shivakumar, M., & Aithal, P. S. 2019)

Promote the use of the Learning Management System (LMS): The LMS was found to be the most effective technology or online resource for enhancing student learning outcomes. Therefore, institutions should promote the use of LMS and provide training to faculty members on how to use it effectively. (Ministry of Education. 2020)

Increase awareness of NEP guidelines: While most of the respondents were familiar with the guidelines of NEP regarding the use of technology and online resources in education, there is still a significant percentage of respondents who are not aware of it. Institutions should increase awareness of NEP guidelines among faculty members to ensure that they are incorporating the latest guidelines and recommendations in their teaching methods.

Use student engagement as a measure of effectiveness: Student engagement in class was identified as the most effective way to measure the effectiveness of technology or online resources in teaching methods. Therefore, institutions should encourage faculty members to monitor and evaluate student engagement when using technology or online resources in their teaching methods. (Sujatha, S. 2013)

Provide support for faculty members with less experience: Respondents with less teaching experience reported using technology or online resources less frequently than those with more experience. Institutions should provide additional support and training for faculty members with less experience to ensure that they are using technology and online resources effectively. (Borup, J., West, R. E., & Graham, C. R. 2012)

Increase the use of online assessments and discussion forums: While the majority of respondents reported using technology and online resources in their teaching methods, the use of online assessments or quizzes and online discussion forums or chat rooms were less frequent. Institutions should encourage faculty members to incorporate these tools into their teaching methods as they can improve student engagement and enhance learning outcomes. (Keengwe, J., & Kidd, T. T. 2010)

Overall, institutions should prioritize the use of technology and online resources in commerce and management education to enhance student engagement, improve student achievement, and enhance the quality of teaching. By promoting the use of effective technology and online resources, institutions can provide a more dynamic and engaging learning environment for students.

Suggestions

Comprehensive Faculty Development: Establish a robust faculty development program that encompasses technical proficiency, pedagogical strategies, and alignment with NEP guidelines. Support both novice and experienced faculty members in effectively integrating technology and online resources.

Leverage Learning Management Systems (LMS): Prioritize the adoption and optimization of Learning Management Systems (LMS) as central platforms for course content, communication, and assessment. Offer extensive training to faculty members to maximize the potential of LMS tools.

Promote Student Engagement Metrics: Emphasize student engagement as a vital metric for evaluating technology integration. Encourage faculty to gauge engagement through real-time feedback, participation rates, and peer interactions to enhance learning outcomes.

Diverse Online Tools: Encourage faculty to diversify their use of online tools, including assessments, discussion forums, and chat rooms. These tools enhance interactivity, foster collaboration, and offer alternative assessment methods for a richer learning experience.

Continuous Improvement and Recognition: Establish a culture of continuous evaluation and adaptation for technology integration initiatives. Recognize and incentivize faculty members who excel in innovative and effective technology integration.

These five recommendations provide a concise yet comprehensive framework for institutions aiming to enhance technology and online resource integration in commerce and management education while addressing the findings and discussion from the study.

Conclusion

The study exploring the use of technology and online resources in commerce and management education in Karnataka found that the majority of respondents believed that the use of technology and online resources enhances student engagement, impacts student achievement, and improves the quality of teaching. The Learning Management System (LMS) was found to be the most effective technology or online resource for enhancing student learning outcomes. While most of the respondents were familiar with the guidelines of NEP regarding the use of technology and online resources in education, there is still a significant percentage of respondents who are not aware of it. Institutions should increase awareness of NEP guidelines among faculty members to ensure that they are incorporating the latest guidelines and recommendations in their teaching methods. Student engagement in class was identified as the most effective way to measure the effectiveness of technology or online resources in teaching methods. Therefore, institutions should encourage faculty members to monitor and evaluate student engagement when using technology or online resources in their teaching methods. (Borup, J.,et.al 2012, Sujatha, S. 2013, Limbu, Y. B., & Rai, S. K. 2020). The study recommends that institutions should prioritize the use of technology and online resources in commerce and management education to enhance student engagement, improve student achievement, and enhance the quality of teaching.

References

Agarwal, M., & Purohit, A. (2019). Barriers to the adoption of technology in education: A systematic review of the literature. *Journal of Educational Technology & Society, 22(2)*, 47-58.

Al-Amin, M., Zubayer, A. al, Deb, B., & Hasan, M. (2021). Status of tertiary level online class in Bangladesh: students' response on preparedness, participation and classroom activities. *Heliyon, 7(1).* https://doi.org/10.1016/j.heliyon.2021.e05943

Al-Busaidi, K. A. (2019). Challenges of Integrating Technology in Education: A Review of Literature. *Journal of Education and Practice, 10(2),* 1-6.

Almahasees Z, Mohsen K and Amin MO (2021) Faculty's and Students' Perceptions of Online Learning During COVID-19. *Front. Educ.* 6:638470. doi: 10.3389/feduc.2021.638470

Almusaed, A.; Almssad, A.; Yitmen, I.; Homod, R.Z. (2023) Enhancing Student Engagement: Harnessing "AIED"'s Power in Hybrid Education—*A Review Analysis. Educ. Sci.*, *13*, 632. https://doi.org/10.3390/educsci13070632

Borup, J., West, R. E., & Graham, C. R. (2012). Improving online social presence through asynchronous video. *Internet and Higher Education, 15(3),* 195-203.

Chandra, R., & Sharma, A. (2021). Impact of Covid-19 on higher education: A review of literature. *International Journal of Research in Humanities, Arts and Literature, 9(1),* 231-243.

Chen, X., Zhu, Z., Zhou, Y., Li, M., & Sun, H. (2020). Technology-based teaching methods and their effects on learning outcomes and student engagement: A meta-analysis of randomized controlled trials. *Computers & Education, 156,* 103933. doi: 10.1016/j.compedu.2020.103933

Cohen, A., Soffer, T., & Henderson, M. (2022). Students' use of technology and their perceptions of its usefulness in higher education: *International comparison. Journal of Computer Assisted Learning, 38(5).* https://doi.org/10.1111/jcal.12678

Danchikov, E. A., Prodanova, N. A., Kovalenko, Y. N., & Bondarenko, T. G. (2021). potential of online learning in modern conditions and its use at different levels of education. *Linguistics and Culture Review, 5(S1).* https://doi.org/10.21744/lingcure.v5ns1.1442

Kaur, H., & Singh, P. (2018). Effectiveness of blended learning in higher education: A review. *International Journal of Emerging Technologies in Learning, 13(7),* 40-48.

Keengwe, J., & Kidd, T. T. (2010). Towards best practices in online learning and teaching in higher education. *MERLOT Journal of Online Learning and Teaching, 6(2),* 533-541.

Limbu, Y. B., & Rai, S. K. (2020). The use of information and communication technology (ICT) in education: A review of the literature. *Education and Information Technologies, 25(4),* 3271-3295.

Ministry of Education. (2020). *National Education Policy 2020. Government of India.* Retrieved from https://www.education.gov.in/hi/nep/nep-2020

Ngqondi, T., Maoneke, P. B., & Mauwa, H. (2021). A secure online exams conceptual framework for South African universities. *In Social Sciences and Humanities Open (3, 1).* https://doi.org/10.1016/j.ssaho.2021.100132

Pandit, D., & Agrawal, S. (2022). Exploring Challenges of Online Education in COVID Times. *FIIB Business Review, 11(3)*. https://doi.org/10.1177/2319714520986254

Ramesh, N., & Rani, G. (2017). Multimedia-assisted teaching and learning: A study of management students. *Indian Journal of Science and Technology, 10(9),* 1-8.

Sahai, N., & Thakkar, M. (2018). Effect of technology-enhanced teaching methods on student engagement and academic performance in commerce education. *International Journal of Recent Technology and Engineering, 7(5S)*, 345-348.

Sharma, P., & Singh, V. (2020). Use of Online Resources by Faculty Members in Higher Education Institutions of India. *Journal of Library and Information Sciences, 6(2),* 47-59.

Shivakumar, M., & Aithal, P. S. (2019). Use of technology and online resources in commerce and management education: A study of Karnataka state. *International Journal of Applied Engineering and Management Letters (IJAEML), 3(2),* 14-27.

Singh, A., & Thakur, D. (2019). Use of Technology in Higher Education in India. In Proceedings of the *International Conference on Recent Developments in Social Sciences and Business Studies* 104-110.

Sujatha, S. (2013). A study of effective classroom management techniques to enhance academic achievement in middle school social studies. *International Journal of Social Science and Interdisciplinary Research, 2(9),* 31-38.

Yildirim, S., & Ozmaden, M. (2017). Faculty members' perceptions on the use of technology in higher education. *International Journal of Higher Education, 6(4),* 56-66.

Yureva, O. v., Burganova, L. A., Kukushkina, O. Y., Myagkov, G. P., & Syradoev, D. v. (2020). Digital transformation and its risks in higher education: Students' and teachers' attitude. *Universal Journal of Educational Research, 8(11 B).* https://doi.org/10.13189/ujer.2020.082232

Research Article

Digital Citizenship, Internet Attitudes and Computer Self-Efficacy: Mapping Factors Influencing Middle School Students' Online Participation

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Abstract

Today's technology, transcending barriers of space and time, has increasingly allowed our younger generations to enter a digital world and form online communities in their personal, social and educational lives. Digital citizenship is the norms and standards for appropriate and responsible online behaviour ensuring a positive, optimal, ethical, and safe use of technology. This study aims to understand middle school students' levels of digital citizenship and its relation to their internet attitudes and perceived computer self-efficacy. It also analyses factors affecting students' level of digital citizenship. A survey of 385 middle school students studying in grades 6, 7 and 8 of private schools in Delhi was conducted. The results reveal that students' grade level but not gender influences their digital citizenship level. Students' internet attitudes and computer self-efficacy were positively correlated to their levels of digital citizenship. The paper ends with educational implications for educators and curriculum designers.

Keywords: Digital Behaviour; Digital Citizenship; Middle School; Digital Practices; Computer Self-Efficacy; Internet Attitude; Digital Literacy; Online Participation; Digital Access; Digital Welfare

Introduction

Advancing information and communication technologies are transforming the world we live in into a small yet global village. Technology today has made it possible for us to overcome barriers of space and time. In the current century, humans use technology for a variety of reasons including working from home, searching for information online, payment of utility bills, casting votes, lodging complaints online, attending virtual classes, and communicating with friends and family, shopping and so on. The restrictions posed by governments across the globe to contain the impact of Covid-19, has further pushed more and more people to go digital in different spheres of their life. This participation in the networked society (Van Dijk, 1991) is not only at a personal or professional level but also civic level, say casting votes, sharing one's public opinion, signing petitions, and organisation and participation in public protests, etc. This citizenship in the digital world is more global and more dynamic in nature (Reynolds & Scott, 2016). The communicative functions of digital technologies indicate new and dynamic forms of engagement with democracy (Baddeley, 1997; Moore, 1999) as well as conducting one's citizenship irrespective of the boundaries of the nation-state, for instance, the #MeTooMovement #BlackLivesMatter, #FarmersProtest, etc. More than the adults, it is nowadays the younger generations, also popularly known as the digital natives (Prensky, 2010), who engage regularly with these digital technologies. With increased exposure to these technologies, yet little or incomplete knowledge about these digital communities and the consequences of one's actions online, our younger generation is left vulnerable to technology disuse, misuse (Miles, 2011) and the evils of the cyber world (Feinberg & Robey, 2008; Mitchell & Ybarra, 2007; VanFossen & Berson, 2008).

Social media and technology access among middle school students compared to primary school students has increased significantly over the past years. According to a 2015 survey conducted by ASSOCHAM, about 95% of teens surveyed used the Internet, about 81% of them were active on social media with about 72% logging into social media more than once a day (IANS, 2015). Middle school is also a time when citizenship education is introduced in the form of civics (political science, a separate subject) in many schools. With continuously increasing online engagement in the personal, social and educational lives of our younger generation, it becomes pertinent to first understand their online digital preparedness, behaviour and practices. This can then help better plan and equip them with relevant skills to actively participate as efficient citizens of the digital world (Ribble, 2004). Achieving 'civic efficiency' or 'good citizenship' based on social and political participation in one's community is one of the primary aims of education (Dewey, 1916). Thus, the present work aims to understand middle school students' preparedness for and participation (i.e., citizenship) in the digital world. It seeks to understand the relation of their internet attitudes and perceived computer self-efficacy on their digital citizenship.

Review of Related Literature

Traditional, Critical and Digital Citizenship

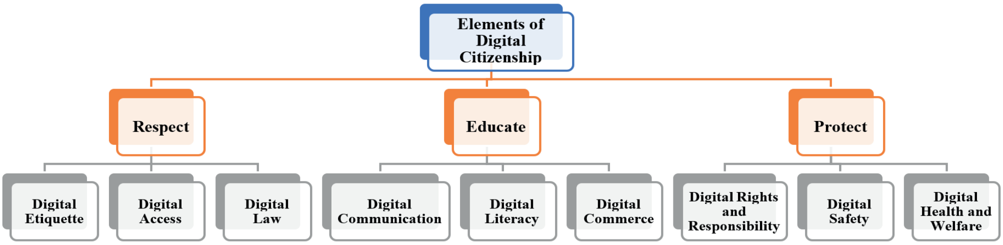
Traditionally, the concept of citizenship is understood as a "legal status/ membership" (Banks, 2008) or a "nationally-bounded membership" (Fischman & Haas, 2012). The phrase 'citizen of a nation-state' has a nationalist right- and responsibilities-based connotation, i.e., the people who are citizens of a nation enjoy certain civil, political, economic, and social rights and responsibilities (Castles & Davidson, 2000). Therefore, a good citizen, from this perspective, obeys laws, follows rules and regulations, and knows and performs their rights and responsibilities, such as voting, paying taxes, preserving national civic culture, heritage, etc. This traditional notion was challenged by many scholars in the late 1990s and 2000s to pave the way for critical conceptions of citizenship. The critical perspective on citizenship recognises the need for expanding the traditional understanding of citizenship by including phenomena like multiculturalism and globalisation, thereby, voicing the inclusion of many ethnically, religiously, linguistically, and culturally marginalised groups to get full citizenship rights (Abu El-Haj, 2007; Agbaria, 2011; Banks, 2008; Ong, 1996; Pike, 2000). Critical Citizenship is a critical form of citizenship wherein a 'good' citizen recognises local, national and global identities and cultural backgrounds and is active and empowered enough to challenge the existing power structures and pursue social equality and justice (Banks, 2008; Westheimer & Kahne, 2004). The prevalent and pervasive use of the Internet in human life paved the way for a new form of citizenship – Digital

Citizenship. Digital citizenship is the "norms of acceptable behaviour with regard to technology use" (Nordin et al., 2016; Ribble, 2004) in social as well as educational environments (Nosko & Wood, 2011). Farmer (2011) explains that digital citizenship is the "ability to use technology safely, critically, productively and civically". It is the users' ability to participate in the online society which in turn requires regular and effective access to the internet and the skills for technology use (Mossberger, Tolbert & McNeal, 2011). This concept emphasizes the internet's empowering capacity for the exercise of economic, political, and social rights and other opportunities often associated with citizenship (Jenson, 2008; Marshall, 1992). For this research, the term digital citizenship is operationalised as norms and standards for appropriate and responsible behaviour (ISTE, 2000; Ribble, 2014) by the users to use technology in an effective, safe, ethical, sensible, critical, reasonable, and productive manner (Farmer, 2011; Miles, 2011), hence, ensuring a positive and optimal use of technology (Alqahtani, Alqahtani & Alqurashi, 2017). Furthermore, education for digital citizenship can offer ways to deal with variegated issues arising from technology use, thereby, also preparing the younger generations with enough knowledge and skills to participate as effective citizens of the twenty-first-century digital world (Ribble, 2011). The sections below elicit the knowledge, actions and skills that encompass digital citizenship and the factors that influence digital citizenship behaviours.

Elements of Digital Citizenship

Bailey, Ribble and Ross (2004) offer a comprehensive framework of nine elements (or skills) of digital citizenship. These elements can be super classified into 3 main themes: 1) Respect oneself and others; 2) Educate oneself and others; and 3) Protect oneself and others. Together, these are popularly known as REP. Each of the themes further consists of 3 basic elements (See figure 1). The first theme Respecting oneself and others in a digital environment involves i) Digital Etiquette (electronic standards for conduct or procedure and being mindful of consequences of one's digital actions on others); ii) Digital Access (extent of individual's participation in society and equitable distribution of technology and e-resources) and iii) Digital Law (Electronic responsibility for owning up one's actions and deeds viz. rules and policies that are meant to address digital issues). The second theme Educate oneself and others about the digital world, its advantages, limitations, etc. also involves 3 basic elements: i) Digital Literacy (being fluent in using technology and being critical of different platforms and information available online); ii) Digital Commerce (ability to engage in e-buying and selling of goods, net banking, etc.); iii) Digital Communication (exchange of information electronically). The third theme Protecting oneself and others from the dangers of the digital world comprises another 3 basic elements (abilities): i) Digital Rights and Responsibilities (being aware of the rights and responsibilities extended to every member in the digital world); ii) Digital Health and Welfare (psychological and well-being in a digital world; maintaining a healthy balance); iii) Digital Security (precautions, prevention, privacy and safety in a digital world). Together, these become a set of nine elements of digital citizenship behaviour.

Figure-1: Main themes and elements of digital citizenship behaviour (Bailey, Ribble and Ross, 2004)



Factors Influencing Digital Citizenship

With increased exposure to technology, people are no longer passive receivers of information but rather have become active information processors and producers (Simsek & Simsek, 2013). Several studies have sought to understand different factors influencing a person's digital citizenship such as their racial and educational differences (Shelly, et. al, 2004), the extent of digital access and exposure (Isman & Canan-Gungoren, 2013; Mossberger, Tolbert & Anderson, 2017), technology attitudes (Al-Zahrani, 2015; ISTE, 2000; Shelley et al., 2004) and computer self-efficacy (Al-Zahrani, 2015; Wangpipatwong, Chutimaskul & Papasraton, 2008). Ohler (2011) argues that if technology is integrated into the school curriculum it can be helpful for enhanced teaching-learning as well as open up opportunities for teaching about responsible internet participation to the learners. Such discussions and interventions, according to Orth and Chen (2013) should start early in children's lives, as early as they start getting exposed to digital technologies.

Digital Citizenship, Computer Self-efficacy, and Internet Attitudes

Self-efficacy, according to Bandura (1994) is an individual's belief or judgement about one's capabilities to produce designated levels of performance on a task. Self-efficacy levels in individuals can differ depending on how individuals construe themselves, their perceived capabilities and achievements, the roles they are expected to play, the views they share with others and their perception of what others think about them (Bong and Skaalvik, 2003). In a study on people's intention to use e-government websites, Wangpipatwong, Chutimaskul and Papasratorn (2008) indicated that an individual's intention to use e-government websites and their perceived computer self-efficacy are positively correlated. Furthermore, students' attitudes towards technology and the internet are essential in promoting their digital citizenship (ISTE, 2000; Shelly, et. al, 2004). The research by Shelly, et. al (2004) reported a direct link between technology attitudes and digital citizenship, thereby, bridging the digital divide in the US. According to Sam, Othman and Nordin (2005) students' attitudes towards technology should be continuously enhanced to use technology in teaching-learning approaches. Al-Zahrani's (2015) research on 174 university students in Saudi Arabia reported a positive link between students' perceived computer self-efficacy and their higher levels of digital citizenship. In the Indian context, however, there seems to be very little research in the area of digital citizenship, computer self-efficacy and internet attitudes as factors affecting an individual's digital citizenship.

Significance of the Study

Over the past few years, digital penetration, especially for mobile technologies has significantly increased in India. The availability of cheaper and high-speed internet packages due to intense corporate competition and the push from the government policies has further accelerated the adoption of Internet, mobile and other digital technologies in urban and rural India. This is true more so in the context of urban and metropolitan cities like Delhi NCR. In the educational sphere, the Government of India is undertaking several measures to integrate technology into teaching-learning practices at all educational levels, thereby, making learning equitable and accessible to all. Examples of such initiatives include subsidies to technology companies (especially start-ups), public-private partnerships to strengthen national digital infrastructure, grants to educational institutions for the purchase of technological equipment and the development of several online teaching-learning platforms such as DIKSHA portal, NROER, SWAYAM, SWAYAM Prabha, etc. In addition to this, the National Education Policy (NEP, 2020), encourages greater use of AI-based technologies and other disruptive technologies in education in the present and the coming future (MHRD, 2020). The NEP (2020) views bridging the digital divide, imparting digital literacy skills, and preparing our students and teachers to tackle the downsides of using technology as prerequisites to realising its vision of technology-enhanced education, governance, and economy (MHRD, 2020). These issues are key to the concept of digital citizenship. Additionally, the NEP (2020) envisages the purpose of our education system to produce "engaged, productive and contributing citizens for building an equitable, inclusive and plural society as envisaged by our Constitution" (MHRD, 2020, p. 5); a core aim of digital citizenship education. As a result, one could see greater adoption of technology both at school and at home in the coming years. Keeping this in view, the present study contributes to the academic and professional interest in digital citizenship and education at 3 levels. First, it provides insights into urban middle school students' digital behaviour, attitudes and notions about their digital capacities, rights and responsibilities. Second, it provides future researchers with a foundation to further understand, in an urban Indian context, how different factors impact one's experiences in the digital world and, thus, their participation and citizenship thereof. Third, the study provides practical educational implications for policymakers, curriculum designers and teachers seeking to integrate digital citizenship education as part of the wider education system.

Research Questions

The current study adopts the digital citizenship framework by Ribble (2014) to gauge middle school students' levels of digital citizenship as well as study the relation of students' age, grade, internet attitudes and their computer-self efficacy with their digital citizenship. The following are the research questions for this study:

1. What is the level of middle school students' digital citizenship in terms of Respect, Educate and Protect (REP)?
2. Does students' gender level influence their level of digital citizenship?
3. Does students' grade influence their level of digital citizenship?
4. Does students' internet attitude influence their level of digital citizenship?

5. Does students' perceived computer self-efficacy impact their level of digital citizenship?

Hypotheses

Following are the hypotheses to support the research questions for this study.

Hypothesis 1 ($H_0$1): *There exists no significant relationship between students' gender and their level of digital citizenship.*

Hypothesis 2 ($H_0$2): *There exists no significant relationship between students' grade (class) level and their level of digital citizenship.*

Hypothesis 3 ($H_0$3): *There exists no significant relationship between students' internet attitudes and their digital citizenship levels.*

Hypothesis 4 ($H_0$4): *There exists no significant relationship between students' computer self-efficacy and their levels of digital citizenship.*

Method

This study utilizes a quantitative research design. The design was conceptualised in two phases. Phase I dealt with students' internet attitudes and self-efficacy towards digital technologies while Phase II focused on understanding students' level of digital citizenship through a series of choices they make and the views they hold on different issues arising out of one's digital participation. Since regular exposure to technology is a prerequisite to being a digital citizen (Mossberger, Tolbert & McNeal, 2011), the study focuses on middle school students studying in private schools in Delhi. This is because the students studying in private schools in India comparatively have far greater exposure and access to digital technology both at school and at home than their counterparts in government schools (Education Quality Foundation of India, 2019). Additionally, the probability of students' exposure to and independent use of the Internet, social networking sites and other digital platforms are higher during their adolescent (teen) years than in children and adults (Lenhart, 2015; Madden, 2013; Martin, et. al., 2018; Nazir, 2014; Raj, et al., 2018). Therefore, the study used a purposive sampling technique to select the school type and grade level to better serve the research objectives. Upon selecting the schools and grade levels, individual participants (students) were selected randomly. As a result, a total of 385 middle school students (Males = 209, Females = 176) participated in the present study (See table 1).

Table-1: Sample for the study

	Number of students			Number of students				Total
School Type	Male	Female	Total	Grade 6	Grade 7	Grade 8	Total	
Private	209	176	385	121	162	102	385	385

The study utilised a survey design wherein a structured (self-reporting) questionnaire constituting three Likert scales – Internet Attitude Scale (IAS), Computer Self-Efficacy Scale (CES) and Digital Citizenship Scale (DCS) was developed. The scale used for Internet attitude was a modified version of Al-Zahrani (2015) who modified the Internet Attitude scale by Sam, Othman and Nordin (2005) that was originally adapted from the 20-item Computer Attitude Scale developed and validated by Nickell and Pinto (1986). The CES and DCS were adapted from Al-Zahrani (2015) and were appropriately contextualized and adapted as per the Indian context and the level of participants. The Cronbach alpha coefficient for Al-Zahrani's (2015) tool was 0.92.

The Digital Citizenship Scale developed for this study was available for rating on five points (5 = Strongly Agree and 1 = Strongly Disagree) that required the participants to mark their agreement or disagreement with a statement. The Internet Attitude Scale was also available for rating on five points (5 = Absolutely Yes; 4 = Yes; 3 = Not Sure; 4 = No; 5 = Absolutely No). The Computer Self-Efficacy Scale included items on three levels of computer proficiency: Basic, Intermediate and Advanced level, as per the guidelines of the National Policy on ICT in School Education (MHRD, 2012). The respondents were expected to rate their perceived abilities on a scale of 5 points (5 = I can do it and can also teach it to a friend; 4 = I can do this by myself; 3 = I don't know if I can do this; 2 = I can do this with someone's help; 1 = I can't do it, I need a lot of help). In the case of the negative items, the procedure of reverse scoring was utilized. These scales were also translated into the Hindi language to avoid any possible language barriers. The tool was subjected to a team of experts to establish its validity (viz. its relevance, content, context, and construction). Only those items in the questionnaire, whose Lawshe's Content Validity Ratio (CVR) value was found to be above 0.99 (Miller, McIntire and Loyler, 2011) were included as part of the final tool. The remaining items were either dropped or modified appropriately as per the experts' suggestions.

The final tool comprised 46 items spread across three scales (See Table 2). The Internet Attitude Scale (IAS) consisted of a total of 6 items that included issues of students' comfort with the Internet; their views on possible uses of the Internet; responsible use of the Internet; the role of the Internet in making individual's lives easy and comfortable; and its role in improving individual's standard of living and bringing us to a newer, brighter era. The Computer Self-Efficacy Scale (CES) consisted of 14 items revolving around students' confidence in performing computer-related tasks (at basic, intermediate and advanced levels) such as understanding terms and concepts regarding computer hardware and software; using hardware devices of computers, performing tasks on a computer such as creating backups, troubleshooting computer problems, protecting one's own information, etc. The Digital Citizenship Scale (DCS) further consisted of three subscales (REPs): a) Respect yourself/respect others, b) Educate yourself/connect with others and c) Protect yourself/protect others. In total, the DCS consisted of 26 items. These items, under the three subscales, belonged to the issues of digital access, law and etiquette (Respect subscale); digital literacy, commerce and communication (Educate subscale); and Digital rights and responsibilities, health and wellness and security (Protect subscale).

The reliability of the tool was established through an internal consistency test (Cronbach's alpha coefficient) wherein the alpha value was found to be 0.80, i.e., above 0.7 (see Table 2). It also must be noted that the data from the protect yourself/others category must be taken with a pinch of salt.

Table-2: Reliability statistics for the tool

Scale	Sub Scale	α	o. of items
Internet Attitude Scale (IAS)		0.729	06
Computer Self-Efficacy Scale (CES)		0.858	14
Digital Citizenship Scale (DCS)	Respect Yourself/Respect Others	0.763	14
	Educate Yourself/Connect with Others	0.756	06
	Protect Yourself/Protect Others	0.510	06
Digital Citizenship Scale (Total)		0.766	26
Total Questionnaire		0.800	46

Delimitations of the Study

The study delimits itself to middle-grade students from private schools located in the Delhi-NCR region. The variables, such as students' socio-economic status that may affect their views and use of digital technologies, were not considered as part of the present study.

Results

Students' Internet Attitude and Computer Self-Efficacy

The total mean of students' responses was calculated to gain a general sense of students' Internet attitudes and perceived computer self-efficacy, respectively (see Table 3).

Table-3: Descriptive statistics for students' Internet attitude and computer self-efficacy (n = 385)

Scale	No. of item	Mean	S.D.
Total Internet Attitude	6	4.18	0.561
Total Computer Self-Efficacy	14	4.11	0.55

It is clear from Table 3, that overall, the students had a good level of attitude towards the Internet (M = 4.18, SD = 0.561) and good level of computer self-efficacy (M = 4.11, SD = 0.55). Thus, it can be said that the students had an overall positive attitude towards the internet and were confident in using computer technology.

Students' Digital Citizenship

The mean of students' responses on the digital citizenship scale was calculated to gain insights into students' level of digital citizenship. This was done in terms of REP (Respect, Educate and Protect: the three sub-scales) as well as the total digital citizenship scale (see Table 4).

Table-4: Descriptive statistics for students' digital citizenship (n = 385)

Scale		No. of items on the scale	Mean	Standard Deviation
DCS	Respect	14	3.88	0.47
	Educate	6	3.57	1.15
	Protect	6	3.62	0.71
	DCS Total	26	3.75	0.47

Table 4 represents the overall descriptive statistics for each of the subscales and the overall digital citizenship scale. For a 14-item Respect subscale, the mean is 3.88 with a standard deviation of 0.47. For a 6-item Educate subscale, the mean comes out to be 3.57 with a standard deviation of 1.15. For a 6-item Protect subscale, the mean comes out to be 3.625 with a deviation of 0.71. It can be observed that the digital citizenship practices with the highest mean score value, as Table 4 represents, are concerned with their practices of respecting oneself and others in a digital environment. This is followed by practices of protecting oneself and others (M = 3.62) and educating oneself (M = 3.57). Overall, the students showed good levels of digital citizenship (M = 3.75).

Students' Gender and their Digital Citizenship: A two-tailed t-test was performed to test whether any significant differences exist between students' gender and their level of digital citizenship. No significant differences were found between students' gender and their level of citizenship ($t = 1.55$ with $p = 0.121 > 0.05$; not significant) (See Table 5). Hence, we accept the 1st null hypothesis, i.e., there exists no significant relationship between students' gender and their level of digital citizenship.

Table-5: t-Test results for students' digital citizenship with respect to gender variable

Gender	n		S.D.	t	Sig. (p)
Male	209	96.72	12.62	1.55	0.121
Female	176	98.72	11.96		

*: Significant at 0.05 level (2-tailed)

Students' Grade (class) level and their Digital Citizenship: To address the second hypothesis, a one-way ANOVA test was conducted to investigate the link between students' class/grade level and their digital citizenship. Table 6 summarises the results from the one-way ANOVA test.

Table-6: One-way ANOVA results for students' digital citizenship with respect to the class variable

Grade (Class)	n	M	S.D.	F	Sig. (p)
Grade 6	121	94.60	13.50	5.731	0.004**
Grade 7	162	98.57	11.99		
Grade 8	102	99.86	10.67		
Total	385	97.60	12.36		

**: Significant at level 0.01 (2-tailed)

Since $p = 0.004 < 0.01$ level of significance, hence, we say that our F-value is significant, and therefore, we reject the 2nd null hypothesis. The grade level of students does influence their level of digital citizenship. Furthermore, assuming equal variances among groups, Tukey's HSD post hoc test revealed that there is a statistically significant mean difference in the digital citizenship level of grade 6 and grade 7 [p = 0.019] at a 0.05 level of significance (See Table 7). In other words, grade 7 students have a significantly better level of digital citizenship than grade 6 students. The post hoc test also revealed a statistically significant mean difference in the digital citizenship level of grade 6 and 8 students [p = 0.006] at a 0.05 level of significance. Therefore, we can conclude that grade 8 students had better digital citizenship levels as compared to grade 6 students.

Table-7: Tukey's HSD Post hoc test results for students' digital citizenship with respect to the class variable

Dependent Variable		Class	(J) Class	ean Difference (I-J)	g. (p)
Digital Citizenship	Tukey HSD	6	7	-3.97*	0.019
			8	-5.26*	0.006
		7	6	3.97*	0.019
			8	-1.29	0.698
		8	6	5.26*	0.006
			7	1.29	0.698

*: Significant at 0.05 level (2-tailed)

Relationship between Internet Attitude, Perceived Computer Self-Efficacy and Digital Citizenship

To address the third and fourth hypotheses, Pearson's product-moment correlation analysis was used to investigate the relationships between students' internet attitude, computer self-efficacy and digital citizenship, respectively. The test revealed several positive correlations (see Table 8).

Table-8: Pearson's correlations for students' internet attitudes, computer self-efficacy and digital citizenship

		Respect Yourself/ Respect Others	Educate Yourself/ Connect with Others	Protect Yourself/ Protect Others	Overall Digital Citizenship
Internet Attitude **(n= 385)**	PC (r)	0.165**	0.272**	-0.22	0.233**
	Sig.	0.001	0.000	0.667	0.000
Computer Self-Efficacy **(n= 385)**	PC (r)	0.229**	0.271**	0.160**	0.330**
	Sig.	0.000	0.000	0.002	0.000

**: Correlation is significant at 0.01 level (2-tailed); PC: Pearson product-moment correlations

From Table 8, it can be concluded that students' higher levels of internet attitude are associated with their higher levels of respect for themselves and others [$r = 0.165$, $n = 385$, $p = 0.001$] and practices of educating oneself and others [$r = 0.272$, $n = 385$, $p = 0.000$], respectively. However, no correlation was found between students' internet attitudes and their practices of protecting themselves/others in online setups. Finally, students' overall digital citizenship was found to be positively correlated with their internet attitude [$r = 0.233$, $n = 385$, $p = 0.000$].

Similarly, it can be concluded that students' higher computer self-efficacy is strongly (positively) correlated with higher levels of respect [$r = 0.229$, $n = 385$, $p = 0.000$], with practices of educating oneself/others online [$r = 0.271$, $n = 385$, $p = 0.000$] as well as protecting oneself/others online [$r = 0.160$, $n = 385$, $p = 0.002$]. Finally, higher levels of computer self-efficacy were strongly linked to higher levels of overall digital citizenship [$r = 0.330$, $n = 385$, $p = 0.000$].

Discussion and Educational Implications

Most participants were regularly exposed to technology both at home as well as at school. At school, however, students only accessed the digital facilities provided by the school itself, i.e., in their respective classrooms and computer labs and were not allowed to carry their own digital devices to the school. Mossberger, Tolbert, and Anderson (2017) argued that having access to mobile devices and broadband is statistically significant in influencing an individual's digital citizenship and their online economic (Latino communities), political and civic activities (Afro-American). Though the students with greater digital exposure had greater digital literacy and computer self-efficacy they were not necessarily critical of the digital technologies and their online practices. This could be because students are using digital devices in a more self-centred manner without giving much thought to the deeper issues and social impact they cause. Hence, there is an urgent need to incorporate critical discussions and analyses of digital technologies and their usage patterns in students' curricula and classrooms.

The results also revealed that middle school students had an overall good level of perceived internet attitude (see Table 3). This means that students are comfortable using the internet and are also confident and motivated to integrate it into their daily lives. These students perceive the Internet as a potentially useful tool and that if used appropriately and responsibly, the Internet can help provide easy, rich, and enjoyable sources of information. The students also believed that the Internet can help them in eliminating a lot of boring work from their lives. Furthermore, the learners perceive the Internet as being responsible for many good things that they enjoy (such as their ability to access a lot of information at their fingertips, videos, and games). Hence, they seemed positive that the Internet is bringing them to a new and brighter era.

The students correspondingly showed good levels of computer self-efficacy (see Table 3), i.e., they were confident in using the ICT tools for performing tasks such as understanding computer hardware, working on, and shutting down a computer, etc. Students were confident in installing and uninstalling any program on their digital devices and using those programs for creating files, reports, presentations, print outs and other outputs. In addition, students were confident about keeping their personal and important information safe in password-protected files and folders. However, the students were not very confident about understanding terms related to computer software and learning advanced skills within a specific program. Moreover, they also perceived themselves to be unable to troubleshoot computer problems on their own. This could be because their ICT curriculum deals more with the day-to-day functional use of digital technology to accomplish a variety of tasks but does not teach them how those technologies are developed and ways to troubleshoot problems that arise while working with these technologies. Due to a fear of permanently damaging the digital device, students are often discouraged to experiment with or attempt to troubleshoot a problem on their own (like opening the nuts and bolts of a CPU or disconnecting wires, etc.) and are advised to seek technical support from a lab assistant or an adult even for the smallest problems encountered by them.

In this study, the students also showed good levels of digital citizenship, especially in terms of their practices pertaining to respecting oneself as well as others in the online digital world. In the previous literature, Al-Zahrani (2015) and Roh (2004) confirmed that in the online world, it is becoming easier than ever to infringe on others. Therefore, respect has become vital in digital societies. The present study also indicates that respect is the foremost important issue for students when participating in the online digital world. Clearly, students preferred to participate only in those environments where they felt respected by their fellow participants. It appeared that the students valued respecting one's and other's identities, cultures rights and responsibilities in the digital communities and that they rejected the acts of cyberbullying, trolling, identity theft, online phishing, and mockery. Parallelly, it can be said that a feeling of lack of respect for oneself in an online community may lead these students to withdraw from or completely stop participating in those communities. However, valuing the idea of respecting others may not necessarily translate into practice. Thus, there is a need to further explore students' actual online practices and behaviours along with making relevant changes in the curriculum that can offer opportunities to practice respecting and protecting oneself and others in a safe online environment. According to Kassam (2013), it is this ability and skill to respectfully participate and argue in digital communities that can be taught in twenty-first-century classrooms.

On further comparison of the Respect, Educate and Protect themes of the digital citizenship scale, it was found that the students felt confident in their education of and respecting behaviours online. However, protecting oneself and others online was an idea that students subscribed to but felt significantly underconfident in taking actions to protect themselves or others when faced with adverse situations online. They also seemed unaware of the various online grievance redressal mechanisms and steps to take when faced with dangerous or risky online situations. Thus, there is a need to also offer opportunities within the mainstream curriculum to discuss and practice ways to protect oneself and others online.

The study revealed that the gender of the students is not related to their digital citizenship practices. Such a finding also suggests that even though girls may (or may not) have greater access to technology than boys (Indiatimes, 2017), still they can be equally sensitive and aware of the issues of digital citizenship. However, this finding might be especially true only in the case of boys and girls from relatively well-to-do families residing in urban, well-developed areas. Further probes in this regard are required.

Furthermore, it was found that the higher the student's class level, the higher their digital citizenship levels. Grade 6 students did not show as much good digital citizenship levels as grade 7 and 8 students did. Students from grades 7 and 8 appeared to be more aware of several skills and issues around ICT than the grade 6 students. However, an interesting point to this interpretation is that there were no significant differences in the digital citizenship practices of grade 7 and grade 8 students. Rather it was only the grade 6 students whose performance differed significantly from the rest of the two grades. Such a finding can be explained with the background information that the students of grades 7 and 8 were active members of social networking sites while grade 6 students were not as active on social media. The finding can also be explained by the rising level of complexity and variety of topics catered to in the ICT curriculum of these grades. However, more studies on curriculum analysis and classroom and home practices may be required to study such a pattern in greater detail.

Through the correlational analysis, it was found that students' higher levels of internet attitude are related to their higher levels of digital citizenship, especially with regards to their respecting and educating behaviours online. This implies that the students with higher levels of internet attitude are likely to be the ones who respect each other in the online world as well as take part in activities for educating themselves and others online. Such a person is likely to be an intelligent online consumer and creator who can efficiently and effectively use online digital services for different purposes. These results correspond with the results of Al-Zahrani (2015) and Shelley et al. (2004) who found a direct correlation between students' technological attitude and their digital citizenship. However, it was found that student's attitude towards the internet is not related to their practices of protecting themselves and others from the prevailing online risks and dangers. Rather this relation was found to be negative, though not statistically significant. This implies that if a person has a highly positive and non-critical attitude toward the internet, they may tend to ignore the potential risks and dangers (physical, social, and psychological) of the online digital space. Hence, might end up falling prey to and being victims of the numerous evils of the online digital world. Thus, there is a need to develop critical attitudes towards the Internet and newer technologies through carefully planned educational interventions.

Furthermore, the study results revealed that the students' computer self-efficacy is positively related to their digital citizenship behaviour, viz., their respecting behaviour towards others in the online world and their efforts to educate and protect themselves and others. It implies that a person with higher levels of computer self-efficacy is likely to be highly motivated and confident to respect others in the online environment, participate in learning and sharing activities that involve themselves and protect oneself and other fellow members in a digital community. While these results contrast with the findings of Al-Zahrani (2015), they correspond with the findings of Wangpipatwong, Chutimaskul and Papasratorn (2008) who found that computer self-efficacy positively influences participants' intention to participate in Internet-based virtual societies.

Finally, given the relationship between internet attitude, computer self-efficacy and digital citizenship behaviour, teachers and school administrators can work towards developing programs that can help improve students' critical attitude towards the internet and ICT as well as educate them and make them confident about their abilities for utilising and synthesising ICT-based technologies to fulfil their needs, and hence, fully participating in the online digital communities, thereby, also contributing towards making the younger generation better digital citizens.

Conclusion

The study revealed that the private school students indicated good levels of digital citizenship. These digital citizenship practices are concerned more with their practices of respecting oneself and others in a digital environment. Students prefer to participate only in those environments where they feel respected by their fellow participants and can display their respect for others. However, they do not feel confident in protecting themselves or others when faced with an adverse situation online. Additionally, it was found that students from grades 7 and 8 were more aware of several skills and issues around digital technologies and used social networking sites more proactively than the grade 6 students. This indicates that the higher the students' class level (in other words, their exposure), the higher their positive digital citizenship practices. Furthermore, it can be concluded that students' gender does not influence the digital citizenship practices undertaken by them. One of the objectives of the study was to investigate the relationship between students' internet attitude and computer self-efficacy with their digital citizenship levels, respectively. It was found that students' internet attitude is positively related to their digital citizenship practices. Similarly, students' high computer self-efficacy leads to their higher levels of digital citizenship. These two factors play an important role in also enhancing students' digital citizenship attitudes and behaviours. Since students must be responsible digital citizens at school and at home, it is, therefore, imperative to nurture their critical attitude toward the internet, raise their computer self-efficacy, and digital literacy and promote consciousness and self-reflection of one's digital behaviours. Addressing issues of the digital world as and when they arise would not serve a much greater purpose. Rather there is a need for integrating practical digital citizenship education into the mainstream curricula as soon as they start engaging with technology. The curricula and pedagogy of the different subjects should in themselves be technology-laden to increase students' overall technology attitudes, expertise, and self-efficacy about their expertise. Thereby, also facilitating the use of technology as an effective learning tool for self-directed lifelong learning. To foster positive digital citizenship practices in their day-to-day digital life, students, at all levels must be continuously educated about the different facets of digital engagement while addressing their context-specific different needs. Finally, more researches are required in the area to study students' actual online behaviours and experiment with ways to educate and nurture conscious, proactive, ethical, and critical digital citizens.

Ethical Considerations

This research was carried out after the ethical clearance of its methods by the research committee at the university where the researchers work. Permission to conduct research with the children was sought from the students themselves, their parents, teachers, and school heads. At all points during the study, it was ensured that participants and their guardians were fully aware of the objectives the nature of the present study and their role in the research process. It was ensured that throughout the research process, the participants were treated with the utmost care, respect and sensitivity, and their comfort was ensured. Participants' identities and choices were kept strictly confidential.

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References

Abu El-Haj, T.R. (2007). "I was born here, but my home, it's not here": Educating for democratic citizenship in an era of transnational migration and global conflict. *Harvard Educational Review, 77*, 285-316.

Agbaria, A. (2011). The social studies education discourse community on globalization: Exploring the agenda of preparing citizens for the global age. *Journal of Studies in International Education, 15*, 57-74.

Alqahtani, A., Alqahtani, F., & Alqurashi, M. (2017). The extent of comprehension and knowledge with respect to digital citizenship among middle eastern and US students at UNC. *Journal of Education and Practice, 8*(9), 96-102.

Al-Zahrani, A. (2015). Towards digital citizenship: Examining factors affecting participation and involvement in the internet society among higher education students. *International Education Studies, 8*(12), 203-217.

Baddeley, S. (1997). Governmentality. In B. D. Loader (Ed.), *The governance of cyberspace* (pp. 64-96). New York: Routledge.

Bailey, G.D., Ribble, M.S., & Ross, T.W. (2004). Digital citizenship: Addressing appropriate technology behaviour. *Learning & Leading with Technology, 32*(1), 6-12.

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behaviour* (vol. 4, pp.71-81). New York: Academic Press.

Banks, J. A. (2008). Diversity, group identity, and citizenship education in a global age. *Educational Researcher, 37*(3), 129-139.

Bong, M. & Skaalvik, E.M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review, 15*(1), 1-40.

Castles, S. & Davidson, A. (2000). *Citizenship and migration: Globalization and the politics of belonging*. New York, NY: Routledge.

Dewey, J. (1916). *Democracy and education*. New York, NY: Macmillan.

Education Quality Foundation of India. (2019). Use of information & communication technology in secondary schools: Research report. *A Study Commissioned by NITI Ayog*. New Delhi.

Farmer, L. (2011). Teaching digital citizenship. *In Proceedings of Global TIME- Online Conference Technology, Innovation, Media and Education* (pp. 291-296). Online: Association for the advancement of computing in education (AACE). Retrieved from https://www.learntechlib.org/p/37093/

Feinberg, T., & Robey, N. (2008). Cyberbullying. *Principal Leadership, 9*(1), 10-14.

Fischman, G.E. & Haas, E. (2012). Beyond idealized citizenship education: Embodied cognition, metaphors, and democracy. *Review of Research in Education, 36*, 169-196.

IANS (2015) *95% underage Indian teenagers use Internet: Assocham*. Available at: https://www.bgr.in/news/95-underage-indian-teenagers-use-internet-assocham-384013/ (accessed 23 August 2022).

Indiatimes (2017). *Inequality in digital India: Only 29 percent females across the country have internet access*. Retrieved from https://www.indiatimes.com/news/india/inequality-in-digital-india-only-29-per-cent-females-across-the-country-have-internet-access-335458.html

Isman, A., & Canan Gungoren, O. (2013). Digital citizenship. *The Turkish Online Journal of Educational Technology, 13*(1), 73-77.

ISTE (2000) National educational technology standards for students: Connecting curriculum and technology. Report, *International Society for Technology in Education*. Available at: https://archive.org/details/nationaleducatio0000inte/page/n9/mode/2up?view=theater

Jenson, J. (2008). Getting to sewers and sanitation: Doing public health within nineteenth-century Britain's citizenship regimes. *Politics and Society, 30*(4), 532-556.

Kassam, A. (2013). Changing society using new technologies: Youth participation in the social media revolution and its implications for the development of democracy in sub-Saharan Africa. *Education and Information Technologies, 18*(2), 253-263.

Lenhart, A., Duggan, M., Perrin, A., Stepler, R., Rainie, L., & Parker, K. (2015). *Teens, social media and technology overview*. Washington, DC: Pew research center's Internet and American life project. Retrieved from http://www.pewInternet.org/2015/04/09/teens-social-media-technology-2015

Madden, M., Lenhart, A., Cortessi, S., Gasser, U., Duggan, M., Smith, A., & Beaton, M. (2013). *Teens, social media, and privacy. Washington, DC: Pew research center's Internet and American life project.* Retrieved from http://www.pewinternet.org/files/2013/05/PIP_TeensSocialMediaandPrivacy_PDF.pdf

Marshall, T. H. (1992). The problem stated with the assistance of Alfred Marshall. In T. H. Marshall & T. Bottomore (Eds.), *Citizenship and Social Class* (pp. 3-51). London: Pluto Perspectives.

Martin, F., Wang, C., Petty, T., Wang, W., & Wilkins, P. (2018). Middle school students' social media use. *Educational Technology & Society, 21*(1), 113-124.

MHRD (2012). *National Policy on Information and Communication Technology (ICT) in School Education*. New Delhi: Department of School Education and Literacy, Ministry of Human Resource Development. Retrieved from http://mhrd.gov.in/sites/upload_files/mhrd/files/upload_document/revised_policy%20document%20ofICT.pdf

MHRD (2020). *National Education Policy*. New Delhi: Ministry of Human Resource Development, Government of India. Retrieved from https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Miles, D. (2011). Youth protection: Digital citizenship -Principles and new resources. Paper presented at the *Second Worldwide Cybersecurity Summit (WCS)*.

Miller, L.A., McIntire, S.A., & Lovler, R.L. (2011). *Foundations of psychological testing: A practical approach* (3rd ed.). London: Sage.

Mitchell, K.J., & Ybarra, M.L. (2007). Prevalence and frequency of internet harassment instigation: Implications for adolescent health. *Journal of Adolescent Health, 41*, 189-195. DOI: 10.1016/j.jadohealth.2007.03.005

Moore, R. K. (1999). Democracy and cyberspace. In B. N. Hague & B. D. Loader (Eds.), *Digital* *democracy: Discourse and decision making in the information age* (pp. 39-59). New York: Routledge.

Mossberger, K., Tolbert, C.J., & McNeal, R.S. (2011). *Digital citizenship: The internet, society and participation*. Cambridge: The MIT Press.

Nazir, T. (2014). Use of social networking sites by the secondary and higher secondary school students of Srinagar, Kashmir. *International Journal of Digital Library Services, 4*(3), 231-242.

Nickell, G. S., & Pinto, J. N. (1986). The computer attitude scale. *Computers in Human Behavior*, *2*, 301-306. DOI: 10.1016/0747-5632(86)90010-5

Nordin, M. S., Ahmad, T. B. T., Zubairi, A.M., Ismail, N. A. H., Rahman, A. H. A., Trayek, F. A. A., & Ibrahim, M. B. (2016). Psychometric properties of a digital citizenship questionnaire. *International Education Studies, 9*(3). 71-80.

Nosco, A., & Wood, E. (2011). Learning in the digital age with SNSs: Creating a profile. In B. White, I. King, & P. Tsang (Eds.), *Social media tools and platforms in learning environments* (pp.399-418). Springer Berlin Heidelberg. DOI: 10.1007/978-3-642-20392-3_24

Ohler, J. (2011). Digital citizenship means character education for the digital age. *Kappa Delta Pi Record, Fall*, 25-28.

Ong, A. (1996). Cultural citizenship as subject-making: Immigrants negotiate racial and cultural boundaries in the United States. *Current Anthropology, 37*, 737-762.

Orth, D., & Chen, E. (2013). The strategy for digital citizenship: Guiding our children in a digital world. *National Association of Independent School*, *Summer,* 56-63. Retrieved from https://www.nais.org/magazine/independent-school/summer-2013/the-strategy-for-digital-citizenship/

Pike, G. (2000). Global education and national identity: In pursuit of meaning. *Theory into Practice, 39*, 64-73.

Prensky, M. (2010). *Teaching digital natives: Partnering for real learning*. USA: Corwin Press.

Raj, M., Bhattacherjee, S., Mukherjee, A. (2018). Usage of online social networking sites among school students of Siliguri, West Bengal, India. *Indian Journal of psychological Medicine, 40*(5), 452-457. DOI: 10.4103/IJPSYM.IJPSYM_70_18

Reynolds, L., & Scott, R. (2016). *Digital citizens: Countering extremism online*. London: Demos.

Ribble, M. (2004). Digital Citizenship: Addressing appropriate technology behavior. *Learning & Leading with Technology, 32*(1), 6-11.

Ribble, M. S. (2014). *Digital citizenship: Using technology appropriately*. Retrieved from http://www.digitalcitizenship.net/Home_Page.php

Roh, Y.R. (2004). Democratic citizenship education in the information age: A comparative study of South Korea and Australia. *Asia Pacific Education Review, 5*(2), 167-177.

Sam, H. K., Othman, A. E. A., & Nordin, Z. S. (2005). Computer self-efficacy, computer anxiety, and attitudes toward the internet: A study among undergraduates in Unimas. *Educational Technology & Society, 8*(4), 205-219.

Shelley, M., Thrane, L., Shulman, S., Lang, E., Beisser, S., Larson, T., & Mutiti, J. (2004). Digital citizenship: Parameters of the digital divide. *Social Science Computer Review, 22*(2), 256-269.

Simsek, E., & Simsek, A. (2013). New literacies for digital citizenship. *Contemporary Educational Technology, 4*(2), 126-137.

Van Dikj, J. (1991). *The network society.* London: Sage.

VanFossen, P. J., & Berson M. J. (2008). Civic literacy in a digital age. *Contemporary Issues in Technology and Teacher Education, 8*(2), 122-124.

Wangpipatwong, S., Chutimaskul, W., & Papasratorn, B. (2008). Understanding citizen's continuance intention to use e-government websites: A composite view of technology acceptance model and computer self-efficacy. *Electronic Journal of e-Government Volume, 6*(1), 55-64.

Westheimer, J., & Kahne, J. (2004). Educating the good citizen: Political choices and pedagogical goals. *Political Science and Politics, 37*(2), 241-247. DOI: 10.1017/S1049096504004160.

Research Article

Digital Learning and Digital Divide: Scaling the Gap of Access and Equity among Schedule Tribe Students during Covid-19 Pandemic: A Case Study Approach

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Abstract

The study is grounded on a qualitative research approach conducted in rural Kashmir to emphasize the challenges of the digital divide among scheduled tribe students. It offers a critical examination of the prevailing techno-strategic debates and parental perspectives on digital learning. This study briefly explores the digital divide in virtual learning by analysing the ground situation among scheduled tribe students to identify and quantify the pattern and severity of the pandemic effect. It examines digital access, digital inclusion, and digital equity among the scheduled tribe students during a period when educational institutes were forced to stop on-campus classes and move to online classes owing to the spreading pandemic. Furthermore, investigating strategies to provide educational content virtually in situations where technology accessibility is limited or non-existent is a top research priority. The results revealed that the majority of presently enrolled ST learners lacked access to basic digital infrastructure, they were academically stagnant, and the marginalisation among them was further worsened during the Covid-19 pandemic. Finally, the study recommends some simple policy directions toward the resolution.

Keywords: Digital– Divide, Pandemic, Schedule Caste, Equity, Access.

Introduction

What the pandemic brings to light, is the tight relationship between education and technology access. Nonetheless, remote learning has become permanent in the field of teaching and learning and it will always be an important part of our educational landscape. While digitization is reshaping societies and powering the majority of digital economic growth of the world, some elements of society continue to lag. Economic, societal, regional, and generational barriers frequently underpin digital disparity or unfair distribution and acceptance of digital goods and services (Maceviciute and Wilson 2018; Van Dijk 2012). This unequal access to technology and internet has dismal effects not only on quality education but also on the mental health and social well-being of students.

The Digital Divide, also referred as the digital split, is a social issue that refers to the disparity that prevails among those who have access to contemporary information and communication technologies and those who do not. As the pandemic of Covid 19 spreads, there has been a major shift towards online classes because of the closing down of educational institutions for an uncertain period of time (Martinez, 2020). Education institutions have abandoned conventional in-class teaching in favour of remote teaching, which involves computers and the internet to connect students to teachers and educational sources. This unique and quick reconfiguration significantly altered the role of technology. As a result, a paradigm shift has emerged, with major ramifications for underprivileged students.

There is a prevalent belief that there is a technological answer to every problem. This technical solutionism is ludicrous because it misses the most fundamental question: can technology solve the educational difficulties caused by lockdown? Our recent experience with COVID-19 demonstrates that technology-based schooling caused by the pandemic has increased academic complications. It has had a negative impact and is exacerbating already existing educational gaps of susceptible students. People who do not have access to ICTs are much more disadvantaged than previously. These digital technical gaps have far-reaching consequences for educational access. They point to new hurdles in achieving the ideal of equal educational opportunity set in fundamental law over decades ago. Concerns have also been expressed about how people who are already marginalized in terms of access to ICTs, notably SCs, STs and girls, may suffer even more as a result of the current scenario. As a result, attempting to make online education a viable option in the aftermath of the COVID-19 issue runs the risk of further lagging many students, particularly the socioeconomically disadvantaged (UNESCO 2020). Therefore, when pupils were suddenly obliged to study from their homes, this disparity would have had a greater impact on the have-nots.

Literature review

A widely discussed phenomenon, the digital divide, was unequivocally exposed by the COVID-19 pandemic. As the Covid 19 pandemic spreads, online services were among the earliest and simplest distance solutions brought out in South Asia in reaction to the shutdown of educational institutes. UNESCO (2021) reported that the duration of closure of educational institutions in India has been amongst the lengthiest around the globe. However, estimates imply that only about 45 per cent of India's population uses the Internet. (Hootsuite and We Are Social, 2021). No doubt, these disparities existed previously, the COVID-19 contagion has highlighted this digital gap (Jæger & Blaabæk, 2020).

The Indian Constitution lists tribal people as Schedule Tribes with a view to providing them basic support to overcome the issues of equity from the general population. According to the 2011 Census, 10.43 corer people in the country belong to the tribal category, which means 8.6% of the total population. Questions persist about whether online learning is successful, engaging, and sustainable, as well as if and how it can reach all students equally, particularly the most vulnerable populations. (UNICEF ROSA, 2020a; Biswas et al., 2020). Low-income households in India, mainly in rural or semi-urban areas, are significantly affected by digital disparity (Maceviciute and Wilson 2018). Furthermore, there are major disparities in ICT adoption and utilization in India. The urban teledensity (about 160 per cent) is roughly three times that of the rural teledensity (approx. 59 per cent), despite the fact that around 70 per cent of India's population lives in rural areas (Census, 2011; TRAI, 2020).

While the pandemic not only highlighted the significance of the digital economy but also revealed many types of digital inequalities that exist between people in developed and underdeveloped nations. (Tadesse and Muluye 2020). Lembani, Gunter, Breines, & Dalu (2020) found that the digital divide existed on the basis of locale; rural students often do not have adequate facilities for ICTS. Grishchenko (2020) also conveyed that the economically underprivileged often have insufficient access to digital technology. Beaunoyer, Dupéré, and Guitton (2020) viewed that the digital divide existed before, but the Covid-19 pandemic has aggravated it. Since online and distant learning is considerably less successful than teacher-led, physical classroom learning, pre-existing learning inequities were amplified when students were forced to adjust to the "new normal" of online instruction. Pandey, N., & Pal, A. (2020) & Calonge, D & M, Aman (2016), the instant transformation to an online forum or virtual mode was possible and accessible to a sizeable population of students, however with many glitches. Urban India swiftly acclimatized to this approach, but there are harrowing reports about how rural India's digital divide has become a bottleneck in its passage towards virtual learning.

Research Context

The present study was carried out in the district Kulgam of Jammu & Kashmir Union Territory. The northernmost part of India, Jammu and Kashmir, is known throughout South Asia for its scenic beauty and charismatic nature. The state is mainly occupied by Kashmiri-speaking people. However, the influence of other ethnic minority groups on the variegated total cannot be neglected. According to the census 2011, about 15 lakh STs were recorded in the State's overall population of 1.25 crores, thus constituting 11.9 % of the total population. But as far as district Kulgam is concerned, STs only comprised 1.78 per cent of the population (Census, 2011).

Methodological Framework

Phenomenological Approach:

Qualitative in nature. The present study adopted a phenomenological approach. The phenomenological research approach aims to better understand people's views, perspectives, and knowledge of a phenomenon. As Wertz (2005) puts it: "phenomenology is a low hovering, in-dwelling, meditative philosophy that glories in the concreteness of person world relations and accords lived experience, with all its indeterminacy and ambiguity, primacy over the known".

Sample

The sample for the present study consisted of 40 students, 20 of whom were from Schedule Tribe (ST) category and 20 from the general category of rural students, in order to analyse the extent of accessibility of ICT-based facilities. In addition, 20 interviews were conducted, which included a sample of 10 parents belonging to the Schedule Tribe and 10 teachers residing in the foothills of the Pir Panjal range in the Kulgam district.

Tools / Instrumentation

The investigators used a checklist for quantitative assessment, and interviews were conducted to get in-depth descriptions and interpretations of the variables under investigation. A checklist comprising a total of 10 items was developed by the investigators to assess the fundamental facilities utilized in online teaching and learning. The items, such as the availability of smartphones, laptops, or television sets, served as the foundation of the checklist. Qualitative data was obtained through in-depth and unstructured interviews, which were recorded using recording devices and transcribed verbatim. The interviewees' answers were mostly presented as direct quotes.

As interviews were unstructured in nature questions like, mentioned below were posed to the respondents.

What specific challenges Schedule tribe Students might have faced in maintaining their academic progress since the onset of the COVID-19 pandemic, particularly in the transition to digital learning?

How has the lack of basic facilities contributed to any academic setbacks they may have experienced?"

How has the combination of poverty and familial illiteracy among tribal students increased the risk of academic disengagement, particularly with the transition to online classes?

How has the role of ICT gadgets been crucial in accessing and equalizing e-learning opportunities in the context of the transition to digital learning during COVID-19?

Research Questions

This study intends to address two major research questions. Firstly, it is intended to analyse the basic ICT facilities available to the Scheduled tribe students of district Kulgam, and secondly, it aims to study the efficacy of digital learning transactions among Scheduled Tribes students. Thus we propose the following research questions:

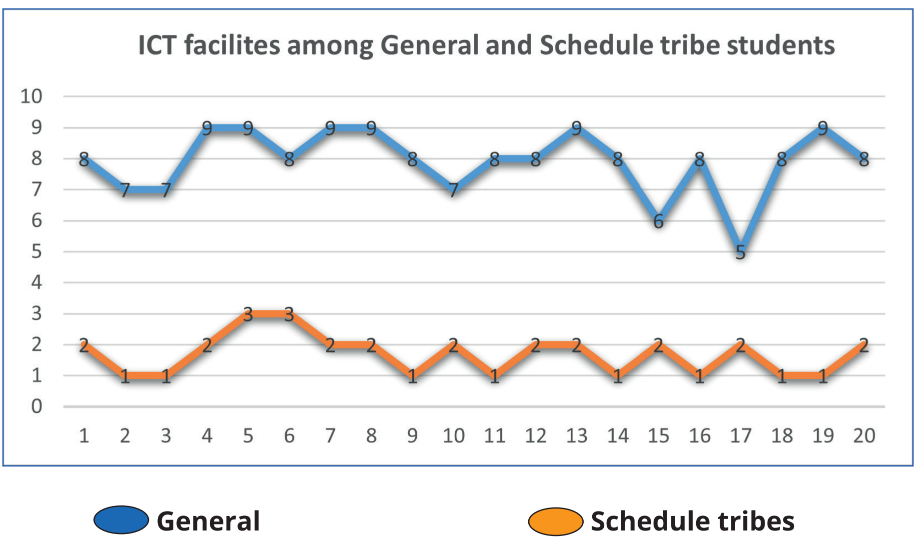
(i) To what extent are the ICT-based facilities available to the children of Scheduled tribes?

(ii) To what extent have the digital learning transactions been successful among Scheduled tribes' students during COVID-19?

Analysis

The interviews were transcribed into English from Urdu language. Furthermore descriptive statistics were used to find out the gap of access between general and scheduled tribe students.

Figure-1: Comparison between ST students and General category rural students on ICT-based facilities (20 each)



As depicted by the figure, (10 item information blank regarding the ICT facilities, 'Yes' counts for '1' & 'No' for '0') a total of 40 information schedules were filled comprised of general and scheduled tribe students, their scores were summed up to find out the gape of access of ICT facilities among the groups. It is indicated that there exists a wider gap between the general students and scheduled tribe students regarding the ICT facilities. So it is obvious that ST students were facing a lot of difficulty, and even most of the time they, were unable to learn anything during the Covid-19 pandemic.

Based on the thematic analysis of interviews, some of the themes which emerged out, are as follows

The themes emerging from the data were clustered under two categories: Academic stagnation. The first theme, Academic stagnation, highlights the underlying narratives gleaned from the interviews of parents. The second theme Exacerbated Marginalisation highlights the perspectives of secondary and senior secondary school teachers on what constitutes good e-learning experiences.

I). Academic Stagnation

Following the COVID-19 outbreak, educational systems switched to new learning techniques facilitated by the Internet, but students in rural and underprivileged regions in India were left behind. Our results indicated that during the COVID-19 pandemic, respondents had a significant variation in their accessibility to remote learning possibilities. The major challenges found were the unavailability of phone credit and internet data; additional challenges cited by students include electricity and gadget access. This is not surprising considering the fact that internet penetration in India is only 45 per cent (Hootsuite and We Are Social, 2021), reflecting that more than half of the population does not have access to the internet. In this manner, one of the parents viewed that

> "Mobile phones play a critical part in accessing and equating e-learning opportunities around the system….."

This tacit separation of children from distressed households has resulted in academic stagnation among the majority of the students. People with higher incomes have a greater chance of embracing ICT. Income is a metric for determining one's ability to buy ICT devices (Asrani, 2020). As reported by another parent

> "The major reason of educational stagnation among pupils is poverty; we cannot afford to have a separate mobile phone for every child….."

In addition, as compared to students from unreserved regions, students from scheduled tribal areas were less likely to be academically engaged. The majority of their children are enrolled into government-run institutions. Moreover, not all students have equal access to and expertise in digital technologies. Even those who did have access to gadgets were unfamiliar with online platforms, which hampered their education. One of the parents reported that ….

> "Lack of awareness of smartphones and the internet is a major concern. Additionally, the dearth of digital expertise of parents has made it more difficult for them to attend online education……"

So therefore inequitable use and dissemination of Information and communication technologies have created new disparities and exclusion by replicating existing inequalities and social classes. This may result in a "Matthew Effect" in digital inclusion in India, with those who "have" broadening their opportunity set whereas those who "don't" become increasingly emasculated and omitted from the mainstream.

II). Exacerbated Marginalisation

It is not new for the educational system in India to have marginalisation, and it does not appear to be slowing down (Dar, 2021). The Remote Learning Reachability Report (2020) by UNICEF concluded that: "The learning gap is likely to widen across high, middle and low-income families, as children from economically disadvantaged families cannot access remote learning". Inequity in accessibility to ICT-based education exacerbates existing learning inequities along socioeconomic and geographic lines. Children from poor families have less access to ICTs, one of the teachers reported that,

> "Our children received formal education until the novel coronavirus (COVID-19) pandemic interrupted schools and required classes to be delivered digitally; they have fallen behind academically due to lack of basic facilities……"

Without careful consideration of how, by, and for whom technology is utilised, it has the potential to worsen existing disparities. This implies that, while pupils from better-off families can easily make the transition to virtual learning, students from less-affluent backgrounds are more likely to succumb to ineffectiveness and a lack of adaptation, either due to the unavailability of technology or the inability of their parents to steer them through tech-savvy applications. The majority of learners from underprivileged families have been deprived of online classes due to the digital disparity. Another teacher reported that…

> "Majority of the tribal students are always at a greater risk of abandoning their studies due to their poverty and familial illiteracy. Furthermore, when classes were shifted online, the majority of the parents were not able to provide a separate smartphone to their children to follow online classes…."

As a result, establishing an online education programme without attempting to address both the vast access gap and inequities in digital infrastructure will result in socioeconomically disadvantaged students being excluded from learning opportunities. Most significantly, such exclusion may worsen the large and systematic socioeconomic inequities in learning opportunities and outcomes, which affects their education, wellness, and capacity to have their views heard.

Discussion

The study employs a phenomenological approach to emphasize the challenges of the digital divide among scheduled tribe students. It offers a critical examination of the prevailing techno-pedagogical debates and parental perspectives on digital learning. It was observed the prevailing context of social and educational marginalisation is exploited by both organization's structure and policy framework. The analysis reveals some vital information, a vast majority of presently enrolled ST Learners lacked access to basic digital infrastructure, such as a laptop or tablet with internet access. Access to key e-learning is incredibly limited among pupils from the poorest socioeconomic backgrounds. Only pupils from the richest socioeconomic groups and those from privileged social groups have better access. What kind of learning and inclusiveness can online education promote when only a few students from STs and Scheduled castes have access? A vast number of learners may be unable to fully participate in and benefit from virtual classrooms due to the twin whammy of limited access and a deep digital disparity. Unfortunately, there is no magic potion that will set things right, and it is a well-known fact that one-size-fits-all thinking no longer works (Bozkurt & Sharma, 2020). Before implementing strategies, we must consider a variety of factors, including the target population, age range, technology infrastructure, and social and economic backdrop. Although it has been argued that developed nations have an edge when it comes to launching emergency remote teaching (Saavedra, 2020), this is not true for all nations, it has been observed that the digital divide remains a problem, and many learners continue to be denied educational opportunities (Bozkurt & Sharma, 2020).

Recommendations

The study recommends some of the policy directions toward the resolution to ensure that everyone has access to and uses information and communication technology, especially the most disadvantaged and marginalised groups.

1. Specific consideration must be given to most disadvantaged populations, including STs, SCs & girls. Adopting an inclusive strategy must serve as the driving concept in bridging the gap of acess and equity among them.
2. Education stakeholders and policy experts need to constantly liaise with governments and large corporations to increase funding to make it easier for schools, students, and teachers to utilise digital learning tools.
3. Efforts are needed to put an emphasis on policies that lower the digital gap and bring the nation closer to reaching the goal of digital equity.
4. The “right to education” must be implemented in such a way that meets every student’s requirements for access to, mastery of, and use of technology as an effective instrument for participating fully in society.

Conclusion

Tribal education cannot be delegated to short-term Plan tactics. E-learning will keep dominating the field of teaching and learning because of its potential benefits. Therefore, it is critical that planners have a long-term perspective that is grounded in a sound policy framework. Guaranteeing all-inclusive and equitable quality education for all should have paramount importance in our policy decisions.

Case Report

India has the world’s second-largest educational system after China. During the COVID-19 crisis, closing schools to preserve social distance was the most rational way to avoid community transmission. This extended shutdown has adversely impacted the most underprivileged pupils and has widened the educational opportunities among them. Maldar area is a socio-economically backward area of the Devsar constituency of Kulgam District. The hamlet is an averagely low economic status region. There are near about 220 students including secondary and senior secondary students. Before the Pandemic, the teaching-learning system was purely based on face to face traditional teaching system. During the pandemic of Covid-19, when entire educational was shifted towards the e-learning platforms, ST students were facing a lot of difficulties to continue their education. On surveying, it was found that all the students were lacking basic ICT facilities except the portable radio set. Their low income forced them not to avail smartphones to their students, which resulted in academic stagnation among students.

No doubt, the Jammu and Kashmir school education board had upgraded all the students through the process of Mass promotion. But the matter of concern is that the gap of educational backwardness has widened enough, that if the pandemic continues for some more time, the widened educational gap is impossible to fill. The digital gap is so vast that many learners have never taken a single online class. Even though the State Government had intended to broadcast lessons and educational activities on Doordarshan for students, what about those who do not have even a television set, or an electricity connection, as a result, the majority of tribal learners were not addressed by either initiative

References

Adam, D. (2020). Special report: The simulations driving the world's response to COVID-19. *Nature*, *580* (7802), 316-319.

Asrani, C. (2021). Spanning the digital divide in India: Barriers to ICT adoption and usage. *Journal of Public Affairs*, 1-16.

Beaunoyer, E., Dupéré, S., & Guitton, M. J. (2020). COVID-19 and digital inequalities: Reciprocal impacts and mitigation strategies. *Computers in human behavior*, *111*, 106424.

Biswas, B., Roy, S. K., & Roy, F. (2020). Students Perception of Mobile Learning during COVID-19 in Bangladesh: University Student Perspective. *Aquademia, 4*(2),2-9 https://doi.org/10.29333/aquademia/8443

Bozkurt, A., & Sharma, R. C. (2020). Emergency remote teaching in a time of global crisis due to Coronavirus pandemic. *Asian journal of distance education*, *15*(1), 1-6

Census, (2011). *Primary Census Abstracts, Register General of India, Ministry of Home Affairs, Government of India*. Retrieved from: https://censusindia.gov.in /census. website/

Dar, W. A. (2021). Teaching–learning process in low-fee-private schools: perspectives of parents and school management. *SN Social Sciences*, *1*(7), 1-15.

Endut, A., Isa, P. M., Aziz, S. R. A., Jono, M. N. H. H., & Aziz, A. A. (2012). E-Learning for Universiti Teknologi MARA Malaysia (UiTM): Campus wide implementation and accomplishments. *Procedia-Social and Behavioral Sciences*, *67*, 26-35.

Grishchenko, N. (2020). The gap not only closes: Resistance and reverse shifts in the digital divide in Russia. *Telecommunications Policy*, *44*(8), 102004.

Jæger, M. M., & Blaabæk, E. H. (2020). Inequality in learning opportunities during Covid-19: Evidence from library takeout. *Research in Social Stratification and Mobility*, *68*, 100524.

Kumar, G., Singh, G., Bhatnagar, V., Gupta, R., & Upadhyay, S. K. (2020). Outcome of online teaching-learning over traditional education during covid-19 pandemic. *International Journal*, *9*(5), 77014-7711.

Lembani, R., Gunter, A., Breines, M., & Dalu, M. T. B. (2020). The same course, different access: the digital divide between urban and rural distance education students in South Africa. *Journal of Geography in Higher Education*, *44*(1), 70-84.

Lor, P. J. (2003). National libraries and the digital divide. *Mousaion*, *21*(2), 62-78.

Macevičiūtė, E., & Wilson, T. D. (2018). Digital means for reducing digital inequality: Literature review. *Informing science: the international journal of an emerging trans- discipline*, *21*, 269-287.

Mathrani, A., Sarvesh, T., & Umer, R. (2021). Digital divide framework: Online learning in developing countries during the COVID-19 lockdown. *Globalisation, Societies and Education*, 1-16.

Pandey, N., & Pal, A. (2020). Impact of digital surge during Covid-19 pandemic: A viewpoint on research and practice. *International journal of information management*, *55*, 102171.

Perc, M. (2014). The Matthew effect in empirical data. *Journal of The Royal Society Interface*, *11*(98), 20140378.

Ragnedda, M., & Muschert, G. W. (Eds.). (2013). *The digital divide: The Internet and social inequality in international perspective*. Routledge.

Santandreu Calonge, D., & Aman Shah, M. (2016). MOOCs, graduate skills gaps, and employability: A qualitative systematic review of the literature. *International Review of Research in Open and Distributed Learning: IRRODL*, *17*(5), 67-90.

Singh, M. P. (2004). *Information Technology and the Digital Divide in India: Ethical Perspectives.* Retrieved from: https://economictimes.indiatimes.com/industry/ services/ education/just-24-per-cent-of-indian-households-have-internetfacility-to-access-eeducationunicef /article show /77784092

Social, W. A. (2021). Hootsuite.(2021). Digital 2021 Global Overview Report. *We are Social*. Retrieved from: https://wearesocial.com/uk/blog/2021/01/digital-2021-the-latest-insig hts-into-the-state-of-digital/

Tadesse, S., & Muluye, W. (2020). The impact of COVID-19 pandemic on education system in developing countries: a review. *Open Journal of Social Sciences*, *8*(10), 159-170.

TRAI, (2020) *Telecom Regulatory Authority of India, Government of India*, Retrieved from: https:// trai.gov.in/new-regulatory-framework-2020

UNESCO. (2022, April, 21) *"Education: From disruption to recovery,"* Retrieved from: https:// www.unesco.org/en/covid-19/education-disruption-recovery

UNESCO. (2017). *Ensure Quality Education for All. Sustainable Development Goal 4: Ten Targets*. Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000259784

UNESCO. (2020a). *Education: From Disruption to Recovery.* Retrieved from https://www. unesco.org/en/covid-19/education-response

UNESCO. (2020b). *Global Education Monitoring Report Summary 2020: Inclusion and Education.* All Means All. https://en.unesco.org/gemreport/

UNESCO. (2020c, July). *Socio-Economic and Cultural Impacts of COVID19 on Africa: What Responses from UNESCO?* Retrieved from: https://unesdoc.unesco.org/ark:/ 48223/pf 000037 3903?locale=en

UNESCO. (2020d, July). *Global Education Coalition.* Retrieved from: https://en.unesco.org/ covid19/ educationresponse/global coalition

UNICEF ROSA, (2020a). *ROSA-COVID19-SitRep-November-2020.* Retrieved from: https://www. unicef.org/media/88701/file/ROSA-COVID19-SitRep-November-2020.pdf

United Nations General Assembly. (2020, May). *Report of the Secretary General – Road Map for Digital Cooperation: Implementation of the Recommendations of the High-Level Panel on Digital Cooperation, United Nations.* Retrieved from: https:// www. un.org /en/ con tent/ digital-cooperation-roadmap/

Van Dijk, J. A. (2012). The evolution of the digital divide-the digital divide turns to inequality of skills and usage. *In Digital enlightenment yearbook 2012* (pp. 57-75). IOS Press.

Wertz, F. J. (2005). Phenomenological research methods for counselling psychology. *Journal of counselling psychology*, 52(2), 167.

Research Article

Factors Affecting Online Teaching: Teachers' Perspective

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Abstract

Online teaching, a method where educators deliver content through virtual classes using digital resources, gained widespread usage during the global COVID-19 pandemic to sustain educational activities worldwide. This study focuses on the perspective of university teachers on factors affecting online teaching. A total of 111 respondents were selected as a sample through the technique of purposive sampling. A self-developed online questionnaire was used to collect data. Both inferential and descriptive statistics were used for analyzing the data that was collected. The study concludes that key variables internet issues and limited technical expertise significantly and negatively impacted the effectiveness of online teaching. However, other constructs, such as resource issues, limited class engagement, disciplinary problems, and uncooperative family were not deemed significant in this study, suggesting no substantial impact on online teaching. The study sheds light on the challenges faced in online teaching, highlighting the critical factors influencing its success or hindrance. The focus on specific variables provides valuable insights for educators and policymakers seeking to enhance the quality of online education.

Keywords: Factors, Affecting, Online Teaching, Teachers' Perspective

Introduction

The global COVID-19 pandemic prompted the widespread closure of educational institutions, affecting a substantial portion of countries and diverse societal groups. The repercussions on the field of education have been profound, as evidenced by the closure of schools and higher education institutions for over 90 per cent of the global student population (UNESCO, 2020). UNESCO's estimates for the impact of the pandemic on education are staggering, indicating that more than 1540 million students across 191 countries were affected by the closure of educational institutions. In India alone, approximately 320 million students felt the impact of these closures during the pandemic (UNESCO, 2020). This unprecedented disruption to traditional modes of education highlighted the need for innovative approaches and adaptive strategies to ensure the continuity of learning in the face of such global challenges.

Addressing the educational needs of students under these circumstances presented a considerable challenge. In response to the imperative and future requirements of students, the entire teaching process had to transition to an online mode. The National Education Policy (2020) recognized the significance of online teaching and envisioned it as a substitute for traditional or face-to-face education during crises. However, online teaching poses distinct challenges compared to traditional methods, particularly in ensuring the delivery of quality education (Dhawan, 2020). Additionally, it was perceived as less productive than offline teaching (Pandey & Kiran, 2021). However, in traditional teaching approaches, students benefit from in-person interactions with teachers and peers. This enables the acquisition of various life skills, such as teamwork, leadership, communication, patience, time management, decision-making, problem-solving, and acceptance of diversity (Kandpal, 2021). Consequently, online education has been criticized for lacking the development of these essential life skills.

Online teaching is an instructional approach where educators utilize digital resources to deliver content through virtual classes. This method offers intriguing possibilities for enhancing the learning experience for diverse student populations. It provides a flexible and alternative option, allowing individuals to learn at their own pace and from any location, enabling education over time (Smith et al., 2005). Moreover, online teaching is recognized for its time and cost-saving benefits for both educators and students (Harini & Varghese, 2021). It offers students various means to access materials, facilitates communication with teachers, and fosters the development of self-directed learning skills (Limniou & Smith, 2010).

Commonly, video conferencing platforms like Microsoft Teams, Google Meet, Zoom App, Skype, and Cisco WebEx, among others, are encouraged for conducting online classes and providing comprehensive support for student learning (Hasan & Khan, 2020). Given students' familiarity with technology, there is a higher likelihood of active engagement in digital learning (Dua et al., 2016). Consequently, online platforms have gained immense popularity in education in recent years. The progress in information and communication technologies has rendered web-based education a viable and widely embraced choice for both learners and educators (Cojocariu et al, 2014; Wu, 2016).

To facilitate high-quality online teaching, both teachers and students require essential digital resources such as smartphones, computers or laptops, internet connectivity, and networks. However, a significant digital divide exists between rural and urban populations in India, as highlighted by a National Statistics Office (NSO) survey. The survey indicated that only 4.4 per cent and 14.9 per cent of rural households possessed computers and internet facilities, respectively, whereas 23.4 per cent and 42 per cent of urban households had access to the same resources (TOI, November 25, 2019). This clear digital gap in India, as noted by Beniwal (2020), results in a substantial portion of the population lacking access to computers and the internet, leading to disparities in learning opportunities for online education.

To address this digital disparity and ensure quality online learning for all, the Indian government initiated the SWAYAM educational platform in 2017. Additionally, the University Grants Commission (UGC) has made various e-books & journals, and web-based TV channels accessible. Recognizing the importance of digital resources, the National Education Policy (2020) rightly emphasizes, "The benefits of online/ digital education cannot be leveraged unless the digital divide is eliminated through concerted efforts, such as the Digital India campaign and availability of affordable computing devices". In the context of this study, the authors aim to investigate the different factors influencing online teaching.

Review of Literature

A growing body of literature delves into the diverse challenges associated with online education, particularly in the context of India where a significant portion of the population faces economic challenges. Pokhrel and Chhetri (2021) underscored in their research that internet penetration in economically disadvantaged nations is relatively low, and data packages are costly compared to people's incomes, thus limiting learners' capacity for online education. Hasan and Khan's (2020) study identified unreliable networks and connectivity as the primary drawbacks of online teaching and learning. They also noted factors such as a lack of interaction, inadequate clarification of doubts and queries, difficulty in understanding concepts, and time constraints as additional challenges in online teaching.

In a case study focused on Oman, Slim (2020) highlighted network issues as a major obstacle to online teaching, given the generally poor internet connections in the country. Oyedotun (2020) pointed out that the abrupt shift from offline to online classes because of the global COVID-19 outbreak exacerbated disparities in the education systems of developing countries. This included issues like, scarcity of devices, limited internet access in rural locations, and insufficient teacher preparation for online teaching, leading to poor quality online education in these regions. Similar trends were observed by Sadikul et al (2018), who identified crucial factors affecting student participation in online education, such as limited access to personal computers or smartphones, lack of internet access, poor study habits, deficient technology skills, and unfamiliarity with technology. Mahyoob (2020) echoed these findings, reporting that technical difficulties posed significant obstacles for English language learners.

Arora and Srinivasan (2020) identified major technical challenges during the pandemic's digital education phase, including the lack of reliable internet, connectivity issues, and a shortage of laptops and microphones. Further, they highlighted challenges faced by teachers in higher education institutions, such as network issues, insufficient training, a lack of interaction, awareness gaps, low interest, and doubts about the utility of virtual classes, low attendance, and a deficiency of personal touch in virtual classes. These multifaceted challenges underscore the complex landscape of online education and the need for comprehensive strategies to address the various obstacles faced by both learners and educators.

Assareh and Bidokht (2011) conducted an in-depth analysis of the barriers to online teaching and learning, categorizing them into four main groups: (a) challenges faced by learners, encompassing financial issues, motivation, progress evaluation, isolation from peers, insufficient knowledge and experiences, and social and emotional domains; (b) challenges faced by teachers, including limited expertise in e-teaching and difficulties in assessing progress across various domains; (c) curriculum-related challenges, taking into account variables such as ambiguity, quality, resources to support teaching, teaching methodology, and evaluation; and (d) challenges related to the school, encompassing organizational and structural variables.

Harini and Varghese (2021) highlighted challenges faced by educators during online teaching, including gadget access, network issues, electricity access, technophobia, distractions, psychological and physical issues, and online abuse or misuse. Rana and Kumari (2021) identified challenges with online teaching faced by teachers, such as shortage of devices and slow internet, expense of internet access, non-responsiveness of students, lack of hands-on experience, distractions, absence of parental support and a feeling of isolation. Pandey and Kiran (2021) reported common issues in online teaching-learning, including technical problems, distractions, difficulty following a course, difficulty staying motivated, ineffective time management, lack of interaction, difficulty adjusting to change, and uncertainty about the future.

Gond and Gupta (2017) outlined key obstacles to online education, including lack of resources and internet connectivity, scarcity of qualified teachers, lack of funding, and inadequate maintenance of technological equipment. Verma and Verma (2022) investigated challenges during switching from traditional to online teaching-learning, identifying lack of interaction, adaptability, and self-motivation as significant challenges. However, they observed a decline trend in the proportion of challenges related to infrastructure, computer skills, and discipline.

Besides, Joshi et al (2020) explored the teacher's perspective on online teaching in higher education institutions, revealing various difficulties encountered by teachers, such as insufficient technological resources, lack of technical knowledge, family disruptions, inadequate training, and a lack of clarity and direction. However, in a study on teachers' satisfaction with web-based teaching experiences post-lockdown, Malhi et al (2022) identified difficulties such as inadequate training for utilizing online platforms, higher expenses, lower teacher-student engagement, lack of basic online teaching resources, limited internet connection plans, unstable power supply, and uncertainty about how effectively students were using e-platforms to learn. The variations in findings across different studies underscored the intricate and multifaceted nature of challenges in online teaching, which helped authors in designing the present study.

Objectives

1. To examine the digital tools utilized by university teachers.
2. To study the perspective of university teachers on factors affecting online teaching.
3. To establish the relationship between key variables and online teaching.

Methodology

The descriptive survey method was used by the authors in the present study.

Sample

The sample for the present study was selected through the purposive sampling method from Aligarh Muslim University, Aligarh, and Uttar Pradesh. There were 111 responses from university teachers, 86 of them were from males and 25 were from females. Among these, 30 responses were from Professors, 15 from Associate Professors, and 66 from Assistant Professors. Regarding the level of instruction, 41 teachers taught exclusively at the undergraduate level, 18 at the postgraduate level, and the remaining 52 taught at both levels. In terms of teaching experience, 21 teachers had less than 5 years, 27 had 5 to 10 years, 23 had 11 to 15 years, and 40 had over 15 years of teaching experience.

Research Instrument

An online survey was employed for data collection. The authors constructed a structured questionnaire in Google Forms by reviewing relevant literature on online education. The questionnaire consisted of 31 items and was divided into four sections (A, B, C & D) i.e. demographic profile, digital tools utilized, the effectiveness of online teaching, and factors affecting online teaching. The tool was designed in such a manner that responses could only be submitted before moving on to the next section. The first section comprised four questions of demographic profile, including gender, designation, class taught, and teaching experiences. Based on digital tools used by teachers during online classes, Section B of the tool contained four items i.e. devices, internet connection, web conferencing apps, and digital platforms used for sharing messages. Five items, easily accessible, convenient mode, the flexibility of nature, enhanced ICT knowledge, and developed professional skills, were included in the third part (Section C) that addressed the effectiveness of online teaching. In Section D, eighteen items covered factors that affect digital pedagogy. These factors included lack of necessary devices, power cuts/ load shedding, expensive digital tools, lack of internet access, poor network connectivity, costly internet data, technical difficulties, lack of technical skills, technophobia, feeling bored in a virtual classroom, poor participation, the limited scope of interaction, online abuses, indifferent attitude of students, students causing destruction, parental inattention, lack of parental support, and family-related disruption. The responses of two Sections (C & D) were recorded on a 5-point Likert Scale ranging from strongly disagree to strongly agree (1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for strongly agree). The tool was validated by five academics who had been using online teaching for more than two years during the COVID-19 pandemic.

Statistical Techniques

The collected data were analyzed with the help of descriptive and inferential statistics to realize the objectives of the present study. Descriptive statistics such as frequency and percentage were carried out to summarise data and understand the perspective of university teachers. Inferential statistics such as linear regression was used to establish the relationship between key variables and online teaching. MS Excel was utilized to tabulate the data, and SPSS statistical version 20 was used for analysis of data.

Procedure of Data Collection

A Google form was created for the online survey. The authors distributed a link to the form among faculty members of Aligarh Muslim University through their official Email ID. One hundred and eleven academic professors responded to the online survey between August to October 2023.

Analysis and Interpretation

This section summarises the data collected from the above-mentioned tool. The analysis and interpretation of the data are presented in three parts viz. digital tools utilized by the study sample, the perspective of university teachers on factors affecting online teaching, and the relationship between key variables and online teaching.

Digital Tools Utilized by the Study Sample

Figure-1: Devices Used by University Teachers (N=111)

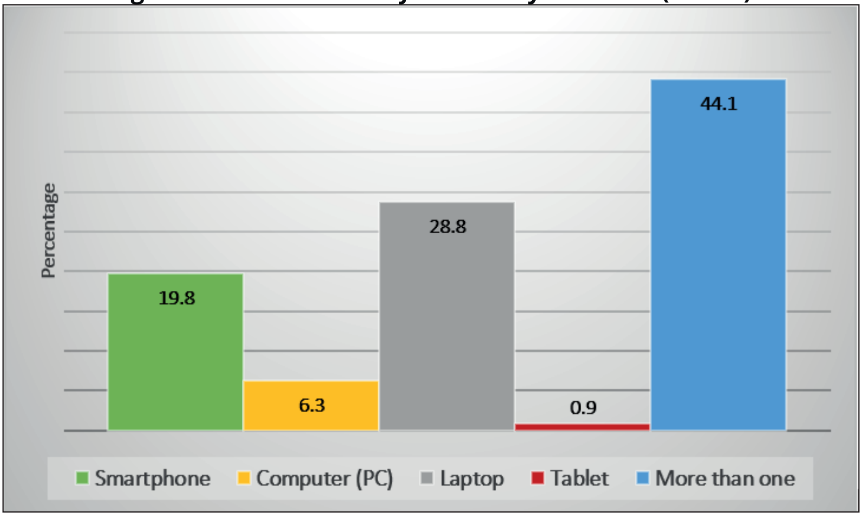
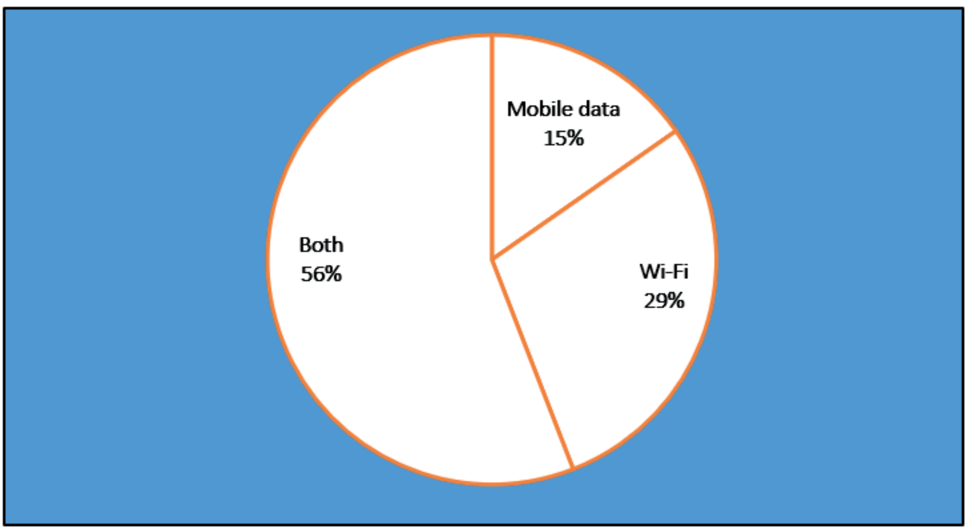


Figure 1 reveals a clear breakdown of the devices utilized by respondents for conducting online classes, 28.8 per cent of respondents exclusively used laptops, while 19.8 per cent relied solely on Smartphones. Additionally, 6.3 per cent of respondents utilized computers (PCs) as their primary devices. Remarkably, a substantial proportion of teachers, constituting 44.1 per cent employed more than one device for online teaching. This highlights a prevalent trend where a majority of university teachers opt for a multi-device approach in facilitating online classes.

Figure-2: Internet Connection Used by University Teachers (N=111)



It is obvious from Figure 2 that, out of 111 respondents 15.3 per cent of respondents relied exclusively on mobile data, 28.8 per cent solely on Wi-Fi, and a significant majority approximately 60 per cent utilized both types of internet connections for online l teaching. This suggests that the vast majority of teachers have ample access to the Internet, as evidenced by the widespread use of both mobile data and Wi-Fi. The conclusion drawn is that almost all university teachers, whether at home or in their workplace, have sufficient internet access to support their online teaching activities.

Figure-3: Web Conferencing App Used by University Teachers (N=111)

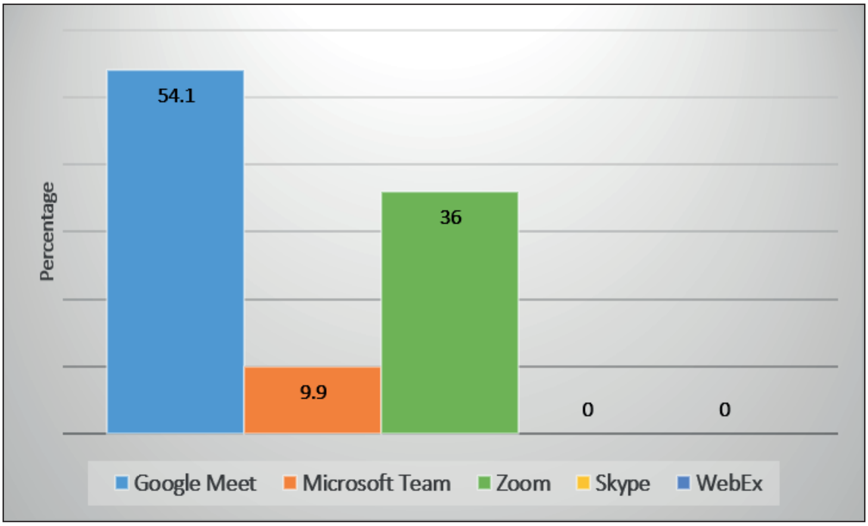
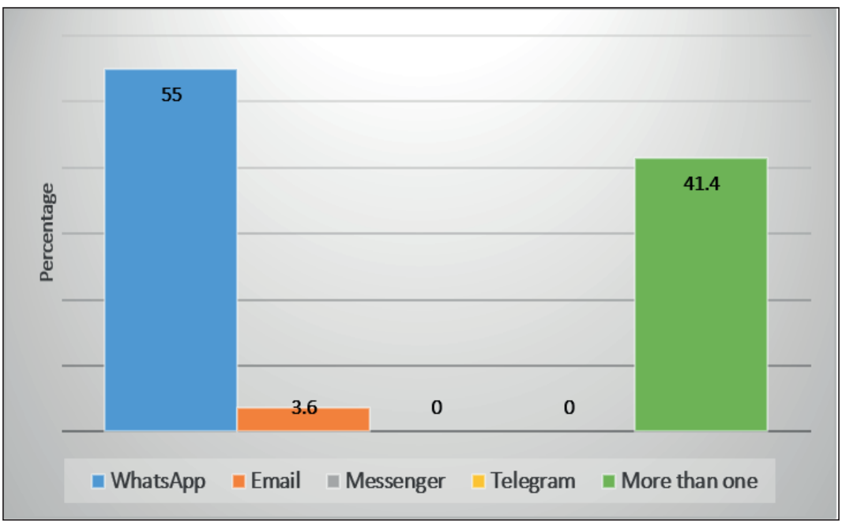


Figure 3 shows that 54.1 per cent of respondents opted for Google Meet, 9.9 per cent utilized Microsoft Teams, and 36 per cent chose Zoom as a web conferencing application for hosting online classes. Notably, none of the respondents reported using Skype or WebEx digital platforms, indicating a clear preference for Google Meet in higher education for conducting virtual classes.

Figure-4: Digital Platform Used by University Teachers (N=111)



It is inferred from Figure 4 that, out of 111 respondents, 55 per cent used WhatsApp, 3.6 per cent utilized Email, and 41.4 per cent employed more than one platform for conveying messages to students. Interestingly, none of the respondents reported using Messenger or Telegram. The findings suggest that WhatsApp is the preferred platform for sharing information and educational content with students. The ease and convenience of Google Meet and WhatsApp, particularly in their Smartphone-operable formats, likely contribute to their popularity among university teachers for online teaching in higher education.

Perspective of University Teachers on Factors Affecting Online Teaching

Table-1: Response of University Teachers on Factors that Affect Online Teaching (N=111)

Sl. N.	Factors	Strongly Disagree	Disagree	Neutral	Agree to Some extent	Strongly Agree
1.	Lack of necessary devices	9.01 %	10.81 %	16.22 %	31.53 %	32.43 %
2.	Power cuts/load shedding	4.50 %	5.41 %	08.11 %	33.33 %	48.65 %
3.	Expensive digital tools	14.42 %	18.92 %	22.52 %	24.32 %	19.82 %
4.	Lack of internet access	7.21 %	7.21 %	11.70 %	36.94 %	36.94 %
5.	Poor network connectivity	3.60 %	4.50 %	5.41 %	29.73 %	56.76 %
6.	Costly internet data	5.41 %	10.81 %	10.81 %	32.43 %	40.54 %
7.	Technical difficulties	4.50 %	12.61 %	13.52 %	33.33 %	36.04 %
8.	Lack of technical skills	8.11 %	14.42 %	11.70 %	37.83 %	27.94 %
9.	Technophobia	9.91 %	18.92 %	26.13 %	23.42 %	21.62 %
10.	Feeling bored in a virtual classroom	3.60 %	9.01 %	11.70 %	36.94 %	38.75 %
11.	Poor participation of students	5.41 %	12.61 %	18.92 %	33.33 %	29.73 %
12.	Limited scope of interaction	2.70 %	4.50 %	6.31 %	29.73 %	56.76 %
13.	Online abuses	4.50 %	13.52 %	30.63 %	33.33 %	18.02 %
14.	Indifferent attitude of students	2.70 %	5.41 %	21.62 %	36.94 %	33.33 %
15.	Students causing destruction	4.50 %	9.91 %	7.21 %	29.73 %	48.65 %
16.	Parental inattention	5.41 %	9.91 %	20.72 %	31.53 %	32.43 %
17.	Lack of parental support	2.70 %	8.11 %	20.72 %	36.04 %	32.43 %
18.	Family-related disruption	1.81 %	10.81 %	12.61 %	37.83 %	36.94 %

Source: Research Survey

As already discussed, there were a variety of issues with teaching through digital platforms. Table 3 shows university teachers' perspectives regarding factors affecting online teaching. It was observed from the responses of 111 respondents, that 63.96 per cent agreed that lack of necessary devices and 81.98 per cent agreed that power cuts/ load shedding were found as factors that affect online teaching. However, it is interesting to note that mixed responses were received regarding the expensive digital tools affect online teaching. The majority of the university teachers (73.88 per cent) agreed that lack of internet access impacts virtual classes. Approximately 87 per cent of respondents agreed that poor network connectivity influences teaching via online platforms. Most of the university teachers (72.97 per cent) expressed that costly internet data is influential and affects online teaching. 69.37 per cent of university teachers faced technical difficulties during online teaching. University teachers seem to agree that online teaching is affected by a lack of technical skills (65.77 per cent). While one-fourth of university teachers (26.13 per cent) responded that they aren't sure about technophobia's impact on online teaching. Further, the majority of university teachers (75.69 per cent) feel bored while taking classes through virtual platforms. Around 63 per cent of university teachers are upset due to the poor participation of students in virtual classrooms. Most of the respondents (86.49 per cent) accepted that online teaching affects the interaction between students and teachers, which showed that teachers and students kept their videos off during online lectures. A considerable section of university teachers (51.35 per cent) faced online abuse while teaching through virtual mode. Most of the respondents (70.27 per cent) felt indifferent attitude of students during online teaching. A large section of university teachers (78.38 per cent) reported destruction during online teaching on the part of students. In addition, most of the university teachers reported that parental inattention (63.96 per cent), lack of parental support (68.47 per cent), and family-related disruption (74.77 per cent) posed as important factors to online teaching.

Relationship between Key Variables and Online Teaching

Initially, the authors identified the key variables that affect online teaching. The literature review revealed several common factors, like lack of necessary devices, power cuts/load shedding, expensive digital tools, lack of internet access, poor network connectivity, costly internet data, technical difficulties, lack of technical skills, technophobia, feeling bored in virtual classroom, poor participation, limited scope of interaction, online abuses, indifferent attitude of students, students causing destruction, parental inattention, lack of parental support, and family-related disruption, that have an impact on online teaching. However, it was found that many factors are interrelated. The authors have taken into account several factors within a major variable, such as lack of necessary devices, power cuts/ load shedding, and expensive digital tools have been considered as variable resource issues. Lack of internet access, poor network connectivity, and costly internet data have all been categorized as one variable in internet issues. One variable of limited technical expertise has been identified as technical difficulties, lack of technical skills, and technophobia. Similarly, feeling bored in a virtual classroom, poor participation of students, and limited scope of interaction have been linked to limited class engagement, while online abuses, indifferent attitude of students, and students causing destruction have all been linked to disciplinary problems. Further, a variable uncooperative family has been considered as one that includes parental inattention, lack of parental support, and family-related disruption. Thus, six key variables such as resource issues, internet issues, limited technical expertise, limited class engagement, disciplinary problems, and uncooperative family have been taken for analysis.

Hypothesis

The following six (06) hypotheses were developed to establish the relationship between key variables and online teaching:

> **H_{01}:** There is a significant impact of variable resource issues on online teaching.
>
> **H_{02}:** There is a significant impact of internet issues on online teaching.
>
> **H_{03}:** There is a significant impact of limited technical expertise on online teaching.
>
> **H_{04}:** There is a significant impact of limited class engagement on online teaching.
>
> **H_{05}:** There is a significant impact of disciplinary problems on online teaching.
>
> **H_{06}:** There is a significant impact of uncooperative families on online teaching.

The stated hypotheses were tested by computing linear regression. The results of the analysis are given in Table 2.

Table-4: Results of Regression Analysis

Dimension	Beta (ß)	P value	Result
Resource issues	0.188	.86	H_{01} : Rejected
Internet issues	-0.292	.021	H_{02} : Accepted
Limited technical expertise	-0.508	.000	H_{03} : Accepted
Limited class engagement	-0.202	.099	H_{04} : Rejected
Disciplinary problems	-0.011	.935	H_{05} : Rejected
Uncooperative families	-0.033	.791	H_{05} : Rejected

Source: Computed Data

Table 2 shows the results of linear regression that establishes the relationship between key variables and online teaching. The value of R Square is .321 which shows that the independent variable all together explains 32.1 per cent of the dependent variable. The proposed model demonstrates significant goodness of fit (df=6, F=8.190, sig=0.000). The second hypothesis, namely H_{02}, "there is a significant impact of internet issues on online teaching". The results of the study revealed that internet issue has a negative impact on online teaching (ß=-0.292 & P<0.05) at a 5 per cent significance level. Similarly, the third hypothesis, namely H_{03}, „there is a significant impact of limited technical expertise on online teaching". The results of the study revealed that limited technical expertise has a negative impact on online teaching (ß=-0.508 & P<0.01) at a 1 per cent significance level. The authors conclude that internet issues and limited technical expertise have a negative impact on online teaching. The study's findings align with the conclusions of several prior research studies, including those conducted by Gond & Gupta (2017), Hasan & Khan (2020), Slim (2020), Oyedotun (2020), Arora & Srinivasan (2020), Harini & Varghese (2021), Pokhrel & Chhetri (2021), and Malhi et al (2022), all indicating that internet issues have a negative impact on online teaching. This consistency is also noted in earlier research by Mahyoob (2020), and Joshi et al (2020).

However, the study's results diverge in terms of other constructs, such as resource issues, limited class engagement, disciplinary problems, and uncooperative family, which did not significantly impact online teaching. Interestingly, this contradicts the findings of Gond & Gupta (2017), Sadikul et al (2018), Joshi et al (2020), Harini & Varghese (2021), and Rana & Kumari (2021), who reported that a lack of gadgets or resources was a key variable affecting online education. Moreover, Arora & Srinivasan (2020) and Pandey & Kiran (2021) emphasized the importance of the variable of lack of interaction, while Joshi et al (2020) and Verma & Verma (2022) highlighted the crucial role of discipline in online teaching. Additionally, Joshi et al (2020) found in their study that family disruption impacts virtual classes.

Conclusions

The effectiveness of online education is influenced by a myriad of factors, and these factors can vary based on the specific context, such as the educational institution, geographic location, technological infrastructure, and the socio-economic background of the students. The study findings indicate that most university teachers possess multiple devices and have access to both Wi-Fi and mobile data for online teaching. Google Meet and WhatsApp are the preferred platforms for conducting virtual classes and communicating with students.

The study identified six key variables as focal points, which include resource issues, internet problems, limited technical expertise, low-class engagement, disciplinary challenges, and uncooperative family. Empirical results reveal that internet issues and limited technical expertise significantly and negatively impact online teaching. However, resource issues, limited class engagement, disciplinary problems, and uncooperative family were not deemed significant in this study, suggesting no substantial impact on online teaching.

Recommendation

The dynamic nature of online teaching, coupled with the diverse backgrounds and circumstances of students and educators, contributes to the complexity of the challenges faced. As a result, there is no one-size-fits-all solution, and addressing the effectiveness of online education requires context-specific approaches. Educational institutions, policymakers, and practitioners need to consider the unique characteristics and challenges of their context when designing strategies and interventions for successful online teaching.

The study underscores the existence of influential factors affecting online teaching, prompting authors to propose recommendations for improvement. These include government financial aid to bridge the digital divide for students lacking devices and internet access, thereby ensuring equal opportunities for all. Additionally, teachers are encouraged to enhance online engagement by turning on cameras, using audio-visual aids, asking questions, and employing various technology tools for personalized learning experiences. Furthermore, the authors advocate for teacher training to create an engaging online learning environment, collaboration among government, NGOs, and academic institutions to educate parents about online education, and the establishment of a supportive home environment for students participating in virtual classes.

References

Arora, A. K., & Srinivasan, R. (2020). Impact of pandemic COVID-19 on the teaching-learning process: A study of higher education teachers. Prabandhan: Indian Journal of Management, 13(4), 43-56.

Assareh, A., & Bidokht, M. H. (2011). Barriers to e-teaching and e-learning. Procedia Computer Science, 3, 791-795. https://doi.org/10.1016/j.procs.2010.12.129

Beniwal, V. (2020). As the digital divide widens, India risks losing a generation to pandemic disruption. The Print, 17 December. https://theprint.in/india/education/as-digital-divide-widens-india-risks-losing-a-generation-to-pandemic-disruption/568394/

Cojocariu, V. M., Lazar, I., Nedeff, V., & Lazar, G. (2014). SWOT analysis of e-learning educational services from the perspective of their beneficiaries. Procedia-Social and Behavioral Sciences, 116, 1999-2003. https://doi.org/10.1016/j.sbspro.2014.01.510

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. Journal of Educational Technology, 49(1), 5-22. https://journals.sagepub.com/doi/pdf/10.1177/0047239520934018

Dua, S., Wadhawan, S., & Gupta, S. (2016). Issues, trends, and challenges of digital education: An empowering innovative classroom model for learning. International Journal of Science Technology and Management, 5(5), 142-149.

Gond, R., & Gupta, R. (2017). A study on digital education in India: Scope and challenges of Indian society. Anveshana's International Journal of Research in Regional Studies, Law, Social Sciences, Journalism and Management Practices, 2(3), 12-18. http://publications.anveshanaindia.com/wp-content/uploads/2017/03/A-STUDY-ON-DIGITAL-EDUCATION-IN-INDIA-SCOPE-AND-CHALLENGES-OF-AN-INDIAN-SOCIETY-2.pdf

Harini C., & Varghese, A. L. (2021). Offline to online: A long way to go. Indian Journal of Educational Technology, 3(2), 106-120.

Hasan, N., & Khan, N. H. (2020). Online teaching-learning during Covid-19 pandemic: Students' perspective. The Online Journal of Distance Education and e-Learning, 8(04) 202-213. https://tojdel.net/journals/tojdel/articles/v08i04/v08i04-03.pdf

Joshi, A., Vinay, M., & Bhaskar, P. (2020). Online teaching amidst COVID-19 in India: An outlook. Asian Journal of Distance Education, 15(2), 105-111. https://files.eric.ed.gov/fulltext/EJ1285307.pdf

Kandpal, K. (2021). Online Shikshan: Shikshaarthiyon Ke Liye Sikhne Ke Awsaron Mein Badhta Antar (Janpad Bageshwar Ke Vishesh Sandarbh Main). Bhartiya Adhunik Shiksha, January, 41(3), 69-82.

Limniou, M., & Smith, M. (2010). Teachers' and students' perspectives on teaching and learning through virtual learning environments. European Journal of Engineering Education, 35(6), 645–653. https://www.tandfonline.com/doi/abs/10.1080/03043797.2010.505279

Mahyoob, M. (2020). Challenges of e-learning during the COVID-19 pandemic experienced by EFL learners. Arab World English Journal (AWEJ), 11(4), 351-362. https://files.eric.ed.gov/fulltext/EJ1287713.pdf

Malhi, P., Bharti, B., Gupta, A., & Sindhu, M. (2022). Post COVID-19 challenges of online teaching in higher education institutes: Teacher's experiences and satisfaction. Indian Journal of Educational Technology, 4(1), 11-21.

National Education Policy. (2020). Ministry of Human Resource Development. Government of India, New Delhi.

Oyedotun, T. D. (2020). Sudden change of pedagogy in education driven by COVID-19: Perspectives and evaluation from a developing country. Research in Globalisation, 2. https://doi.org/10.1016/j.resglo.2020.100029

Pandey, P., & Kiran, U. V. (2021). COVID-19 outbreak: eLearning resources and online classes, advantages and disadvantages. Indian Journal of Educational Technology, 3(2), 220-229.

Pokhrel, S., & Chhetri, R. (2021). A literature review on the impact of the COVID-19 pandemic on teaching and learning. Higher Education for the Future, 8(1), 133-141. https://journals.sagepub.com/doi/pdf/10.1177/2347631120983481

Rana, P., & Kumari, S. (2021). Inside online classrooms: Teachers' online teaching experience during COVID-19 pandemic. Indian Journal of Educational Technology, 3(2), 77-91.

Sadiku, M. N. O., Adebo, P. O., & Musa, S. M. (2018). Online teaching and learning. International Journals of Advanced Research in Computer Science and Software Engineering, 8(2), 73-75. https://www.researchgate.net/publication/324821090

Slim, Z. (2020). Online learning and teaching during COVID-19: A case study from Oman. International Journal of Information Technology and Language Studies (IJITS), 4(2), 44-56. https://journals.sfu.ca/ijitls/index.php/ijitls/article/view/135

Smith, P. J., Coldwell, J., Smith, S. N., & Murphy, K. L. (2005). Learning through computer-mediated communication: A comparison of Australian and Chinese heritage students. Innovations in Education and Teaching International, 42(2), 123-134. https://www.tandfonline.com/doi/abs/10.1080/14703290500062441?journalCode=riie20

Times of India Newspaper. November 25, 2019. https://timesofindia.indiatimes.com/india/nso-survey-finds-big-rural-urban-divide-in-computer-internet-use/articleshow/72215450.cms

UNESCO. (2020). Education: from school closure to recovery. https://www.unesco.org/en/covid-19/education-response

Verma, V., & Verma, R. (2022). The transition from traditional to digital teaching-leaning due to COVID-19: A comparative study. Indian Journal of Educational Technology, 4(1), 1-10.

Wu, B. (2016). Identifying the influential factors of knowledge sharing in e-learning 2.0 systems. International Journal of Enterprise Information Systems, 12(1), 85-102. https://doi.org/10.4018/IJEIS.2016010105

Research Article

Relevance of eContent in Learning-Teaching of Geography with special reference to School Education in India

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Abstract

Geography as a discipline has seen various paradigm shifts in approaching the goal of studying human-environment relationships. Comparatively recent developments in studying Human Geography have incorporated themes like the use of Information and Communications Technology (ICT) in making quality education accessible to the masses and also helping in enhancing the understanding of the subject. India, being a developing country with a large population, is still struggling with making quality education accessible to its learners living in various locations. The integration of ICT with different aspects of learning-teaching has not only enhanced the relevance of digital content in the present context but has also given new dimensions to various subjects, including Geography.

This paper reflects on the effectiveness and relevance of the use of digital content, specifically video content, for learning concepts in Geography. Videographic Geography is an emerging concept to promote learning, teaching and research in Geography and is being considered as an innovative way of learning and teaching, especially in the case of India. This paper therefore, tries to explore this area of use of video resources for learning-teaching of Geography. Based on a field survey, this paper, therefore, aims to explore the possibilities, effectiveness and relevance of video content on Geography for school students in India. With the increased engagement of learners with computers and other hand-held devices, the use of video resources can be considered useful in catering for their educational needs. The National Education Policy (NEP) 2020 also suggests the use of eContent in learning-teaching of various subjects. Considering these aspects, the paper also tries to explore present and future prospects of video content in the learning-teaching process.

Keywords: Digital Learning, eContent, Geography, Educational video, Geography Teaching, Videographic Geography

Introduction

Human Geography has evolved immensely from the mere study of the distribution of human beings to the use of technology and its impact on the educational achievements of learners. Educational films (videos) and videos are one such domain where human geography has expanded. Films have been considered as representatives of identities and social constructs (Cresswell & Dixon, 2002) and modes of instruction for the enhancement of learner's understanding of a particular topic. Film has been considered as an instructive mode through which an understanding of geographical issues, and a key site in the communication of geographical knowledge (Saunders & Strukov, 2018) can be achieved. There are various forms of popular culture of interest to human geographers – including cartoons (Thorogood, 2020), comic books (Holland & Dahlman, 2017) and television series (Glynn & Cupples, 2015). A close analysis of gaming scores offers new ways of understanding the spatiality of musical style, structure and form (Kirby, 2022) that can be yet another area of research. Ilesanmi (2022) points out, “By using different media avenues, such as models, audio-visuals, audios, and presentational tools, a friendly learning environment and experience will be enabled for learners to promote knowledge acquisition”.

The need for digital content has been identified in transforming education in terms of accessibility to quality education and enhancement in learning outcomes, at least to some extent (Li Sandy C. & Karen B. Petersen, 2022 Bazelais P et al. 2022). In the rapidly growing world of ed-tech institutions, the development of creative content, dissemination of information, and technological awareness seem to be prolonged requisitions. Digital learning-teaching is strongly dependent on mastering and fostering the use of ICT in an effective manner. The traditional curriculum of Geography and geographic knowledge is seeing a revival with the integration of technologies and even Artificial Intelligence (AI)-enabled systems of learning-teaching. The strategized use of Remote Sensing and Geographical Information Systems (RS and GIS) has been effectively used in location analysis, climatic and planning activities. It is said that it may bring a technocentric revolution in learning and teaching of Geography (Kadhim, 2020). Coming to the use of eContents in the form of video resources, learning-teaching of Geography has taken a newer face in India with the aim of making quality content available to learners belonging to various socio-economic groups and geographical locations. Videographic Geography has increasingly been considered as a way of dealing with the study of various concepts of Geography (Garrett, 2011).

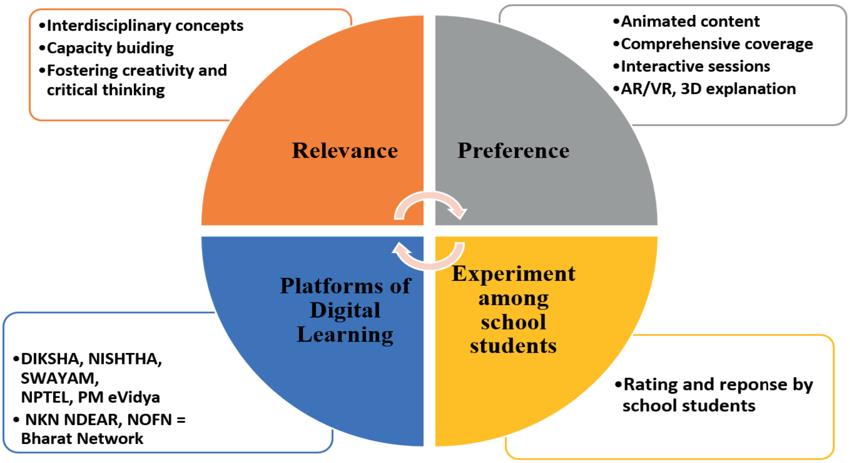
With the improvement in digital technology, creating videos have become easier and there has been reduction in the cost of their production and distribution. Apart from these benefits, videos can be used in the classroom for recording and analyzing interactions between students and with the teachers, develop critical thinking, creativity and enhance collaborative learning (Evangelou, 2023).

This paper deals with the use of eContent in the form of video in teaching Geography at the school level in the Indian context. It presents the outcomes of a field trial carried out through a questionnaire to find out the effect of video as a learning resource. It tries to study the interest of students and probabilities of learning-teaching in Geography through video content. Therefore, the study is part of an experiment that can be taken up further for the development of educational videos.

Conceptual Framework and Background of Study

The utilization of digital content can be associated with four main factors- relevance, preference, platforms of digital learning and experiment of video content for school students in India.

Figure-1: Conceptual Framework of Utilization of eContent in India



Like many other parts of the world, the use of eContent in general and video resources in particular, in India got a sudden thrust after the outbreak of the COVID-19 pandemic in the year 2020. Since there was a sudden closure of physical schools all across the country and there existed a sharp digital divide between the learners of various socio-economic groups and living in various geographical locations, the Government of India (GoI) decided to freely disseminate quality educational eContent through various modes i.e. internet-based platforms and mobile apps, television telecast and radio broadcast under the PM eVidya initiative (https://ciet.nic.in/pages.php?id=pmevidya). The enhanced focus was on school education, keeping in mind more than 264 million school students and their limited access to digital modes.

Various institutions started developing eContent, especially videos, to cater to the needs of learners. National Council for Education Research and Training (NCERT), being one of the central institutes in India working for the development of curriculum, textbooks and learning-teaching materials at the school level, was given the responsibility of developing curriculum-based quality content. These eContent were based on the NCERT's curriculum, which is widely used in the country, especially in the Government-run schools. Dissemination of learning-teaching material through a multi-modal strategy was undertaken as part of the recommendations made in the newly developed National Education Policy (NEP) 2020 of the country (https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf). These modes of dissemination, also low-cost in nature ensured greater access to these quality learning resources. Availability of these curricular videos (in the context of this paper) in English and Hindi languages further enhanced the access to these resources as these two are the most widely spoken languages in India. Given the continuation of dissemination of videos through internet-based platforms and apps and television even after the opening of schools, the need was felt to make these supplementary resources for continued access to these quality videos for the learners. Currently, about 7,000 such videos are being disseminated for classes 1-12 of school education in the country. In order to have a sustained interest of learners, the quality of videos needed to be enhanced to make them more engaging for the learners. The development of the video used in the present study is a part of this continued effort to make quality learning resources freely accessible to learners of diverse backgrounds.

Objectives:

The following are the objectives of this paper:

1. To assess the impact of learning-teaching through videos at the school level.
2. To find out the relevance of video content in learning-teaching of Geography.
3. To list out the challenges and future prospects of the use of video content in learning-teaching of Geography.

Sample and Methodology

The survey to assess the impact of the use of video resources in learning-teaching Geography was conducted in two schools- Jawahar Navodaya Vidyalaya, Gurugram, Haryana (Government) and Bal Bharti Public School, Ghaziabad, Uttar Pradesh (Private) of Delhi-National Capital Region (NCR). The survey was conducted in September-October 2022 in a face-to-face mode. The sample schools were randomly selected and are located on the outskirts of the Indian capital city, New Delhi. The idea was to take responses from learners who are not much exposed to such high quality video resources specifically designed for topics related to their curriculum. These schools were also found to be using ICT-like smart classes in learning-teaching processes. Some of the teachers of Jawahar Navodaya Vidyalaya were also engaged in creating video content and reviewing videos for various subjects for PM eVidya and DIKSHA initiatives of the MoE during the COVID-19 pandemic. The sample consists of 101 students from classes 8-9 in accordance with the content of the video. That is, they would have studied the concept in the previous class.

The video used for the survey titled, Origin of the Earth', was developed in the Central Institute of Educational Technology (CIET), NCERT, New Delhi, in the year 2022. The development of the video was done as part of the PM eVidya initiative of the Ministry of Education (MoE), Government of India (GoI), initiated during the outbreak of the COVID-19 pandemic in 2020. The video uses emerging technologies such as Augmented Reality-Virtual Reality (AR-VR) to explain the concept of the origin of the earth. This video is the first part of the series of Geography programmes, Earth's Processes. The video is accessible through the link https://diksha.gov.in/play/content/do_3135650179044966401129

The questionnaire was designed as part of the field trial of the video and was reviewed by experts for suggestions. It is attached in the Annexure. It consists of two sections: one based on general questions related to an educational video and the second with questions specific to the content of the video. In total, there were seventeen questions (10 in section 1 and 7 in section 2). The responses were collected for both sections and were used for analysis. As the questionnaire was given after showing the video, it can be categorised as a post-test survey.

Analysis

This paper is an attempt to analyse the use of videos for learning-teaching of concepts of Geography and the objectives mentioned in the beginning of this paper. The study of eContent (video) is based on asynchronous interaction, as the video was developed beforehand. Studies have shown that e-learning generates more interest in learning-teaching that improves academic achievement (Saunders & Strukov, 2018 and Kambar & Bamagond, 2018 Li Sandy C. & Karen B. Petersen, 2022). It also sets free the learning-teaching process from the constraints of time and place (Kambar & Bamagond, 2018). Video content has been found to facilitate a visual form of learning-teaching through animations, demonstrations, simulations, and visualization of complex concepts. It is believed to have more power to engage the learners for a longer duration of time as compared to the traditional mode of learning. Video, just like films/movies, captures the attention of the learner/viewer, which implies that learners can retain the information for a longer time also through active participation. Videos can also act as an effective way to record geographical phenomena and explain the concepts in space and time. Videographic works also provide an avenue to describe any place, society, movement, anthropology or any other narrative (Garrett, 2011).

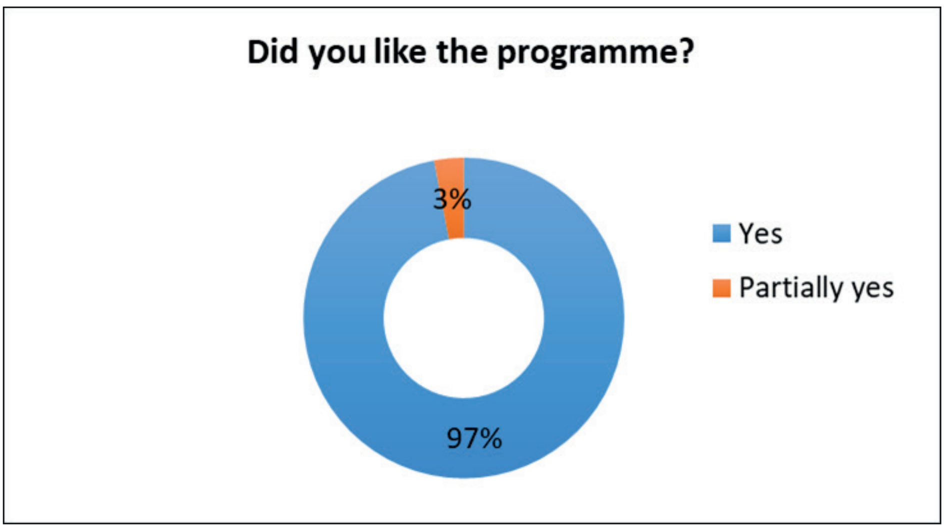
The impact assessment of learning carried out through the questionnaire had a positive response towards the use of video in learning-teaching of geography at the school level. As mentioned earlier, the questionnaire had two sections with a total of seventeen questions focussing on different aspects of the video programme. The details of responses received for these questions have been given here.

Section one had ten questions related to the video, in general. A question-wise analysis has been done.

1. Did you like the programme? (Yes/No/Partially

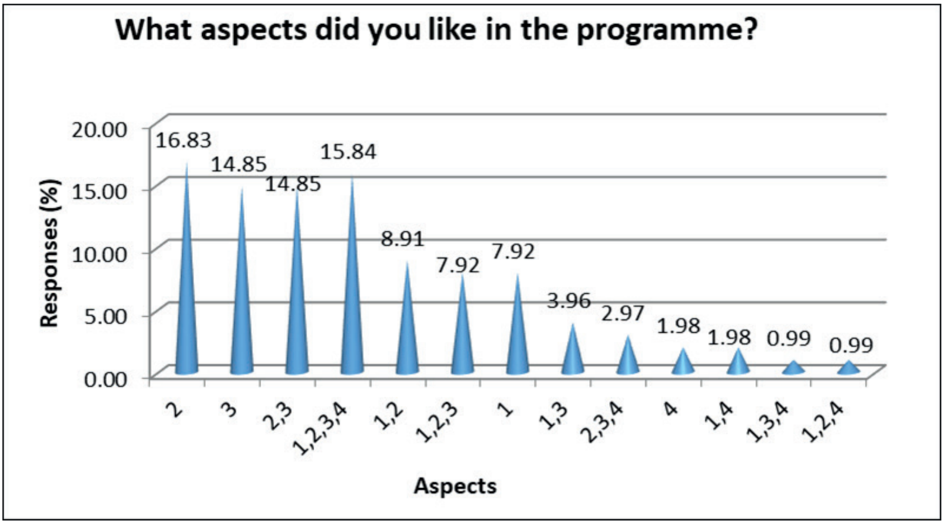
   This responses show that observe that out of 101 students, only 3 students liked the programme partially whereas, rest of the 98 students (97 per cent) liked the programme and none of them disliked the programme (Fig-2). This indicates that the video was interesting and engaging for the students.

Figure-2: Details of responses for Q. no.1



2. What aspects did you like in the programme? (i, ii, iii, iv- can have multiple selections)

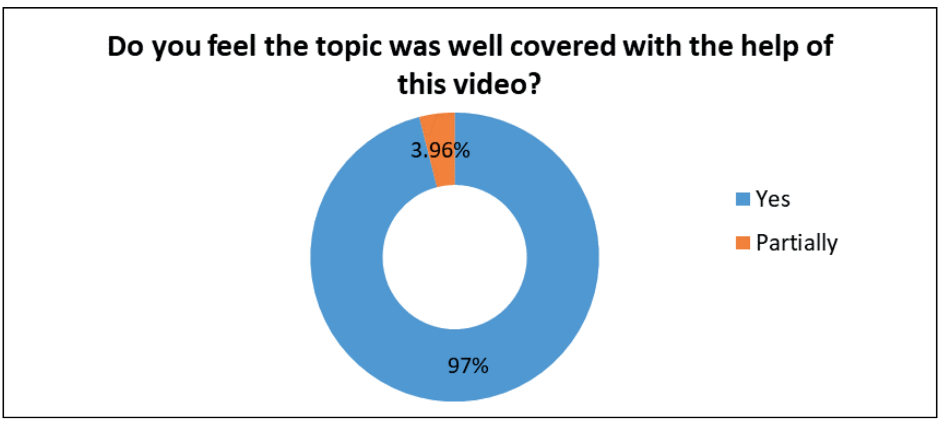
Figure-3: Details of responses for Q. no.2



As per the options given in the questionnaire, the responses show that the way of presentation and the visuals used in the video were in general, liked by the students. However, students wanted some improvement in the sound and coverage of the topic. Many of the students even gave mixed responses about coverage, presentation, usage of pictures and supporting sounds (Fig.-3). The details of options can be seen in the questionnaire given in the annexure.

3. Do you feel the topic was well covered with the help of this video? (Yes/No/Partially)

Figure-4: Details of responses for Q. no.3



For this question, only 4 students (3.96 per cent) said that they partially liked the programme with respect to the coverage of the topic whereas, about 97 per cent of students seemed liking the programme in terms of coverage of content (Fig.-4).

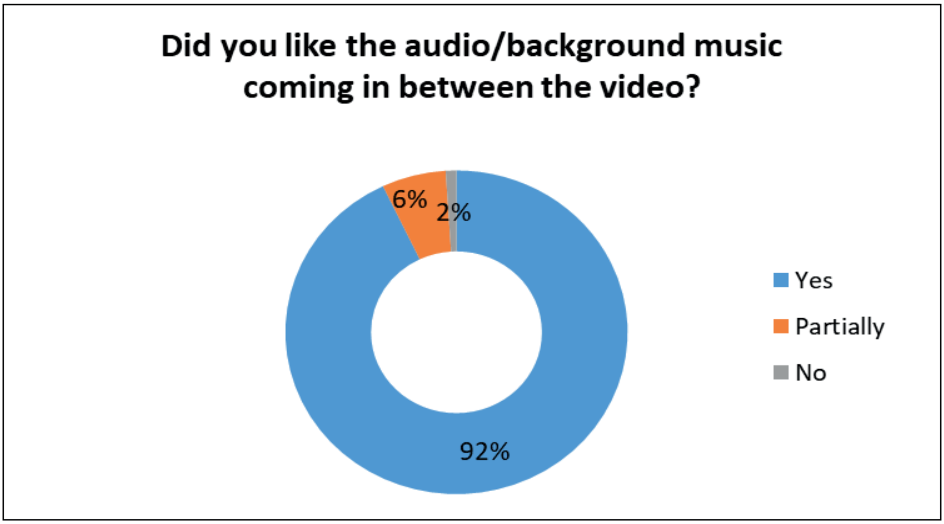
4. Was the duration of the programme adequate? (Yes/No/ Partially)

   Out of 101 students about 88 per cent of students responded in favour of the question asked. The rest of them felt that the duration of the programme could be changed or increased.

5. Did you like the audio/background music coming in between the video? (Yes/No/Partially)

   Here also, a similar response was received as 92 per cent of students liked the audio/ background music of the video, whereas the rest of them either did not like or partially liked them (Fig-5).

Figure-5: Details of responses for Q. no.5



6. Is the language easy to understand? (Yes/No/Partially)

   Regarding understanding the language used in the video programme, a majority of the respondents (96 per cent) responded in favour of the language used and reported that it was easy to understand.

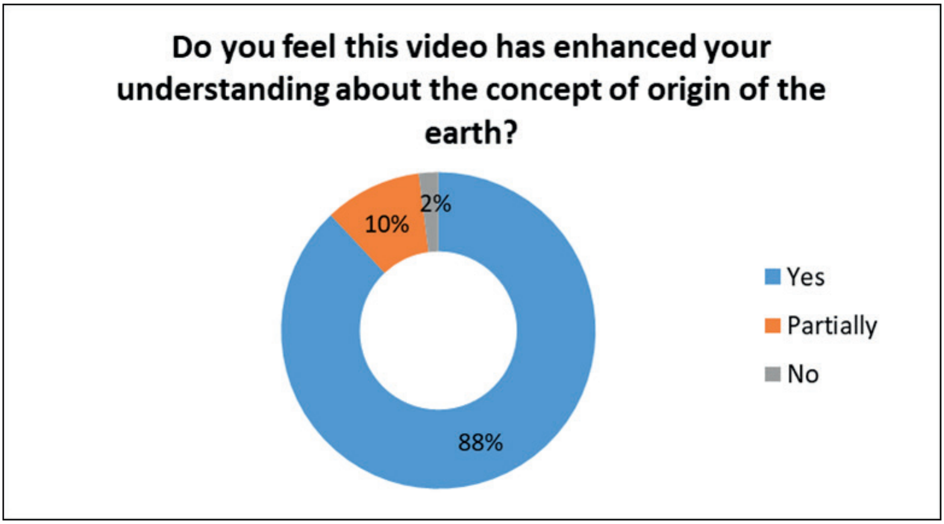
7. Have you ever seen such video programmes before? (Yes/No)

   Here, about 35 per cent of students reported that they had never seen such a programme earlier. The rest of the 65 per cent of students gave a mixed response. Regarding the source of the programme, if seen, the response was for educational TV channels such as Discovery Channel and National Geographic channel being telecast in India and various YouTube channels (names not specified).

8. Do you feel this video has enhanced your understanding of the concept of the origin of the earth? (Yes/No/Partially)

   Barring about 2 per cent of the students who said that this video doesn't enhance their understanding, the rest of the 98 per cent of students replied in favour of the enhancement of their understanding of the concept with the help of this video either partially or completely (Fig.6).

Figure-6: Details of responses for Q. no. 8



9. What more type of programme do you see/would you like to see? (Documentary/Drama/ Demonstration or experiment-based/Puppet-based/Fun-based)

10. Most of the students responded in favour of demonstration or experiment-based programmes. Documentary and fun-based programmes were other options suggested by them.

    Do you have any suggestions related to the programme?

    This was an open ended question where the students were asked to write whatever they felt. Majority of the students liked the programme. However, some wanted more animations, modifications with respect to visual effects in the video.

The second section of the questionnaire consisted of assessment questions (seven in number) specifically related to the content of the video. Out of this, the last question was a little open-ended and was not included in the scores. The details can be seen in the questionnaire (Annexure). The scores of students for all these questions were added, and it was found that about 60 per cent of the students scored 50 per cent or above out of the six questions asked of them. The rest of the 40 per cent of students scored less than 50 per cent. This indirectly signifies that they could grasp some of the information shown in the video program.

Scope of Video Content in Geography

Geography as a subject inherits several supporting disciplines, physical and human in nature, that open the scope for video content and further innovations in it with changing technological advancements. With a wide variety of themes such as geomorphology, climatology, oceanography, demography and related phenomena, human-environment relationship, meteorology, biogeography, ethnography, etc., included in the subject matter, there is a wider scope of developing video content in support of the topic. Many of the phenomena, such as soil formation, weathering, movement of glaciers and movement of lithospheric plates, either take a very long time or cannot be experienced on the surface of the earth. In such cases, the use of videos in explaining the topic can be useful and effective in the learning-teaching process. The use of emerging technologies such as 3D animations or AR-VR can enhance the visual feel of the topics being covered and can enhance the interest in the topic among the learners.

The responses to the field survey also support that such videos generate interest among the learners about the topic being covered. This also makes the learning process enjoyable for them. The majority of the respondents liked the video, and the format encourages the use of technology in learning-teaching of Geography. However, the scores of students received in the second section of the questionnaire could not show a clear transcend of the overwhelming response received in the first section, though about 60 per cent of them received 50 per cent.

Conclusion and the way forward

The use of technology in Geography in multiple ways can be seen as a paradigm shift in studying the subject. The use of technology and ICT, in particular in teaching the subject, has emerged as an integral part of the education system in various countries, including India. Incorporating online courses, blended learning and also flipped learning is being done in the traditional and existing modes of practice. Though the use of videos was done in a few instances its enhanced use and proliferation of agencies developing educational videos has been a recent trend. Probably, such developments have been instrumental in the emergence of branches like videographic geography within Geography. Educational videos have been found to be helpful in the learning-teaching process. However, the integration of such resources should be made effective and in accordance with the explanation of the topic and other pedagogical ways. The utilization of eContent is also being considered as green consumerism (Mishra et al, n.d.). Issues of over-exposure to digital modes, particularly with respect to screen timing and cyber safety, should be taken care of. Though the use of digital content can on hand enable better access to quality education for learners who are deprived of it, it further draws attention towards the existing digital divide and related issues in developing countries like India.

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References

Bazelais, P., Breuleux. A., & Doleck. T. (2022). Investigating a blended learning context that incorporates two-stage quizzes and peer formative feedback in STEM education. Knowledge Management & E-Learning, 14(4), 395–414. https://doi.org/10.34105/j.kmel.2022.14.021

Cresswell & Dixon. (2002). Engaging Film: Geographies of Mobility and Identity, Rowan and Littlefield: Lanham, MD. ISBN 9780742508842

F. Evangelou. (2023). Video as an Educational Tool for Teaching and Learning for Primary School Students: A Research Approach by Greek Teachers, European Journal of Education and Pedagogy, Published Online: February 16, 2023ISSN:2736-4534DOI:10.24018/ejedu.2023.4.1.575

Garrett, B. L. (2011). Videographic geographies: Using digital video for geographic research. In Progress in Human Geography (Vol. 35, Issue 4, pp. 521–541). SAGE Publications Ltd. https://doi.org/10.1177/0309132510388337

Ilesanmi Abayomi. (2022). Teaching and Learning with Instructional Videos: Issues and Concerns for Educational Practice, International Journal of Instructional Technology and Educational Studies (IJITES) ISSN (Print): 2682-3918 - ISSN (online): 2682-3926 Volume4 / Issue1, January 2023 DOI: 10.21608/ihites.2022.121271.1110

Joe Thorogood. (2020). Cartoon controversies and geopolitics: Archer, animators and audiences, Social and Cultural Geography, Vol. 21 Issue3, Routledge, DOI: 10.1080/14649365.2018.1497190

Kadhim, A. J. (2020). Effective Use of ICT for Learning and Teaching Geography. In Aalborg Academy Journal of Human and Social Sciences (Vol. 1, Issue 1). https://www.researchgate.net/publication/347849381

Kambar, S. B., & Bamagond, V. A. (2018). TEACHING GEOGRAPHY THROUGH E-CONTENT. www.lbp.world

Kevin Glynn & Julie Cupples (2015) Negotiating and queering US hegemony in TV drama: popular geopolitics and cultural studies, Gender, Place & Culture, 22:2, 271-287, DOI: 10.1080/0966369X.2013.855711

Li Sandy C. & Karen B. Petersen. (2022). Does ICT Matter? Unfolding the Complex Multilevel Structural Relationship between Technology Use and Academic Achievements in PISA 2015, Educational Technology & Society, International Forum of Educational Technology & Society, National Taiwan, Normal University, Taiwan, October 2022, Vol. 25, No. 4 (October 2022), pp. 43-55, https://www.jstor.org/stable/10.2307/48695980

Mishra, U., Patel, S., Doshi, K., & Doshi, M. K. (2017). E-CONTENT: AN EFFECTIVE TOOL FOR TEACHING AND LEARNING IN A CONTEMPORARY EDUCATION SYSTEM (Vol. 2 Issue 1). International Journal of Advance Research and Innovative Ideas in Education (IJARIIE), ISSN no. Online 2395-4396, www.ijariie.com p 79-83.

Philip Kirby. (2022). Musical orientation in virtual space: videogame score and the spatiality of musical style and topic, Social & Cultural Geography, 23:6, 855-872, DOI: 10.1080/14649365.2020.1821392, https://ijites.journals.ekb.eg/article_255260_ 1ade885135551173890dc9bb2dffe91d.pdf

Robert A. Saunders and Vlad Strukov (Ed) 2018 Popular Geopolitics Plotting an Evolving Interdiscipline, Routledge, ISBN 9780367591625

National Education Policy (NEP) 2020. (2020). Ministry of Human Resource Development (MHRD) now Ministry of Education (MoE), Government of India (GoI) https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

https://ciet.nic.in/pages.php?id=pmevidya

Annexure 1

Questionnaire for Field Trial

Name of the Programme: Origin of the earth Type of programme: Video (AR-VR series) Subject: Geography Duration: 09:30 min	Name of the organization/school: State/UT: Students/Teachers: Class:

Section-1

(Choose (√) the right option)

1. Did you like the programme? Yes/No/Partially
2. What aspects did you like in the programme? (You can choose multiple options)
   i. The topic/theme covered?
   ii. The way it was presented/narrated?
   iii. The pictures/visuals used?
   iv. The sound supporting the video?
3. Do you feel the topic was well covered with the help of this video? Yes/No/Partially
4. Was the duration of the programme adequate? Yes/No/Partially
5. Did you like the audio/background music coming in between the video? Yes/No/Partially
6. Is the language easy to understand? Yes/No/Partially
7. Have you ever seen such video programmes before? Yes/No (If yes, mention the source)
8. Do you feel this video has enhanced your understanding about the concept of origin of the earth? Yes/No/Partially
9. What more type of programme do you see/would you like to see? (Documentary/Drama/Demonstration or experiment-based/Puppet-based/Fun-based)
10. Do you have any suggestions related to the programme?

    ____

    ____

    ____

    ____

Section-2

11. When did the earth and other planets of our solar system originate?

    i. About 4 billion years ago

    ii. About 4.6 billion years ago

    III. About 5 billion years ago

    IV. Time of origin is not known

12. The Solar system is the system of the __________and other____________________________ which is bound together by ___________________ ____________________________.

13. The graphical representation of time span showing the history of the earth on a scale is known as the ____.

14. The theory to explain origin of universe and then our planet earth is known as the ________________________________ Theory.

15. What are the three most important factors that make the earth unique to have life?

    i. Suitable temperature, breathable air & availability of water

    II. Suitable temperature, various gases & atmosphere

    III. Cold temperature, plants & soil

16. Terrestrial planets are also known as ____________________planets and Jovian planets are also known as _______________________planets depending upon their position with respect to the sun.

17. Can you compare the life of living things with the life of a planet like earth? Yes/No/Maybe

    If yes, in what way? ____

    ____

    ____

    If no, then why not? ____

    ____

    ____

Research Article

Status of Science education and ICT at Secondary school stage in Aspirational Districts of North India: An Analysis of NAS 2021 District Report

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Abstract

This study aimed to examine the status of science education and ICT at the secondary school stage in the Aspirational Districts of North India. For this study, the districts report card of the National Achievement Survey (NAS) District Report 2021, which was considered a data source for 22 aspirational districts of six states and one Union Territory in North India. The secondary data were statistically analysed using frequencies, percentages, and averages. Finding of the study reveals that (1) students' performance level decreases as they progress from the basic level to the advanced level, and not satisfactory (2) aspirational districts of North India show positive up to some extent developments in science education for girls, (3) the current state of science education indicates that students are not achieving the expected learning outcomes, and (4) the status of ICT is not in a good position in terms of accessibility to digital devices, particularly regarding internet connectivity and the adequacy of audio-visual resources in all aspirational districts of North India. Study concluded that the status of science education and ICT are not in good position in most of the aspirational districts of North India. Therefore, more collective efforts are needed to improve science education and ICT integration at the secondary school stage.

Keywords: Aspirational Districts, ICT, Science education, Learning Outcomes, Girls Education

Introduction

ICT in education is generally considered a discipline, a set of resources, and a key skill. Within these three broad areas, ICT offers enormous benefits to society (Abdullai, 2013). The impact of technology on students' achievement in science and the development of technological skills, pedagogical beliefs, and ICT capabilities is increasing (Lee et al., 2017). The use of digital simulations in learning Earth sciences has been found to have a positive impact on understanding relative chronology concepts (Nafid et al., 2018). ICT-rich environments provide a range of possibilities that enhance science learning (Rocha Fernandes et al., 2019). The use of technology in education can support the teaching-learning process at various stages (NEP 2020).

ICT and Learning Outcomes in Science education

Science education necessitates innovative techniques that enable students to grasp dynamic scientific concepts. Conventional teaching methods need technological updates to enhance learning efficiency through psychological features. Therefore, the integration of ICT in science widely embraced by teachers and students. Technology is crucial for comprehending complex scientific terms and processes deeply. ICT-integrated learning techniques motivate students, foster collaboration, and encourage innovative thinking by providing opportunities to develop their own ideas. Furthermore, interactive multimedia learning applications enrich the learning process, improving the ability to present information systematically to achieve learning outcomes. For instance, Augmented Reality (AR) enhances motivation by integrating multimedia elements with theoretical concepts. AR merges virtual information with the real environment in real-time, enhancing user perception through visual, auditory, and tactile feedback, thereby exceeding traditional learning expectations (Sinha & Kumar, 2020).

Girls in science education

Science education should be leveraged as a tool for social change to reduce the socio-economic divide (National Focus Group on Science Education, 2006). In particular, providing quality education to girls from socio-economically disadvantaged groups will significantly enhance overall educational standards (NEP, 2020). Thus, understanding the progress of girls in science education at the secondary level is important.

Aspirational Districts in North India

To maintain and uplift the human development index and enhance the socio-economic conditions from the grass-root level to a higher level for national development (Puri, 2020), Niti Aayog launched the Aspirational District Programme (ADP) (UNDP, 2020). Subsequently, an Aspirational development programme aims to transform under-developed districts across India. The programme Centre's around five primary themes: Health & Nutrition, Education, Agriculture & Water Resources, Financial Inclusion & Skill Development, and Basic Infrastructure to directly impact the quality of life at different stages and integrate the socio-economic productivity of citizens. An aspirational district involves 124 (16.91 per cent) out of 733 total districts of India (Maps of India, 2021) which is the most under-developed district in phase-I & phase II across the country (MyMSME, n.d). If we look into North Indian States/UTs excluding Delhi, Rajasthan, Uttarakhand, Uttar Pradesh, Punjab, Himachal Pradesh, Jammu & Kashmir and the Haryana States having Aspirational District(s) as shown in Table 1.

Table-1: Aspirational Districts in North India

Region	State	Total Districts in State/UT	Total Aspirational Districts	State wise %
North India	Rajasthan	33	6 (Baran, Dholpur, Jaisalmer, Karauli, Sirohi and Barmer)	18.18
	Uttarakhand	13	2 (Haridwar, Udham Singh Nagar)	15.38
	Uttar Pradesh	75	8 (Bahrich, Balampur,Chandauli, Chitrakoot, Fatepur, Shraswasti, Shiddarthnagar andSonabhadra)	10.67
	Punjab	22	2 (Ferozpur, Monga)	9.09
	Jammu and Kashmir	22	2 (Baramullah, Kupwara)	9.09
	Himachal Pradesh	12	1 (Chamba)	8.33
	Haryana	22	1 (Nuh)	4.54

(Source data: NAS-2021 Districts Report Card, https://nas.gov.in/report-card/2021)

Table 1 depict that Rajasthan has the highest percentage of Aspirational Districts in North India. Uttarakhand is the second highest 15.38 per cent of aspirational Districts among all the North Indian. While Uttar Pradesh, Punjab, Himachal Pradesh, Jammu & Kashmir and Haryana have a low percentage of Aspirational Districts(s) comparatively to Rajasthan and Uttarakhand. It can be state that including other aspirational districts in percentage of North India, districts of Rajasthan, Uttarakhand and Uttar Pradesh need to give more intervention programme or teaching-learning activities. Hence, these aspirational districts need more academic, administrative, financial and other related resources and outcomes based activities.

Educational profile of the Aspirational Districts

The schools and teachers in different management schools in Aspirational Districts of North India is presented in Table 2. This data helps to understand the actual position of schools in the mentioned aspirational districts.

Table-2: Educational profile of the Aspirational Districts

State/UTs	Total Aspirational Districts	Total No. Schools	Total No. Teachers	SGS	TSGS	GAS	TGAS	CGS	TCGS	PURS	TPURS
Rajasthan	Baran	2123	13253	1594	8065	-	-	4	79	525	5109
	Dhaulpur	1816	13114	1144	7201	-	-	3	46	669	5867
	Jaisalmer	1626	7866	1302	5392	-	-	5	122	319	2352
	Karauli	2186	15462	1452	8203	-	-	2	54	732	7205
	Sirohi	1394	9353	999	6000	-	-	3	66	392	3287
	Barmer	5532	27472	4822	21075	-	-	4	110	706	6287
Uttarakhand	Haridwar	2047	14549	946	4045	92	911	4	145	1005	9448
	Udham Singh Nagar	2129	16033	1137	4508	68	605	3	70	921	10850
Uttar Pradesh	Bahrich	3765	19588	2876	12672	57	646	4	38	828	6232
	Balampur	2336	10341	1850	7071	33	384	2	50	451	2836
	Chandauli	2056	14920	1230	7386	81	785	3	112	742	6637
	Chitrakoot	1685	8735	1295	5856	45	290	2	44	343	2545
	Fatepur	3628	19047	2189	9963	142	1027	2	25	1295	8032
	Shraswasti	1370	6890	1018	4248	19	239	2	24	331	2298
	Shiddarth nagar	3030	14783	2297	9387	78	835	2	33	653	4525
	Sonabhadra	2765	13876	2123	8075	16	210	4	100	622	5491
Punjab	Ferozpur	1100	9322	841	4786	10	88	5	136	244	4312
	Monga	857	9308	595	4385	12	108	1	20	249	4795
Jammu and Kashmir	Baramullah	2401	14176	1975	8967	-	-	3	53	423	5156
	Kupwara	2177	11471	1844	7652	-	-	1	3	332	3816

State/UTs	Total Aspirational Districts	Total No. Schools	Total No. Teachers	SGS	TSGS	GAS	TGAS	CGS	TCGS	PURS	TPURS
Himachal Pradesh	Chamba	1847	7880	1671	6219	-	-	7	157	169	1504
Haryana	Nuh	1118	6886	941	4727	-	-	1	19	176	2140
Total		48988	284325	36141	165883	653	6128	67	1506	12127	110724

(Where, State Govt. Schools= SGS, TSGS= Total No. of Teachers in Schools, Govt. Aided Schools=GAS, TGAS= Total No. of Teachers in Govt. Aided Schools, Central Govt. Schools=CGS, TCGS= Total No. of Teachers in Central Govt. Schools, PURS= Private Unaided Recognized Schools and TPURS =Total No. of Teachers in Private Unaided Recognized Schools; Note: - means there is no Govt. Schools established in these districts and teachers were not appointed). (Source data: NAS-2021 Districts Report Card, https://nas.gov.in/report-card/2021)

Table 2 shows that teachers, different management schools are available in the Aspirational Districts of North India. While less number of Government aided and Central schools available in these districts. It can be stated that teachers in these Aspirational districts contributing their educational services in State Government and Private Unaided Recognized Schools is more. In this scenario, State Government can create the integrated approach of resource sharing with other management schools.

Educational Indicators for Aspirational Districts

Out of all focused themes of Aspirational Districts, 30 per cent weightage was given to the education sector. The following eight key indicators have been identified for the improvement of education in Aspirational Districts:

- Indicator 1(a): Transition from primary to upper Primary
- Indicator 1(b): Transition from upper primary to secondary
- Indicator-2: percentage of schools with functional girls' toilets
- Indicator 3: Learning outcomes (Mathematics and Languages from class three to eight)
- Indicator 4: Female literacy
- Indicator 5: percentage of schools with functional drinking water facilities
- Indicator 6: percentage of schools with functional electricity facility at secondary level
- Indicator 7: percentage of elementary schools complying with Right to Education specified PTR
- Indicator 8: percentage of schools providing textbooks to children

Samagra Siksha Flagship Programme for Aspirational Districts

The Samagra Siksha Flagship Programme aims to transform Aspirational Districts through the implementation of ICT and digital initiatives. These initiatives will specifically target students in grades six to twelve. Hence, the ability to get hardware such as tablets, laptops, notebooks, and integrated teaching learning devices, along with open source operating systems, as well as hardware, software, training, and resource support. This would encompass assistance for digital whiteboards, intelligent classrooms, virtual classes, and DTH channels, allocated proportionally based on the number of authorised schools. Projects that involve community participation will be given priority, particularly those that are eligible for schools. Therefore, the status of ICT at the secondary stage in school is presented in terms of accessibility of digital devices in the schools, internet connectivity and adequacy of Audio-Visual resources.

Literature Review

Adeyemo (2010) investigated the impact of ICT on the teaching and learning of physics, revealing significantly enhances the learning experience and makes the subject more engaging for students. Byker (2014) highlighted the lack of empirical research on ICT in Indian elementary schools, which obstructs India's efforts to provide education and prepare children with 21st-century skills. Das (2012) emphasized the critical role of understanding and leveraging ICT for social and economic progress, stressing the necessity of embedding ICT-based resources in educational systems to equip students with necessary skills.

Paul and Mondal (2012) analyzed the role of ICT in enhancing the quality of school education and found that ICT can predict future educational technologies and improve education quality, provided that proper infrastructure is in place. Simin (2015) corroborated this by analyzing teachers' perceptions of ICT integration's effectiveness, highlighting that well-equipped ICT tools and professional development are crucial for successful technology-based teaching and learning. Agrahari and Singh (2013) focused on the impact of ICT on student achievement in chemistry, revealing the necessity of lifelong education and the importance of modern educational technologies, in meeting the growing demand for scientific knowledge.

Ruiz et al. (2014) examined the influence of technologies in science teaching on gender differences and found that ICT tools improved motivation and learning scores, particularly for women. Shanmugam and Balakrishnan (2019) also highlighted the positive impact of ICT on student motivation in learning science. Aboderin and Bamisile (2021) examined ICT skills significantly enhanced students' perceptions of the influence of ICT in science teaching and learning practices.

Sharma and Sharma (2017) studied the effectiveness of ICT in science teaching and found that students enjoyed ICT in lessons and useful for teachers. Roy and Sehrawat (2018) conducted an experimental study on the effectiveness of ICT-enabled classrooms for science students and showed that students taught through video modules performed better and improving academic achievement. Mann and Mohanty (2018) examined the status of technological infrastructure and training needs for ICT among school teachers and noted that ICT use was limited, with few motivated teachers using personal ICT resources for teaching. Kumar et al. (2020) analysed the socio-economic status of people in aspirational districts for inclusive growth and revealed the need for priority interventions. Kumar et al. (2021) investigated the effectiveness of skill development training programs in aspirational districts and found that the majority of trainees perceived an improvement in their knowledge and skills. Saha (2022) studied the issues and status of teacher management in the aspirational districts and revealing it is difficult task. Finally, Igboanugo et al. (2020) studied the efficacy of ICT integration in teaching methods for effective chemistry curriculum delivery and showed that significantly enhanced curriculum delivery.

Based on a literature review, ICT significantly enhances learning experiences and student engagement in science education. However, persistent barriers such as a lack of resources, training, and infrastructure hinder the effective implementation of ICT in learning science. No study has been conducted on ICT and science education in the Aspirational Districts. Therefore, this study examined the status of ICT and science education at the secondary school stage, especially in the Aspirational Districts of North India.

Operational definition

- **Science Education:** It means, the teaching-learning of science in classroom environment to cultivate knowledge, develop scientific temper, problem solving and critical thinking and ability to solve the problems in real life.
- **Information and communication Technology (ICT)**: ICT, in the context of present study, means employing technology and related resources for teaching-learning process.
- **Aspirational Districts**: Here, aspirational District can be defined as districts which are affected by poor socio-economic factors including education in different States/ UTs of India.

Research Questions

- What is the status of science education at the secondary school stage in the aspirational districts of North India?
- What is the status of ICT at the secondary school stage in the aspirational districts of North India?

Objectives of the Study

- To examine the status of students in science at the secondary school stage in Aspirational Districts of North India.
- To study the status of ICT at the secondary school stage in Aspirational Districts of North India.

Delimitations

- The present study comprises student data at the secondary stage from the National Achievement Survey 2021, district report card.
- The present study comprises data on science education and ICT in schools at the secondary stage from the National Achievement Survey 2021, district report card.
- The present study comprises district reports belonging to aspirational districts of North India as given in the National Achievement Survey 2021, district report card.
- In the present study, the performance of students and learning outcomes is considered as the status of their science education.

Methodology

This study employs a quantitative research methodology, utilizing secondary data. Data on science education and ICT were collected from the National Achievement Survey 2021 District Report Card, prepared by NCERT, through an online visit to the National Achievement Survey Portal of the Department of School Education and Literacy, Ministry of Education, Government of India. The researcher subsequently organized, tabulated, and statistically analyzed the secondary data using descriptive statistics, including frequencies, percentages, and averages.

Status of science education at secondary school stage

The status of science education at the secondary stage is categorized into the following three sections: performance levels of students in science education, performance levels of girls in science education, and learning outcomes of students in science education, presented in Table 3, Table 4 and Table 5 respectively.

Table-3: Performance of students in Science education

State/UTs	Aspirational Districts in North India	District wise Performance in Science education (%)	% of students by performance level in Science education in Aspirational Districts			
			BB	BS	PR	AD
Rajasthan	Baran	37	66	23	11	0
	Dholpur	56	18	29	37	16
	Jaisalmer	38	64	21	13	2
	Karauli	43	46	32	20	2
	Sirohi	43	49	28	20	3
	Barmer	42	52	27	19	2
Uttarakhand	Haridwar	34	75	17	8	1
	Udham Singh Nagar	33	80	13	5	1
Uttar Pradesh	Bahrich	29	90	9	1	0
	Balampur	31	87	9	3	1
	Chandauli	32	35	46	16	4
	Chitrakoot	43	30	35	22	12
	Fatepur	32	80	16	4	0
	Shraswasti	31	85	13	1	0
	Shiddarthnagar	33	80	15	5	0
	Sonabhadra	32	84	12	4	0
Punjab	Ferozpur	50	34	25	33	8
	Monga	47	38	34	25	3
Jammu and Kashmir	Baramullah	60	69	22	8	1
	Kupwara	43	30	35	22	12
Himachal Pradesh	Chamba	32	64	26	7	2
Haryana	Nuh	31	74	18	8	1
Overall performance		37.36	60.45	22.95	13.27	3.22

Where BB=Below Basic level, BS= Basic level, PR= Proficiency level and AD= Advanced level

(Source data: NAS-2021 Districts Report Card, https://nas.gov.in/report-card/2021)

This table 3 presents the performance in science education across 22 aspirational districts of North India. Each district's performance is broken down into four categories: Below Basic (BB), Basic (BS), Proficient (PR), and Advanced (AD). The performance in science education across various aspirational districts varies from (31 per cent to 60 per cent). In the three districts, 16 per cent of students from Dholpur, 12 per cent from Kuphwara, and 12 per cent from Chitrkoot demonstrated advanced performance in science education.

While the performance levels in the other 19 districts ranged from (1 per cent to 8 per cent). Student's proficiency in science education varied between (22 per cent and 37 per cent) in the five aspirational districts. These were 37 per cent of students from Dholpur, 33 per cent of students from Ferozpur, 25 per cent of students from Monga, 22 per cent of students from Chitrkoot, and likely 22 per cent of students from Kuphwara. In the other 17 districts, the percentage of students performing at the proficiency level ranged from 1 per cent to 20 per cent. In the five aspirational districts, students' basic performance levels in science education ranged from (22 per cent to 37 per cent). These were 37 per cent of students from Dholpur, 33 per cent of students from Ferozpur, 25 per cent of students from Monga, 22 per cent of students from Chitrkoot, and likely 22 per cent of students from Kuphwara. While the percentage of basic-level performance in the other 17 districts varied from 1 per cent to 20 per cent, respectively. As a result, the performance level of students in science education in the thirteen aspirational districts was below-basic (64 per cent to 90 per cent), three districts had a below-basic (46 per cent to 52 per cent), and six aspirational districts had a below-basic (18 per cent to 38 per cent). The table also show that overall performance of science education across various aspirational districts is 37.36 per cent. Furthermore, the overall performance shows that 60.45 per cent students are at the below basic level, 22.95 per cent students at the basic level, 13.27 per cent students at the proficiency level, and 3.22 per cent students at the advanced level. The analysis above indicates significant differences in students' performance in science education, ranging from basic level to advanced levels. The percentage of students at each performance level decreased as they progressed from the basic level to the advanced level. While it should be increased from below basic level to advanced level. It means that the overall status of science education in the aspirational districts of north India is not in a good position. It may be due to student's attitude towards science education, teaching-learning process, and resources utilisation. Chikendu & Obikezie (2020) revealed that the attitude of students significantly impacts their science education. Therefore, there is a special need to emphasise and identify the factors behind the low percentage of proficiency and the advanced level of science education. Similarly, it needs intervention in the teaching-learning process as well as resource utilisation for better performance in science education at the secondary school stage.

Table-4: Performance and progress of girls in Science education

State/UTs	Aspirational Districts in North India	District wise performance in Science education (%)	% of performance and progress in Science education at secondary school stage of Girls		
			%	% Progress	Indicators
Rajasthan	Baran	37	39	2%	+
	Dholpur	56	57	1%	+
	Jaisalmer	38	36	2%	-
	Karauli	43	44	1%	+
	Sirohi	43	46	3%	+
	Barmer	42	44	2%	+

State/UTs	Aspirational Districts in North India	District wise performance in Science education (%)	% of performance and progress in Science education at secondary school stage of Girls		
			%	% Progress	Indicators
Uttarakhand	Haridwar	34	33	1%	-
	Udham Singh Nagar	33	32	1%	-
Uttar Pradesh	Bahrich	29	28	1%	-
	Balampur	31	29	2%	-
	Chandauli	32	31	1%	-
	Chitrakoot	32	31	1%	-
	Fatepur	32	31	1%	-
	Shraswasti	31	31	No Change	=
	Shiddarthnagar	33	32	1%	-
	Sonabhadra	32	31	1%	-
Punjab	Ferozpur	50	52	2%	+
	Monga	47	48	1%	+
Jammu and Kashmir	Baramullah	36	35	1%	=
	Kupwara	35	35	No Change	=
Himachal Pradesh	Chamba	32	32	No Change	=
Haryana	Nuh	34	35	1%	+

(Where, - sign = progress decrease, + sign = progress increase, and = sign =no change in progress) (Source data: NAS-2021 District Report Card, https://nas.gov.in/report-card/2021)

The table 4 highlights the performance and progress of girls in science education at the secondary school stage across various aspirational districts in North India. Among the all aspirational districts, 3 per cent of progress in science education found in girls of one district Sirohi district of Rajasthan, 2 per cent of progress in the science education found in girls of five districts as Baran, Jaisalmer, Barmer, Balampur, and Ferozpur, and 1 per cent of progress in science education found in girls of twelve districts as Dhopur, Karauli, Haridwar, Udham Singh Nagar, Bahrich, Chandauli, Chitrkoot, Fatepur, Shiddarthnagar, Sonabhadra, Moga and Baramillah, and there were no change found in progress in the science education in girls of five districts as kupwara, chamba and sharaswasti. Based on above results, it can be interpreted that aspirational districts of North India yet more positive developments in science education for girls. The result of the study favoured by the some other studies and reveal that girls were underperforming and underrepresented in science education in developing countries worldwide

(Ullah et al, 2021; Roberts & Huges, 2022; Fussy et al., 2023). However, the absence of progress in Kupwara, Chamba, and Shrawasti signals potential areas where educational strategies may need re-evaluation and targeted interventions to foster improvement. Therefore, policies and schemes for including students from SEDGs should focus on girls by establishing a 'Gender-Inclusion Fund' to enhance the nation's ability to offer equitable, quality education for all (NEP-2020). Overall, the progress percentages indicate both successful and stagnant regions, highlighting the need for policy recommendations to address the unique challenges faced by each aspirational district in girls' science education.

Table-5: Learning outcomes percentage of Science education

LOs	Percentage of learning outcomes in science education																					
	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_{10}	D_{11}	D_{12}	D_{13}	D_{14}	D_{15}	D_{16}	D_{17}	D_{18}	D_{19}	D_{20}	D_{21}	D_{22}
LO1	43	58	42	50	49	48	37	36	31	33	35	34	36	36	35	34	55	50	36	38	33	35
LO2	38	53	38	44	48	41	37	34	34	36	34	33	33	35	34	34	49	49	36	36	33	39
LO3	44	64	44	52	51	48	36	35	33	32	33	34	34	35	36	34	61	52	38	37	35	42
LO4	37	63	40	45	45	45	34	33	30	30	31	33	34	30	34	33	52	50	38	37	30	34
LO5	31	35	33	34	31	34	28	30	26	31	28	28	30	28	32	27	30	32	34	31	32	33
LO6	28	35	27	30	30	26	27	28	25	26	31	31	26	26	29	29	34	29	27	25	26	27
LO7	45	70	44	50	51	50	36	33	30	30	37	36	39	33	41	36	56	57	45	41	30	32
LO8	34	56	36	40	38	41	33	30	27	29	32	31	29	28	31	29	49	47	32	29	27	31
LO9	37	59	38	45	44	42	35	35	29	33	32	33	33	30	34	32	51	48	37	37	37	35
LO10	31	54	33	33	38	32	27	26	24	26	24	24	24	23	24	25	44	39	28	26	24	27

(Where D_1= Baran, D_2=Dholpur, D_3=Jaisalmer, D_4=Karauli, D_5=Sirohi, D_6=Barmer, D_7=Haridwar, D_8=Udham Singh Nagar, D_9=Bahrich, D_{10}=Balampur, D_{11}=Chandauli, D_{12}=Chitrakoot, D_{13}= Fatepur, D_{14}=Shraswasti, D_{15}= Shiddarthnagar, D_{16}= Sonabhadra, D_{17}= Ferozpur, D_{18}= Monga, D_{19}= Baramullah, D_{20}= Kupwara, D_{21}= Chamba and D_{22}= Nuh) and (Source data: NAS-2021 District Report Card, https://nas.gov.in/report-card/2021) and

Learning Outcomes: LO1 to LO10 follows as

LO1: Differential material, objects, organisms, phenomena and processes based on properties and characteristics.

LO2: Classifies materials, objects, organisms, phenomena and processes based on properties and characteristics.

LO3: Relates processes and phenomena with cause and effects.

LO4: Explains processes and phenomenon.

LO5: Analysis and interprets data, graphs and figures.

LO6: Calculate using the data given.

LO7: Uses scientific conventions to represent units of various quantities, symbols, formulae and equations.

LO8: Applies learning to hypothetical situations

LO9: Applies scientific concepts in daily life and solving problems

LO10: Derives formulae, equations and laws

Table 5 reveals that only three out of the 22 aspirational districts show more than 50 per cent to 55 per cent achievement in learning outcomes (LOs) in science (excluding analysis and interpreting data, graphs, figures, and calculations using the data) at the secondary school level, as in Dhaulpur of Rajasthan, Ferozpur, and Monga of Punjab. In the secondary stage, the majority of students achieved less than 50 per cent success in science learning outcomes. Similarly, learning outcomes of science students are still low (Rizaki et al., 2022). Students should cultivate their scientific development, critical thinking, and problem-solving skills. NEP-2020 also emphasizes the importance of cultivating a scientific mindset among learners. The current state of science does not indicate that students are achieving the expected learning outcomes, as their performance across most districts does not exceed the expected threshold of 50 per cent. Therefore, educational institutions, researchers, and other stakeholders, such as teachers, teacher educators, and administrations, need to come together on a successive path to achieving learning outcomes in science for students in the secondary school stage.

Status of ICT at Secondary school stage in Aspirational Districts of North India.

The following table 6 presents the status of ICT at the secondary school stage in terms of accessibility to digital devices, Internet connectivity, and adequacy of audio-visual resources.

Table-6: ICT resources & adequacy in Aspirational districts

(Source: NAS-2021 District Report Card, https://nas.gov.in/report-card/2021)

State/UTs	Aspirational Districts	Students have access to digital devices in the Schools (%)	Students having Internet Connectivity at Home (%)	Heads of School responses for Adequacy of Audio-Visual resources (%)
Rajasthan	Baran	76%	50%	39%
	Dhaulpur	67%	49%	48%
	Jaisalmer	80%	62%	42%
	Karauli	66%	46%	39%
	Sirohi	87%	62%	42%
	Barmer	74%	56%	42%
Uttarakhand	Haridwar	81%	61%	38%
	Udham Singh Nagar	79%	62%	41%
Uttar Pradesh	Bahrich	70%	49%	43%
	Balampur	67%	44%	30%
	Chandauli	64%	51%	29%
	Chitrakoot	59%	41%	30%
	Fatepur	64%	48%	27%
	Shraswasti	72%	45%	28%
	Shiddarthnagar	68%	47%	30%
	Sonabhadra	66%	51%	31%

State/UTs	Aspirational Districts	Students have access to digital devices in the Schools (%)	Students having Internet Connectivity at Home (%)	Heads of School responses for Adequacy of Audio-Visual resources (%)
Punjab	Ferozpur	97%	82%	90%
	Monga	96%	77%	88%
Jammu and Kashmir	Baramullah	76%	62%	24%
	Kupwara	77%	60%	21%
Himachal Pradesh	Chamba	82%	65%	43%
Haryana	Nuh	69%	52%	43%
Overall ICT resources		**74.41%**	**55.54%**	**40.36%**

Table 6 depicts the ICT resources in terms of accessibility of digital resources, Internet connectivity, and adequacy of Audio-visual resources at the Secondary Schools stage in Aspirational districts of

North India. In the case of Aspirational Districts of North India, 80 per cent to 97 per cent of students belonging to Jaisalmer and Sirohi of Rajasthan, Haridwar of Uttarakhand, Ferozpur, and Monga of Punjab, and Chamba of Himachal Pradesh admitted that schools have digital devices. The 60 per cent to 82 per cent of Students having Internet Connectivity at home belong to Jaisalmer, Sirohi, Haridwar, Udham Singh Nagar, Ferozpur, Monga, Baramullah, Kupwara, and Chamba districts. In the others aspirational Districts of North India, 44 per cent to 56 per cent of students admitted that they have less percentage in Internet connectivity at home belongs to Baran, Dhaulpur, Karauli, Barmer, Bahrich, Balampur, Chandauli, Chitrakoot, Fatepur, Shraswasti, Shiddarthnagar, Sonabhadra and Nuh. Heads of schools of Ferojpur and Monga of Punjab showed the highest 90 per cent and 88 per cent Audio-Visual resources available in their schools at the secondary level. While Dhaulpur, Jaisalmer, Sirohi, Barmer, Udham Singh Nagar, Bahrich, Nuh, and Chamba showed 41 per cent to 48 per cent availability of Audio-visual resources, while the rest 12 Aspirational Districts Heads admitted that schools had 21 per cent to 39 per cent audio-visual resources. Furthermore, the overall ICT resources availability and adequacy shows that 74.41 per cent students have access to digital devices in the Schools, 22.95 per cent students have internet connectivity at home, 40.46 per cent heads of school admitted that adequacy of Audio-Visual resources in the respective schools. It can be stated that the status of ICT not in good position related to accessibility of digital device, particularly for internet connectivity and adequacy of audio-visual resources in all aspirational districts of North India. Similarly, Lack of ICT resources, coupled with limited internet connection and speed, has been found in the schools (Mann & Mohanty, 2018; Sahoo et al., 2022; Baruah & Mohalik, 2022). NEP-2020 states that teaching-learning should be ICT integrated at various stages of teaching-learning multidimensional subjects or discipline. Therefore, need on both ICT resources and its integration in science at secondary stage.

Conclusion

Government of India has taken positive initiatives to uplift the education status of Aspirational Districts. According to the NAS-21 district report, the status of science education among students at the secondary school stage in aspirational districts is not satisfactory. Findings indicate that approximately 30-60 per cent more intervention is required to achieve 100 per cent performance in science education for students. Furthermore, the performance of science education among girls at the secondary school stage is also not much improved. This study suggests that the available teaching-learning processes and applied resources are not student-centric. Currently, there is a need to assess the holistic development of individual learners based on their learning outcomes. Addressing this need is a major concern for various stakeholders including teachers, teacher educators, researchers, policymakers, and educational institution management. The study concludes that emphasis should be placed on an integrated approach to science education and ICT which is not presented in the Aspirational Districts of North India to achieve global standards through quality education (NEP, 2020). Therefore, educational programs developed by government organizations should incorporate science teaching-learning interventions across different phases. Initiatives in science education need to adopt an integrated pedagogical approach with ICT at both the secondary school management levels in Aspirational Districts of North India, from grassroots to leadership.

Educational Implications

- ICT based intervention studies can be conducted to enhance the status of science education in aspirational districts in North India and other aspirational districts.
- There is a necessity for gender-focused programs and related educational initiatives in aspirational districts to ensure equitable learning opportunities in ICT and science education.
- The low availability of ICT resources, particularly internet connectivity and audio-visual aids, suggests the need for substantial investment in digital infrastructure to support modern teaching and learning practices in aspirational districts.
- An ICT-integrated science curriculum can be developed to enhance learning outcomes by providing students with access to interactive and engaging educational resources.
- There is a need for continuous professional development programs for teachers in aspirational districts to equip them with effective pedagogical strategies and the skills to utilize ICT for science teaching.
- Policymakers should prioritize the allocation of resources to the aspirational districts to ensure all students have the necessary tools and opportunities to succeed in science education.

References

Abdullai, Hannatu (2013). The Role of ICT in Teaching Science Education in Schools. *Journal of Educational and Social Research, 3*(9), 127-131.

Adeyemi, T. O. (2008). Teachers' teaching experience and students' learning outcomes in secondary schools in Ondo State, Nigeria. *Educational Research and Review, 3*(6), 204-212.

Baruah, S., & Mohalik, R. (2022). Status of ICT Integration in Teacher Education Institutions of Assam: An Exploratory Study. *Indian Journal of Educational Technology, 4*(1), 85-95.

Fussy, D. S., Iddy, H., Amani, J., & Mkimbili, S. T. (2023). Girls' participation in science education: Structural limitations and sustainable alternatives. *International Journal of Science Education, 45*(14), 1141-1161. https://rb.gy/obg3vz

Kumar, Dheeraj (2019). Programme and policies in science education: an overview. *International Educational Applied Scientific Research Journal*, *4*(12), 7-9. https://ieasrj.com/journals/index.php/ieasrj/article/view/161/156

Lee, H., Longhurst, M., & Campbell, T. (2017). Teacher learning in technology professional development and its impact on student achievement in science. International Journal of Science Education, *39*(10), 1282–1303

Mann, D., & Mohanty, B. B. (2018). Identifying Status of Technological Infrastructure and Training Needs in ICT of Primary Schools Teachers in District North. *District Institute of Education and Training Keshavpuram.*

Maps of India (2021). https://www.mapsofindia.com/districts-india/ retrieved on 6.7.2022

MHRD (2020). National Educational Policy 2020. *Government of India*. https://www.education.gov.in/sites/upload files/mhrd/files/NEPFinal English_0.pdf

Ministry of Education (2022). National Achievement Survey 2021: District Report Card. *Department of School Education and Literacy, Government of India. https://nas.gov.in/report-card/2021#About*

MyMSME (n.d). List of Aspirational Districts (Phase-I & II). *Government of India* https://my.msme.gov.in/MyMsme/List_of_AspirationalDistricts.aspx). retrieved on 15.7.2022

Nafidi, Youssef. , alami, Anouar., Zaki, Mocncef., Batri, Bouchta El., & Afkar, Hanane. (2018). Impacts of the use of a digital simulation in Learning Earth sciences (the case of relative dating in High School). *Journal of Turkish Science Education*. 15(*1*), 89-108. https://eric.ed.gov/?id=EJ1344524

NCERT (2006). Position paper: National Focus Group on Teaching Science. *Publication Department by the Secretary, National Council of Educational Research and Training*. https://ncert.nic.in/pdf/focus-group/science.pdf

NCERT (2019). Learning Outcomes at the Secondary stage. *Publication Division by the Secretary, National Council of Educational Research and Training*. https://ncert.nic.in/pdf/notice/learning_outcomes.pdf

Prui, Natasha (2018). *A Review of the Aspirational Districts Program of the National Institute of Transforming India,* Government of India. https://ssrn.com/abstract=3511027

Rizki, Y., Darvina, Y., Desnita, & Rahim, F. R. (2022). Meta analysis of the effect of cooperative learning models on student learning outcomes in physics. *Pillar of physics education*, *15*(3), 215-224.

Roberts, K., & Hughes, R. (2022). Recognition matters: The role of informal science education programs in developing girls' science identity. *Journal for STEM Education Research, 5*(2), 214–232.

Rocha Fernandes, G. W., Rodrigues, A. M., & Rosa Ferreira, C. A. (2019). ICT-Based Science Education: *Main Digital Resources and Characterisation*, 1-37. https://doi.org/10.1007/978-3-030-17895-6_1

Sahoo, R., Behera, L., & Dhenkanal. (2022). Use of ICT in Teaching-Learning Process in Elementary Level. *Indian Journal of Educational Technology, 4*(1), 96-110.

Sinha, Sharad & Kumar, Dheeraj (2020). Achieving science learning outcomes at secondary stage leveraging information communication technology. *International Education &*

Research Journal, *6*(3), 60-63. https://ierj.in/journal/index.php/ierj/article/view/1997

Ullah, R., Raza, M. A., & Ullah, Dr. (2021). Girls' academic performance in science subjects: Evidence from industrializing and least industrialized countries. *Girls Academic Performance in Science, 30*(2), 187-200. https://rb.gy/9x4esi

UNDP (2020). *Aspirational Districts Programme: An Appraisal: United Nations Development Programme. https://www.niti.gov.in/sites/default/files/2023-03/Aspirational-Districts-Programme-An-Appraisal.pdf*

UNESCO (2015). The 2015 Global Monitoring Report – Education for All 2000-2015: Achievements and Challenges. United Nations Educational, Scientific and Cultural Organization, 1-556. https://unesdoc.unesco.org/ark:/48223/pf0000232205

Omeodu, M. (2022). Innovations for pedagogical learning in science education in the era of COVID-19: Focusing on information and communication technology. *International Journal of Advanced Research and Learning, 1*(1). Retrieved from http://rajournals.net/index.php/ijarl/article/view/37

Kumar, V., Gaur, P., & Malik, S. (2021). Status of ICT available resources and practices adopted by schools in South Delhi. District Institute of Education & Training Moti Bagh.

Paul, P. K., & Mondal, N. K. (2012). Integration of ICT in school education: An analytical study in Burdwan District in West Bengal, India. *Research Journal of Management, 1*(4), 21-25. Retrieved from https://pdfs.semanticscholar.org/c3ca/ff57991bcbd406859f7f374787fb19e16653.pdf

Byker, E. J. (2014). ICT in India's elementary schools: The vision and realities. *The International Education Journal: Comparative Perspectives, 13*(2). Retrieved from http://iejcomparative.org

Ghavifekr, Simin., & Wan Rosdy, W. A. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science, 1*(2). Retrieved from https://files.eric.ed.gov/fulltext/EJ1105224.pdf

Das, R. (2012). Integrating ICT in teaching learning framework in India: Initiatives and challenges. Retrieved from http://bcjms.bhattercollege.ac.in/integrating-ict-in-teaching-learning-framework-in-india-initiatives-and-challenges/

Adeyemo, S. A. (2010). The impact of information and communication technology (ICT) on teaching and learning of physics. *International Journal of Educational Research and Technology, 1*(2), 48-59.

Agrahari, A., & Singh, S. (2013). The impact of information and communication technology (ICT) on achievement of students in chemistry at secondary level of CBSE and UP Board in India. *International Journal of Science and Research, 2*(8).

Mann, D., & Mohanty, B. B. (2018). Identifying status of technological infrastructure and training needs in ICT of primary schools teachers in District North. *District Institute of Education and Training Keshavpuram.*

Shanmugam, K., & Balakrishnan, B. (2019). Motivation in information communication and technology based science learning in Tamilnadu. *Indonesian Journal of Science Education, 8*(1), 141-152. Retrieved from https://journal.unnes.ac.id/nju/index.php/jpii/article/view/16564

Igboanugo, B. I., Ekwuem, A., Igboegwu, E., & Georgina, O. I. (2020). Efficacy of integration of information communication technology (ICT) in teaching method for effective chemistry curriculum delivery. *International Journal of Education (IJE), 2*(1), 1-10.

Roy, M. M., & Sehrawat, M. (2018). *An experimental study of effectiveness of ICT enabled classroom in relation to academic achievement of 6th class students in science subjects*, retrieved from http://scert.delhi .gov.in/sites/default/files/Ghumanhera %20Publication %20 pdf /R1%20GH.pdf

Igboanugo, B. I., Ekwuem, A., Igboegwu, E., & Georgina, O. I. (2020). Efficacy of integration of information communication technology (ICT) in teaching method for effective chemistry curriculum delivery. *International Journal of Education (IJE), 2*(1), 1-10.

Kumar, G. S. A., Nain, M. S., Singh, R., Kumbhare, N. V., Parsad, R., & Kumar, S. (2021). Training effectiveness of skill development training programmes among the aspirational districts of Karnataka. *Indian Journal of Extension Education, 57*(4), 67-70.

Kumar, Anil, Jeeva, J. C., Sarangi, D. N., Panda, A. K., & Srivastava, S. K. (2020). Analysis of socio-economic status of people in aspirational districts of Odisha for inclusive growth. *Journal of AgriSearch, 7*(3), 158-162.

Saha, P. (2022). Issues and status of teacher management in the aspirational districts of Odisha. *International Journal of Multidisciplinary Research, 11*(12[2]), 82-84.

Chikendu, R. E., & Obikezie, M. C. (2021). Students' attitudes towards science education: Evidence from secondary schools in Onitsha South of Anambra State. *International Journal of Trend in Scientific Research and Development (IJTSRD), 6*(1), 144-150. https://www.ijtsrd.com/papers/ijtsrd47782

Research Article

Exploring Users' Satisfaction towards University's Learning Management System

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Abstract

Post Covid-19, there has been paradigm shift in the way students and teachers interact with the institutions for their daily tasks. It's a shift from traditional manual interaction to web aided interaction. For this, it is made mandatory by UGC for all institutions to have Learning Management systems (LMS) also referred to as websites in some cases. However, the users' perception of the effectiveness of the LMS depends on how well it is updated and maintained. In Indian context not much literature review is available on satisfaction as regards LMS. Even few studies that have been conducted they focus on students. Teachers and Administrators/Head of institution viewpoint is ignored. Based on literature review, the study identified web architecture, understandability, effectiveness, efficiency, portability, security as s parameters for assessing satisfaction of students, teachers and administrators. The study observed that there is lot of scope of improvement as regards reliability, portability and security aspect. Further analysis revealed that policy makers need to work upon training of not so young teachers, as these people don't find themselves so comfortable with the usage and knowledge of LMS. Only if teachers are apt with e-initiatives usage, they can motivate and make the students use these initiatives.

Keywords: Web architecture, understandability, effectiveness, efficiency, portability, security, LMS.

Introduction

Universities now a days, provide majority services through electronic means. Electronic interface i.e., website is not one way interaction, that is just providing downloadable and informative services. It refers to two-way interaction between the management and all the stakeholders. The LMS is not restricted to completing office procedures. LMS also can help students/teachers gain knowledge beyond books. They can access online journals, e-books and research articles. Students/ teachers/administrators can also do collaborative learning if the system is fully interactive and offers facilities like video conferencing. But this is possible only if the users perceive the system to be effective and beneficial. The more satisfied user is the greater will be the acceptance of the system.

Literature Review

Post Covid-19, learning management systems have become part of education system. Assessing and understanding students' satisfaction of learning management system has been objective of many recent researches. (Balkaya & Akkucuk, 2021; Mehrolia et al., 2021; Camilleri & Camilleri, 2021; Alturki & Aldraiweesh, 2021; Salem Al-Mamary, 2022). Pham et al. (2019) reiterated that student's satisfaction is supreme, students become the customers of higher education institution. To assess the satisfaction of users of LMS many researches have been conducted worldwide. Mouakket and Bettayeb (2015) researched on factors affecting adoption of LMS by faculty and found perceived ease of use, web design, training and technical assistance as determinants. Ease of use, high-speed access to information, reliability, , attractive features, security and user-friendliness were identified as success factors for LMS (Hassanzadeh et al., 2012; Ramírez-Correa et al., 2017; Costa et al., 2020; Kurdi et al., 2020).

A number of studies have used Technology Acceptance Model (TAM) (Davis, 1989). TAM model focusses on perceived usefulness and perceived ease of use as the main determinants. This model has been criticised by a number of researchers. It was contended though both ease of use and usefulness are determinants of success but are not equivalent to success, other factors also play a role (Petter et al., 2008; Sukendro et al., 2020). In this context, the present research uses a theoretical model which though is comparatively new but is extensive in elaborating the factors affecting the satisfaction of LMS, which is Nguyen's (2021). Bifurcating the factors identified (Nguyen, 2021) in Indian context we get parameters as web architecture, understandability, effectiveness, efficiency, portability and security. In India not much of the research work has been done on assessing satisfaction of students and particularly of teachers and administrators. The type of research is necessary to add value to LMS which has not been discarded after Covid-19 rather has become indispensable part of education system.

Objectives

The research paper intends to achieve the under said objectives:

1. To assess the users' satisfaction towards Learning Management System in the University.
2. To offer suggestions to improve the Learning Management System.
3. Hypothesis

H_0:1: There is no significant difference between different users as regards Web Architecture.

H_0:2: There is no significant difference between different users as regards Understandability.

H_0:3: There is no significant difference between different users as regards Effectiveness.

H_0:4: There is no significant difference between different users as regards Efficiency.

H_0:5: There is no significant difference between different users as regards Reliability.

H_0:6: There is no significant difference between different users as regards Portability

H_0:7: There is no significant difference between different users as regards security

Sampling Design

Population

- Administrators (Head of Institution and Vice-Principal) of Non-Technical (General) and technical colleges of Delhi and NCR at the undergraduate level.
- Faculty in Non-Technical (General) and technical colleges of Delhi and NCR at the undergraduate level.
- Students studying in Non-Technical (General) and technical colleges of Delhi and NCR at the undergraduate level.

Sample Size

Table-1: Number of Non-Technical (General) and Technical Colleges in Delhi (NCT) Uttar Pradesh, Rajasthan and Haryana in 2020-21

States/NCT	Non-Technical (General) Colleges	Technical Colleges
Delhi	93	15
Haryana	554	74
Rajasthan	2282	71
Uttar Pradesh	5449	114

Source: All India Survey on Higher Education Report 2020-2021

Table-2: Number of Colleges Sector Wise in Delhi (NCT) Uttar Pradesh, Rajasthan and Haryana 2020-2021

States/NCT	Private Colleges	Government Colleges	Total
Delhi	75	98	173
Haryana	823	258	1081
Rajasthan	2217	722	3339
Uttar Pradesh	6315	812	7127

Source: All India Survey on Higher Education Report 2020-21.

As can be seen from the tables above, number of general colleges are more than the number of technology colleges. In Delhi NCR more of higher education institutions are in the private sector. Data is available for different categories of institutions as per specialization and ownership for the entire state as a whole. No segregate data is available for number of colleges in individual districts of states. The entire Haryana, Rajasthan and Uttar Pradesh is not part of NCR. Further for sample size determination specific formula (Cochran, 1977) could not be used as the average enrolment ratio is different in all three states and Delhi. So non-probability convenience sampling method is used to select general and technical colleges from both the public and private sector.

Table-3: Number of Institutions Selected as Sample for the Study

States/NCT	Non-Technical (General) Colleges		Technical Colleges		Total
	Private	Government	Private	Government	
Delhi and NCR	7	7	7	7	28

Table-4: Sampling Unit, Sample Size, Sampling Method, Total Sample Size

Unit	Size	Sampling Technique	No. of institutions chosen	Total Sample Size
Students	10	Non-probability Judgement Sampling	28	280
Teaching Staff	5	Non-probability Judgement Sampling	28	140
Administrator	2	Non-probability Judgement Sampling	28	56
Total	17	Total		476

Data Set

The researcher has collected inputs from both primary and secondary sources. Primary data was collected from the stakeholders on quality parameters identified on 5-point Likert scale. For the research stakeholders are divided into three categories: administrator, teachers, students.

Ambit of Study

Data collection has been done from Delhi NCT and Delhi NCR regions.

Data Testing

Data Analysis is carried out using SPSS 22. First normality of data is checked. Kruskal Wallis also referred to as H-test is applied to check the hypothesis.

Normality Test

Foremost assumption for the application of any parametric test is the normality of the data for all categories of independent variable.

Table-5: Normality Test for Students, Teachers and Administrators on Various Quality Parameters

Quality Parameter	Category of Respondent	N	Kolmogorov-Smirnov		
			Statistic	Df	Sig.
Web Architecture	Student	280	.321	280	.000
	Teacher	140	.221	140	.000
	Administrator	56	.254	56	.000
Understandability	Student	280	.332	280	.000
	Teacher	140	.334	140	.000
	Administrator	56	.289	56	.000
Effectiveness	Student	280	.301	280	.000
	Teacher	140	.358	140	.000
	Administrator	56	.360	56	.000

Quality Parameter	Category of Respondent	N	Kolmogorov-Smirnov		
			Statistic	Df	Sig.
Efficiency	Student	280	.310	280	.000
	Teacher	140	.288	140	.000
	Administrator	56	.260	56	.000
Reliability	Student	280	.332	280	.000
	Teacher	140	.289	140	.000
	Administrator	56	.332	56	.000
Portability	Student	280	.306	280	.000
	Teacher	140	.198	140	.000
	Administrator	56	.404	56	.000
Security	Student	280	.270	280	.000
	Teacher	140	.333	140	.000
	Administrator	56	.341	56	.000

As the above table reflects p value is 0.000, which means that null hypothesis cannot be accepted. This indicates it is normally distributed. In case of violation of normality condition, parametric test cannot be applied. Hence, in this case, Kruskal Wallis also referred to as H-test is used.

Kruskal Wallis Test is a non-parametric test based on ranks. It is also known as one-way ANOVA on ranks. The table below gives he ranks on the various quality parameters.

Table-6: Ranks as Per Kruskal Wallis

	Category of Respondent	N	Mean Rank
Web Architecture	Student	280	245.13
	Teacher	140	229.26
	Administrator	56	228.43
	Total	476	
Understandability	Student	280	233.69
	Teacher	140	240.18
	Administrator	56	258.35
	Total	476	
Effectiveness	Student	280	235.21
	Teacher	140	227.85
	Administrator	56	281.58
	Total	476	

	Category of Respondent	N	Mean Rank
Efficiency	Student	280	247.70
	Teacher	140	216.14
	Administrator	56	248.41
	Total	476	
Reliability	Student	280	206.98
	Teacher	140	278.38
	Administrator	56	296.38
	Total	476	
Portability	Student	280	275.59
	Teacher	140	167.75
	Administrator	56	229.94
	Total	476	
Security	Student	280	270.30
	Teacher	140	181.32
	Administrator	56	222.47
	Total	476	

Table-7: Kruskal Wallis Test Statistics

	Web architecture	Under-standability	Effective-ness	Efficiency	Reliability	Portability	Security
Chi-Square	1.867	1.970	8.269	5.896	41.280	64.746	45.072
Df	2	2	2	2	2	2	2
Asymp. Sig.	.393	.373	.016	.052	.000	.000	.000

The above table depicts that for Web Architecture, Understandability and Efficiency dimensions there is no significant difference in quality perception among different users while it varies on other quality parameters.

Post-Hoc Analysis

Further, to find out which category of independent variable differs significantly from which other category Post-Hoc analysis is carried out. The table below lists the post-hoc analysis for each of the quality parameters.

(a) Web Architecture

Table-8: Web Architecture Aspect Hypothesis Test Abstract

Null Hypothesis H_0:1	Test	Significant Value	Result
The Dispersal of web architecture is alike across all groups of Respondent	Independent Samples Kruskal-Wallis Test	.393	Accept null hypothesis

As regards Null Hypothesis H_0:1, significant value 0.393(p>.05), indicates null hypothesis is not rejected i.e. there is no statistical difference between three groups. All the three students, teachers and administrators have almost given similar rank.

(b) Understandability

Table-9: Understandability Aspect Hypothesis Test Abstract

Null Hypothesis H_0:2	Test	Significant Value	Result
The Dispersal of Understandability is alike across all groups ofRespondent	Independent SamplesKruskal-Wallis Test	.373	Accept null hypothesis

As regards Null Hypothesis H_0:2, significant value 0.373(p>.05), indicates null hypothesis is not rejected i.e. there is no statistical difference between three groups. All the three students, teachers and administrators have almost given similar rank.

(c) Effectiveness

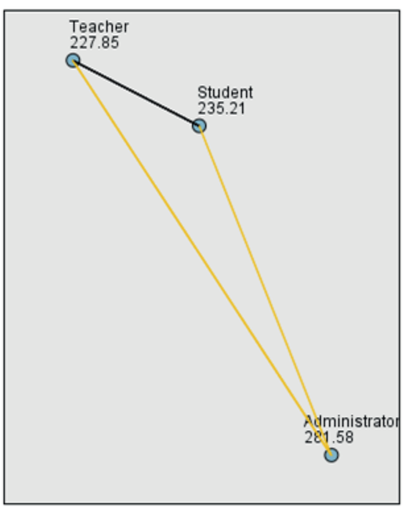
Table 1.10: Effectiveness Aspect Hypothesis Test Abstract

Null Hypothesis H_0:3	Test	Significant Value	Decision
The Dispersal of Effec-tiveness is alike across all groups of Respond-ent	Independent Samples Kruskal-Wallis Test	.016	Discard null hypothesis

As regards Null Hypothesis H_0:3, significant value 0.016 (p<.05), indicates null hypothesis is rejected i.e. statistical disimilarity between mean scores of the three groups is observed.

Table -11: Pairwise Comparison on Effectiveness Aspect

Pairwise Comparision of Category of Respondent



Each node shows the sample average rank of Category of Respondent.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig
Teacher-Student	7.364	12.617	.584	.559	1.000
Teacher-Administrator	-53.734	19.273	-2.788	.005	.016
Student-Administrator	-46.370	17.843	-2.599	.009	.028

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is. 05.

As on effectiveness parameter, pairwise comparison reveals that there is not much difference between teacher and student perception on effectiveness of the system used to extend e-Governance initiatives. However, both teacher-administrator and student-administrator differ in their opinion on the effectiveness of the system. The administrators have ranked the effectiveness parameter higher than both teachers and students. i.e. administrators believe that system is meeting the expectations of the users but teachers and students feel otherwise.

(d) Efficiency

Table-12: Efficiency Aspect Hypothesis Test Abstract

Null Hypothesis H_0:4	Test	Significant Value	Result
The Dispersal of Efficiency is alike across all groups of Respondent	Independent Samples Kruskal-Wallis Test	.052	Accept null hypothesis

As regards Null Hypothesis H_0:4, significant value 0.052 (p>.05), indicates null hypothesis is not rejected i.e. there is no statistical difference between three groups. All the three students, teachers and administrators have almost given similar rank.

(e) Reliability

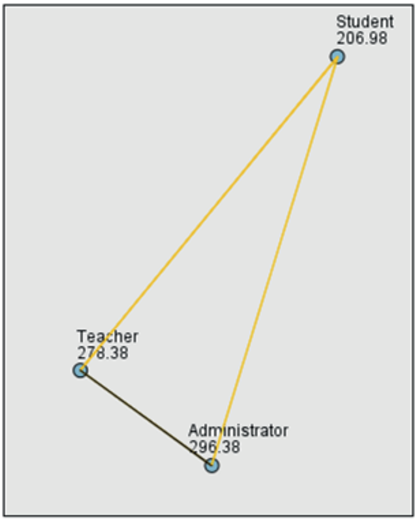
Table-13: Reliability Aspect Hypothesis Test Abstract

Null Hypothesis H_0:5	Test	Significant Value	Result
The Dispersal of Reliabilty is alike across all groups of Respondent	Independent Samples Kruskal-Wallis Test	.000	Discard the null hypothesis

As regards Null Hypothesis H_0:5, significant value 0.000 (p<.05), indicates null hypothesis is rejected i.e. statistical disimilarity between mean scores of the three groups is observed.

Table-14: Pairwise Comparison on Reliability Aspect

Pairwise Comparision of Category of Respondent



Each node shows the sample average rank of Category of Respondent.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig
Teacher-Student	-71.398	13.367	-5.342	.000	.000
Teacher-Administrator	-89.391	18.903	-4.729	.000	.000
Student-Administrator	-17.993	20.418	-.881	378	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.

Asymptotic significances (2-sided tests) are displayed. The significance level is. 05.

Pairwise comparison reveals that both teachers and administrators consider the system to be more reliable than students. Students differ in their opinion from both the teachers and administrators. The reason for this may be attributed to the fact that students are now a days more technology savvy and use number of mobile applications. So, they are comparing the college software to other advanced Apps and in comparison, the college information technology infrastructure is falling short on their reliability expectation.

(f) Portability

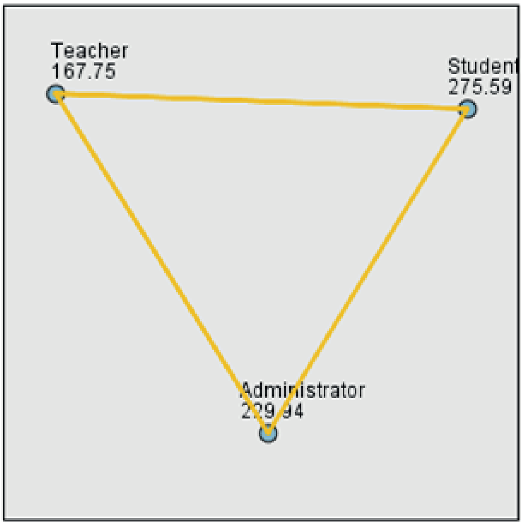
Table-15: Portability Aspect Hypothesis Test Abstarct

Null Hypothesis H_0:6	Test	Significant Value	Result
The Dispersal of Portability is alike across all groups of Respondent	Independent Samples Kruskal-Wallis Test	.000	Discard null hypothesis

As regards Null Hypothesis H_0:6, significant value 0.000 (p<.05), indicates null hypothesis is rejected i.e. statistical disimilarity between mean scores of the three groups is observed.

Table-16: Pairwise Comparison on Portability Aspect

Pairwise Comparision of Category of Respondent



Each node shows the sample average rank of Category of Respondent.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig
Teacher-Student	-62.188	20.515	-3.031	.002	.007
Teacher-Administrator	107.838	13.430	8.029	.000	.000
Student-Administrator	45.650	18.994	2.403	016	.049

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.

Asymptotic significances (2-sided tests) are displayed. The significance level is. 05.

Pairwise comparison reveals that all three students, teachers and administrators differ in their opinion on the portability dimension. Students find the system to be highly portable whereas the teachers find it to be the least and administrators fall mid-way. The reason for this may be attributed to technology savvy orientation of the students because of which they find it easier to open the college portal and access its features from any operating environment and across any device. Whereas teachers are not so comfortable with the technology so they encounter problem in accessing it across various devices and operating systems.

(g) Security

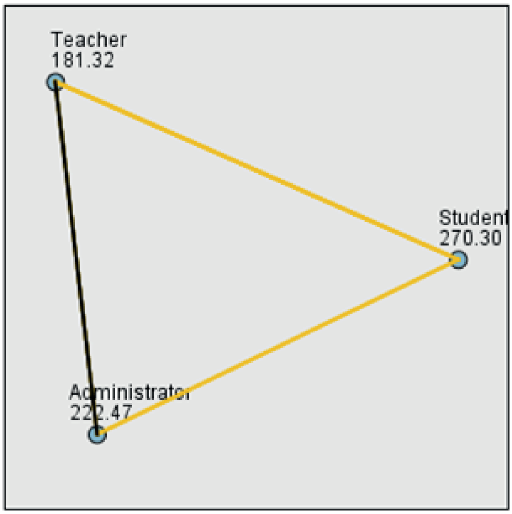
Table-17: SecurityAspect Hypothesis Test Abstract

Null Hypothesis H_0:17	***Test***	***Significant Value***	***Result***
The Dispersal of Security is alike across all groups of Respondent	Independent Samples Kruskal-Wallis Test	.000	Discard null hypothesis

As regards Null Hypothesis H_0:7, significant value 0.000 ($p<.05$), indicates null hypothesis is rejected i.e. statistical disimilarity between mean scores of the three groups is observed.

Table-18: Pairwise Comparison on Security Aspect

Pairwise Comparision of Category of Respondent



Each node shows the sample average rank of Category of Respondent.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig
Teacher-Student	-41.155	20.467	-2.011	.044	.133
Teacher-Administrator	88.979	13.399	6.641	.000	.000
Student-Administrator	47.823	18.949	2.524	.012	.035

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is 05.

Pairwise comparison reveals both teachers and administrators are on the same footing regarding their opinion on security aspect. Out of the three groups students have ranked security parameter highest. Students' opinion differs from both teachers and administrators. As students are using online applications a lot, they fear the least about security aspect. They are aware that online systems are completely safe. Though teachers are quite apprehensive and fear a lot about leakage/misuse of information. However, their fears seem to be unfounded.

Suggestions

1. Bandwidth must be increased to support increased users which will ensure more reliability,
2. To address security issues, gate walls need to be installed.
3. Different passwords should be allotted to teachers and students to identify potential miscreants.
4. Periodical induction programs, hands on training sessions must be organised to train and update all the stakeholders.
5. A proper feedback mechanism needs to be developed so that grievances and queries of the users are addressed timely.

References

Al Kurdi, B., Alshurideh, M., Salloum, S., Obeidat, Z., & Al-dweeri, R. (2020). An empirical investigation into examination of factors influencing university students' behavior towards elearning acceptance using SEM approach.

Al-Mamary, Y. H. S. (2022). Why do students adopt and use learning management systems?: Insights from Saudi Arabia. *International Journal of Information Management Data Insights*, *2*(2), 100088.

Alturki, U., & Aldraiweesh, A. (2023). An Empirical Investigation into Students' Actual Use of MOOCs in Saudi Arabia Higher Education. *Sustainability*, *15*(8), 6918.

Balkaya, S., & Akkucuk, U. (2021). Adoption and use of learning management systems in education: The role of playfulness and self-management. *Sustainability*, *13*(3), 1127.

Camilleri, M. A. (2021). Evaluating service quality and performance of higher education institutions: a systematic review and a post-COVID-19 outlook. *International Journal of Quality and Service Sciences*, *13*(2), 268-281.

da Costa, R. D., de Souza, G. F., de Castro, T. B., de Medeiros Valentim, R. A., & de Pinho Dias, A. (2020). Identification of learning styles in distance education through the interaction of the student with a learning management system. *IEEE Revista iberoamericana de tecnologías del Aprendizaje*, *15*(3), 148-160.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Hassanzadeh, A., Kanaani, F., & Elahi, S. (2012). A model for measuring e-learning systems success in universities. *Expert systems with Applications*, *39*(12), 10959-10966.

Long, P., Limbu, Y. B., Bui, T. K., Nguyen, H. T., & Pham, H. T. (2019). Does e-learning service quality influence e-learning student satisfaction and loyalty? Evidence from Vietnam. *International Journal of Educational Technology in Higher Education*, *16*(1), 1-26.

Mehrolia, S., Alagarsamy, S., & Sabari, M. I. (2021). Moderating effects of academic involvement in web-based learning management system success: A multigroup analysis. *Heliyon*, *7*(5).

Mouakket, S., & Bettayeb, A. M. (2015). Investigating the factors influencing continuance usage intention of Learning management systems by university instructors: The Blackboard system case. *International Journal of Web Information Systems*, *11*(4), 491-509.

Nguyen, N. T. (2021). A study on satisfaction of users towards learning management system at International University–Vietnam National University HCMC. *Asia Pacific Management Review*, *26*(4), 186-196.

Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: models, dimensions, measures, and interrelationships. *European journal of information systems*, *17*, 236-263.

Ramirez-Correa, P. E., Rondan-Cataluña, F. J., Arenas-Gaitán, J., & Alfaro-Perez, J. L. (2017). Moderating effect of learning styles on a learning management system's success. *Telematics and Informatics*, *34*(1), 272-286.

Sukendro, S., Habibi, A., Khaeruddin, K., Indrayana, B., Syahruddin, S., Makadada, F. A., & Hakim, H. (2020). Using an extended Technology Acceptance Model to understand students' use of e-learning during Covid-19: Indonesian sport science education context. *Heliyon*, *6*(11).

Research Article

Quantitative Insights from Research on Artificial Intelligence for Digitally Empowered Teachers: A Bibliometric Analysis

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Abstract

To implement AI-enhanced pedagogy in Indian schools, educators must understand the importance of AI in education, stay updated on current research, know India's position in this field, and identify what digitally empowered teachers need to become professionals in this area. Using bibliometric analysis, this study provides the insights needed to guide these educators. We can properly implement AI-enhanced pedagogy in schools only if digitally empowered teachers improve their awareness of artificial intelligence. As shapers of today's students, their expertise is essential. In this study, the researchers conducted a Bibliometric analysis based on publications collected from the dimension database. The key term for the study was "artificial intelligence". The researchers used a quantitative method, and the search strategy was limited to title and abstract only, the publication year was limited to 2014-2023, and the research field is limited to education to exclude research other than the field of education like robotics, machine learning, programming, etc. The research findings throw light on the need for international collaboration for digitally empowered teachers in India for their professional development in artificial intelligence. The recorded citation count of 443 for India suggests a discernible variance in global academic recognition when compared to the United States. This dissimilarity in citation metrics may signify disparities in research output, levels of international collaboration, or the overall impact of Indian research within the broader global academic community, thereby highlighting important considerations for further investigation and analysis. This investigation revealed quite a few interesting findings related to citation, co-citation, and bibliography.

Keywords: Digitally Empowered Teachers, Bibliometric Analysis, Publication and Citation Trend, Co-Citation, Bibliographic Coupling

Introduction

With the emergence of technology, particularly artificial intelligence, we can reimagine the classrooms, replacing the four walls, blackboard, and constricted space with immersive virtual worlds. As the world around us is changing at an unprecedented pace, shouldn't our learning spaces change the traditional education model to keep pace? (Chen et al., 2020) highlight the importance of artificial intelligence in education, especially in instruction, administration, and learning. Artificial intelligence will help in personalized learning and prepare learners and educators to face the challenges of educational technology (Hamal et al., 2022). (Xue & Wang, 2022) suggest that as there are many possibilities for artificial intelligence in education, it is necessary to create awareness among teachers in this field. The research possibilities on artificial intelligence will certainly create such an awareness among teachers (Hagger & Mcintyre, 2000). Here the researchers are trying to do this by bibliometric analysis. Bibliometric analysis, a crucial tool in research evaluation, involves quantitatively examining scholarly publications (Sethi et al., 2016). For Digitally empoweredteachers, navigating the vast sea of academic information is essential for staying current in their fields. Bibliometric analysis assists researchers in identifying influential publications, tracking research trends, and making informed decisions about resource allocation (Scientometrics Recent Advances, n.d.-b). The databases and visualization tools are used by educational researchers to give valid information regarding emerging research areas and trends to provide guidelines for Digitally empowered teachers to focus on academic efforts related to such areas. Digitally empoweredteachers can enhance their professional development and contribute their best to the educational field by using Bibliometric data. We can use VOSviewer as a powerful tool to extract research data files from various database types for Bibliometric analysis and visualization.

Literature Review

AI and Big Data Analytics research is expanding in five fields: Business, Engineering, Healthcare, Sustainable Operations, and Hospitality Tourism (Thayyib et al., 2023). As an emerging field of expertise, educational artificial intelligence has the potential to transform our learning experiences (Bates et al., 2020). Artificial intelligence can influence human performance (Yang et al., 2021). Hwang et al. (2022) studied the role of artificial intelligence in nursing and found its positive impact. Park and Kwon (2023) suggested that AI programs were effective in technology education. Garcia et al. (2024) highlight the need for integrating artificial intelligence in medical education. Through a bibliometric analysis, it was concluded that artificial intelligence can advance health education (Zapata et al., 2024). Singh et al. (2023), through a bibliometric pattern, say that artificial intelligence can help attain sustainable development goals. Nica et al. (2024) highlight the influence of fuzzy logic and AI in financial analysis, marked by a growth in research outputs and global collaborations. Fijačko et al. (2024) explain the capabilities of generative artificial intelligence in their bibliometric analysis. Rahman et al. (2024), in their bibliometric study, indicate a rising pattern of artificial intelligence in language learning. Ivanova et al. (2024) understand artificial intelligence as a transformative force. Looking at the research done on artificial intelligence, it is clear that it has a lot of impact on today's society. The relevance of the current study lies in how to effectively raise awareness among digitally empowered teachers so that they can successfully incorporate this into Indian school education pedagogy. For this purpose, primarily they should be aware of the research updates in this field and should know where India lies in the area of this research.

Need and Significance Of The Study

Androshchuk (2022) suggests that bibliometric analysis helps teachers understand where to find relevant information and how to apply it in practice, allowing for the qualitative use of information and communication technologies in teaching Generation Z students. For digitally empowered teachers, it's crucial to keep up with the latest education research. Bibliometric analysis helps them do this by using a systematic approach to figure out impactful academic articles (Donthu et al., 2021). By using tools for Bibliometric analysis, digitally empowered teachers can quickly find key publications, spot new trends, and make the most of scholarly resources (Kalantari et al., 2017). This not only makes their research easier but also helps them make smart choices, creating a culture of always learning and innovating in the classroom. A trend analysis of research in artificial intelligence (AI) within the field of pedagogy is essential to stay abreast of the rapidly evolving landscape of educational technology. Our teaching and learning methodologies can be improved by integrating artificial intelligence into pedagogical practices. Tracking trends allows educators, researchers, and policymakers to identify emerging patterns, innovative applications, and best practices in AI-driven educational tools. This analysis not only informs the development of more effective and personalized learning experiences but also facilitates the identification of potential challenges and ethical considerations associated with AI in education. By keeping pace with the evolving trends in AI pedagogy, stakeholders can make informed decisions, foster collaboration, and ultimately contribute to the enhancement of educational outcomes in the digital age.

Objectives of the Study

The main objective of the study is to answer the following research questions.

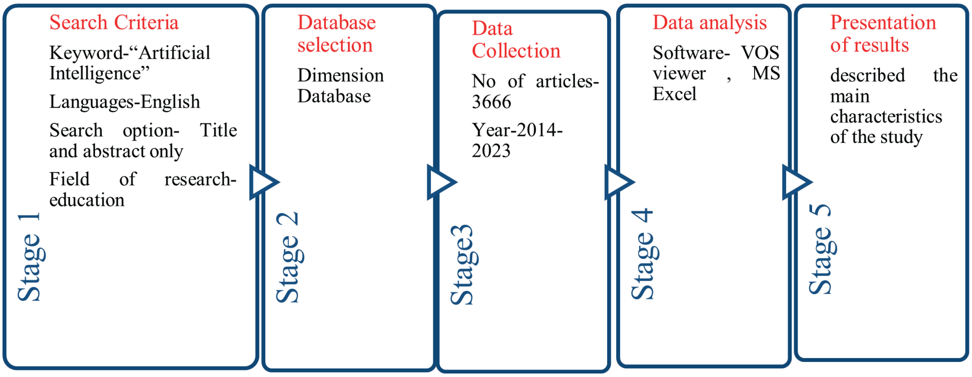
- How can digitally empowered teachers use the latest publication and citation trends in educational research on artificial intelligence to enhance their professional outcomes?
- Which authors in "artificial intelligence" are the most influential, according to co-citation analysis, and how can digitally empowered teachers benefit from this?
- Which countries have gained the most citations for their research contributions in "artificial intelligence," and how can digitally empowered teachers use insights from these leading nations?
- Which journals have the most influence in publishing research on "artificial intelligence" in education, and how can digitally empowered teachers use these journals to stay informed and enhance their teaching practices?

Method

Here the researchers used the quantitative method as it involves the systematic measurement and analysis of scientific literature using numerical and statistical techniques. Bibliometric analysis relies on numerical data such as the number of publications, citations, and various metrics (e.g., h-index, impact factor). The method uses statistical tools and techniques to analyze patterns, trends, and relationships within the data. This includes co-citation analysis, citation analysis, and network analysis. Bibliometric analysis was done on "artificial intelligence" in the field of education

Research design: Descriptive Bibliometric- This design focuses on summarizing and describing patterns within a specific set of publications. It includes analyzing publication trends, citation patterns, co-citation patterns and bibliographic coupling. Fig 1 explains the research design.

Figure-1: Research design



Search strategy

Data of journal articles published in the field of artificial intelligence in education during the period 2014-2023 were collected from the Dimension database. To obtain clean data, we searched the key terms in the title and abstract only, and the research was limited to articles written in English alone. Without substantial research in artificial intelligence, our nation cannot prepare our digitally empowered teachers for the current scenario. The significance of Dimension lies in its ability to aggregate scholarly publications across diverse disciplines, offering a wealth of information that enhances the depth and breadth of our investigation. By leveraging the extensive and up-to-date resources within the Dimension database, we ensure the reliability and relevance of our findings. Table 1 shows the search strategy.

Table-1: Search strategy

No. of Documents	**3666**
Search Term	"Artificial Intelligence"
Languages	English
Publication Years	2014-2023
Document Types	Article
Field of research	Education
Search option	Title and abstract only

Exclusion Strategy

To maintain the precision of the results, some documents were excluded from the study. The exclusion was determined by specific criteria to ensure the accuracy and integrity of the analysis.

1. The papers that are written in any other language than English.
2. Excluded research other than the field of education like robotics, machine learning, programming, etc.

Co-citation and bibliographic coupling are two Bibliometric measures that reveal different aspects of scholarly relationships. Co-citation indicates thematic similarity by identifying documents frequently cited together by third parties, showcasing shared intellectual themes. In contrast, bibliographic coupling identifies content similarity between two documents when they independently cite the same source, reflecting a direct intellectual affinity. While co-citation emphasizes shared influence, bibliographic coupling highlights common foundational references, providing nuanced insights into the intellectual connections within the scholarly literature.

Analysis and Interpretation

Publication and citation trend

Figure-2: Publication and citation trend

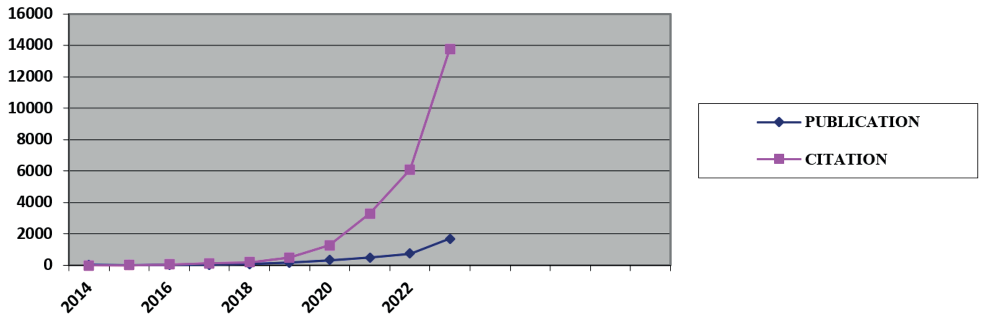


Fig 2 shows the publication and citation trends. The data reveals a consistent upward trend in both the number of publications and citations related to Artificial Intelligence in the field of education from 2014 to 2023, indicating a sustained and growing interest in this field. This surge in scholarly output and recognition through citations underscores the significance and evolving prominence of AI in shaping educational practices.

Figure-3: Co-citation pattern

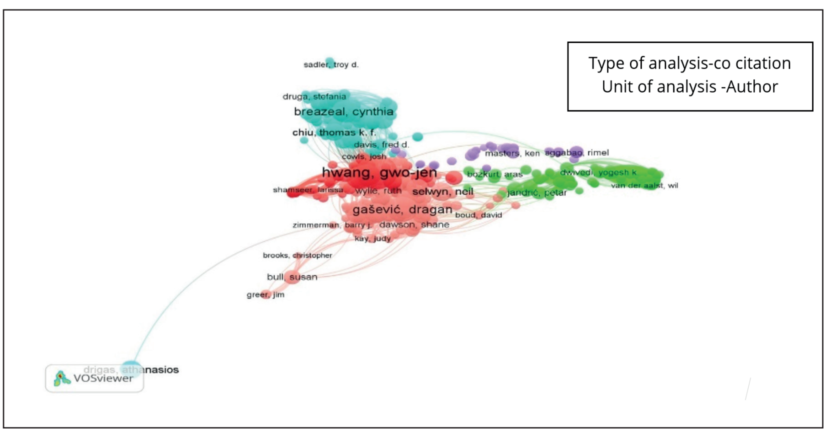


Figure-4: Citation pattern

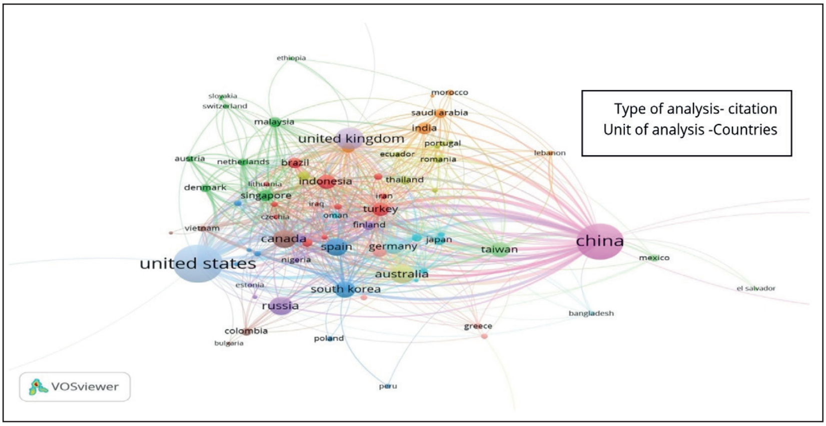


Fig 3 & Fig 4 shows the co-citation and citation patterns. The highly influential authors have been selected based on this pattern. The results are given in table 2.

Table-2: Highly influential authors based on total link strength in co-citation analysis

Author	Affiliation	H index
Gwo-jen Hwang	National Taiwan University of Science and Technology	101
Dragan Gasevic	Monash University	83
Cynthia Breazeal	Massachusetts Institute of Technology	92
Haoran Xie	Lingnan university Hong Kong	47
Simon J. Buckingham Shum	University of Technology Sydney	62

All authors being discussed have a highly impactful scholarly output, as indicated by their H-index exceeding 40. This implies a substantial and sustained contribution to their respective fields, reflecting a significant level of influence and recognition within the academic community.

Table 3 shows the leading countries that gained more citations for their research contributions.

Table-3: Leading countries that gained more citations for their research contributions

Country	*Citations Received*
US	*3544*
China	*3090*
Australia	*1984*
UK	*1891*
Canada	*1202*

India has received a comparatively lower number of citations, 443, suggesting a lower level of global academic recognition in comparison to the United States. This discrepancy may reflect differences in research output, international collaboration, or the impact of Indian research on the global academic community.

Figure- 5: Bibliographic coupling map

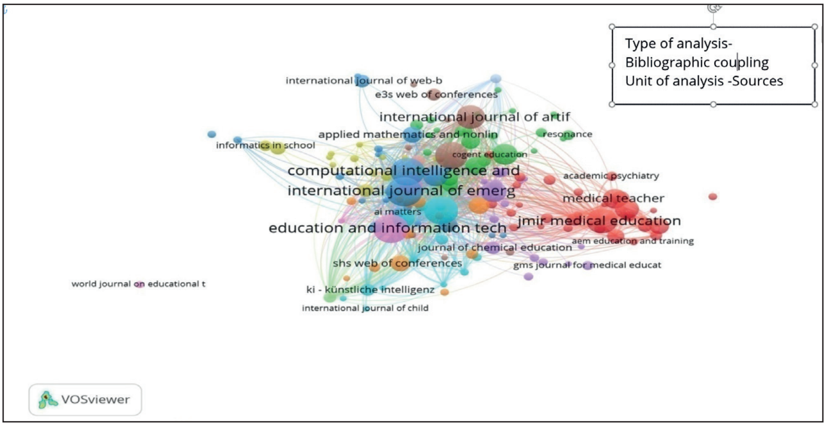


Fig 5 shows the bibliographic coupling map, and the overall performance of each journal was calculated and tabled in table 4.

Table-4: A journal's overall influence in its field based on their citations in bibliographic coupling map

Source	Impact factor	Citations
Computers and education artificial intelligence	13.62	1597
international journal of educational technology in higher education	9.4	1174
international journal of artificial intelligence in education	4.9	1173
JMIR medical education	3.6	898
Sustainability	3.8	621

Computers and Education Artificial Intelligence" has the highest impact factor among the listed journals. The "Impact Factor" is a measure of the average number of citations that articles in a journal receive over a specific period.

Findings

- There is a consistent upward trend in both the number of publications and citations related to Artificial Intelligence in the field of education from 2014 to 2023
- Leading authors in the field of Artificial Intelligence in Education are Gwo-jen Hwang (National Taiwan University of Science and Technology), Dragan Gasevic (Australia), Cynthia Breazeal (Massachusetts Institute of Technology), Haoran Xie (Hong Kong), and Simon J. Buckingham Shum (Australia). Authors from India do not find a place on this list. This suggests a need for international collaboration to enhance the professional development of digitally empowered teachers in the current scenario.
- The observed citation count of 443 for India implies a relatively lower degree of global academic recognition compared to the United States. This difference in citation metrics may be indicative of variations in research output, international collaboration, or the impact of Indian research within the global academic community.
- The prominence of "Computers and Education Artificial Intelligence" with the highest impact factor and the most citations underscores its significant influence in the field.

Conclusion

The application of Bibliometric analysis in the realm of artificial intelligence (AI) in pedagogy provides invaluable benefits for educators and researchers alike. Publications and citations related to Artificial Intelligence in education, spanning from 2014 to 2023, showed an ongoing upward trend, which underscores the growing significance of this field in the present educational landscape. This finding agrees with the study of Bozkurt et al. (2021) which suggests a rise in artificial intelligence studies in the field of education on themes like adaptive learning, personalization, AI in higher education, etc. The prevalent influence of non-Indian leading authors and the lower citation count for India in comparison to the United States highlight the need for international collaboration in shaping educational practices. Digitally empowered teachers should recognize the pivotal role played by influential journals like "Computers and Education Artificial Intelligence" to stay updated with the research trends. In the present landscape, a proactive approach to balancing awareness of impactful journals and fostering global collaborations emerges as a valuable strategy for digitally empowered teachers, enabling them to effectively enhance their professional development within the dynamic realm of AI in education. By understanding where India stands in AI research, teachers can identify specific areas where knowledge and resources are lacking. This can help them focus on those gaps and seek out the best international resources, tools, and research to integrate into their teaching practices. Digitally empowered teachers can study the successful AI-enhanced pedagogical practices of these leaders and adapt them to fit the Indian educational context, bringing proven methods into their classrooms. Knowing that India is behind can make teachers aware of the need to collaborate with international researchers and institutions. Teachers can use the analysis to design curricula that incorporate AI concepts, ensuring that students are learning current and relevant information. This can help prepare students for future careers in AI and technology, bridging the knowledge gap from the ground up. By using bibliometric analysis in these ways, Digitally empowered teachers in India can turn the current challenges into opportunities for growth and innovation, significantly enhancing the quality of education through AI.

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Reference

Androshchuk, I., Banit, O., Shtepura, A., Rostoka, M., &Cherevychnyi, G. (2022). Modern Information and Educational Environment in the Context of the Theory of Generations. *International Journal of Pedagogy, Innovation and New Technologies*. https://doi.org/10.5604/01.3001.0016.2095.

Bates, T., Cobo, C., Mariño, O., & Wheeler, S. (2020). Can artificial intelligence transform higher education? *International Journal of Educational Technology in Higher Education*, 17, 1-12.

Chen, L., Chen, P., & Lin, Z. (2020). *Artificial Intelligence in Education: A Review*. IEEE Access, 8, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988510

de Oliveira, O. J., da Silva, F. F., Juliani, F., Barbosa, L. C. F. M., & Nunhes, T. V. (2019). Bibliometric method for mapping the state-of-the-art and identifying research gaps and trends in literature: An essential instrument to support the development of scientific projects. In *Scientometrics recent advances*. Intech Open.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133, 285-296.

Fijačko, N., Creber, R. M., Abella, B. S., Kocbek, P., Metličar, Š., Greif, R., & Štiglic, G. (2024). Using generative artificial intelligence in bibliometric analysis: 10 years of research trends from the European Resuscitation Congresses. *Resuscitation Plus*, 18, 100584.

Garcia, M. B., Arif, Y. M., Khlaif, Z. N., Zhu, M., de Almeida, R. P. P., de Almeida, R. S., & Masters, K. (2024). Effective integration of artificial intelligence in medical education: Practical tips and actionable insights. In *Transformative Approaches to Patient Literacy and Healthcare Innovation* (pp. 1-19). IGI Global.

Hagger, H., & McIntyre, D. (2000). What can research tell us about teacher education?. *Oxford Review of Education*, 26(3-4), 483-494.

Hamal, O., Faddouli, N. El, Hachem, M., Harouni, A., & Lu, J. (2022). *Artificial Intelligent in Education*. 1–11.

Hwang, G. J., Tang, K. Y., & Tu, Y. F. (2024). How artificial intelligence (AI) supports nursing education: Profiling the roles, applications, and trends of AI in nursing education research (1993–2020). *Interactive Learning Environments*, 32(1), 373-392.

Ivanova, M., Grosseck, G., & Holotescu, C. (2024, February). Unveiling Insights: A Bibliometric Analysis of Artificial Intelligence in Teaching. In *Informatics* (Vol. 11, No. 1, p. 10). MDPI.

Kalantari, A., Kamsin, A., Kamaruddin, H., Ale Ebrahim, N., Gani, A., Ebrahimi, A., & Shamshirband, S. A bibliometric approach to tracking big data research trends. J Big Data. 2017; 4 (1): 30.

Nica, I., Delcea, C., & Chiriță, N. (2024). Mathematical Patterns in Fuzzy Logic and Artificial Intelligence for Financial Analysis: A Bibliometric Study. *Mathematics*, 12(5), 782.

Park, W., & Kwon, H. (2024). Implementing artificial intelligence education for middle school technology education in Republic of Korea. *International journal of technology and design education*, 34(1), 109-135.

Rahman, A., Raj, A., Tomy, P., & Hameed, M. S. (2024). A comprehensive bibliometric and content analysis of artificial intelligence in language learning: tracing between the years 2017 and 2023. *Artificial Intelligence Review*, 57(4), 1-27.

Sethi, B. B., Maharana, B., & Mohanty, B. K. (2016). Periodical Literature Bibliometric Analysis: A case study of four International Journals. *Library Philosophy & Practice*.

Singh, A., Kanaujia, A., Singh, V. K., & Vinuesa, R. (2024). Artificial intelligence for Sustainable Development Goals: Bibliometric patterns and concept evolution trajectories. *Sustainable Development*, 32(1), 724-754.

Thayyib, P. V., Mamilla, R., Khan, M., Fatima, H., Asim, M., Anwar, I., Shamsudheen, M. K., & Khan, M. A. (2023). State-of-the-Art of Artificial Intelligence and Big Data Analytics Reviews in Five Different Domains: A Bibliometric Summary. *Sustainability* (Switzerland), 15(5). https://doi.org/10.3390/su15054026

Xue, Y., & Wang, Y. (2022). Artificial Intelligence for Education and Teaching. *Wireless Communications and Mobile Computing*, 2022. https://doi.org/10.1155/2022/4750018

Yang, S. J., Ogata, H., Matsui, T., & Chen, N. S. (2021). Human-centered artificial intelligence in education: Seeing the invisible through the visible. *Computers and Education*: *Artificial Intelligence*, 2, 100008.

Zapata, R. E., Guerrero, E. C., & Montilla, R. E. (2024, January). Emerging Technologies in Education: A Bibliometric Analysis of Artificial Intelligence and its Applications in Health Sciences. In *Seminars in Medical Writing and Education* (Vol. 3, pp. 49-49).

Research Article

ICT Integration in Teaching-Learning Process for Sustainable Education: A Study

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Abstract

Integrating "Information and Communication Technology (ICT)" into education is essential for achieving sustainable education in line with the National Education Policy (NEP) 2020. ICT enhances personalized learning, boosts student engagement, and equips students with necessary digital-era skills. Utilizing interactive multimedia, online resources, and collaborative tools nurtures critical thinking and problem-solving abilities. Education must instil knowledge, mindsets, interests, and competencies that support sustainable development. Foundational education focusing on functional literacy, vocational skills, environmental awareness, and responsible citizenship is crucial for sustainable progress. ICT improves education quality by making educational content and best practices more accessible. Challenges in sustainable educational development can be effectively addressed through ICT interventions. ICT-based strategies, such as social networking, promote constructivist learning and facilitate transformative changes, making ICT a powerful tool for advancing sustainable education. This research paper investigates the use of ICT in Meghalaya's schools for sustainable education and identifies obstacles schools face in utilizing ICT for Sustainable Development. A descriptive survey approach was used, involving questionnaires distributed to secondary school teachers in East Khasi Hills, Meghalaya. Data analysis through percentage calculations highlights the need for appropriate measures to enhance education quality through ICT integration.

Keywords: Information and Communication Technology (ICT), Sustainable Development, Quality Education, School Education.

Introduction

Technology and information are the key drivers in the 21st century. The utilization of technology has actively contributed to enhancing efficiency, advancement, and flawlessness in the realm of education, enabling the dissemination of vast amounts of information in a shorter span of time, thereby making the learning process more interactive. UNESCO asserts that the integration of technology into education can elevate the learning environment, foster active collaboration, nurture creativity, and pave the way for the provision of quality education to all. It states - "the vision of education stresses upon a holistic, interdisciplinary approach to the development of knowledge and skills required for a sustainable future as well as changes in values, behavior and lifestyles (UNESCO, 2003)." There is a firm belief that acknowledging innovative "Information and Communication Technology (ICT)" practices in education can catalyze further educational advancements (Dkhar, 2013). ICT promotes access to educational material in a more sustainable manner wherein individuals can access the information directly from the database in a digitized format. Additionally, it can also enable access to information beyond the traditional limitations of borders and regions. In this manner, ICT is representative of a deep and pervasive revolution that is impacting human existence as a whole by breaking down the barriers to education and access to learning and knowledge by allowing people to tap into new information sources, ultimately allowing them to expand their knowledge base while at the same time sparking student interest in new areas (Oni, et.al. 2013).

Information and Communication Technology (ICT) Advancements in Education

"The phrase ICT is very wide in its ambit and it encompasses a wide variety of technologies within itself, including but not limited to computers, the Internet, mobile phones, e-learning, and video conferencing technologies, etc. These technological tools have brought forth a revolution in the manner in which information is generated, stored, reused, and also communicated on a global scale, thus impacting all relevant sectors of human society. ICT also functions as an integrating and enabling technology. By acting as integrating and enabling technologies, ICT plays a revolutionary role in enhancing productivity for sustainable development (Shadap, 2013)."

"Sustainable Development Goal (SDG 4)" mandates that universal access to high-quality and inclusive education must be provided to all to ensure continuous development in the educational sector by the year 2030. To attain universal accessibility in the educational sector, existing disparities in the financial status of individuals and social problems such as gender disparities are to be addressed to provide uniform access to appropriate job-related education (Abdin, 2018). A dynamic role is played by ICT in promoting sustainability in the development of education through a refinement of educational levels and by removing constraints, thereby enabling the application of scientific knowledge in order to meet societal purposes. Therefore, ICT is a real and substantial tool for promoting sustainable education (Kadir, 2014).

Introductory academic education, which promotes functional knowledge, livelihood abilities, and understanding of the immediate wisdom and values of responsible citizenship, is a precondition for sustainable development (Saha, 2012). "Education for Sustainable Development (ESD)" means preparing learners for present challenges that the world is facing and also future challenges that the world will face, primarily in consideration of technological interventions and growth. Added connectivity brought forth by an ICT regime can be instrumental in enabling students to access educational assets even in regions and areas that are remote and low–income in nature. as well as fostering innovation and growth. Educators can now prepare materials for students across the globe without consideration of the regions, including backward ones, and can approach valued educational and learning resources. Thus, the inclusion of new technology can be instrumental in opening up new avenues for advancing the ESD- recommended modifications that deal with educational practices (Paas & Creech, 2008, as cited by Adu and Adeyinka, 2009).

Sustainable education is a phrase that aims to bestow upon children and learners of all ages the knowledge, skills or values that are necessary for holistic development of the learners. It is focused on the promotion of awareness and the understanding of environmental, social and economic issues with a focus on encouraging responsible behavior as well as decision-making. The integration of ICT has enabled the inculcation and incorporation of innovative standards of teaching into education. It has also allowed the simplification of complicated topics through audio-visual inputs and has allowed educators to dilute traditional boundaries of geography by allowing access to a vast plethora of academic resources. It can also foster collaborative learning among the students wherein the educators can focus on individualized teaching standards through ICT to cater to the various needs of the learners. Furthermore, long-distance learning is also enabled through the introduction of ICT into this domain. All this has enabled greater achievement of sustainable education standards.

In conclusion, ICT is vital for sustainable education, providing access to environmental information, interactive learning through educational apps, simulations, and virtual labs and facilitates collaborative learning through online platforms, real-time data analysis, energy-efficient technologies, global awareness, teacher professional development, equipping students and teachers with digital knowledge and critical thinking abilities. It also facilitates collaborative learning, connects teachers to global initiatives, and enhances teacher skills. The integration of ICT in education enhances accessibility, improves the quality of education, supports lifelong learning, promotes scientific knowledge, and prepares learners to tackle global challenges. By leveraging ICT, education systems can become more inclusive, effective, and adaptable, ensuring that all individuals have the opportunity to thrive in the digital age.

Review of Related Literature

Kadir et al. (2014) identified ICT as crucial for sustainable education in Nigeria, facilitating scientific knowledge application. Gidadawa and Dogondaji (2014) concluded that ICT-based education supports sustainable development. Saidu et al. (2014) emphasized the role of ICT in sustainable education, noting the need to address curriculum, infrastructure, capacity building, language, content, and financing barriers. Nevin (2008) highlighted the high quality and diversity of current ESD programs. Moodly and Adu (2014) highlighted ICT's potential for knowledge distribution and effective learning, expanding access to ICT resources.

Tyagi et al. (2020) noted ICT's impact on sustainable education through job creation and economic participation. Mohanty and Dash (2018) advocated for a "Whole School Approach" for sustainable change in schools. Paul and Mehera (2016) showed a positive relationship between education and sustainable development, impacting income, women's status, population growth, environmental protection, living standards, and decision-making. Kanvaria (2011) revealed that ICT-integrated teaching promotes professional growth and sustainable education. Singh (2010) identified four major ESD thrusts: expanding basic education, reorienting education for sustainability, improving public awareness, and enhancing training and skill development.

Bera (2020) stated that ICT improves education quality by supporting challenging subjects. Olita and Orong (2023) found that teachers face challenges such as lack of skills, poor internet connection, insufficient computers, outdated ICT equipment, and students' difficulty with technology. Lantaron et al. (2022) observed improved learning outcomes and student engagement when using apps and social media like WhatsApp.

It is evident from various studies that ICT plays a vital role in sustainable school education. Numerous studies have demonstrated that the use of ICT significantly improves the quality of education, not just in India but in many regions worldwide. However, while there is substantial evidence of ICT's positive impact on education, there is a notable gap in the specific application and challenges of ICT in the teaching-learning process within Meghalaya.

Existing research highlights the benefits of ICT, such as enhancing personalized learning, boosting student engagement, and equipping students with necessary digital skills. Despite these advantages, there is limited understanding of how ICT is practically implemented in the classrooms of Meghalaya. Furthermore, the specific problems teachers face when integrating ICT into their teaching practices remain underexplored. This research gap is particularly significant in the context of Meghalaya's unique educational and socio-cultural landscape. The East Khasi Hills district, being diverse and distinct, offers a valuable case study for understanding the practicalities and hurdles of ICT integration in education. Addressing this gap is crucial for developing tailored strategies that can effectively harness ICT for sustainable educational development in this region.

Therefore, the present study was undertaken to investigate the application of ICT in the teaching-learning process in Meghalaya. It aims to identify the specific challenges teachers encounter when using ICT in their classrooms. By focusing on these aspects, the study seeks to provide comprehensive insights that can inform educational policies and practices, ultimately enhancing the quality of education through effective ICT integration in Meghalaya.

The state of Meghalaya has been selected for the present study because it presents a unique position since it is a state that sits at the cusp of technological innovation. Presently, the state is transforming the realm of ICT and while some regions have integrated ICT into their teaching style, other regions remain deprived of the same primarily because of a lack of technological development vis-à-vis ICT. In this regard, it is important to understand the existing applications of ICT within the education sector in the state of Meghalaya to try and understand the challenges and shortcomings being faced by the various stakeholders. The information thus gathered from this research can become a pertinent source of data for the future implementation of ICT within the educational sector of the state and improve its efficacy and efficiency.

Need and Significance of the Study

The fundamental purpose of education is to empower learners to understand life and coexist peacefully with nature, fostering justice and responsibility. Moodly and Adu (2014) showed that ICTs enhance information sharing, productive learning, and effective educational programs. "Education for Sustainable Development" (ESD) should be included in curricula to provide everyone with the knowledge, skills, and values essential for a sustainable future. ESD promotes creative thinking, innovation, problem-solving, and decision-making, engaging formal, informal, and non-formal education modes. The pandemic highlighted ICT's crucial role in education. Mohanty and Dash (2018) found that ESD fosters awareness of global complexities and drives positive changes. Recent ESD literature on SDGs for 2030 supports a Whole School Approach for sustainable change in school practices and policies.

This study aims to inform educational designers, curriculum creators, academics, policymakers, and stakeholders, driving positive developments in Meghalaya's school education. The East Khasi Hills district, chosen for its diversity, needs research on ICT's role in sustainable education. Understanding ICT access and utilization for sustainable education will aid in the overall development of students.

Research questions

1. How is ICT applied in the teaching-learning process for Sustainable school education?

2. What type of problems do school teachers face with regard to ICT in teaching-learning?

Objectives of the study

1. To study the application of ICT in the teaching-learning process for Sustainable school education.
2. To study the problem faced by Teachers with regard to ICT integration in the teaching-learning process.

Delimitation of the study

The study is delimited to the Secondary Schools of Meghalaya Board of Secondary Education (MBOSE), in East Khasi Hills District, Meghalaya.

Methodology

The Descriptive survey study method was implemented for the present study. Data has been collected through a self-constructed questionnaire from teachers of secondary schools in East Khasi Hills, Meghalaya. The data was collected from Government, Government Aided and Private school teachers. For the analysis of data, frequencies and percentages were calculated.

Population and Sample of the Study

The population of the present study comprised of Government, Government Aided and Private Secondary Schools affiliated to Meghalaya Board of Secondary Education (MBOSE) in East Khasi Hills District, Meghalaya.

Sample and Sampling Technique

The sample of the study was comprised of teachers of Government, Government-aided and Private schools affiliated with MBOSE at the secondary level. A total of 100 teachers were selected for the study including 19 teachers from Government schools, 41 teachers from Govt. Aided and 40 teachers from private schools were taken as samples. Disproportionate stratified random sampling technique was adopted for the present study.

Data Collection

The data was collected from the secondary school teachers of the East Khasi Hills district, Meghalaya, in the month of October-November 2023.

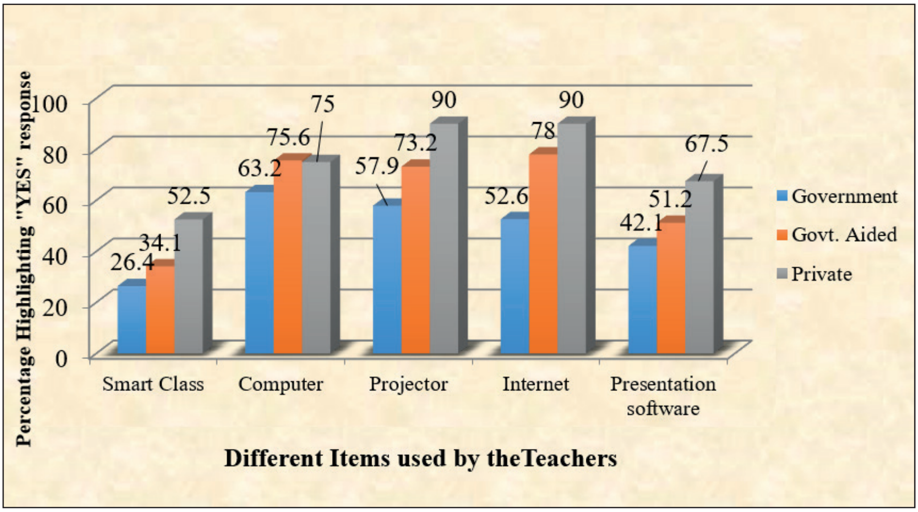
Data Analysis and Interpretation

Objective 1. To study the application of ICT in the teaching-learning process for Sustainable school education.

Tables-1: Showing the Application of ICT by teachers for teaching - learning

Management	Government				Govt. Aided				Private			
	Responses											
Items	Frequency		Percentage		Frequency		Percentage		Frequency		Percentage	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Smart Class	5	14	26.4	73.7	14	27	34.1	65.9	21	19	52.5	47.5
Computer	12	7	63.2	36.8	31	10	75.6	24.4	30	10	75	25
Projector	11	8	57.9	42.1	30	11	73.2	26.8	36	4	90	10
Internet	10	9	52.6	47.4	32	9	78	22	36	4	90	10
Presentation software	8	11	42.1	57.9	21	20	51.2	48.8	27	13	67.5	32.5

Figure-1: Showing the Application of ICTs by teachers for teaching - learning

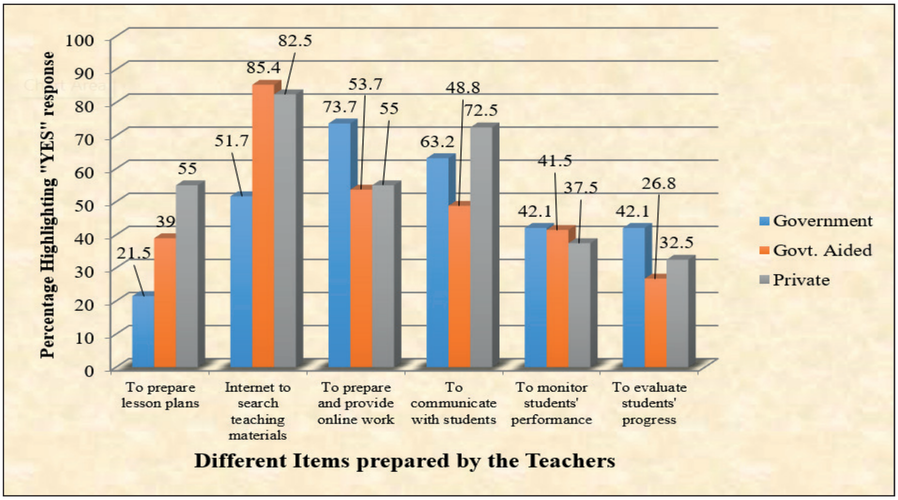


The above Table 1 and Figure 1 showed the result of the application of ICT by teachers, which indicated that only 26.4 per cent of government school teachers were using smart classes, and a maximum of 63.2 per cent of government school teachers used computers for learning purposes. The study found that a minimum of 34.1 per cent of govt aided teachers used smart classes for teaching, while a maximum of 78 per cent govt aided teachers used the Internet for teaching learning, whereas 52.5 per cent of private school teachers made use of smart classes and a maximum of 90 per cent of private school teachers were using projector and internet for teaching purpose. This clearly showed that there was less use of ICTs by govt school teachers.

Table-2: Showing the Use of ICT by teachers for teaching-learning

Management	Government				Govt. Aided				Private			
	Responses											
Items	Frequency		Percentage		Frequency		Percentage		Frequency		Percentage	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
To prepare lesson plans	4	15	21.5	78.9	16	25	39	61	22	18	55	45
Internet to search teaching materials	10	9	51.7	47.4	35	6	85.4	14.6	33	7	82.5	17.5
To prepare and provide online work	14	5	73.7	26.3	22	19	53.7	46.3	22	18	55	45
To communicate with students	12	7	63.2	36.8	20	21	48.8	51.2	29	11	72.5	27.5
To monitor students' performance	8	11	42.1	57.9	17	24	41.5	58.5	15	25	37.5	62.5
To evaluate students' progress	8	11	42.1	57.9	11	30	26.8	73.2	13	27	32.5	67.5

Figure-2: Showing Use of ICT by teachers for teaching –learning

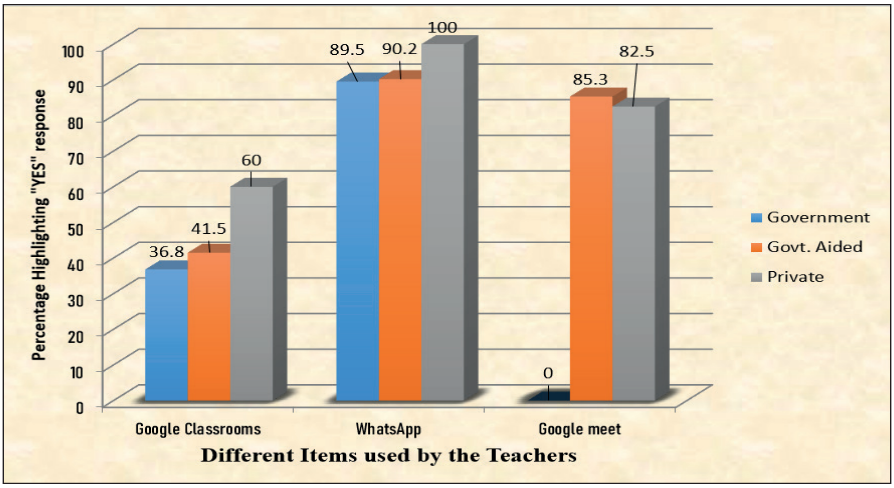


With regards to the use of ICTs by teachers the above Table 2 and Figure 2 revealed that only 21.5 per cent of teachers from govt schools use ICTs for lesson plans and a maximum of 73.7 per cent of government school teachers were using to prepare and provide online work to students, while a maximum of 85.4 per cent teachers from govt aided schools were using the internet to search study materials and a minimum of 26.8 per cent govt aided school teachers were using ICTs to evaluate students' progress. 82.5 per cent of private school teachers were using the Internet to search study materials whereas a minimum of 32.5 per cent of private school teachers were using ICTs for evaluation purposes. The result showed that more ICTs were used by government-aided school teachers and private school teachers than government-school teachers.

Table-3: Different Apps used by teachers for teaching learning

Management	**Government**				**Govt. Aided**				**Private**			
	Responses											
Items	**Frequency**		**Percentage**		**Frequency**		**Percentage**		**Frequency**		**Percentage**	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Google Class-rooms	7	12	36.8	63.2	17	24	41.5	58.5	24	16	60	40
WhatsApp	17	2	89.5	10.5	37	4	90.2	9.8	40	0	100	0
Google meet	0	0	0	0	35	6	85.3	14.7	33	7	82.5	17.5

Figure-3: Different Apps used by teachers for teaching learning



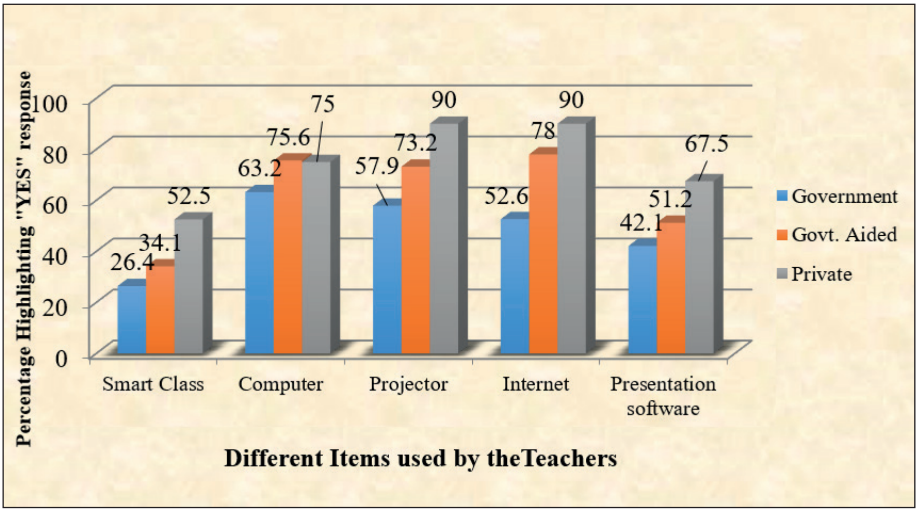
With regards to Table 3 and Figure 3, different Apps used by teachers, the study showed that a maximum number of govt school teachers, 89.5 per cent, use WhatsApp while no teachers from government schools were using Google Meet. 41.5 per cent of govt aided teachers were using Google Classrooms, while a maximum of 90.2 per cent of govt aided school teachers were using WhatsApp; however, 100 per cent of private school teachers used WhatsApp, and 60 per cent of private school teachers used Google Meet. This clearly showed that most of the teachers are not aware of Google Meet, which is an integral part of ICT for teaching the teaching-learning process.

Objective 2. To study the problem faced by Teachers with regard to ICT integration in teaching teaching-learning process.

Table-4: Problems faced by teachers during the use of ICT in teaching-learning

Management	Government				Govt. Aided				Private			
	Responses											
Items	Frequency		Percentage		Frequency		Percentage		Frequency		Percentage	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Infrastructure	17	2	89.5	10.5	36	5	87.8	12.1	32	8	80	20
Lack of e-resources	15	4	78.9	21.1	35	6	85.4	14.7	18	22	45	55
Constraints of time	6	13	31.6	68.5	23	18	56.1	43.9	21	19	52.5	47.5
Lack of electronic devices	17	2	89.5	10.5	38	3	92.7	7.3	23	17	57.5	37.5
Lack of technical support	17	2	89.5	10.5	35	6	85.4	14.7	29	11	72.5	27.5
Lack of maintenance	17	2	89.5	10.5	38	3	92.7	7.3	33	7	82.5	17.5

Figure-4: Problems faced by teachers during use of ICT in teaching –learning



According to the above Table 4 and Figure 4, regarding problems faced by teachers, 31.6 per cent of school teachers said constraints of time as they have to finish the syllabus, while a maximum of 89.5 per cent of govt school teachers said about infrastructure, lack of electronic devices, lack of technical support and lack of maintenance. A maximum of 92.7 per cent of government-aided educators said lack of electronic devices and lack of maintenance of available devices, whereas a minimum of 56.1 per cent of government-aided school teachers talked about constraints of time. 45 per cent of private school teachers said lack of e-resources, while 82.5 per cent of private school teachers said about lack of maintenance of the ICT devices in school.

Findings and Discussions

Objective 1. To study the application of ICT in the teaching-learning process for Sustainable school education.

1. The findings of the study indicated that teachers from all three managements were using computers in the computer lab as there were no computers in the classroom. The teachers use PowerPoint presentations to help their students understand difficult subjects in simpler terms, which encourages creativity and improves learning outcomes. Shaikh (2013) and Chatterjee and Nath (2015) also found the same result in their respective studies. It has been seen, that teachers use multimedia materials and presentation tools like Google Slides and PowerPoint to teach a variety of subjects. A vast number of educators have been accessing study materials over the Internet. The use of new technology can present intriguing new opportunities to encourage the modifications in teaching strategies demanded in "Education for Sustainable Development" (Paas & Creech, 2008 as cited by Adu and Adeyinka, 2009, January).
2. The findings of the present study suggested that teachers from all three types of management used the Internet for making lesson plans and assigning online work to students as well as to get study materials. However, a limited

number of teachers were utilizing ICTs to create lesson plans, track student progress, and observe student performance. The main utilization of ICTs was for communication with other instructors and students. These results were supported by Koc (2005), who found that "ICT-enabled study interconnects, assigns and works collaboratively anywhere anytime" and Bera (2020)." who cited that "Educators need to be involved in cooperative endeavours, which would include teaching partnerships with ICT as a tool."

3. The findings showed that teachers from all three kinds of management shared assignments, grades, and other information online using Google Classroom and Google Meet, which are online learning management systems. Educators also utilized WhatsApp by creating groups specifically for each class or subject and then using these groups to communicate with students regarding assignments, multimedia content, instructional films, and other visual materials. It is found that instant communication like this increases student involvement and informs them of upcoming events and deadlines. "Lantaron et al. (2022), in their study, recognized better learning outcomes by students who used the apps." With free online resources, students can find any kind of information on any topic (Angadi, (2015).

Objective 2. To study the problem faced by Teachers with regards to ICT integration in the teaching-learning process:

1. The outcomes of the study indicated that teachers had a sturdy desire for the incorporation of ICT into education but they faced many difficulties with it. According to the study, teachers were having a variety of issues when integrating ICTs for teaching and learning, including inadequate infrastructure, a lack of e-resources, time constraints, and a shortage of electronic equipment like computers and projectors in the classroom. It was discovered that a lack of technical assistance, including fewer employees with ICT training and inadequate tool maintenance, was making it difficult to utilize. Aside from these, slower networks, improper power backup, and power outages were a few issues in incorporating ICTs into teaching and learning. Olita, and Orong (2023) found the same problem as educators faced challenges such as a lack of ability to teach with ICT incorporation, modest Internet connection, inadequate computers in the classroom, unavailability of the latest ICT equipment and pupils' difficulty with technological devices. Habibu, Mamun, and Clement, (2012) also found the same in their study that if educators were to be made aware of the importance of ICT in their teaching and learning processes, then their training in pedagogical concerns need to improve

Conclusion

From the above study, it is clear that teachers used a variety of ICTs in the teaching and learning process. Teachers are sharing assignments and messages using social media platforms like WhatsApp and various online classroom management systems like Google Classroom and Meet. The study concludes that there are a number of problems that come up when integrating ICTs for teaching and learning, such as inadequate infrastructure, lack of electronic resources, time constraints, and a shortage of electronic equipment like projectors and computers in the classroom. It is found that lack of technical support including fewer employees with training in ICT and inadequate maintenance of ICT equipment is hindering easy access to ICTs. To make use of new opportunities offered by ICT, the school should be provided necessary infrastructure with ICT equipment to enhance quality education.

The government of Meghalaya has implemented various plans and initiatives to endorse the use of ICT in education. These initiatives include providing schools with ICT infrastructure, training teachers, and developing digital content. However, the success and effectiveness of these efforts may vary. Several hurdles may deter the seamless integration of ICT in education in Meghalaya, such as insufficient funding, absence of technical support, and struggles in maintaining the ICT infrastructure. Furthermore, the state's cultural and linguistic diversity may present challenges in creating and deploying digital content that caters to the diverse needs of students. While there are ongoing efforts to promote ICT in education in Meghalaya, it is crucial to address issues related to infrastructure, connectivity, teacher training, and resource allocation to guarantee an equal approach to high-quality ICT-enabled education for all students in the state.

References

Abdin, Md. J. (2018, June). Ensure inclusive and quality education for all and promote lifelong learning. *SSRN*.https://www.researchgate.net/publication/325709908_Ensure_Inclusive_and_Quality_Education_for_All_and_Promote_Lifelong_Learning

Adu, E., & Adeyinka, T. (2009). Information communication technology (ICT) and curriculum development: The challenges for education for sustainable development. *ResearchGate*.

Angadi, R. G. (2015). *Information and communication technology in education*. New Delhi, India: A. P. H. Publishing Corporation.

Bera, S. (2020, September). Enhancing quality of teaching-learning by using information and technology (ICT). *Scholarly Research Journal for Interdisciplinary Studies, 3*(18), 100-112.

Best, J. W., & Kahn, V. K. (2014). *Research in education*. Delhi, India: PHI Private Limited.

Chatterjee, P., & Nath, A. (2015). The future of ICT education in India: A pilot study.

Creswell, J. W. (2014). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Delhi, India: PHI Learning Private Limited.

Dkhar, B. R. (2013). Use of ICT in improving quality in education: Challenges and issues. In B. B. Kharbirymbai (Ed.), *ICT in education* (pp. xx-xx). Guwahati, India: EBH Publishers.

Government of Meghalaya. (2018). Final draft Meghalaya state education policy. https://megeducation.gov.in/edu_dept/notices_and_circulars/2018/Final-Draft-of-Education-Policy_2018.pdf

Gidadawa, Z. S., & Dogondaji, M. B. (2014, June). Application of ICT in Nigerian educational system for achieving sustainable development. *International Letters of Social and Humanistic Sciences, 32*, 62-71.

Habibu, T., Mamun, Md. A. A., & Clement, C. (2012, September). Difficulties faced by teachers in using ICT in teaching-learning at technical and higher educational institutions of

Uganda. *International Journal of Engineering Research and Technology*. https://www.researchgate.net/publication/281349386_Difficulties_Faced_by_Teachers_in_Using_ICT_in_TeachingLearning_at_Technical_and_Higher_Educational_Institutions_of_Uganda

Kadir, H., Kadir, M., Yusuf, T. M., & Rasheed, D. (2014). Role of ICTs in enhancing a sustainable educational development in selected secondary schools in Ilorin Metropolis. *Journal of Economics and Sustainable Development, 5*(9), 89-93.

Kanvaria, V. K., & Bisht, S. (2016, October). Integrating ICT in education for sustainable development: A facilitator's comprehension. *International Journal of Education & Applied Sciences Research, 3*(6), 51-58.

Kharbirymbai, B. B. (Ed.). (2013). *ICT in education*. Guwahati, India: EBH Publishers.

Koc, M. (2005). Implications of learning theories for effective technology integration and preservice teacher training: A critical literature review. *Journal of Turkish Science Education, 2*, 2-18.

Lall, S. (2015). In S. R. Singh (Ed.), *Environment education and sustainable development*. New Delhi, India: A. P. H. Publishing Corporation.

Lantaron, B. S., Ruiz, Y. D., Perales, N. G., & Reche, I. S. C. (2022, August). The educational use of WhatsApp. *Sustainability, 14*(17). https://www.mdpi.com/2071-1050/14/17/10510

Mohanty, A., & Dash, D. (2018). Education for sustainable development: A conceptual model of sustainable education for India. *International Journal of Development and Sustainability, 7*(9), 2242-2255.

Moodly, A. L., & Adu, O. (2014). Information and communication technology (ICT) in education for sustainable development (ESD): Quality teaching and learning outcomes. *J. Communications, 5*(2), 197-202.

Nayak, C. K. (2020, November 11). Meghalaya students had greater access to smartphones, study material during lockdown, survey shows. *The Shillong Times*.

Nevin, E. (2008). Education and sustainable development. *Policy and Practice: Education for Sustainable Development, 6*, 49-62.

Olita, A. M., & Orong, M. Y. (2023). Challenges experienced by teachers in the utilization of information and communication technology in the classroom. *United International Journal for Research & Technology, 4*(6), 67-76. https://uijrt.com/articles/v4/i6/UIJRTV4I60007.pdf

Paul, P. K., & Mehera, C. (2016). Impacts of education on sustainable development: A micro study in Burdwan District of West Bengal, India. *American Journal of Educational Research, 4*(7), 551-555.

Saha, S. (2015). *Environmental education*. New Delhi, India: APH Publishing Corporation.

Saidu, A., Tukur, Y., & Adamu, S. H. (2014, June). Promoting sustainable development through ICT in developing countries. *European Journal of Computer Science and Information Technology, 2*(2), 24-29.

Shadap, P. A. (2013). ICT and sustainability. In B. B. Kharbirymbai (Ed.), *ICT in education*. Guwahati, India: EBH Publishers.

Shaikh, F. (2013). Challenges of ICT in teaching and learning process. *International Journal of Engineering Research and Technology*.

Sharma, I., & Koli, S. K. (2014). *Information and communication technologies in education*. New Delhi, India: Arpan Publications.

Singh, H. (2010, January). Education for sustainable development in 21st century. *Sodh Sanchayan, 1*(1).

Tyagi, R., Vishwakarma, S., Alexandrovich, Z. S., & Mohammed, S. (2020, April). ICT skills for sustainable development goal 4. *ResearchGate*.

UNESCO. (2003). Decade of education for sustainable development (January 2005 – December 2014): Framework for a draft international implementation scheme. Paris: UNESCO.

Research Article

Digital Integration in School Education and the Role of COVID-19 Crisis

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Abstract

The COVID-19 pandemic struck human life as a disaster worldwide and left no choice for people other than to keep themselves locked inside their houses for months to years. Many professional and developmental activities in daily life were interrupted completely in the early phase of the pandemic, including school education. Digital tools, technologies, and digital media were adopted as the lifelines for social connectivity, professional work, information sharing, and, most importantly, continuing education in virtual classrooms. As utilizing digital tools and technology was the best choice, among few others, to continue education both for teachers and students, they adopted it and tried their best to search and utilize the best options of such tools and techniques available at that time, and the search is still going on. A study was conducted in different types of schools in Delhi to explore digital integration in school education during and post COVID-19 crisis. The study attempted to understand the role of the crisis created by the COVID-19 pandemic in digital integration in school. While interacting with principals/heads of the schools, teachers, parents, and students from different types of schools in Delhi, they shared their experiences of becoming digitally well-skilled during that period. Despite the digital divide regarding the availability of digital tools, digital skills, and network data, they tried to find ways. Necessities that emerged due to the COVID-19 crisis played the role of a catalyst in the process of developing digitally well-skilled teachers and students that would speed up the process of achieving the goal of "NEP 2020".

Keywords: COVID, Pandemic, school education, Digital tools, digital skills, digital integration

Abbreviations: COVID (Corona Virus Disease), GoI (Government of India), ICT (Information and Communication Technology), NEP (National Education Policy), PoA (Programme of Action)

Introduction

The report of The Education Commission 1964-66 (Government of India, Part 1.01 of chapter-1, 1970) states, "the destiny of India is being shaped in her classrooms". Therefore, the classroom is the place that gives the framework, direction, and demonstration through its experiences at ground level to decide in which shape, up to what extent, and how it would be done. National Education Policy (NEP) 2020 talks about developing digital and skilled India, and the process has already begun in our school education. Children in schools today will become the future of the country tomorrow, creating a digitally skilled workforce to participate in the development of the country.

The COVID-19 pandemic struck the life of human beings as a disaster (announcement of the COVID-19 pandemic on March 12, 2020, by the World Health Organization, 2020) and left no choice other than to keep themselves locked inside their house for months to years. People of all ages had to face this situation, including school students, teachers and parents. This horrible situation forced everyone to maintain physical distancing, resulting in social distancing too in physical form. As it is a universal fact that necessity is the mother of invention, so the necessity of how to connect socially with friends, relatives, and colleagues while taking care of physical distancing is motivated towards massive use of social media platforms, which are majorly based on digital media nowadays. Digital tools and technology became the major means and methods to continue teaching and learning along with becoming a major source of communication while sitting at home due to lockdown.

Though the seed of digital integration was sown in the past in the field of education in India at all levels, including school education and germination took place much before the COVID-19 pandemic through Computer Literacy And Studies in School (CLASS) project in 1984-85, PoA in 1992, Government of India (GoI, 1995)), ICT @ School in 2004 (GoI, 2004) and National Policy on ICT In School Education (GoI, 2012). However, the growth was not as vigorous as it became during the pandemic due to digital and online school education. Just like a catalyst in a chemical reaction, necessities that arose due to the pandemic worked to enhance the process of developing digital and online education in schools, resulting in vigorous digital integration in school education.

While reviewing the literature, it was found that CLASS projects could not become very successful due to the lack of hands-on experience for the learner teachers (Gupta, 1996). The national policy on education (GoI,1986) found modern communication technology capable of managing the constraints of time and distance, but nothing more was described about the integration of such technologies in education. In PoA,1992 (GoI, 1995), it was proposed to expand CLASS project. With the purpose of providing opportunities to build the capacity of secondary-stage students in ICT skills, the ICT@ school was launched in December 2004 and revised in 2010 (GoI,2004). "National Policy on ICT in school education (GoI, 2012)" emphasized on ICT literacy for teachers and students and their ICT competency enhancements. NEP (GoI, 2020), which was unveiled during the pandemic, placed more emphasis on utilizing digital technology to make teaching, learning, and evaluation effective by integrating such technologies in education in different forms and for different purposes.

Kanvaria (2011) reported that Google groups were quite helpful to learn in a face-to-face in-service training program for teachers. Bordoloi et.al. (2024) reported that ICT helped in promoting learning as perceived by the head teachers of secondary schools. In a study conducted by Arora & Chander (2024), teachers opined that the academic performance of students was enhanced by using social media for learning. In the same study, parents said that it helped their children clear doubts, gain knowledge and develop awareness.

Moreira et al. (2019) opined that better integration of information and communication technology required sufficient training, which helped teachers for strong educational integration of ICTs in school. Rathnabai (2023) reported that online training resulted in the creation of an environment of learning and integrating technology in the self-interest of the teachers. Wadhwani & Abraham (2017) reported that there was no orientation for teachers by the manufacturers for using different tools of smart class, resulting in their underutilization. After the arrival of the COVID-19 pandemic and the beginning of the lockdown situation, many countries began to look for digital resources and technology to provide the opportunity for remote learning to students, as reported by the World Bank (2020). Many digital activities were provided in India also, to be utilized for school education (India Report: Digital Education, GoI, 2020). Jena (2020) reported that many students had no digital tools for learning purposes. NCERT survey found that 27 per cent of students did not have digital devices to attend online classes (PTI, 2020). Dhawan (2020) reported the challenge for education to move to online mode from offline mode. Jain et al. (2020) reported that teachers were not trained to cater to the situation of online learning. Grover & Mathew (2022) reported that teachers needed to develop their own teaching resources in the initial phase of lockdown as there was no availability of ready-to-use resources. They tried to learn how to conduct online classes, and most of them learned to some extent before getting any formal training. School teachers were reported to have a positive view of teaching online during the COVID-19 crisis (Kamal & Illiyan, 2021). The massive rise in conferences, seminars, and meetings in virtual form due to COVID-19 has been observed as a positive feature by Dar & Lone (2021).

Digital technology was considered just a resource to be utilized by teachers and learners if they wanted to do so, as evidenced by the literature available before the pandemic. However, during the pandemic, it became a need to integrate such technology into teaching and learning, again evident from the literature available during and after the pandemic, which led to the objectives of this study.

The rationale of the study

Though it is evident from the literature, news sources and real-time observation during the COVID-19 crisis that digital tools and technology were adopted as the main source for continuing education at all levels, there is a lack of evidence directly from the field to understand the live experiences of the head of the schools, teachers, parents and students. There are studies conducted during lockdown through virtual media to understand the problems of teachers in conducting online classes and the efforts made by them, but only a few studies are about students. There is a lack of study on the students, parents, and teachers at the upper primary level. Various studies conducted to explore online education depicted the problems faced by teachers and students in conducting online education and the efforts made by the government, schools and some techno-savvy teachers. But other aspects, like the efforts made by students, their family and friends, and by the teachers who had nominal knowledge of digital technology before this pandemic, were given a nominal place in the exploration and discussion. This study was conducted on upper primary level school education to understand the efforts made by teachers, students, and parents to integrate digital technology into education to overcome the challenges created by the COVID-19 crisis and lockdown. Delhi has been chosen as the area of this study due to the wide socio-economic divide that creates a divide in the context of the availability of resources and the environment at home for teaching and learning.

Objectives

1. To understand the role of the crisis created by the COVID-19 pandemic in digital integration in schools.
2. To explore digital integration in schools during and just after the COVID-19 crisis.

Methodology

The study was conducted in different types of schools in Delhi to explore digital integration in school education during the COVID-19 crisis and just after the reopening of schools. It is qualitative in nature based on the focus group discussion and purposive interaction with school students, principals/school heads, teachers, and parents from different types of schools in Delhi. The study was conducted in 12 schools, out of which 6 schools belong to the Directorate of Education, Delhi Government, 4 belong to Kendriya Vidyalaya Sangathan, Government of India, and 2 belong to private management. Formal interaction with different stakeholders was done after unlocking of schools for classes 6th, 7th and 8th in the year 2022.

Sampling and data collection

12 focus group discussions were conducted with students, one in each school, through a random selection of members for each group from classes 6th, 7th, and 8th. Another 12 focus group discussions with teachers were done, one group in each school selected through purposive sampling, who taught at the upper primary level during the lockdown and just after the unlocking. The interaction with parents was done in small groups through purposive selection for each school. School heads also shared their experiences about the role of the crisis of the COVID-19 pandemic in the integration of digital technology in school education.

Tool

The tool adopted was a semi-structured group discussion/interaction schedule comprising a few questions about their (samples') digital skills learned before the pandemic, their experience with the need for those skills in their day-to-day teaching and learning at that time, and the availability of digital tools with them during that phase. Other questions were related to their experience with the need for new digital skills in their day-to-day teaching and learning during the COVID-19 crisis, their digital skills learned and developed during the pandemic, and the need for digital tools created due to that situation and how they manage to equip them with digital tools and skills during that phase (Table-1).

A qualitative thematic analysis technique was adopted to analyze the responses and to reach a conclusion.

Table-1: Samples and Semi-structured Group Discussion/interactionSchedule

S. No.	Sample type	sample	Semi-structured Group Discussion/ interaction Schedule (questions were based on the following semi-structured group discussion schedule)
1	Students from classes 6th ,7th and 8th	12 groups (having 10-15 students in each group), 1 group from each school	Digital skills learned before the pandemic, their experience with the need for those skills in their academic work at that time, and the availability of digital tools with them during that phase. Need for new digital skills in their day-to-day academic work during the COVID-19 crisis, their digital skills learned and developed during the pandemic, and the need for digital tools created due to that situation and how they manage to equip them with digital tools and skills during that phase
2	Teachers	12 groups (having 5-9 teachers who taught upper primary level during the COVID-19 phase), 1 group from each school	
3	Parents	12 groups (having 4-5 parents of the students of upper primary level)	
4	Principals/ Heads of the schools	12	

Findings and discussions

Necessities arisen due to the pandemic pushed to search out the ways, means and methods

As the pandemic continued to expand, different types of means and methods were being searched, tried, and utilized by teachers, students, parents, and school administration for teaching, evaluating, and all-round development of students. On the basis of responses from different groups (teachers, parents, and students), it was found that most of those means and methods were based on digital tools and techniques, which was mentioned by the World Bank (2020) also. Most of them were being utilized till the date of interaction, even after the reopening of schools.

Though it was not possible to meet face to face physically to play and to learn together, at least it became possible to see each other and to communicate through digital media. It became possible to learn in virtual classrooms in the absence of real classrooms. Students were happy to share their experiences during the group discussion that they learned together and celebrated important days and festivals together, even celebrated their birthdays with their teachers and classmates in virtual classrooms. Teachers, too, expressed their happiness about how they tried day and night to search and to learn to use various digital skills and applications to keep communicating with their colleagues and students and to continue to provide education to their students.

Pressures of Lockdown and the New Found Opportunity of Virtual Learning

The scenario was different for almost everyone, either the teachers the students or the parents. The closure of schools due to the COVID-19 pandemic left children to be educated at home (Moroni et al., 2020). In the beginning, students felt difficulty in joining classes, participating in different classroom activities, doing assignments, downloading and uploading question papers and answer scripts, etc., as expressed by them during the group discussion. But they learned quickly, with the help of parents, teachers, friends, and relatives through social media, how to open and log into their virtual classes, download their assignments and question papers, and upload their completed assignments and answer scripts. They enjoyed learning various digital skills. Their curiosity kept on rising, and they learned to search for new resources and new Apps to improve their learning, similar to what was reported by Deschaine (2021). Rasmitadil et al. (2021) reported that collaboration among various stakeholders in school education resulted in the success of online education during the situation of crisis in Indonesia. Such collaboration has also been observed in the case of India, in these schools in Delhi, but only in cases where digital tools and the opportunities to learn digital skills were available to the stakeholders.

Thus, this pandemic crisis pushed the stakeholders of school education, mainly teachers and students, to learn digital skills and to make themselves digitally skilled for their professional work.

Dependence on digital tools and techniques

It has been observed through the interaction with school heads and group discussions with teachers that in the beginning phase of the pandemic, most of the schools, teachers, and students were waiting for the situation to be normal for around 2-3 weeks. After that, WhatsApp was selected as the initial digital platform to begin the regular exchange of information among different members of the school through WhatsApp groups created either before the pandemic or just after the arrival of the pandemic for the nominal formal exchange of information. The WhatsApp platform was then utilized for educational purposes as a beginner tool to share notes, question papers, links to educational resources, information about new tools and technologies, etc., and to share the latest updates on COVID-19 by the teachers among themselves and with parents and students.

Searching and utilizing new tools and techniques

Slowly, virtual classrooms began to take shape through the introduction of other Applications like Facebook Live, Zoom, Google Meet, Google Classroom, etc. There was no option for teachers, students, and even parents other than to learn the skills to utilize these platforms for continuing teaching-learning. Step by step, the process of sharing, teaching, learning, and evaluating began to evolve as teachers, learners, and parents began to search and find new ways, new tools, and new techniques to fulfil their necessities. Most of the teachers, parents, and students expressed during the discussion that they were puzzled in the beginning; some of them were nervous about how to learn so many digital skills in such a hurry. But they learned. Though there was a big digital divide among students, they tried to search their ways, shared a single device among siblings, keeping in view their requirements, managed to share a digital device with friends in their neighbourhood, and took help from relatives having a digital device and living in the neighbourhood. Even parents suffering from financial problems tried to buy a mobile phone on loan for their children to enable them to continue their education. Some of the parents bought new smartphones, but some managed to buy second-hand used mobile phones, and only a few of them got old second-hand mobiles as a donation from school teachers, relatives, etc. Though many students did not attend their online classes regularly due to various reasons, they attended now and then. If they had access to a mobile phone and internet data, they would have taken an interest in learning digital skills to do their class work and homework online. Self-interest, self-motivation, and peer motivation among students played a great role in the process of learning these skills, as stated by both students and parents during focus group discussions. Even, some parents made efforts to learn digital skills instructed by the teachers for online classes to help their children while facing any technical problems during online classes and examinations. Teachers learned either due to self-motivation or group motivation or due to situational demand and many other reasons, like fear of lagging behind and fear of not being digitally skilled at a time of high demand for digitally skilled teachers.

Rising needs and demands of new Apps: giving a boost to organizations and industries dealing with digital tools and technology

Some groups of teachers expressed that when the use of digital tools and techniques was growing day by day, different types of needs were being felt by the users, resulting in demands for new applications and new digital tools with advanced features like; interactive classrooms and online interactive writing boards to give the ease and feel of a real classroom, online markers to check the answer scrips, etc. Such needs motivated the professionals in the field of software and hardware development to create new tools and Apps to serve the purpose, which gave a push to develop a digitally skilled society and gave a boost to both software and hardware industries to develop new applications (Apps) and new devices with advanced features. Such developments were needed throughout the world, including India, resulting in a push to develop digital India. The government of India provided free digital resources for teachers and students (India Report: Digital Education, GoI, 2020), for example, the National Repository of Open Educational Resources portal, DIKSHA portal, e-Pathshala App, Swayam Prabha, NCERT app, etc. which were utilized along with YouTube and other online resources during the absence of offline classes and were still being utilized by school teachers and students, as reported by them during the interaction with the researcher. Qshala, an offline quizzing platform (Bangalore-based ed-tech startup) for students, was converted into an online mode during the pandemic in the form of a Sunday family quiz (India Today, 2021-12-22). Similarly, Digital Aristotle, an online platform, helped students with a learning-based approach. Such online educational platforms and tools gave students, teachers, and educational institutions the opportunity to continue learning online. Indian Edtech companies are expected to soon start their expansion into other countries also due to the benefits of online learning felt by students, teachers, and parents (Shekhar, 2021).

Series of online meetings, workshops and webinars

Teachers said that as the dependence on digital tools, techniques, and digital media kept rising, the need to learn to utilize them also kept rising, resulting in conducting a series of online workshops and webinars. Various online workshops and webinars were being organized continuously for the teachers, even by the teachers other than those organized by the government, educational boards, organizations, and management of the institutions for catering to the demand of learning digital skills, which were proved like an opportunity in disaster (Aapda me awasar) that helped to prepare them for virtual classes and to become digitally resourceful. Such workshops and webinars also helped teachers to share the ease and difficulties of working in a highly transformed new teaching-learning environment in virtual form and to find solutions to the problems that emerged in professional work. Groups of teachers organized online meetings among themselves to create teaching-learning resources in collaboration for their subjects of teaching and shared those resources among the group members to be utilized by all. It helped to save their time and energy and to make their teaching-learning effective in spite of working from home. Once the teachers became digitally skilled, they helped students also to learn those skills. Many teachers from all these different types of schools said that students also helped teachers and parents learn digital skills in some cases.

Achieving the objectives of the study

Though all the major points of findings discussed above achieved both of the objectives of this study, the initial three points are more helpful in achieving the first objective of the study, and the other three points are more helpful in achieving the second objective of the study. It has been observed that both teachers and students faded up with too much technology and long screen hours when the lockdown continued for a longer period, and they had been waiting eagerly for offline classes to commence. However, most of them felt that they were now equipped with such digital skills that would help them in their teaching and learning in the present as well as in the future.

Conclusion

The slogan "Aapda me awasar (opportunity in disaster)" was taken seriously by different stakeholders in school education, especially by the teachers. They tried their best to learn from others and to share what they had learned with others. Teachers helped their students also to learn digital skills that they had learned to conduct virtual classes, utilize online resources, and create their own digital resources. Some of the students even helped their parents and teachers learn new digital skills as they emerged as quick learners of various digital skills during this critical situation. The best thing was that most of the parents gave their full support to their children in this process, though they were not digitally skilled for educational purposes. Some of them even sat with the children in virtual classes and learned digital skills taught by the teachers to help their children. Thus, it is concluded that though the integration of digital technology in school education was initiated many years back and is going on continuously, it has been enhanced due to the role played by the necessities that emerged due to the COVID-19 crisis as a catalyst in the process that demanded to switch over to online mode of education from offline mode during the lockdown. It left no choice other than to trigger the process of developing digitally well-skilled teachers and students that would speed up the process of achieving one of the goals of NEP 2020 (GoI, 2020), which emphasizes "integrating digital technology in school and teacher education, and developing the use of alternative modes of quality education in case of impossibility of traditional and face to face in-person modes of education.".

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References

Arora, C., & Chander, S. (2024). Exploring the Role of Social Media in Adolescence Ecology. *Indian Journal of Educational Technology, 6*(1), 90-101. Retrieved on February 19th 2024 from https://ncert.nic.in/pdf/publication/journalsandperiodicals/indianjournalofeducationaltechnology/IJET_January2024.pdf

Bordoloi, A., Choudhury, A., & Roy, S. C. (2024). Role of ICT in Improving Quality of Education: Perception of Head Teachers of Secondary Schools of Kamrup (Metro) District, Assam. *Indian Journal of Educational Technology, 6*(1), 143-158. Retrieved on February 19th 2024 from https://ncert.nic.in/pdf/publication/journalsandperiodicals/indianjournalofeducationaltechnology/IJET_January2024.pdf

Dar, S. A., & Lone, N. A. (2021). IMPACT OF COVID 19 ON EDUCATION IN INDIA ". *Kala : The Journal of Indian Art History Congress*, *26*(2), 47-55. https://www.researchgate.net/profile/Naseer-Lone/publication/350382831_IMPACT_OF_COVID_19_ON_EDUCATION_IN_INDIA/links/60815113907dcf667bb63e45/IMPACT-OF-COVID-19-ON-EDUCATION-IN-INDIA.pdf

Deschaine, M. E. (2021, January). *ACADEMIA Letters "Ala Carte" Education: An Inevitable Outgrowth of COVID?"* www.academia.edu. Retrieved on 29th January, 2021 from https://www.academia.edu/44992727/_Ala_Carte_Education_An_Inevitable_Outgrowth_of_COVID?auto=download&email_work_card=download-paper

Dhawan, S. (2020). Online Learning: A Panacea in the Time of COVID-19 Crisis. *Journal of Educational Technology System*, *49*(1), 5-22. Retrieved on June 20th 2023 from https://journals.sagepub.com/doi/pdf/10.1177/0047239520934018

Government of India. (1970). *Report of The Education Commission, 1964-66*. Ministry of Education and Youth Services, Government of India. website: http://dise.in/Downloads/KothariCommissionVol.1pp.1-287.pdf. Retrieved on 17th March 2020.

Government of India. (1995). *National Policy on Education 1986 Programme of Action· 1992*. Retrieved on 21st November, 2019 from https://mhrd.gov.in/sites/upload_files/mhrd/files/document-reports/POA_1992.pdf

Government of India. (2004). *Information and Communication Technology @ Schools*. Department of School Education and Literacy, Ministry of Human Resource Development, Government of India website: https://mhrd.gov.in/sites/upload_files/mhrd/files/upload_document/ICTold%20scheme.pdf. Retrieved on 21st November, 2019.

Government of India. (2012). *National Policy on Information and Communication Technology (ICT) In School Education*. Department of School Education and Literacy, Ministry of Human resource Development, Government of India. Retrieved on 1st September, 2019 from https://mhrd.gov.in/sites/upload_files/mhrd/files/upload_document/revised_policy%20document%20ofICT.pdf.

Government of India. (2020). *India Report Digital Education Remote Learning Initiatives Across India*. Digital Education Division, Department of School Education & Literacy, Ministry of Human Resource Development, Government of India, Shastri Bhawan, New Delhi – 110 115, India. Retrieved on 8th October 2020 from https://www.mhrd.gov.in/sites/upload_files/mhrd/files/India_Report_Digital_Education_0.pdf

Government Of India. (2020). *National Education Policy 2020*. Ministry of Human Resource Development. Retrieved on 10th February 2023 from https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Grover, S., & Mathew, L. (2022). Exploring the Digital Revolution in Education in India during the COVID-19 Pandemic. *International Journal of Social Quality*, *12*(2), 51-71. https://doi.org/10.3167/IJSQ.2022.120204

Gupta, R. P. (1996). School level computer education: CLASS Project. In *Computer education in India Past, present and future (edited by Banerjee, U. K.)* (pp. 73-85). New Delhi, India: Concept Publishing Company. Retrieved from https://books.google.mv/books?id=QCYEJXzmbpQC&printsec=frontcover#v=onepage&q&f=false

India Today Web Desk. (2021, December 22). 5 online learning platforms that revolutionised learning for students in 2021. India Today. https://www.indiatoday.in/education-today/featurephilia/story/5-online-learning-platforms-that-revolutionised-learning-for-students-in-2021-1890363-2021-12-22

Jain, S., Lall, M., & Singh, A. (2021). Teachers' Voices on the Impact of COVID-19 on School Education: Are Ed Tech Companies Really the Panacea? *Contemporary Education Dialogue*, *18*(1), 58-89. DOI: 10.1177/0973184920976433

Jena, P. K. (2020). Impact of Pandemic COVID-19 on Education in India. *Purakala (UGC Care Journal), 31*(46), 142-149. Retrieved on 27th April, 2023 from https://www.researchgate.net/profile/Pravat_Jena3/publication/342123463_Impact_of_Pandemic_COVID-19_on_Education_in_India/links/5ee3549192851ce9e7dcd1ba/Impact-of-Pandemic-COVID-19-on-Education-in-India.pdf

Kamal, T., & Illiyan, A. (2021). School teachers' perception and challenges towards online teaching during COVID-19 pandemic in India: an econometric analysis. *Asian Association of Open Universities Journal*, *16*(3), 311-325 Retrieved on 20th July, 2023 from https://www.emerald.com/insight/content/doi/10.1108/AAOUJ-10-2021-0122/full/pdf

Kanvaria, V. K. (2011). Technology enhanced capacity building: Web 2.0 tools for inservice teacher education. *Staff and Educational Development International*, *15*(2), 135-141. Retrieved on 19th May, 2020 from http://repository.usp.ac.fj/8181/1/Final_Staff_E_September_2011.pdf

Moroni, G., Nicoletti, C., & Tominey, E. (2020, April 9). *Children's socio-emotional skills and the home environment during the COVID-19 crisis.* VOX CEPR Policy Portal. Retrieved on 27th June, 2020 from https://voxeu.org/article/children-s-socio-emotional-skills-and-home-environment-during-covid-19-crisis

Moreira, M. A., Rivero, V. H., & Alonso, J. S. (2016). Models of educational integration of ICTs in the classroom. *Media Education Resesarch Journal, 24*, 79-87. Retrieved on 21st March, 2020 from https://www.researchgate.net/publication/294276193_Models_of_educational _integration_of_ICTs_in_the_classroom/link/58a2e83c45851598bac0126c/do wnloa

PTI. (2020, August 20). At least 27 pc students do not have access to smartphones, laptops for online classes: NCERT survey. *The Economic Times*. Retrieved from https://economictimes.indiatimes.com/industry/services/education/at-least-27-pc-students-do-not-have-access-to-smartphones-laptops-for-online-classes-ncert-survey/articleshow/77649763.cms?from=mdr

Rasmitadila, Aliyyah, R. R., Rachmadtullah, R., Samsudin, A., Syaodih, E., Nurtanto, M., & Tambunan, A. R. S. (2020). The Perceptions of Primary School Teachers of Online Learning during the COVID-19 Pandemic Period: A Case Study in Indonesia. *Journal of Ethnic and Cultural Studies, 7(*2), 90-109. http://dx.doi.org/10.29333/ejecs/388 see Google Scholar. Retrieved on 9th October, 2020.

Rathnabai S, A. (2023). Online Training as a Strategy for Continuous Professional Development (CPD) of Teachers. *Indian Journal of Educational Technology*, *5*(2), 237-247. Retrieved on February 19th 2024 from https://ciet.nic.in/IJET_Jul_2023/docs/IJET_JULY2023_final.pdf?reload=1691743858106

Shekhar, A. (2021, December 24). Year-ender 2021: How COVID-19 pandemic enabled EdTech to become leading sector for growth. *India Today*. Retrieved from https://www.indiatoday.in/education-today/featurephilia/story/year-ender-2021-how-covid-19-

pandemic-enabled-edtech-to-become-leading-sector-for-growth-1891605-2021-12-24

The World Bank. (2020, March 31). *How countries are using edtech (including online learning, radio, television, texting) to support access to remote learning during the COVID-19 pandemic*. Website: www.worldbank.org. Retrieved on 30th June,2020 from

https://www.worldbank.org/en/topic/edutech/brief/how-countries-are-using-edtech-to-support-remote-learning-during-the-covid-19-pandemic

Wadhwani R., & Abraham, J. (2017). Exploring the Optimum Utilization of Interactive Whiteboards in Classrooms. *Jamia Journal of Education, 4*(1), 17- 30. Retrieved on 7th March, 2020 from https://www.jmi.ac.in/upload/menuupload/jamiajournalofeducation_vol4_n1_ 2017november.pdf

Research Article

Mental Health Concerns of School Going Adolescents in India during the COVID-19 Outbreak through Tele-helpline services

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Abstract

The COVID-19 pandemic has exacerbated mental health challenges globally. Adolescents on the cusp of adulthood, already grappling with significant developmental pressures and life changes, were further tested by the uncertainty created by the pandemic. This article aims to mapping and analyze trends in mental health concerns among adolescents in the post-pandemic era, based on calls received by the Manodarpan toll-free tele-helpline. The helpline was launched to provide psycho-social support to students, parents, and teachers through trained counsellors. The reported concerns relate to psycho-social issues such as a lack of skills to manage emotions, health-related problems, academic issues, difficulties with online classes, and anxiety related to studies and exams. The findings of this study will have significant implications for mental health practitioners and educators in providing support and planning policies related to mental health and well-being

Keywords: Mental health, Adolescents, Tele-helpline, Psycho-social, Academic, COVID-19

Introduction

Mental Health concerns of school students in India during COVID-19 outbreak increased due to several reasons. The virulent nature of the virus prompted a nationwide lockdown, disrupting everyday life and routines. Once the lockdown was lifted, strict rules and regulations on social distancing were enforced by the government, with fines for violations. These guidelines included avoiding social interactions, and large public functions like weddings were also restricted. As a consequence of these social distancing measures, coupled with the non-availability of vaccines, especially for children, schools had no choice but to shut down temporarily. This abrupt closure initially disrupted education, leaving students without their usual routines and engagement.

However, the education system gradually adapted by transitioning to online classes. Despite this adjustment, the initial shutdown caused upheaval, and students faced challenges. While adults resumed work in hybrid modes, children often found themselves unattended and with limited to no movement outside the house. While the challenges in mental health of adolescents can lead to heightened emotional stress, feelings of helplessness, and fear, over time, these difficulties may develop into mental illnesses like anxiety and depression (Meherali et al., 2021). Furthermore, early identification of mental health risks is crucial to reducing these risks (Schulte-Körne, 2016).

Amidst significant efforts by the government, the education system in India made a crucial shift to online classes, providing a much-needed relief during the pandemic. However, this transition came with its own set of challenges. Loneliness, exacerbated by learning loss and uncertainty about the future (including board exams and career prospects), weighed heavily on the minds of school students, especially adolescents. The social restrictions imposed due to fear of infection and death further compounded their mental well-being concerns. Conversations around these issues impelled a search for solutions, as educators, parents, and policymakers grappled with how best to support students during these unprecedented times.

In order to address the holistic well-being of students, the government of India, launched the Manodarpan[1] initiative in July 2020. Through tele-helpline, this initiative aimed to provide psycho-social support to students, parents, and teachers with the help of trained counsellors from across the country. It is important to understand that tele-helplines have been playing an important role in offering convenient access and immediate assistance to individuals in need (S. Sriram et al., 2016). The current analysis is based on the data collected from calls received on the Manodarpan toll-free tele-helpline, which operates 12 hours a day (from 8 am to 8 pm) every day of the week.

Pandemic and its Psychological Implications

History tells us the occurrence of pandemics and the havoc caused on humanity as a consequence. The unpredictability of pandemics, coupled with the world's unpreparedness for such occurrences, remains the biggest challenge for humankind. The sufferings caused by the pandemic have the potential to leave a deep impact on the psyche of individuals and societies for generations to come. These challenges are amplified many folds in contemporary global village realities. The Coronavirus (SARS-CoV-2) or COVID-19, with a high capacity to infect, made it a lethal virus in today's interconnected world. Unlike in the past, where geographical movement was restricted, the ease of movement and the social and economic interdependence of people have exacerbated problems due to the virus's spreading nature. Similar to previous pandemics, COVID-19 not only served as a serious medical threat but has also impacted the psycho-social welfare of individuals and societies worldwide. In the quest to contain the virus and minimize the loss of human life, the use of unavoidable methods has inadvertently created mental and emotional imbalances. The impact extends to the student's learning process and has also brought to light, the unpreparedness of the system for dealing with large-scale mental health issues and long-term challenges that can affect the individuals.

The unprecedented and unplanned lockdowns imposed worldwide have not only triggered the fear of getting infected but also the experience of isolation, losing loved ones, and various unexpected challenges, leaving individuals with existential questions and looming anxieties. The effect on the Indian subcontinent was particularly extensive due to its large population and densely populated metro cities. The essential services were compromised, and hospitals were overly crowded. Everyday life was disrupted, educational institutes at all levels were closed, transportation was halted, and tourism was completely shut down. Even for

1. Under the 'Aatma Nirbhar Bharat Abhiyaan, Ministry of Education (MoE), Government of India (GoI)', the Manodarpan initiative was launched in 2020, to support on the psycho-social concerns of students, parents, and teachers during and beyond COVID-19.

essential survival needs, people were fearful to go out. To tackle the situations created by the pandemic, governments worldwide took measures to protect their citizens, addressing both physical and mental well-being. It is now evident that the pandemic has deeply affected the mental health of individuals of all age groups, including children and adolescents.

Adolescence and Concerns during the Pandemic

It is well known that adolescence is an age of development of abstract thinking, exploration of sexual identities, and the emergence of developmental skills to be used for coping and problem-solving (Erikson, 1963). When COVID-19 hit the world, adolescents, like everyone else, were restricted to staying at home and faced the consequences of disruption in everyday life. There were sudden changes in regular classroom interactions, including a transition to an online mode of learning with virtual classrooms and video conferencing. The lack of direct teacher-student interaction, along with limited access to resources, has impacted academic progress and played a crucial role in the learning loss of adolescents (Hammerstein, et. al. 2021). The impact was massive, particularly for those who faced socio-economic disadvantages, and belonged to low-income families, minority groups, and remote areas (Singh et al., 2020).Top of Form

As the situation evolved, educational systems attempted to address these issues and find solutions to support students' learning by redesigning lesson plans for remote delivery and exploring alternative evaluation methods to assess student performance. With this change parents had to take on more active roles in their children's education, supporting them with their studies while juggling work and other responsibilities. On the socio-emotional front, the students were caught off-guard as were the parents. The unpredictable nature of the pandemic compounded by its highly infectious nature led to anxiety and fear of death amongst all beyond age, gender, socio-economic level, and so on.

It is evident that COVID-19 has brought efforts and discussions on mental health-related issues to the forefront. Adolescents, already particularly vulnerable to mental health issues due to significant developmental changes and challenges at this stage of life, were further strained by the uncertainty, loneliness, and confusion brought about by the situation (Singh et al.,2020). Uncontrollable situations caused by the pandemic created issues for adolescents, such as social isolation, disruption in daily routines, lack of in-person interaction with friends and peers, uncertainty about the future, and fears related to the spread of the virus, which only exacerbated the existing mental health issues (Caffo & Belaise, 2003). The restrictions on social movements and physical activities forced them to face their fears without peer support and the known and comforting touch of the school environment, increasing the sense of fear and anxiety among adolescents. As India is a vast country with a large population and cultural variations, the complexity of the challenges increases, as does the approach and implementation of remedies for managing the mental health and well-being of students. Top of Form

Importance of Mental Health and Well-being of Adolescents

Mental health is essential not only for physical well-being but also because it shares a symbiotic connection with physical health. Since adolescents are on the verge of embarking on their journey as young adults in society, concerns for their well-being are high.

The psychological challenges if left unaddressed today may create backlogs that can impact their well-being and, subsequently, their mental health. As adolescence is a crucial period for providing mental health and well-being support to develop social-emotional habits, it also lays the foundation for better mental health and well-being later in life.

The nationwide lockdowns and decreased physical activities have led to increased sedentary lifestyles, affecting not only the physical but also the mental health of students. Psychological issues such as anxiety, depression, stress, loneliness, etc. seen a significant rise after the COVID-19 pandemic (Sarah et al., 2021). The UNICEF report *'Life in Lockdown'* in 2022 delves into the mental health and well-being of approximately 130,000 children and adolescents across 22 countries, seeking to comprehend the effects of lockdown on them. The document reports evidence of depressive symptoms, stress, anxiety, increased substance use, and other behavioral problems in children and adolescents after COVID-19. Despite the challenges posed by the pandemic, there were also noteworthy positive developments in mental health. These included increased quality family time, greater engagement in physical and recreational activities, and more personal introspection, all of which made positive contributions to individuals' mental well-being.

To address the concerns highlighted due to COVID-19, the Government of India is focusing on a comprehensive plan to boost economic growth, improve the quality of the healthcare system, adapt to the new digital world, and provide psycho-social support to the impacted citizens of the country. In this ever-evolving situation with changing pandemic impacts, it remains crucial for parents to stay informed, reach out for support when necessary, and place a high priority on both their own well-being and that of their children. Building a strong support network and maintaining open communication with children can help them navigate challenging times more effectively. The findings from the "Mental Health and Well-being of School Students- A Survey, 2022" suggest that the students have experienced anxiety regarding studies, examinations and results. They have also reported a lack of concentration as the major reason for lagging behind in studies.

Due to the vulnerability of the adolescent group and the need to prevent risky behaviors, it is important to look out for and prioritize their mental health and wellness. The need for intervention in mental health is also visualized in the National Education Policy (NEP), 2020, of the Government of India. The NEP, 2020 emphasizes recognizing, identifying, and fostering the unique capabilities of each student and strengthening mental health and well-being in school education. Such implications can not only help the child in holistic development but also assist in identifying and providing interventions for mental health-related issues.

Objective

- The objective of the paper is to analyze the trends of mental health concerns experienced by middle and secondary-stage school students from July 2020 to December 2022, through data provided by counsellors in information sheets about calls received on Manodarpan tele-helpline.
- Methodology

Sample

The information collected was based on calls received from *July 2020 to December 2022* on IVRS through toll-free tele-helpline calls from students across the nation, as part of the Manodarpan initiative, which primarily focuses on addressing psycho-social concerns of students, parents and teachers. A total of *2,356* calls documented under middle and secondary stage of education have been analyzed in the paper. Among these calls, 19.5 per cent were related to psychosocial concerns, while 80.5 per cent pertained to academic issues. The calls received on the helpline were recorded on performas by the counsellors who had received the calls and shared the details with Manodarpan Cell. The concerns of adolescent students are reported by counsellors from all four regions (north, south, east, and west) of India and collated by the Manodarpan cell in the form of information sheets. Furthermore, the information collected over 2.5 years (July 2020 to December 2022) was compiled and qualitatively analyzed. While the helpline concerns were studied within the context of the COVID-19 situation, the analysis identified trends across two significant domains, namely:

(i) Psycho-social issues

(ii) Academic concerns

Although the collected data is segmented into foundation, preparatory, middle and secondary stages, there were limited calls for the foundation and preparatory stages. This limitation is primarily because children in these age groups may not possess the maturity to fully comprehend and articulate mental health issues or actively seek direct assistance. Consequently, the study relies on calls from the middle and secondary stages.

Result and Findings

The data collected from the Manodarpan toll-free tele-helpline number is categorized into two major concerns: psycho-social and academic. The analysis is divided into three phases to understand the evolving nature of these concerns during the pandemic: *Phase I (July 2020 to* December 2020), Phase II (January 2021 to December 2021), and Phase III (January 2022 to December 2022).

Phase-wise analysis indicates the following results:

Phase I (July 2020 to December 2020)

Academic Concerns: Admission queries, challenges with online learning, concentration difficulties, exam and career-related stress, procrastination issues, and study methods.

Psycho-social Concerns: COVID-19-related anger management, sadness, anxiety, and family-related concerns. Higher academic stage students reported difficulties in online learning, exam stress, concentration issues, poor study habits, and career guidance.

Phase II (January 2021 to December 2021)

Academic Concerns: Admission queries, difficulty in online learning and communication, lack of concentration, fatigue, exam stress, poor study habits, and techniques. Higher stage students sought help for government forms, admissions, examinations, scholarships, e-pathshala, syllabus, study materials, board exam stress, and offline exam anxiety.

Psycho-social Concerns: Loneliness, sadness, loss of interest, anxiety, fear, worry, stress from high COVID cases, nervousness, irritation, excessive social media use, mobile game addiction, mood swings, and body image issues.

Phase III (January 2022 to December 2022)

Academic Concerns: Admission and entrance exam queries, NCERT books, online classes, entrance exam preparation, study tips, and various exams like NTSE, CBSE, NEET, UP board.

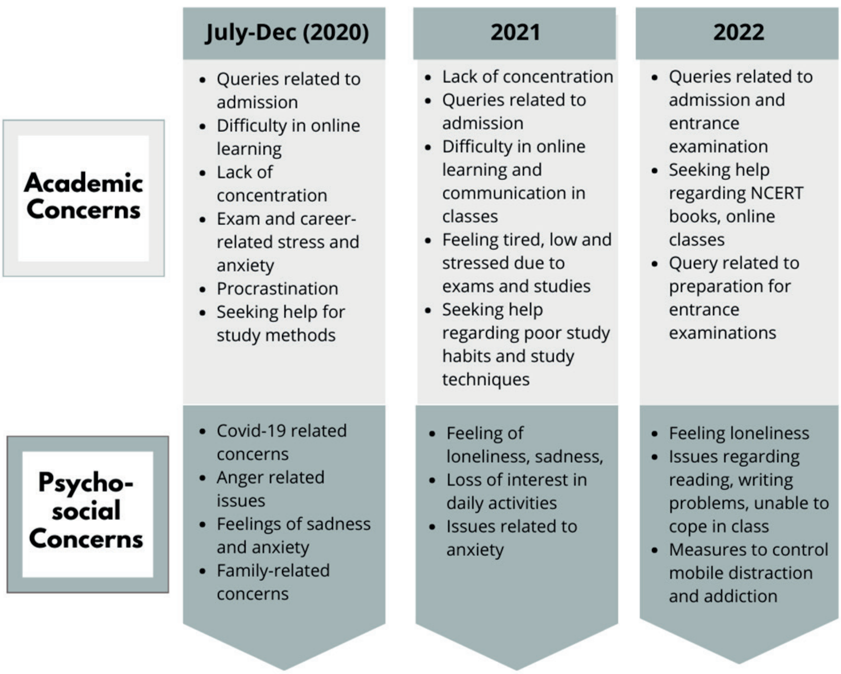
Psycho-social Concerns: Loneliness, overthinking, confusion, anxiety, depression, addiction to substances, video games, social media, mobile phones, adjustment problems due to family environment, sibling rivalry, friend misunderstandings, and body image issues.

Education stage-wise analysis showed the following results:

Middle Stage

Middle-stage students focused on academic issues such as admission queries, online learning adaptation, concentration problems, procrastination, and study habits. Amid these academic concerns feelings of sadness, loneliness, and anxiety often crept in, highlighting the importance of addressing both academic and emotional well-being to support these students effectively.

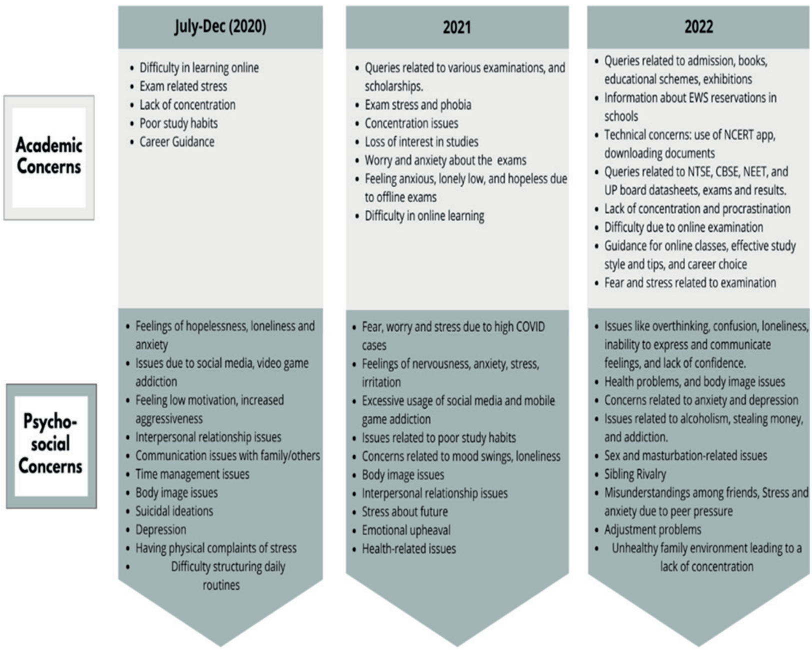
Figure-1: Concerns of Middle Stage Students



Secondary Stage

The secondary-stage students reported grappling with a diverse range of concerns, with both academic and psycho-social issues occupying a prominent place in their lives. The transition to online learning posed a significant challenge, leaving students struggling to adapt to this new educational landscape. The stress stemming from exams and difficulties in maintaining concentration further exacerbated their academic woes. Moreover, secondary students were found to be increasingly contending with psycho-social issues, including body image insecurities, excessive use of social media, and addiction to mobile games. These digital distractions can contribute to feelings of loneliness and exacerbate concerns related to anxiety and depression, which were also commonly reported throughout the years. As indicated in other studies, secondary-stage students have showcased a higher prevalence of anxiety and stress compared to middle-stage students (Zhang et al, 2020).

Figure-2: Concerns of Secondary Stage Students



Analysis and Interpretations

The impact of the COVID-19 pandemic was felt in India in March 2020. Media reports were filled with the global impact of the pandemic, creating a climate of anxiety, fear, and panic. The news primarily focused on the loss of life and the struggles of hospitals and medicine supply chains to cope with the novelty and severity of the virus.

In this context, school-going students, initially happy about the closure of schools, began to fully comprehend the threat they were exposed to. The maximum percentage of calls received for academic issues (approximately 80 per cent) also indicates concerns such as stress and anxiety related to students' academics, which they experienced once the impact of COVID settled in. The period from March to July, traditionally the time for final exams and admissions, added stress to students in the middle and secondary stages. They grappled with the challenges of learning in an online mode, facing concentration issues due to virtual interactions in classrooms with teachers and peers. Students in classes 10th, 11th, and 12th were particularly concerned about how exams would take place and if the final results under such conditions would negatively impact their college or professional institution admissions (Barbayannis et al., 2022).

"The Impact of the COVID-19 Pandemic on Education," a report by UNESCO (2022), also highlighted that a considerable number of students expressed anxiety regarding interruptions to their education, especially those from low socio-economic backgrounds who exhibited lower confidence in independently completing school assignments. Common issues faced by students in the middle and secondary stages of education included challenges with online learning, academic stress, exam-related anxiety, lack of concentration, procrastination, and queries related to admissions, indicating the adverse impacts that academic stress can have on anxiety (Zhu et al., 2021).

The anxiety related to new teaching-learning and assessment methods led many students to seek counselor assistance for study methods, causing confusion and further increasing anxiety about their future. Students also sought counseling for career choices. On the social front, latent anxiety about the pandemic, fear of infection, and concerns about academic and career choices manifested in students' behaviors, leading to feelings of anger and sadness, among other emotions. As rightly stated in the report "On My Mind" by WHO, "Indeed, these are very challenging times for children and young people, and this is the state of their world in 2021."

Additionally, concerns related to the spread of COVID-19 were more prominent during both 2020 and 2021. These concerns included anxieties related to the health of oneself, family, and friends; restlessness and stress due to lockdown measures; feelings of loneliness and fear due to the pandemic (Brooks et al., 2020 & Enea et al., 2021); and worry and stress attributed to the high number of COVID cases.

Phase I concerns revolved around difficulty in adjusting to a new routine, shifting from offline to online classes, feeling bored, and losing interest in everyday activities. Phase II exacerbated these issues, leading to feelings of stress, tiredness, and low energy, as supported by the findings of "Mental health and Well-being of School Students- A Survey". In line with the concerns of Phase III, the report "Life in Lockdown" by UNICEF (2021) states that "Social isolation and loneliness during lockdowns contributed to a range of outcomes, including depression, irritability, anxiety, stress, alcohol use, and sedentary behaviors." Psycho-social issues in this phase seemed to have intensified, with students reporting loneliness, overthinking, adjustment issues, depression, and an inability to express feelings, among other problems.

Students sought support for handling feelings of loneliness, sadness, and loss of interest in daily activities. Students in the secondary stage of education called counselors to seek support on various government forums for admission, examinations, and scholarships. During this phase, students had also started using and accessing the digital world for resources on learning, showing their increasing comfort with the online medium, as reflected in secondary stage students calling to ask about e-pathshala. However, the exposure and familiarity with the medium were not entirely positive, as many students called counselors to seek help in handling addiction to social media, mobile games, etc. School syllabus and study material-related concerns were also common.

Queries related to admission were reported in all three years, indicating uncertainties about the admission processes and difficulties of remote education. Seeking consistent assistance and information regarding admission processes also highlights the necessity of providing information in a more effective manner. Overall, the data not only highlights that the vulnerable period of COVID-19 has left adolescents with psychological stressors, which can have long-lasting implications, including procrastination and increased coping depletion (Sirois, 2023), but also underscores the significance and need to address these concerns proactively through appropriate interventions, counseling, and support systems. Given that schools are among the most crucial settings for mental health promotion and protection among children and adolescents, they can assist in providing students with the knowledge, skills, competencies, and lifestyles necessary for them to thrive (WHO, 2022).

Conclusion

The role of tele- helpline for mental health and well-being during the COVID outbreak cannot be overemphasized. Not only did it provide remote accessibility, which was especially important during lockdowns and travel restrictions, but it also allowed people to prioritize their mental health while minimizing the risk of COVID exposure. Manodarpan has also played a crucial role in providing psycho-social support through its tele- helpline service.

The major findings from the analysis of data received from the Manodarpan helpline highlight that adolescent students in the middle and secondary stages have experienced significant negative impacts from the pandemic, posing challenges to their overall well-being. Initially, during 2020, the fear of infection and loss of loved ones, along with the shift to a new medium of instruction, disrupted adolescents' everyday harmony, affecting their mental health. The analysis also indicates that, later in 2021 and 2022, the extended lockdown and social isolation instilled feelings of loneliness (Christiansen et al., 2021 & Cooper et al., 2021), stress, depression, and unidentified anxieties. On the academic front, the learning loss, combined with the decline in social skills, will have long-lasting effects that will be evident in the years to come, both on a personal and societal level.

It can be said that the negative impact of the pandemic on students' mental health is evident, and schools and parents need to recognize and address these issues in their own ways. Nonetheless, there is room for hope and positive signs emerge when children seek assistance after recognizing that certain issues could disrupt their daily lives and potentially affect their mental and physical well-being. This reflects a growing sense of self-awareness among young individuals. The data source, consisting of forms filled out by counselors on the tele-helpline, had limitations, as some forms were not adequately completed or shared by counselors, resulting in data loss. The major limitation of the study was the absence of quantitative data, which could enhance the generalizations of the analysis. Additionally, detailed case studies would have helped in data triangulation, making the study more informative and in-depth.

In conclusion, addressing the potential long-term consequences of the challenges mentioned earlier is crucial and need of the hour. It is imperative for educational institutions, policymakers, and communities to allocate resources and efforts toward remedial education, mental health support, and initiatives aimed at reducing educational disparities.

References

Baird, S., Jones, N., Goel, N., Dutton, R., Oakley, E., Presler-Marshall, E., … and Yadete, W. (2021) *Adolescent Well-Being in the Time of COVID-19.* Adolescent Well-being: Background Papers for Multi-stakeholder Consultations. Geneva: Partnership for Maternal, Newborn & Child Health. (https://pmnch.who.int/resources/publications/m/item/adolescent-well-being-in-the-time-of-covid-19)

Barbayannis G, Bandari M, Zheng X, Baquerizo H, Pecor KW and Ming X (2022) Academic Stress and Mental Well-Being in College Students: Correlations, Affected Groups, and COVID-19. Front. Psychol. 13:886344. doi: 10.3389/fpsyg.2022.886344

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet*, 395(10227), 912–920. https://doi.org/10.1016/s0140-6736(20)30460-8

Caffo, E., & Belaise, C. (2003). Psychological aspects of traumatic injury in children and adolescents. *Child and Adolescent Psychiatric Clinics of North America, 12*(3), 493–535. https://doi.org/10.1016/S1056-4993(03)00004-X

Christiansen, J., Qualter, P., Friis, K., Pedersen, S., Lund, R., Andersen, C., Bekker-Jeppesen, M., & Lasgaard, M. (2021). Associations of loneliness and social isolation with physical and mental health among adolescents and young adults. *Perspectives in Public Health*, *141*(4), 226–236. https://doi.org/10.1177/17579139211016077

Cooper, K., Hards, E., Moltrecht, B., Reynolds, S., Shum, A., McElroy, E., & Loades, M. (2021). Loneliness, social relationships, and mental health in adolescents during the COVID-19 pandemic. *Journal of Affective Disorders*, 289, 98–104. https://doi.org/10.1016/j.jad.2021.04.016

Enea V, Eisenbeck N, Petrescu TC and Carreno DF (2021) Perceived Impact of Quarantine on Loneliness, Death Obsession, and Preoccupation With God: Predictors of Increased Fear of COVID-19. Front. Psychol. 12:643977. doi: 10.3389/fpsyg.2021.643977

Erikson, E. H. (1963). Childhood and society (2nd Ed.). New York: Norton.

Hammerstein S, König C, Dreisörner T and Frey A (2021) Effects of COVID-19-Related School Closures on Student Achievement-A Systematic Review. Front. Psychol. 12:746289. doi: 10.3389/fpsyg.2021.746289

Innocenti Research Report, UNICEF Office of Research. (2021). Life in Lockdown: Child and adolescent mental health and well-being in the time of COVID-19. Innocenti, Florence

Meherali, S.; Punjani, N.; Louie-Poon, S.; Abdul Rahim, K.; Das, J.K.; Salam, R.A.; Lassi, Z.S. Mental Health of Children and Adolescents Amidst COVID-19 and Past Pandemics: A Rapid Systematic Review. *Int. J. Environ. Res. Public Health 2021*, 18, 3432. https://doi.org/10.3390/ijerph18073432

National Education Policy, 2020. Ministry of Education, Government of India, New Delhi.

Schulte-Körne, G. (2016). Mental health problems in a school setting in children and adolescents. Deutsches Ärzteblatt International. https://doi.org/10.3238/arztebl.2016.0183

Sibia, A., Chakraborty S. & Shukla, R. (2022). Mental Health and well-being of School Students –A Survey. *Publication Division*, Sri Aurobindo Marg, New Delhi, NCERT

Singh, S., Roy, D., Sinha, K., Parveen, S., Sharma, G., & Joshi, G. (2020). Impact of COVID-19 and lockdown on mental health of children and adolescents: A narrative review with recommendations. *Psychiatry Research*, *293*, 113429. https://doi.org/10.1016/j.psychres.2020.113429

Sirois, F.M. Procrastination and Stress: A Conceptual Review of Why Context Matters. *Int. J. Environ. Res. Public Health 2023*, 20, 5031. https://doi.org/10.3390/ijerph20065031

Sriram, S., Joshi, N. A., & Sharma, N. P. (2016). Telephone Counselling in India: Lessons from iCALL. In *Springer eBooks* (pp. 201–216). https://doi.org/10.1007/978-981-10-0584-8_11

United Nations Children's Fund, The State of the World's Children 2021: On My Mind – Promoting, protecting and caring for children's mental health, UNICEF, New York, October 2021.

World mental health report: transforming mental health for all. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO

Zhang, A., Ye, M., Fu, Y., Yang, M., Luo, F., Yuan, J., and, Tao, Q. (2020). The Psychological Impact of the COVID-19 Pandemic on Teenagers in China, *Journal of Adolescent Health, 67(6)*, pp 747-755.Top of Form

Zhu, X.; Haegele, J.A.; Liu, H.; Yu, F. Academic Stress, Physical Activity, Sleep, and Mental Health among Chinese Adolescents. *Int. J. Environ. Res. Public Health 2021*, 18, 7257. https://doi.org/10.3390/ijerph18147257

Research Article

Cyber Etiquettes of Prospective Teachers: An Empirical Research

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Abstract

Cybercrime is a significant problem in cyberspace, but cyber etiquette empowers and helps users avoid it. This study was done with the prime objective of exploring the cyber etiquette of prospective teachers. The descriptive research method with the quantitative approach was adopted. 250 prospective teachers were selected randomly from the "Department of Education of the University of Delhi" and its Colleges. A standardized tool was administered to collect data. Concerning the data analysis, various statistical measures of descriptive and inferential statistics were applied. Raw scores were converted into the z-standard score to bring scores on a common standard scale and secure meaningful data interpretation. Mean, standard deviation, skewness, kurtosis, and standard errors were computed. The Shapiro-Wilk Test was applied to verify the normality. Independent t-tests and analysis of variance were applied to test the null hypothesis. The finding reveals that the majority of the prospective teachers had average-level cyber etiquette. Gender, types of family, habitat, and caste as factors were found to be significant factors in explaining the cyber etiquettes of prospective teachers, whereas stream could not create any variation.

Keywords: Cyber etiquette, Cybercrime, cyberspace, and social behaviour

Introduction

Digital technology is a rapidly growing domain of development. India has given a special focus on the development of digital technology. Digital technology has affected almost all domains of life and brought revolutionary changes in society. Although Digital Technology has numerous advantages, it is also a fact that Cybercrime has emerged as a challenge in society. "The share of cybercrime in India is bigger; more than 6 lakh complaints have been received regarding cybercrime, and 12776 FIRs have also been recorded", as reported by (the Home Ministry of India, 2021). Looking into the seriousness of Cybercrime in the country, the "Ministry of Home Affairs" (2022), in response to some questions in the Rajya Sabha, stated that various measures have been taken to control Cybercrime. "National Cyber Forensic Laboratory (NCFL)" has been set up. In addition, the "Indian Cyber Crime Coordination Centre" has also been set up to develop a good ecosystem, guidelines, and framework to deal with the cases of Cybercrime in the country. Most importantly, the "National Cyber Crime Reporting Portal" has also been launched to enable the public to register their cases regarding cybercrime, especially for women and children, which will automatically be routed to the concerned state or UTs for further enforcement of law and policies regarding Cybercrime. Further, the "Citizen Financial Cyber Fraud Reporting and Management System" is also functional for lodging online complaints in case of any financial fraud committed by any fraudster. For training purposes, various MOOC programs on Cybercrime have been developed through the "CyTrain portal" to build the capacity of various judicial and police officers. Despite legal provisions and policies, many cyber crimes can still be observed in society. Cyber laws, policies, acts, measures, etc., will work in their own way according to rules and regulations. However, there is a big question of cyber etiquette/morality, ethics, and values to reduce Cybercrime. The importance of cyber etiquette increases much more for prospective teachers because, directly or indirectly, the cyber behaviour of their students will be highly influenced by the cyber etiquette of prospective teachers in the future. Considering this, it is one of the basic needs to acquaint the prospective teachers to be the guiding light in this unforgiving and unsettled sea with the practical details of the virtual world. As per Oral (2023), "Digital platforms are not environments where freedoms are experienced unlimitedly and without rules. It should not be forgotten that only the environment is virtual, but the people are real." Further, "there are expected social, behavioural rules or "etiquettes" that are equally applicable to the virtual classroom to both teacher and students, which helps to regulate the classroom environment. These rules and regulations are termed Cyber etiquette or Netiquette (net+etiquette) and may be described as the informal guidelines for the users of the internet for acceptable online behaviour" (Kaynay, 2004). If anything is implemented forcefully by law, then it has the possibility that the effectiveness is not likely to be as expected or desired, whereas if the people of the society accept anything (cyber etiquette) unanimously with their conscience, then the possibility of sustaining that behaviour increases and be accepted effectively. Therefore, the lack of awareness about cyber etiquette may cause many negative consequences and make it difficult to avoid various cyber crimes such as phishing, hacking, fraud, theft, health risks, and illegal/unauthorized access to contents that are protected. The prospective teachers needed to be groomed in a manner that would allow them to use these cyber etiquette not only in the classroom but also everywhere in cyberspace. Shea (2015) emphasized, "Cyberspace is the mass consensual hallucination in which humans all over the planet meet, converse, and exchange information". Hence, a pre-service teacher must be well-versed in cyber etiquette related to email, group formation, texting apps, virtual meetings, and social media, as well as digital ethics and digital security. It will help to raise the awareness of pre-service teachers and their future students towards cyber ethics, data security, data theft, cyberbullying, and coping strategies (Gümüş, Çakır, & Korkmaz, 2023; Arslan, 2023). The increasing amalgamation of the internet in our day-to-day life, easy access to smartphones, and the popularity of social media presents an ideal environment for Cybercrime against children, who are the most avid and naïve segment of Internet users (Bele, Dimc, Rozman, & Jemec, 2014). A survey done by "Satyarthi Global Policy Institute for Children" (2023) on Cybercrime against children in India confirmed that the incidents of Cybercrime against children increased fifteen times in the last five years, and the irony is that only one per cent of cases ended in conviction listed in 2021 under the POCSO act. School-going children are vulnerable to various types of Cybercrime, such as cyberbullying, sexual abuse and exploitation, cyber blackmailing, grooming, sexting, cyberstalking, online trafficking, etc. Due to a lack of proper knowledge of cyber etiquette, the roots of Cybercrime are becoming deeper in cyberspace day by day, which leads to a decreasing possibility of being safer and good in cyberspace for others and safer and good for themselves. Hence, in the backdrop of all these examples and cases, there are big concerns and a lack of cyber etiquette. The findings of the previous research not only provide evidence about the dangerous outcomes of cybercrime and poor cyber etiquette but also the inconsistencies noticed in the findings, which are presented systematically below.

Literature Review

In the case of international research, high contradictions can be seen. As per the report of Pusey and Sadera (2011), teachers lack the ability and knowledge to teach different software and protective firewalls and different laws related to Cybercrime. At the same time, a study by Simanjuntak, Limbong, and Wardani (2023) claims that pre-service teachers acquired expertise in digital competencies but still lacked copyright and licensing issues. As per Milton, Giæver, Mifsud, Spain, and Gassó (2021), all the pre-service teacher respondents lack sufficient application knowledge of copyright and privacy rules in online setups. In addition, these students exhibit irresponsible behaviour toward posting images of friends on social media platforms. Regarding gender, there are inconsistencies and contradictions in the findings. In the case of the pre-service teachers, female participants exhibited more sensitivity towards cyberbullying and the danger posed by the Internet, while male participants were more knowledgeable in data security and digital ethics, as reported by (Gümüş, Çakır & Korkmaz, 2022; Yılmaz, Şahin, & Akbulut, 2016).

Similarly, Arslan and Aydin (2023) highlighted that female prospective teachers also possess higher cyberbullying coping knowledge than male teachers, but coping knowledge decreases with time spent on the internet. In contrast, Tarhan (2022) revealed that gender does not make any important difference in data security awareness. Similarly, Promsri, Chaigusin, and Tupmongkol (2019) found no notable variation in digital etiquette between male and female students. Likewise, Mehmet and Teker (2017) endorsed findings that male and female pre-service teachers were the same in the netiquettes. Concerning the knowledge of the netiquettes based on different subjects/programs, the contradictions in the findings also noticed as Iqbal, Hanif, Ali, Tahir, Minhas, Yasmeen, and Laique (2021) found that in-service teachers also lack the requisite knowledge of netiquette guidelines. Further, Gümüş, Çakır, and Korkmaz (2022) reported that the language, sports, and arts departments were better at digital data security than any other department. In contrast, Mehmet and Teker (2017) reported that foreign language pre-service teachers showed better netiquette behaviour than literature and physics programs. In addition, Mehmet and Teker (2017) reported that the netiquette behaviour of pre-service teachers increases with the grade level.

Regarding the type of Cybercrime and its adverse outcomes, researchers have dissimilar perspectives on their findings. Defamation and violence threats are the most common types, as investigated by (Näsi, Oksanen, Keipi & Räsänen, 2015), whereas internet theft and information sharing related to pornography, as reported by (Lu et al., 2006). Digital piracy, cyber harassment, and hacking as researched by (Donner, 2016). The study conducted by Näsi, Oksanen, Keipi, and Räsänen (2015) considers males at high risk of being cyberbullying victims as they are more active users. In contrast to this, Hutchings and Chua (2016) consider Cybercrime to be a male-dominated area. It is supported by Donner (2016) and Li (2006) that in the case of online harassment and digital piracy, more men were involved, whereas Park, Na, and Kim (2014) do not find any gender difference among bullying, victimization and witnessing online.

Further, regarding the metro cities, Näsi, Oksanen, Keipi, and Räsänen (2015) reported that those who live in big cities, are not very social, and have less interaction with parents, are more prone to Cybercrime. Park, Na, and Kim (2014) inferred that frequent communication with parents and involvement in only online studies supported good netiquette behaviour to keep a check on cyber victimization. Similarly, Weijer, Steve, and Leukfeldt (2017) found out that those who are emotionally unstable and more curious youngsters are more vulnerable to Cybercrime. Virtanen (2017) found out that those who are disadvantaged in economic status, low in self-confidence, and women were more fearful of Cybercrime. Similarly, in the case of secondary victimization, the fear intensifies more in victims of low socio-status, whereas it is equal in males and females. In contrast, Navarro (2015) presented the fact that cyberbullying was an extension of school bullying, and it was more for those children, especially males, who diverged from normal stereotypical gender identity.

Research studies that have been done on the international level are subject to different research methodologies and approaches, types of samples, subjectivity, and diversity in culture, environment, and location. All these factors reduce the possibility of generalizing the power of the above studies in the Indian context. However, these studies are helpful in understanding comprehensively the issues of cyber etiquette and Cybercrime on an international level.

Concerning the research gaps in the case of India, research on cyber etiquette is still scarce. Although research has been done on Cybercrime, there are contradictions. As per Dhar and Gayan (2022), the student teachers showed a shallow level of awareness about reference software, netiquette, copyright, etc, whereas regarding cybercrime awareness, no important variation occurs between male and female prospective teachers as investigated by (Shekhar & Nathyal, 2018; Sunder, 2018; Goel, 2014; Jha & Bhutia). In contrast, Kumaravelu (2018) established that female students possessed better awareness, whereas Kumar, Grewal, and Khosla (2021) found that male students have better cybercrime awareness. Whereas Rizal, Rusdiana, Setiawan, Siahaan, and Ridwan (2021) reported that in the case of digital literacy, male student teachers were found to be better than female student teachers, while those who have computers at home possessed better cybercrime awareness as supported by (Kumaravelu 2018; Bhutia, and Passah 2019; Jha & Bhutia, 2018). It shows inconsistent findings based on gender and indicates a lack of cyber etiquette. Further, concerning the stream of education, it is noticed that cybercrime awareness of science teachers was better than that of social science teachers (Sunder, 2018; Bhutia & Passah, 2019), whereas as per Jha and Bhutia (2018), teacher trainees in Mathematics exhibited favourable attitudes towards cyber resources.

In case of vulnerability to cyberbullying, women are more vulnerable, as reported by (Jain and Agrawal, 2020; Sandhu and Kaur 2017). In contrast, male participants are more cyberbullied than females as investigated by (Khawrin, 2022). Concerning perpetrators, Sandhu and Kaur (2022) provided evidence that those who are highly stressed, anxious, depressed, substance abuse, and antisocial behaviour are most likely to victimize others. Similarly, the findings of Kaur and Saini (2023) exhibit that victims of Cybercrime generally exhibit aggressiveness, depression, strained relationships, and substance abuse. Apart from this, the victims may often exhibit suicidal tendencies, as researched by (Maurya, Muhammad, Dhillon & Maurya 2022; Rao, Bansal, and Chandran 2018). Concerning the relationship between netiquette and age, the absence of agreement is also noticed because Ghatak (2013) investigated and reported no relationship between netiquette and age, but in contrast, there is evidence from the findings of Dhar and Gayan (2022) that age influences the literacy of net ethics. Similarly, a higher sense of digital etiquette was reported in students of higher age groups (Kumar & Raj, 2020). Hence, at the national level, findings are also contradictory.

Justification

Teacher training programs are the most effective and powerful means not only for creating prospective teachers but also for developing those futuristic teachers who will shape responsible citizens and good human beings. Teachers deeply influence students and are the most effective component of human development in society. It is the reason that this skill of the teachers gives them a special place and status in society. In the age of technology, student-teacher relationships are not limited to the school's boundary wall. They stay connected by the social media platform and observe the activities of each other. If a student observes negative behaviour or unethical activity of teachers in cyberspace. Under such circumstances, students will get negative motivation. Hence, it is very much necessary that prospective teachers have such cyber etiquettes that leave an ethical impact on their students to follow cyber etiquettes in cyberspace so that students may be inspired to display good cyber etiquettes in cyberspace. The good etiquette of the teachers served as a safeguard for their students to stay away from the world of Cybercrime and adopt good digital citizenship in the future. The importance of cyber etiquette increases much more when the "International Society for Technology in Education" (2018) recognizes cyber etiquette as an essential competency not only for the teacher but also for the students for good digital citizenship. Hence, considering the above logic and arguments, exploring the status of cyber etiquette among prospective teachers is very significant. Besides, the aforementioned study will also examine whether different variables like gender, habitat, stream, and cast are important factors in explaining or making cyber etiquettes high or low among prospective teachers. Hence, based on outcomes, various interventions may be designed to improve the cyber etiquette of prospective teachers.

Statement of the problem

Cyber Etiquettes of Prospective Teachers: An Empirical Research

Objectives

1. To study cyber etiquettes of prospective teachers
2. To study cyber etiquettes of prospective teachers concerning gender
3. To study cyber etiquettes of prospective teachers concerning types of families.
4. To study cyber etiquettes of prospective teachers concerning stream
5. To study cyber etiquettes of prospective teachers concerning cast.
6. To study cyber etiquettes of

prospective teachers concerning habitat.

Hypothesis

1. There is no significant difference in cyber etiquettes of male and female prospective teachers.
2. There is no significant difference in cyber etiquettes of prospective teachers of joint and nuclear families".
3. There is no significant difference in cyber etiquettes of art, science, and commerce prospective teachers.
4. There is no significant difference in cyber etiquettes of general, SC, ST, OBC, EWS, prospective teachers
5. There is no significant difference in cyber etiquettes of rural, urban, and metro prospective teachers.

Operational definitions

Prospective Teacher

"Prospective teacher refers to those students who registered themselves in the B.Ed program (pre-service teacher training) of the University of Delhi".

Cyber Etiquette

Cyber etiquette refers to those manners or attitudes toward digital technology that help avoid unethical activity in cyberspace.

Research method

As this research was descriptive, therefore, a descriptive research method was adopted with the quantitative approach.

Population

All the prospective teachers who registered themselves in the B.Ed. The program of the University of Delhi was the population of this study.

Sampling

250 prospective teachers were selected randomly from the "Department of Education, Central Institute of Education (CIE), University of Delhi", and its affiliated colleges. The composition of the sample is presented in the table 1

Table-1: Sample Structure

Category	Description	Sample Size	Total
Gender	Male	126	250
	Female	124	
Family	Joint Family	84	250
	Nuclear family	166	
Stream	Arts	127	250
	Commerce	46	
	Science	77	
Social Category	General	112	250
	OBC	65	
	SC	31	
	ST	15	
	EWS	27	

Category	Description	Sample Size	Total
Habitat/Locality	Metro	148	250
	Urban	67	
	Rural	35	

Collection of Data

Description of tool

Concerning the data collection, the Cyber Etiquette Scale developed and standardized by Santhosh and Thiyagu (2022) was applied. This scale has 50 items, which are distributed into three dimensions, namely "Privacy and confidentiality", "Piracy and Plagiarism", and "Integrity and Politeness" The extraction of these three dimensions was done through factor analysis. Before the extraction of the dimensions, the sampling adequacy was examined by the "Kaiser-Meyer-Olkin test" (KMO). The adequacy of intercorrelation was also verified by "Bartlett's Test of Sphericity". These three dimensions have a 33.956 per cent explained variance in total. Overall, this scale has 29 positive items and 21 negative items. The cyber etiquette scale is a four-point scale. Respondents can record their responses by marking any option of the choice like yes, to a great extent, yes, to a large extent, yes, to a small extent, and no, Not at all. A minimum of 50 and a maximum of 200 scores are possible on the cyber etiquette scale. A higher score indicates a higher status in cyber etiquette, whereas a lower score indicates a low level of cyber etiquette. The discrimination power of the scale was determined. For this purpose, the t-test was applied. Only those items were retained in the scale that had the significant value of the t-test. Those items that didn't have the significant value of the t-test were dropped from the scale. The index of reliability was determined by Cronbach's Alpha and split-half method. The reliability coefficient by Cronbach's Alpha was 0.889, whereas the reliability index by the split-half method was 0.839. Hence, it shows that this scale is highly reliable. Concerning the validity, it has content as well as face validity, which provides evidence that this is a valid scale for assessing the cyber etiquette of prospective teachers. The administration of the Cyber Etiquette scale was done in small groups of prospective teachers.

Statistical Analysis

For scientific data analysis, various measures of descriptive and inferential statistics were applied. Under descriptive statistics, the mean was computed to determine the central tendency of cyber etiquette scores. The mean was also used to detect the significant difference among the means through the t-test. Deviation among the scores from the mean was explored by standard deviation. Further, standard deviation was also used to determine the standard error of the means. For the testing of the normality of the data set, skewness and kurtosis were computed. The Shapiro-Wilk Test was also used to verify the data's normality. In inferential statistics, a t-test was used to map the significant difference between the two means of different groups of cyber etiquette, such as gender (male and female) and types of family (nuclear and joint family). An analysis of variance was also computed to test the significant difference among more than two means concerning different groups based on cyber etiquette, such as stream (Art, Science, and Commerce), social categories (general, OBC, SC, ST, and EVS), and locality (Metro, rural, and urban). A t-test and analysis of variance were used to test the null hypothesis.

Table-2: Cyber Etiquette of Prospective Teachers

Z-score Rage	Level of Category	Total
+ 2.01 & above	Extremely High	1.20%
+ 1.26 to + 2.00	High	9.20%
+ 0.51 to + 1.25	Above Average	20.80%
- 0.50 to + 0.50	Average	38.80%
-1.25 to -0.51	Below Average	18.40%
-2.00 to -1.26	Low	9.20%
-2.01 to below	Extremely Low	2.40%

Concerning the cyber etiquettes of the prospective teachers, as mentioned in Table 2, it is noticed that the maximum prospective teachers have an average level of 38.80 per cent cyber etiquettes. Further, there is not too much of a gap in the above-average and below average categories because 20.80 per cent of prospective teachers had above average, whereas 18.40 per cent of prospective teachers possessed below-average cyber etiquette. In addition, 9.20 per cent of prospective teachers reported high and low cyber etiquette, respectively. Data also indicates that a few prospective teachers had extremely high 1.20 per cent and extremely low 2.40 per cent cyber etiquette, respectively.

Table-3: Descriptive statistics of cyber etiquettes of prospective teachers

			Statistic	Std. Error
TOTAL	Mean		156.6000	.86629
	95% Confidence Interval for Mean	Lower Bound	154.8938	
		Upper Bound	158.3062	
	5% Trimmed Mean		156.7422	
	Median		157.0000	
	Variance		187.614	
	Std. Deviation		13.69724	
	Minimum		118.00	
	Maximum		194.00	
	Range		76.00	
	Interquartile Range		19.00	
	Skewness		-.143	.154
	Kurtosis		-.157	.307

As shown in Table 3, the computed value of the skewness is -.143, which means that there is negative skewness in the data set, but this skewness index is very near to the normal index of the skewness, i.e. (0). Similarly, the index of kurtosis is -.157, which implies that computed kurtosis is very close to the normal index of the kurtosis, i.e. (0.263). Although slight deviation occurs in the index of the skewness and kurtosis but both values are very close to their normal values. Further, If the computed values of the skewness and kurtosis are divided by their standard errors, then the value of the skewness and kurtosis will be (0.92 and 0.511) respectively, which also fall between the normal span of the normal probability curve, i.e. -1.96 to +1.96 because both values neither below -1.96 nor greater +1.96. In addition to it, the Shapiro-Wilk Test was also computed for testing the normality of the data set. The computer value of the Shapiro-Wilk Test was 0.996, which is larger than 0.05 and is desirable to be called the data set normal in the distribution, as indicated in Table 4. This trend is also confirmed by Figure 1, which indicates that data falls exactly on a straight line with a very slight deviation. Hence, after being fully satisfied with the condition of the normal distribution of the data set, various measures of inferential statistics were applied.

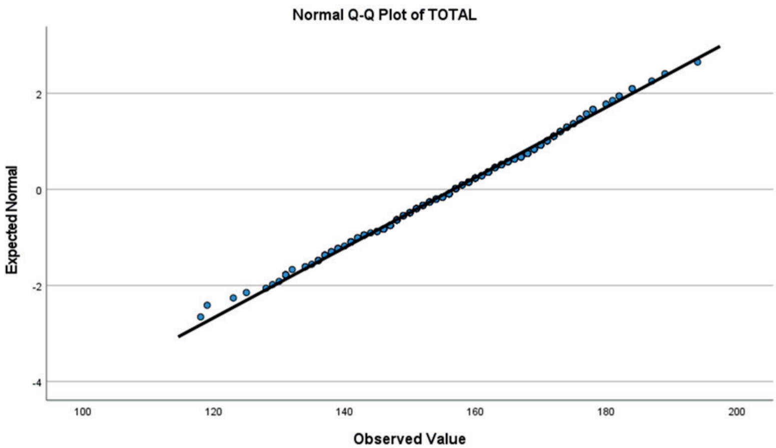

Figure-1:Normal Q-Q Plot of the Data Set

Table-4: Index of the Shapiro-Wilk Test

Statistic	Df	Sig.
.996	250	.831

Table-5: Group statistics and independent t-test of cyber etiquettes of male and female prospective-teachers

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
TOTAL	Male	126	153.7063	14.10536	1.25661
	Female	124	159.5403	12.66157	1.13704

Table-6: Independent t-test of cyber etiquettes of male and female prospective teachers

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
TOTAL	Equal variances assumed	1.284	.258	-3.440	248	<.001	<.001	-5.83397	1.69614	-9.17465	-2.49330
	Equal variances not assumed			-3.443	245.937	<.001	<.001	-5.83397	1.69467	-9.17190	-2.49605

As indicated in Table 5, it is evident that the standard deviations and means of cyber etiquettes of male and female prospective teachers are (14.10536, 12.66157) and (153.7063, 159.5403) respectively. The equal variance assumed (0.258) is desirable as the obtained value is non-significant, as mentioned in Table 6. Further, the computer value of the independent t-test is (3.440), which is significant at <.001 level of significance for the degree freedom of 248. Therefore, the Null hypothesis, "There is no significant difference in cyber etiquettes of male and female prospective teachers", is rejected because the mean value (159.5403) of the female prospective teacher is absolutely larger than the mean value (153.7063) of the male prospective teachers. Hence, it can be concluded that gender is the significant factor that creates the difference between the cyber etiquettes of the male and female teachers, which are in favour of the females. In other words, female prospective teachers have significantly higher cyber etiquette than male prospective teachers while they are in cyberspace.

Table-7: Group statistics of cyber etiquettes of prospective teachers of the joint and nuclear families

Group Statistics

	TypesofFamily	N	Mean	Std. Deviation	Std. Error Mean
TOTAL	Joint Family	84	152.9405	15.00229	1.63688
	Nuclear Family	166	158.4518	12.63500	.98067

Table-8: Independent t-test of cyber etiquettes of prospective teachers of the joint and nuclear families

"Independent Samples Test"											
		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
TOTAL	Equal variances assumed	2.7	0.102	-3.06	248	0.001	0.002	-5.5113	1.80411	-9.0647	-1.958
	Equal variances not assumed			-2.89	143.95	0.002	0.004	-5.5113	1.90817	-9.283	-1.7397

As demonstrated in Table 7, the standard deviations and means of cyber etiquette of prospective teachers of joint and nuclear families are (15.00229, 12.63500) and (152.9405, 158.4518), respectively. The desirability of the equal variance assumed (0.102) is fit as it is non-significant. Further, the calculated value of the independent t-test (3.055) is noteworthy at <.001 "level of significance" for the degree of freedom of 248, as indicated in Table 8. Therefore, the null hypothesis, "There is no significant difference in cyber etiquettes of prospective teachers of joint and nuclear families", is rejected. Hence, it can be concluded that the mean (158.4518) of prospective teachers of nuclear families is significantly greater than the mean (152.9405) of prospective teachers of joint families. In other words, the family as a factor is an important factor in generating the difference in the cyber etiquettes of joint and nuclear families prospective teachers, which is in favour of prospective teachers of nuclear families.

Table-9: Cyber etiquettes of art, science, and commerce prospective teachers.

ANOVA

TOTAL

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	221.397	2	110.698	.588	.556
Within Groups	46494.603	247	188.237		
Total	46716.000	249			

Concerning Table 9, the computed value of analysis variance is 0.588 which is not significant at 0.01 "level of significance for the degree of freedom" of (2, 247). Therefore, the null hypothesis, "There is no significant difference in cyber etiquettes of art, science, and commerce prospective teachers", is accepted, which means that the cyber etiquettes of Art, Science, and Commerce prospective teachers are the same. Further, stream as a factor could not create a significant variance in the cyber etiquettes of the prospective teachers. Therefore, the stream is not important in explaining the cyber etiquettes of prospective teachers.

Table-10: Descriptive statistics of cyber etiquettes of social categories.

Descriptives

TOTAL

					"95% Confidence Interval for Mean"			
	N	Mean	"Std. Deviation"	"Std. Error"	"Lower Bound"	"Upper Bound"	Minimum	Maximum
General	112	159.9911	13.89957	1.31339	157.3885	162.5936	123.00	194.00
O.B.C	65	154.4000	13.11583	1.62682	151.1501	157.6499	129.00	182.00
S.C.	31	155.0323	11.01358	1.97810	150.9924	159.0721	131.00	177.00
S.T.	15	152.3333	10.32104	2.66488	146.6177	158.0489	134.00	173.00
E.W.S.	27	152.0000	15.94220	3.06808	145.6935	158.3065	118.00	184.00
Total	250	156.6000	13.69724	.86629	154.8938	158.3062	118.00	194.00

Table-11: Cyber etiquettes of General, SC, OBC, ST, and EWS prospective teachers

ANOVA				
	"Sum of Squares"	df	Mean Square	F
"Between Groups"	2523.108	4	630.777	3.497
"Within Groups"	44192.892	245	180.379	
Total	46716.000	249		

As indicated in Tables 10 and 11, the statistics provide evidence that the computed analysis of variance is 3.497, "which is significant at 0.01 level of significance for the degree of freedom" (4, 249). Therefore, the null hypothesis, "There is no significant difference in cyber etiquettes of general, SC, ST, OBC, and EWS prospective teachers", is rejected and concludes that the four groups of prospective teachers that were developed on the ground of five social categories like general, SC, ST, OBC, and EWS, are not the same in their cyber etiquette and differ significantly. The significant variation is noticed based on the social categories, which makes social categories an important factor in explaining the cyber etiquettes of the prospective- teachers.

Table-12: Post-ANOVA Tukey test of cyber etiquettes of General, SC, OBC, ST, and EWS prospective teachers

"Multiple Comparisons"						"95% Confidence Interval"	
	(I) Caste	(J) Caste	"Mean Difference (I-J)"	"Std. Error"	Sig.	"Lower Bound"	"Upper Bound"
Tukey HSD	General	O.B.C	5.59107	2.09418	.061	-.1642	11.3463
		S.C.	4.95881	2.72566	.365	-2.5318	12.4495
		S.T.	7.65774	3.69267	.235	-2.4905	17.8059
		E.W.S.	7.99107*	2.87945	**.046**	.0778	15.9044
	O.B.C	General	-5.59107	2.09418	.061	-11.3463	.1642
		S.C.	-.63226	2.93151	1.000	-8.6886	7.4241
		S.T.	2.06667	3.84712	.983	-8.5060	12.6393
		E.W.S.	2.40000	3.07502	.936	-6.0508	10.8508
	S.C.	General	-4.95881	2.72566	.365	-12.4495	2.5318
		O.B.C	.63226	2.93151	1.000	-7.4241	8.6886
		S.T.	2.69892	4.22421	.969	-8.9101	14.3079
		E.W.S.	3.03226	3.53545	.912	-6.6839	12.7484
	S.T.	General	-7.65774	3.69267	.235	-17.8059	2.4905
		O.B.C	-2.06667	3.84712	.983	-12.6393	8.5060
		S.C.	-2.69892	4.22421	.969	-14.3079	8.9101
		E.W.S.	.33333	4.32504	1.000	-11.5528	12.2194
	E.W.S.	General	-7.99107*	2.87945	.046	-15.9044	-.0778
		O.B.C	-2.40000	3.07502	.936	-10.8508	6.0508
		S.C.	-3.03226	3.53545	.912	-12.7484	6.6839
		S.T.	-.33333	4.32504	1.000	-12.2194	11.5528

It shows from multiple comparisons and outcomes of the post-ANOVA Tukey Test, as mentioned in Table 12, that cyber etiquette of different social categories such as general and OBC, general and SC, general and ST, OBC and SC, OBC and ST, OBC and EWS, SC and ST, SC and EWS, ST, and EWS are identical because the means of each category are not significantly greater from means of each other. In contrast, the mean of the cyber etiquettes of prospective teachers (159.9911) of the general category is significantly greater than the mean (152.0000) of the EWS category prospective teachers, which implies that general category perspective teachers have better cyber etiquettes than EWS category prospective teachers. Another important thing is to notice. Although the means of cyber etiquettes are proportional to increase higher as indicated in Table 10. However, it is only significant in the case of the general and EWS categories.

Table-13: Descriptive Statistics of cyber etiquettes of metro, urban, and rural prospective teachers

Descriptives								
TOTAL								
					"95% Confidence Interval for Mean"			
	N	Mean	"Std. Deviation"	"Std. Error"	"Lower Bound"	"Upper Bound"	Minimum	Maximum
Metro	148	158.5608	13.74017	1.12943	156.3288	160.7928	125.00	194.00
Urban	67	154.6866	11.00580	1.34457	152.0020	157.3711	123.00	176.00
Rural	35	151.9714	16.63180	2.81129	146.2582	157.6847	118.00	187.00
Total	250	156.6000	13.69724	.86629	154.8938	158.3062	118.00	194.00

Table-14: Cyber etiquettes of metro, urban, and rural prospective teachers

ANOVA				
	"Sum of Squares"	df	"Mean Square"	F
"Between Groups"	1564.158	2	782.079	4.278
"Within Groups"	45151.842	247	182.801	
Total	46716.000	249		

It is noticed from Tables 13 and 14 that the determined value of analysis of variance is 4.278, which is "significant at 0.01 level of the significance for the degree freedom" (2, 247). Therefore, the null hypothesis, "There is no significant difference in cyber etiquettes of rural, urban, and metro prospective teachers", is rejected. This analysis indicates that the cyber etiquette of rural, urban, and metro prospective teachers is not the same, which implies that habitat is an important factor in explaining the cyber etiquette of prospective teachers because habitats create significant variation.

Table-15: Post-ANOVA Tukey test of Urban, Rural, and Metro prospective teachers

"Multiple Comparisons"							
						"95% Confidence Interval"	
	(I) Area	(J) Area	"Mean Difference (I-J)"	"Std. Error"	"Sig".	"Lower Bound"	"Upper Bound"
Tukey HSD	Metro	Urban	3.87424	1.99086	.128	-.8201	8.5685
		Rural	6.58938*	2.54126	.027	.5973	12.5815
	Urban	Metro	-3.87424	1.99086	.128	-8.5685	.8201
		Rural	2.71514	2.81980	.601	-3.9337	9.3640
	Rural	Metro	-6.58938*	2.54126	.027	-12.5815	-.5973
		Urban	-2.71514	2.81980	.601	-9.3640	3.9337

***. "The mean difference is significant at the 0.05 level".**

Concerning multiple comparisons post-ANOVA, the Tukey test was applied to detect significant variation among the means. The statistics, as reported in Table 15 that the cyber etiquettes of the prospective-teachers associated with metro and urban, urban, and rural were the same, as the means of these groups were not significantly greater than from each other. However, the mean value of rural (151.9714) prospective teachers was significantly less than the mean value of metro (158.5608) prospective teachers, which means that metro prospective teachers had better cyber etiquette than rural prospective teachers (refer to Tables 13 and 15). Hence, it can be concluded that habitat created a significant variance in the cyber etiquette of the prospective teachers, and it is important to explain cyber etiquette. In other words, It is noticed from Table 12 that the means from rural, urban to metro are proportional to increase, but variations in cyber etiquettes are important only for the prospective teachers of rural and metro areas.

Results

The following results are obtained:

- Prospective teachers neither possessed extremely high nor extremely low cyber etiquette. Maximum prospective teachers possessed a moderate level of cyber etiquette.
- Male prospective teachers had lower cyber etiquette than female prospective teachers. Therefore, the null hypothesis, "There is no significant difference in cyber etiquette of male and female prospective teachers", was rejected.
- Cyber etiquettes were found to be greater in prospective teachers of nuclear families than in joint families. Therefore, the null hypothesis, "There is no significant difference in cyber etiquettes of prospective teachers of joint and nuclear families", was rejected.
- In the background of streams like art, science, and commerce, prospective teachers found the same in their cyber etiquettes. Therefore, the null

hypothesis, "There is no significant difference in cyber etiquettes of art, science, and commerce prospective teachers", was retained.

- Based on different social categories like general, SC, ST, OBC, and EWS, prospective teachers were found to be significantly different in their cyber etiquettes. Therefore, the null hypothesis, "There is no significant difference in cyber etiquettes of general, SC, ST, OBC, EWS prospective teachers", was rejected. It was noticed from the group-wise comparison that general class prospective teachers possessed significantly greater cyber etiquettes than EWS prospective teachers, and the rest had similarities in their cyber etiquettes.
- Similarly, habitat also created variation in the cyber etiquettes of rural, urban, and metro prospective teachers. Therefore, the null hypothesis, "There is no significant difference in cyber etiquettes of rural, urban, and metro prospective teachers", is rejected. Metro prospective teachers possessed significantly better cyber etiquette than rural prospective teachers.

Conclusion

The analysis provides certain conclusions about the cyber etiquettes of prospective teachers. Gender, types of family, caste as a social category, and habitat are significant factors in explaining the cyber etiquettes of the prospective teachers because, based on these variables, there was significant variation noticed in the cyber etiquettes. However, based on academic streams like art, science, and commerce, no variation was found. Therefore, the stream is not an important factor in explaining the cyber etiquette of prospective teachers. Concerning the magnitude of the cyber etiquettes, the maximum prospective teachers had average-level cyber etiquettes, whereas very few prospective teachers possessed extremely high or extremely low cyber etiquettes.

Discussion

This study was carried out with the prime objective of exploring the cyber etiquettes of students- and teachers, and the findings provide great insights about the cyber etiquettes. Some research findings from the literature endorse the findings of this research, but on the other hand, some research is inconsistent with this research. It was found that female prospective teachers had better cyber etiquette than male prospective teachers. The probable reasons for such findings can be analyzed in the context of the accessibility of digital equipment, freedom, and opportunity for utilization and observation. In Indian society and culture, girls using mobile phones and being in cyberspace before marriage is seen as a risk factor. Due to such reasons, generally, not only family members but also known/nearest persons keep monitoring and vigilance about girls being in cyberspace, especially on social media. In addition, girls are expected to be more cultured and disciplined, whereas in the case of males, generally, they are less monitored and have more opportunity and time in cyberspace. Apart from this, males are more active users, as reported by (Näsi, Oksanen, Keipi, and Räsänen 2015). Hence, it may be the possible reason that all these factors cumulatively have made girls more conscious about cyber etiquette while they are in cyberspace. This research finding is inconsistent with the finding as reported by Mehmet and Teker (2017) that male and female pre-service teachers were the same in netiquette.

Similarly, Tarhan (2022) also reported that gender does not make any difference. However, male participants had more digital ethics as investigated by (Gümüş, Çakır & Korkmaz, 2022; Yılmaz, Şahin, & Akbulut, 2016). Further, the prospective teachers of the nuclear family had much better cyber etiquette than the joint families. There may be a probable reason for such a finding: Due to nuclear families, parents are more conscious not only about the careers of their sons and daughters but also more vigilant about their mobile internet usage and the adverse outcomes of cybercrime. It may also be that parents have been giving constant feedback and training about Cybercrime and being more ethical in cyberspace.

Further, different streams like art, science, and commerce could not make a difference in the cyber etiquette of the prospective teachers. This finding has contradiction with the finding of Mehmet and Teker (2017) who investigated that foreign language pre-service teachers showed better netiquette behavior than literature and physics programs which means that stream is the significant factor in creating the variation in the cyber etiquettes of the prospective teachers. Looking into the average level of cyber etiquette, it is suggested that the feasibility of the inclusion of cyber etiquette in the syllabus of the teacher training program should be explored so that proper training may be provided to secure the better development of good cyber etiquettes among prospective teachers.

References

Arslan, K., & Aydin, I. (2023). Cyberbullying: Senior Prospective Teachers' Coping Knowledge and Strategies. *Journal of Cybersecurity Education, Research and Practice*, 2023 (1). https://eric.ed.gov/?id=EJ1396061

Arunkumar, K., & Premalatha, T. (2021). Social Media: Do the Prospective Teachers Use it with Awareness? *i-Manager's Journal of Educational Technology*, *18*(3), 54-62. http://dx.doi.org/10.26634/jet.18.3.18277

Bele, J. L., Dimc, M., Rozman, D., & Jemec, A. S. (2014, Feb 28-Mar 2). *Raising Awareness of Cybercrime--The Use of Education as a Means of Prevention and Protection.* International Conference on Mobile Learning 2014, Madrid, Spain. https://eric.ed.gov/?id=ED557216

Bhutia, Y., & Passah, E. R. (2019). Cyber Crime Awareness among Student-Teacher of B. Ed in Relation to Internet Usage. *Learning Community-An International Journal of Educational and Social Development*, *10*(1), 17–27. Chicago. https://shorturl.at/epxP5

Brands, J., & Van Doorn, J. (2022). The measurement, intensity, and determinants of fear of Cybercrime: A systematic review. *Computers in Human Behavior*, *127*, 107082. https://doi.org/10.1016/j.chb.2021.107082

Dhar, P., & Gayan, M. A. (2022, Nov 17-19). *Academic Integrity, Information Use, and Information Literacy in the Digital Environment: A Study from An Ethical Use Perspective*[Paper Presentation]. 13th International CALIBER, BHU, Varanasi. http://ir.inflibnet.ac.in/handle/1944/2358

Donner, C. M. (2016). The Gender Gap and Cybercrime: An Examination of College Students' Online Offending. *Victims & Offenders, 11*(4), 556–577. https://doi.org/10.1080/15564886.2016.1173157

Ghatak, M. S. (2013). Netiquette: exploratory study of actual usage and agreed upon norms in India. *SCHOLARS WORLD-IRMJCR, 1*(3). Https://t.ly/8jywv

Goel, U. (2014). Awareness among B. Ed teacher training towards Cyber-crime-A Study.

Learning Community-An International Journal of Educational and Social Development, *5*(2and3), 107–117.http://dx.doi.org/10.5958/2231-458X.2014.00013.X

Gümüş, M. M., Çakır, R., & Korkmaz, Ö. (2023). Investigation of pre-service teachers' sensitivity to cyberbullying, perceptions of digital ethics, and awareness of digital data security. *Education and Information Technologies*, *28*(11), 14399-14421.https://doi.org/10.1007/s10639-023-11785-7

Herry, E., & Mulvey, K. L. (2022). Gender-based cyberbullying: Understanding expected bystander behaviour online. *Journal of Social Issues,* pp. 1–21. https://doi.org/10.1111/josi.12503

Home Ministry of India (2021) Press Information Bureau Government of India. https://www.mha.gov.in/sites/default/files/2022-09/MHAConsultativeCommittee_22122021%5B1%5D.pdf

Hutchings, A. & Chua, Y. T. (2017). Gendering Cybercrime. In Holt, T. J. (Ed.), *Cybercrime through an interdisciplinary lens* (pp. 167–188). Routledge. https://shorturl.at/fmxC4

International Society for Technology in Education (2018).Annual Report. https://cms-live-media.iste.org/www-root/PDF/ISTE%20Annual%20Report_2018_web_vf.pdf.

Iqbal, S., Hanif, R., Ali, F., Tahir, M., Minhas, R., Yasmeen, R., & Laique, T. (2021). Teachers' perceptions of netiquette practices by undergraduate dental students during online classes in the COVID-19 pandemic. *P J M H S*, *15*(12). https://doi.org/10.53350/pjmhs2115123498

Jain, S., & Agrawal, S. (2020). Perceived vulnerability of cyberbullying on social networking sites: effects of security measures, addiction, and self-disclosure*. Indian Growth and Development.* doi:10.1108/igdr-10-2019-0110

Jha, K. K., & Bhutia, Y. (2018). Attitude of B. Ed. Student Teachers towards using Cyber Resources. *International journal of science and research*, *8*(7). https://t.ly/wgXsX

Kaur, M., & Saini, M. (2023). Indian government initiatives on cyberbullying: A case study on cyberbullying in Indian higher education institutions. *Educ Inf Technol, 28,* 581–615. https://doi.org/10.1007/s10639-022-11168-4

Kayany, J. M. (2004). Internet Etiquette (Netiquette). *The Internet Encyclopedia.* https://shorturl.at/pADL2

Khawrin, M. K. (2022). An Assessment of Cyberbullying Behavior among Gujarat University Students in Relation to Gender, Age, and Internet Surfing. *IAHRW International Journal of Social Sciences Review*, *10*(4), 390–395.https://shorturl.at/equM1

Kozík, T., & Slivová, J. (2014). Netiquette in Electronic Communication. *International Journal of Engineering Pedagogy, 4*(3), 67. https://doi.org/10.3991/ijep.v4i3.3570

Kumar, H., & Raj, P. (2020). An indagation on experiences and awareness of digital footprint among pupils of higher education. *Acad Res Int*, *11*(3), 16-31. http://www.savap.org.pk/journals/ARInt./Vol.11(3)/ARInt.2020(11.3-03).pdf

Kumar, S., Grewal, & Khosla, M. (2021). Cyber Crime Awareness among Teacher Trainees. *IARJSET, pp. 8*, 471–473. DOI: 10.17148/IARJSET.2021.8683

Kumaravelu, G. (2018). Awareness of Cybercrime among b. ed teacher trainees in

Li, Q. (2006). *Cyberbullying in Schools. School Psychology International, 27(2), 157–170.* doi:10.1177/0143034306064547

Lu, C., Jen, W., Chang, W., & Chou, S. (2006). Cybercrime & cybercriminals: An overview of the Taiwan experience. *J. Comput.*, *1*(6), 11–18. http://www.jcomputers.us/vol1/jcp0106-02.pdf

Maurya, C., Muhammad, T., Dhillon, P., & Maurya, P. (2022). The effects of cyberbullying victimization on depression and suicidal ideation among adolescents and young adults: a three-year cohort study from India. *BMC psychiatry, 22*(1), 599. https://link.springer.com/article/10.1186/s12888-022-04238-x

Mehmet, K., & Teker, N. Identifying Pre-service Teachers' Netiquette Behaviors. *Bartın University Journal of Faculty of Education*, *6*(2), 749–769. https://dergipark.org.tr/en/download/article-file/315023

Milton, J., Giæver, T. H., Mifsud, L., Spain, *N.*, & Gassó, H. H. (2021). Awareness and knowledge of cyberethics: A study of pre-service teachers in Malta, Norway*ic Journal of Comparative and International Education (NJCIE), 5*(4), 18–37. https://doi.org/10.7577/njcie.4257

Ministry of Home Affairs (2022) Rajya Sabha Unstarred Question NO. 368 https://sansad.in/getFile/annex/257/AU368.pdf?source=pqars

Näsi, M., Oksanen, A., Keipi, T., & Räsänen, P. (2015). Cybercrime victimization among young people: a multi-nation study. *Journal of Scandinavian Studies in Criminology and Crime Prevention, 16(2), 203–210.* https://doi.org/10.1080/14043858.2015.1046640

Navarro, R. (2015). Gender Issues and Cyberbullying in Children and Adolescents: From Gender Differences to Gender Identity Measures.In Smith, P. K.(Ed.) *Cyberbullying Across the Globe, (pp. 35–61).* doi:10.1007/978-3-319-25552-1_2

Oral, U. (2023). Netiquette: fundamentals of etiquette in digital communication. *European Journal of Theoretical and Applied Sciences*, *1*(5), 833–847. https://doi.org/10.59324/ejtas.2023.1%285%29.70

Park, S., Na, E. Y., & Kim, E. (2014). The relationship between online activities, netiquette, and cyberbullying. *Children and Youth Services Review, 42,* 74–81*.* https://doi.org/10.1016/j.childyouth.2014.04.002

Promsri, C., Chaigusin, S., & Tupmongkol, T. (2019). Perceived Digital Etiquette Behaviors among College Students: Gender and Study Program Comparisons. *Cross Current Int J Peer Reviewed J Human Soc Sci, 5*(8), 250-254. https://www.saspublishers.com/media/articles/CCIJHSS_58_250-254.pdf

Pusey, P., & Sadera, W. A. (2011). Cyberethics, Cybersafety, and Cybersecurity. *Journal of Digital Learning in Teacher Education, 28*(2), 82–85*.* https://doi.org/10.1080/21532974.2011.10784684

Rao, T. S., Bansal, D., & Chandran, S. (2018). Cyberbullying: A virtual offence with real consequences. *Indian journal of psychiatry*, *60*(1), 3-5. https://rb.gy/qy5hab

Rizal, R., Rusdiana, D., Setiawan, W., Siahaan, P., & Ridwan, I. M. (2021, March). *Gender differences in digital literacy among prospective physics teachers. Journal of Physics: Conference Series.* doi:10.1088/1742-6596/1806/1/012004

Sandhu, D., Kaur, K. (2022). Cyberbullying and Online Negative Experiences of School and College Students in India. In: Sia, S.K., Crane, L.S., Jain, A.K., Bano, S. (Eds.), Understanding Psychology in the Context of Relationship, Community, Workplace and Culture. *Springer*. https://doi.org/10.1007/978-981-19-2693-8_8

Santhosh, T. and Thiyagu, K (2022). Cyber Etiquette Scale. National Psychological Corporation, Agra

Sardessai, N., Arti. A., Mclaughlin, B., & Sarge, M. A. (2021). Examining teachers' intentions to intervene: Formative research for school-based cyberbullying interventions in India. *Psychology in the Schools*, *58*(12), 2328-2344.**https://doi.org/10.1002/pits.22595**

Satyarthi Global Policy Institute for Children. (2023).*Entangled in the web: Cybercrimes against children in India.* https://satyarthi.org.in/wp-content/uploads/2023/04/Cyber-Crime-Report_F.pdf

Shea, V. (1994). *Netiquette*. Albion Books. http://www.albion.com/netiquette/corerules.html

Shekhar, C., & Nathyal, S., (2018). Cybercrime Awareness among B.Ed. Teacher Trainees. *Periodic research, 7*(1).

Simanjuntak, L. I. M. F., Limbong, E., & Wardani, I. (2023). The Pre-service Teachers' Experiences in Developing Digital Competences in Digital Literacies course. *E3L: Journal of English Teaching, Linguistics, and Literature*, *6*(1), 20-42.https://doi.org/10.30872/e3l.v6i1.2393

Sunder, P. (2018). A comparative study of the awareness of teachers towards Cybercrime. *International journal of advanced research and development*, *3*(1), 846–848. https://www.multidisciplinaryjournal.net/assets/archives/2018/vol3issue1/3-1-227-105.pdf

Tarhan, N. (2022). Digital Data Security awareness: A study with pharmacy students. *Fabad Journal of Pharmaceutical Sciences*, *47*(2), 193–200. https://dergipark.org.tr/tr/pub/fabadeczacilik/ issue/72155/1134564.

Virtanen, S. M. (2017). Fear of Cybercrime in Europe: Examining the Effects of Victimization and Vulnerabilities. *Psychiatry, Psychology and Law, 24(3), 323–338.* https://doi.org/10.1080/13218719.2017.1315785

Weijer, V., Steve, G. A., & Leukfeldt, E. R. (2017). *Big Five Personality Traits of Cybercrime Victims. Cyberpsychology, Behavior, and Social Networking, 20(7), 407–412.* doi:10.1089/cyber.2017.0028

Wong, P.T.P.(n.d.). *A Lifelong Search for Meaning: Lessons on Virtue, Grit, and Faith. http://www.drpaulwong.com/once-a-teacher-always-a-teacher/*

Yılmaz, E., Şahin, Y. L., & Akbulut, Y. (2016). Teachers' Digital Data Security Awareness. *Sakarya University Journal of Education*, *6*(2), 26–45. https://doi.org/10.19126/suje.29650

Zhang, X. H. (2010). *An Exploration of Student Teachers Interaction with On-line Activities, and Their Influence on Their Teaching Topics Such as Netiquette and Cyber-bullying: An Australian and Chinese Study* [Doctoral Thesis, Griffith University]. DSpace. http://hdl.handle.net/10072/367942

Research Article

ChatGPT and Social Science Research in Higher Education

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Abstract

In recent times, advancements in Artificial Intelligence (AI) have made promises for major technological developments. AI has broadened the scope of computer applications, which has expanded to understand real-world problems. ChatGPT, the artificial intelligence tool, has further gained popularity in a short span of time. In the field of education and research, ChatGPT is used widely as a tool to ease out prominent research tasks like the generation of problems, literature review, providing problem statements, etc. A large portion of the research community has been using this tool without any reasonable restriction or any mechanism of checks and balances, further fostering a threat of unethical research practices. However, is the usage of ChatGPT de-burdening researchers, or is it suppressing creativity? Will the usage of ChatGPT contribute to research in higher education, or will it be detrimental? This paper aims to understand the impact of ChatGPT on social science research in higher education. With the aim of understanding the concept of artificial intelligence and ChatGPT, this paper locates the potential challenges which are caused by using the chatbot in the field of education and research.

Keywords: Chat GPT, Artificial Intelligence, Social Science Research, Technological Intervention

Introduction

AI and ChatGPT are the current buzz in the world of technology which has the potential to affect every other domain of human life. Countries across the world are investing a lot in the development of artificial intelligence. ChatGPT has been rapidly growing as a tool to solve problems in the human world. It is the recent advancement in artificial intelligence which has caught attention because of its ability to understand human conversation and generate responses- this is termed generative AI.

The impact of ChatGPT on academic learning and higher education has been high. As it has been accused of being misused by the academic community. Some have also appreciated its intervention as an effective tool which aids in generating new research ideas and developing research outlines. However why is there a need to have tools to generate ideas? Is not research by default a method of arriving at the new? Especially in a discipline like social science, whose epistemological premise is thinking and creating. Paradoxically, rather than aiding researchers and academicians in the task of writing and research, ChatGPT can deprive them of understanding the essentials of the discipline. The confluence of ChatGPT and social science needs a deeper understanding as ChatGPT, apart from aiding, is altering the epistemology of the discipline. Therefore, this paper tries to understand the ChatGPT tool of artificial intelligence in the first section. In the second section, the paper analyses the impact of ChatGPT on social science education.

Research Objective

The objective of this paper is to understand the contours of artificial intelligence in order to distinguish between various types of artificial intelligence. The primary focus of the paper is on ChatGPT tool of artificial intelligence and how does it impact the academic discipline. Further investigating the impact of use and misuse of ChatGPT in social science research. A discipline whose foundation lies in generating ideas and perspective how is the chatbot impacting the nature of this discipline.

Methodology

The methodology used is qualitative in nature. Though qualitative research is an umbrella term for a range of strategies conducting inquiry that are aimed at discerning how human beings understand, experience, interpret and produce the social worlds, this article particularly maps how social science research itself is undergoing a magnitude of change through ChatGPT and the possible impact it may have. It is therefore exploratory on the one hand and critical and analytical on the other.

Literature Review

Prieto-Gutierrez, Juan-Jose & Segado-Boj, Francisco & França, Fabiana. (2023) in their article "Artificial Intelligence in Social Science: A Study Based on Bibliometrics Analysis. Human Technology" have argued the progression of artificial intelligence is inevitable through their analysis, they have observed that the impact of AI in the discipline of social science can improve quality of life and help institutions in dealing with global challenges by developing theories, bringing change in education, society, law, politics and thereby advancing economic growth in the country.

Sadiku, Fagbohungbe and Musa (2021) noted in their paper "Artificial intelligence (A.I.) in Social Sciences: A Primer" a fourfold application of AI on social science, which they outline as:

Explainable AI: This type of AI will be useful in arriving at definitions, concepts and theories. Generally, people lack the trust and confidence to believe in explanations which are generated by humans based on set data or small sample sizes. The use of AI in this field will be instrumental in generating definitions and explanations which can be universal in nature. The field of explanation AI is an under researched area which has potential for emerging as a lucrative research subject.

AI-assisted Peer Review: In the domain of social science research, peer review of the research work is a long and exhausting process. As there is an increase in demand for peer review due to the volume of submissions and the multiplicity of peer review journals. This arrangement often exerts pressure on the reviewer and subjects their review to scrutiny for being biased. The development of AI tools to assist the peer review process would help in fastening the process with a decreased risk of biases. The tool can provide authentication and help in gaining reliability and trust in the peer review process.

Human Behaviour: AI's access to large data sets can help in understanding human behaviour better. In the discipline of social science research, it can comprehend social interactions and map human behaviour in different social setting. The conclusion thereby made will to the best possible extent free from judgments and biases of any nature.

Human Labour: One of the major

criticisms of AI is that it can completely replace human labour and create large-scale unemployment. Well, definitely, it will be an alternative to human labour; nonetheless, it will generate new-age jobs and employment opportunities which will be free from manual work and reduced errors. AI will create opportunities in the field of technology and computers, which will be less physically and socially exploitative as compared to jobs based on manual labour.

Banerjee, Debraj, Souvik and Dey (2023), in “Role of ChatGPT on Social Science Research in Future Perspective”, have concluded about the advancement which can be brought by the artificial intelligence tool ChatGPT in social science research. As they observe that the tool can help in aiding the time-consuming yet crucial elements of research like locating research problems, summarizing research, comprehending literature review, data analysis, analysis of text, generating research questions and the like. Which can be instrumental to research, thereby simplifying the tedious tasks and making research student-friendly and less time-consuming.

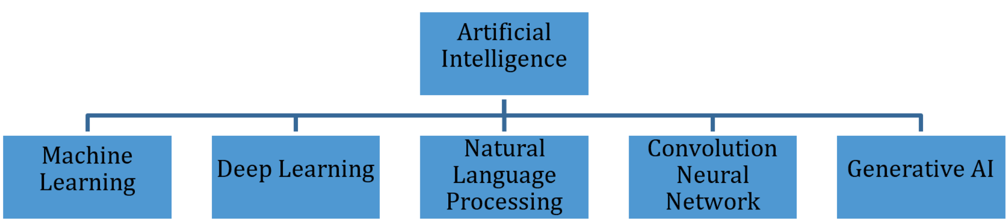
The literature cited above has understood the impact of Artificial intelligence and one of its tools, ChatGPT, as an enabler in doing social science research. They note that the progression of AI and, subsequently, ChatGPT would transform the way social science research is conducted, thereby creating a differential impact in the field of public policy, governance, development, society, etc. However, the given literature and research done in the domain of AI and social science research have yet not grasped the impact of AI tools on the nature of social science discipline. Social science, whose genesis is embedded in the field of critical thinking and creative analysis how will be impacted by the advancement of AI in this field. This shortcoming has generated a void in this field of inquiry; thus, this paper is an attempt to bridge this research gap.

Artificial Intelligence

Artificial intelligence (AI) is the byproduct of advancement of technology which marks the period of fourth industrial revolution. It is the branch of computer science which is advancing rapidly. Artificial Intelligence, unlike computer science, which progressed in digitization of work, aims to create machines which are intelligent, self-modulated and generative. This means the task of such machines would not be restricted to an input of command and output of result, but it will extend to thinking, analyzing, evaluating and thus producing a result which is suitable. Artificial intelligence poses a serious threat to human work and labour as through its capacity and intelligence; it might replace humans.

Types of Artificial Intelligence

Figure-1: Types of Artificial Intelligence



There are numerous types of AI; however, out of a huge list, there are five dominant types of AI, namely machine learning, deep learning, natural language processing, convolution neural network, and generative AI. Machine learning is a type of AI which uses an array of data sets to understand patterns and provide output. (Deng and Lin, 2022). Deep learning is a subset of machine learning, which means this category of AI is also dependent on data for generating results. However, deep learning is based on a neural network which compromises two or more layers. Natural language processing (NLP) is a type of AI which is based on the neural network model that uses algorithms to understand and generate human-like conversations. Neural networks basically replicate the structure of the human brain. Unlike deep learning, which has multiple layers, NLP comprises a web of networks (Deng and Lin, 2022). Convolutional neural networks (ConvNets or CNNs) using the neural network model have the capacity to be utilized for classification and computer vision tasks. Generative AI is the type of AI which can learn and update itself from existing data and algorithms. It does not repeat data but learns to update to provide accurate and relevant answers. Generative AI has the capacity for content like text, images, software code, graphic designs and the like. ChatGPT, which is the locus of this paper, cannot be categorised in any of the subtypes of artificial intelligence as it has some or the other features from each category. Moreover, ChatGPT should not be mistaken to be a type of AI but as an AI tool. The following section throws light on the nature of ChatGPT.

ChatGPT

ChatGPT (Chat Generative Pre-Trained Transformer) using natural language processing (NLP) was a tool developed by OpenAI. It is designed to generate human-like conversations by understanding the context of a conversation and generating appropriate responses. ChatGPT is based on a deep learning model called GPT-3 (Generative Pre-trained Transformer), which is trained on a large dataset of conversations. While ChatGPT is the tool with which human-like conversations can be made and understood by the machine, GPT-3 is the platform or the system upon which ChatGPT is based. ChatGPT is a variant of generative AI, which is different from normal AI. While normal AI requires datasets and algorithms to update from time to time, generative AI is self-learning and can update through learning from the available data sets.

ChatGPT is widely known for understanding human language and responding accordingly. It can take input in any language be it English, Spanish or Hindi. ChatGPT does not connect with a hyperlink but provide answer like it can write a letter, it can write a book on any given topic, it can write emails, short essay or even a thesis, generate music, debug software, create software, write codes and program and many other. Basically, it performs logical and reason-based task digitally to assist human world.

ChatGPT has claimed to make education accessible and interesting with the use of the tool; instead, it has been misused by students and the teaching fraternity for generating answers, assignments, making question papers, lesson plans and the like. Similarly, in the field of research, ChatGPT provides help by generating research problems, research gaps and research questions, which are the most time-consuming aspects of research; however, this intervention of the chatbot mares the sanctity of research. Especially with respect to social science research, which brings us to the last section of this paper, which is the impact of ChatGPT on social science research.

Methods in Social Science Research

Research in social science deals with-Sociology, History, Geography, Political Science, Economics, etc. and thus, all research based on these disciplines are social science research. Social science research can be historical, descriptive, exploratory, case study, experimental, comparative and textual. The two important tools to conduct social science research are- qualitative and quantitative. Where quantitative research specifies the type of research and techniques of data collection appropriate to the objectives of the project. Qualitative research is a tool for a detailed study of a social science subject. Through this tool, in-depth insight into real-life problems can be obtained. This type of research is not dependent on empirical findings but on normative data.

In social science research, whichever tool one uses, either qualitative or quantitative, there are set primary procedures to follow for finding the research gap, stating the hypothesis, locating the research problems/ questions, literature review, data collection, data analysis, hypothesis testing and thus conclusion. Each of these processes, whether it is a qualitative method of testing the hypothesis or a quantitative method, is equally important.

Chat GPT and Social Science Research

The relationship between technology, education and research is not new albeit it is modern. However, this relation in the latter case has impacted in both positive and negative ways. Talking about positive intervention, technology has enabled a method of creative pedagogy which is different from the traditional method of rote learning and classroom lectures. It has aided the usual teaching-learning process by providing pedagogical tools and providing creative learning outcomes (Rajendran, [1]2023).

Historically, computers have played a rather narrow role in social science, where statistical analysis was the most common application. Modern advancement in computer sciences has expanded the ambit of computation in the field of social science. Various research tools are now available for data collection and data analysis. Bibliographic retrieval, communications, instruction, and the graphic presentation of data and data modelling for all these advanced computer applications are available. However, all these developments aid in providing ease to mechanical tasks of social science. The key tasks of thinking, theorizing, conceptualization, or logical development of theories were not assigned to computers. (Drass, 1980)

Technological intervention, as claimed, made education accessible to people who are marginalized or for whom access to education is a problem. For instance, in case of the students who are especially abled, technology and its advancement has made education easy and accessible. Likewise in case of students in remote rural location the advent of technology has made education accessible. However, technology does not come without ill-effects there is a reverse side to the story of technological success. As pointed out by Henriksson and Karlsson, 2023 technology has disrupted education in two ways: one through the introduction of a learning management system in the 1990s and the second by Wikipedia.

Learning management systems (LMS) is a computer software which has been inspired from the concept of e-learning (Lafferty and Edwards, 2004). LMS platform are therefore managing courses, managing online assessments,

1 Rajendran, Madushan. (2023). Impact of Technology on Education.

giving feedback to the learners, and has enabled asynchronous education (Lafferty and Edwards, 2004; Al-Fraihat et al., 2020). Which enables access to education in the remotest parts of the country. E-learning gained popularity during the COVID-19 period as the entire education system shifted to e-learning platforms to continue with education during catastrophic situations. However, a model which was adopted during a health emergency faced by the world soon became the new normal. Online classes and education soon took over classroom lectures, and almost the entire education system has been dominated by LMS platforms. This domination by technology has rather been disabling. Firstly, adapting to e-learning platforms has not been easy, especially for teachers who have relied on traditional methods of teaching. Secondly, the availability of technology is one thing and accessibility of the same is another; not every household is equipped with computers or phones to enable e-learning, especially in India, where socio-economic diversities have been huge.

A second instance of disruption made by technology in the field of education has been with the advent of Wikipedia (Lafferty and Edwards, 2004). Wikipedia is an online free encyclopedia which is visited and the most cited encyclopedia on the internet. It is an open platform where all registered users can edit articles and add or delete information. This challenges the authenticity and reliability of the platform. However, since it is a widely used browser, its use in universities and schools have been rampant without any consideration of its validity. The paradox is that instead of resistance to the plagiarised content, it has gained popularity in the teaching-learning environment.

These are the two disruptions presented; nonetheless, another potential disruption in education is AI, majorly ChatGPT. Interestingly Artificial Intelligence (AI) has been considered one of the most effective tools for developing education globally. And the interest in the application of AI in higher education is gradually increasing. Hence, ChatGPT has created a huge roar in the academic community with both preachers and criticisers. ChatGPT, in its current operational form, has major intervention within the research domain. Apart from providing answers to questions, writing assignments and other academic work, the chatbot claims to generate new research ideas. It has been instrumental in accomplishing the primary yet crucial tasks of research like generating research gaps, writing problem statements, providing research questions and the like.

Agreeably, these primary tasks of research are the most time-consuming yet difficult part, but a solution like borrowing the same from a chatbot poses a serious threat to the entire community of research, especially social science research; in the preceding section, we shall see how. According to Richard Mason, 1986 AI-based innovations like that of ChatGPT pose serious ethical challenges in the field of research like Privacy, Accuracy, Property, and Accessibility.

Privacy is serious matter of concern with respect to ChatGPT which is largely data driven. The problem of data privacy is growing in research field. Meaning it has led to serious misuse of data and threat to the individual privacy.

Accuracy, the data which the chatbot uses to deliver results is not necessarily authentic or accurate. The data through which the chatbot is driven uses data quantitatively not qualitatively, as there are no filters to screen out inaccurate data. Hence overreliance on AI driven ChatGPT can be alarming.

Property is a serious ethical challenge with respect to AI-driven ChatGPT. The results which the Chatbot delivers has no credible sources as it is gathered from a large set of data available with multiple authors and owners. In case of inaccuracy, piracy or, for instance, any kind of misuse of the parent data, who should be held accountable? The chatbot, the data, the software creator, the original owner, or the platform provider. The issue of ownership of intellectual property is a matter of serious ethical challenge in the use of the chatbot.

Finally, Accessibility, with respect to data it is not available to everyone, thereby creating a divide between those who have information and those who do not. This characteristic of data is discriminating. As it might leave behind a section of data "have nots" who will be bereft of information and hence may be at a loss. Those who have the information could benefit in an unjust manner. Unless access to information is universal the issue of undue advantage of data will sustain (Mason, 1986).

Apart from these ethical challenges outlined by Mason (1986) there are certain discipline centric problems with respect to the use of ChatGPT in social science research which are the key findings of this paper. These challenges can be understood as follows: creative, originality and epistemological.

ChatGPT, with its features of generating research ideas can impact human creativity showcased in social science research. Being a part of the humanities discipline social science research relies on ideas which are creative and different (Bryman, 2016). Unlike scientific research, which deals with logical inquiry and where the focus is on finding solutions, social science research is not based on pure logic but the reason that leads to the generation of new ideas, new relationships and interconnectedness Heylighen (1997). If the chatbot helps in generating ideas then the philosophy of creativity in social science will be hampered. In social science research, the beginning of the problem, which is -the creation of ideas, is the primary yet crucial element of research.

Secondly, the Originality of research is another problematic domain of inquiry with respect to the use of ChatGPT in social science. ChatGPT can generate ideas, provide problem statements, introduce research gaps and conduct literature review (Dowling and Lucey, 2023). If ChatGPT can provide all this to the consumer for use, who should be credited, the consumer or the chatbot? Who claims the ownership of research, and thereby, who will claim the copyright of the result thus produced? In the entire field of research, originality is of utmost importance. If ideas are not original and unique, how can they be called research in the social science discipline?

The third challenge emerges with respect to Ontology: the emergence of theories in social science is a result of the creation and destruction of ideas (Bryman, 2016)). Either by methods of falsification as presented by Karl Popper or through a paradigm shift outlined by Thomas Kuhn. The premise of social science research is based on the process of understanding research gaps to find answers. The task of locating research gaps to writing a thesis is a creative research process in the domain of social science (Richardson, 2000). ChatGPT, through its feature of generating research ideas, has reduced important research components to the mechanized tasks. Locating a research gap makes the researcher aware of the shortcomings of the subject to which he/she is introduced with knowledge of the field, second literature review, as opposed to its mechanized understanding, is rather a creative yet intellectual exercise which builds the foundation of research, similarly generating problem statements. These elements are the very basis of the social science research. If these tasks are outsourced, then the purity and essence of social science will be seriously triggered. Thereby reducing it to a 'degree generating' exercise and not 'fact-finding' or 'creative-intellectual discourse.

Conclusion

Artificial Intelligence is a welcome development in the field of technology. Which has grabbed attention and keen interest from every field and industry. It promises to make tasks automated and supposedly provide ease to people. ChatGPT, the AI tool, is no less praised and widely used today by industry-specific personnel. However, in the realm of higher education and research, it poses a potential threat which can disturb the foundation of the discipline. It has ethical as well as epistemological challenges which can alter the core of social science research. Social science research is designed to not only provide answers to questions but also stimulate the creative-cognitive capacity of the individual. ChatGPT, without considerable checks and balances, will hamper the philosophy of social science research. ChatGPT needs a restriction as well as accountability for operation. Otherwise, unregulated usage of ChatGPT would generate content, which is not original but plagiarized, inaccurate and non-reliable. Ironically this kind of content will be widely used because it is easy and accessible. Thereby making the task of higher education and research go redundant and further replacing human originality and creativity with a chatbot.

Bibliography

Al-Fraihat, D. Joy, M and Sinclair, J. (2020). Evaluating E-learning Systems Success: An Empirical Study. *Computers in Human Behavior* (102): 67-86

Banerjee, Biplab and Paul, Debraj and Adhikari, Souvik and Dey, Samarjit. (2023). Role of ChatGPT on Social Science Research in Future Perspective: An Overview, October 12.

Bentley's. F. Arthur. (1978). Philosophy of Social Science, *American Journal of Political Science*, Aug, Vol. 22, No. 3

Brent, Edward. (1988). Is There a Role for Artificial Intelligence in Sociological Theorizing? *The American Sociologist*, Vol. 19, No. 2, pp. 158-166

Brodbeck, May. (1954). On the Philosophy of the Social Sciences. *Philosophy of Science*, Vol. 21, No. 2, pp. 140-156.

Bryman, A. (2016). *Social Research Methods*. Oxford University Press.

Deng, Jianyang and Yijia Lin. (2022). The Benefits and Challenges of ChatGPT: An Overview. *Frontiers in Computing and Intelligent Systems,* Vol. 2, No. 2

Dowling, Michael and Lucey, Brian. (2023). ChatGPT for (Finance) Research: The Bananarama Conjecture**.**

Drass, Kriss. (1980). The Analysis of Qualitative Data. *Urban Life* 9: 332-53.

Forsythe. E. Diana. (1993). Engineering Knowledge: The Construction of Knowledge in Artificial Intelligence. *Social Studies of Science*, Vol. 23, No. 3, pp. 445-477

Goller, Daniel, Christian Gschwendt and Stefan C. Wolter. (2023). "This Time It's Different"-Generative Artificial Intelligence and Occupational Choice. *Institute of Labor Economics*.

Harmon, Paul, and David King. (1985). Expert Systems: Artificial Intelligence in Business. Wiley.

10.7916/salt.v8i1.1498

Heylighen, F. (1993). Epistemology: Introduction.

Jen Hwang, Gwo and Nian-Shing Chen. (2003). Editorial Position Paper, *Educational Technology & Society*, Vol. 26, No. 2

Koertge. N. (1972). On Popper's Philosophy of Social Science. *Proceedings of the Biennial Meeting of the Philosophy of Science Association*, Vol. 1972. pp. 195-207

Lafferty, S., and Edwards, J. (2004). Disruptive Technologies: What Future Universities and Their Libraries? *Library management*, *25*(6/7): 252-258

Preston, Beth. (1993). Heidegger and Artificial Intelligence, *Philosophy and Phenomenological Research*, Vol. 53, No. 1, pp. 43-69

Prieto-Gutierrez, Juan-Jose & Segado-Boj, Francisco & França, Fabiana. (2023). Artificial Intelligence in Social Science: A Study Based on Bibliometrics Analysis. *Human Technology*. 19. 149-162.

Rajendran, Madushan. (2023). Impact of Technology on Education

Rich, Elaine. (1985). Artificial Intelligence and the Humanities, Computers. *The Humanities*. Vol. 19, No. 2, pp. 117-122

Richard, D. Mason. (1986). Four Ethical Issues of the Information Age. *MIS Quarterly 10(1)* 5.

Richardson, L. (2000). Evaluating ethnography*. Qualitative Inquiry*, 6(2), 253–255. https://doi.org/10.1177/107780040000600207

Sadiku, N.O Mathew, I. Fagbohungbe, and Sarhan M. Musa. (2021). Artificial intelligence (A.I.) in Social Sciences: A Primer. *International Journal of Engineering Research and Advanced Technology (IJERAT)*. Volume.7, Issue 4. April -2021

Shackter, Henriksson. Emilia and Marcus Åshage Karlsson. (2023), Race Against the Machine: Managing Disruption of Generative AI in Higher Education. Umea University.

Shimbori, Michiya. (1979). Sociology of Education, *International Review of Education*, Vol. 25, No. 2/3, pp. 393-413

Torshin, Ivan. (2023). Deep Learning for Natural Language Processing: Current Trends and Future Directions. 10.13140/RG.2.2.25409.53602.

Research Article

Exploring 21st Century Digital Literacy Skills among the Prospective Teachers for Holistic Learning

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Abstract

The research study presents the status of 21st century digital literacy skills among prospective teachers including media literacy, ICT literacy, and ability to access, assess, and share information. The investigations on the perception levels of digital literacy skills with the demography of prospective teachers, their gender, locality, educational qualification and specialized subject have highlighted. The reflection of prospective teachers on their teacher education curriculum emphasizing the techno-pedagogical integration, technology enabled hands on experiences opportunities and adaptability as per changing educational needs have also explored for holistic learning. Kerala, is being recognized as model state in the country effectively implementing the ICT curriculum for school education. As a sample for data collection, the 860 prospective teachers of five districts of northern part of Kerala have taken. The Multiple sources of data, including a Likert scale and a closed ended questionnaire have used to gather data. The various descriptive and inferential statistical techniques and tests such as independent sample t-test, ANOVA, and percentage analysis have used to calculate and interpret the obtained data. The findings revealed that the prospective teachers have an average level of digital literacy skills. It has also been reported that present curriculum for teacher education does not provide enough opportunity for fostering the digital literacy skills. The findings have also discussed in the light of the relevant literature.

Keywords: Digital literacy skills, prospective teachers, techno-pedagogy, ICT literacy, 21st century skills

Introduction

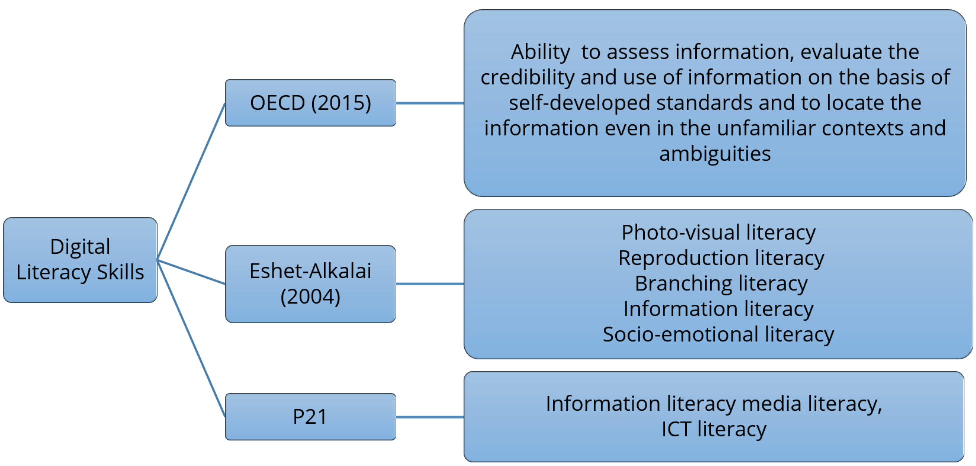
The National Education Policy 2020 recognises the need of optimizing the technological advantages and underlines the benefits of online/digital education. To address the present and future difficulties of delivering quality education for all, it is essential to optimize and expand existing digital platforms and ongoing ICT-based educational initiatives. In this context, it is essential to understand the perceptions of the future teachers about the digital literacy skills as it is one of the prominent skills enlisted in 21st century skills set. Technological proficiency is considered to be one of the key indicators of quality education in the prospective teaching-learning scenario (Maderick, Zhang, Hartley, & Marchand, 2015) and the quality of the teachers is assessed on the basis of their level of perception and degree of awareness of digital literacy skills and related competencies and extent to which they are easily integrate them into their classroom practices (Ata & Yıldırım, 2019). It is essential to investigate whether prospective teachers of the present time, even though they are all digital natives, do possess enough digital literacy skills and self-reliant in using technology in the classroom? (Li & Ranieri, 2010).

Therefore, the present study aims at investigating the very significant question that to what extent do prospective teachers possess digital literacy skill (Figure 1). To answer this question, it is necessary to check how far teacher education program really prepare the prospective teachers with these skills. This will help to understand whether there is any growing gap between essential teaching practices in the current classrooms and the application of digital tools by teachers. For this, the understanding the beliefs and attitudes of prospective teachers on digital literacy skills and its significance in the present education scenario is crucial (Partnership for 21st Century Skills; 2009).

Review of Literature

At present, there are only limited studies available to prove overarching information on digital skills of the prospective teachers. There are few selected of studies which investigated the levels and perceptions of digital competence of the teacher trainees (Alarcón, del Pilar-Jiménez, & Vicente-Yagüe, 2020; Gutiérrez-Porlán & Serrano-Sánchez, 2016; Lázaro-Cantabrana, Usart-Rodríguez, & Gisbert-Cervera, 2019) and few studies emphasized the relevance of integrating digital literacy skills in the curriculum of pre service teachers (Angeli & Valanides, 2009; Mishra & Kohler, 2006). The researches of Chai, Koh, & Tsai (2010); Finger, Jamieson-Proctor, & Albion (2010); Harris et al., (2009); Jang (2010); Mishra & Kohler (2006) examined the possession of various components of Technological Pedagogical Content Knowledge (TPACK) among the prospective teachers. It is also evident from the above studies that the teachers who are fresh appointed in the schools need to have both theoretical and practical knowledge of technology and possible means of integrating the educational technology into the curricular practices.

Figure-1: Meaning of Digital Literacy Skills



Rationale for the Present study

The success of teacher education program in the 21st century is depended on the achievement of producing digitally competent teachers and how far they are able to apply digital tools in their classrooms. The teacher training programs must focus on preparing the teacher trainees with digital literacy (Agyei & Voogt, 2011; Gudmundsdottir & Hatlevik, 2018). Research on the enhancement of digital competencies revealed that the teacher trainees feel that their teacher education programme inadequately and inefficiently integrated digital technologies (Instefjord & Munthe, 2017). Therefore, the present study aims at investigating the very significant question that to what extend do prospective teachers possess digital literacy skills. To answer this question, it is necessary to check how far teacher education program really prepare the prospective teachers with these skills. For exploring the answers, the following objectives were formulated and accordingly the hypotheses were framed:

1. To understand the status of 21st century digital literacy perception levels of prospective teachers?
2. To analyze if there exists any significant difference in the mean scores of digital literacy skills among prospective teachers based on their gender, locality, educational qualification and specialized subject
3. To understand the views and opinion of prospective teachers about current teacher education programme in preparing them with digital literacy skills?

Based on the above objectives, certain hypotheses were framed:

1. There is no significant difference in the mean scores of digital literacy skills among prospective teachers based on certain demographics (gender, educational qualifications, types of institution, locale)
2. There is no significant difference in the mean scores of digital literacy skills of prospective teachers belonging to various subjects.

Methodology

The present study adopted descriptive survey method to assess the status and issues of the digital literacy of the prospective teachers of Kerala. Being one of the recognized as model states in the country, Kerala effectively implement the ICT curriculum for school education and hence it is used as sample reference.

Participants

The survey involved 860 prospective teachers (male n=157 and female n= 703) from five districts of Northern part of Kerala who were enrolled in three state universities of Kerala and their affiliated teacher education colleges. Purposive sampling was carried out for the selection of the sample. There were 860 participants (male= 175 female=382; studying in government institutions= 359, private colleges= 501; Under Graduates = 274, Post Graduates= 586; living in urban areas= 463, rural= 397) who responded to the data collection tools during the data collection. The participants were all in the second semester of their course belonging to five subject specialization (N= Language= 146, Social Science=312, Mathematics= 126, Science=232, and Commerce=44).

Data collection tool

The researchers constructed Digital Literacy Scale based on the P21 Century Skills Framework and OECD framework of 21st Century Skills and was used for data collection. The Scale was prepared to cover three dimensions of digital literacy skills ("Information literacy", "Media Literacy" and "ICT Literacy"). Ten teachers who are expert in the area of ICT and educational technology were identified and asked to evaluate the scale and revisions were made on the items as per their guidance. It is a 5-point Likert-type scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The Cronbach's alpha was found to be .78 and ensured the content validity of the tool. A Questionnaire was also developed by the researchers to analyse the opinion of the prospective teachers related to their views and opinion about the teacher education programme that we have today in preparing and enabling them with digital literacy skills. The Questionnaire contains 10 items related to their views regarding how far the present mode of transaction of curriculum is enhancing digital literacy skills among them. The draft questionnaire was given to 10 subject experts and modified as per their corrections and modifications. The items and the responses of the participants (in percentage) are presented in Table 4.

Data analysis

Both descriptive and inferential analysis were carried out for the analysis and interpretation of the obtained data. The assumptions about the statistical analysis were tested before a analysis. In this context, the normality of the distributions of the responses were examined by calculating Skewness (.328) and kurtosis (.447) and since these values were in the ranges specified by George & Mallery (2010), it can be said that the normal distribution assumptions were met. To analyse prospective teachers' perception of digital literacy skills on the basis of various demographic variables, independent sample t-test and one-way ANOVA were applied.

Data Analysis and Interpretation

This section presents the major findings of the study on the existing level of digital literacy skills among prospective teachers and whether those skills significantly differ on the basis of gender, type of institution, subject specialization, locality, and educational qualifications. Hence the collected data are analysed as per the objectives and hypotheses constructed for the study.

What are the perceived levels of digital literacy among prospective teachers?

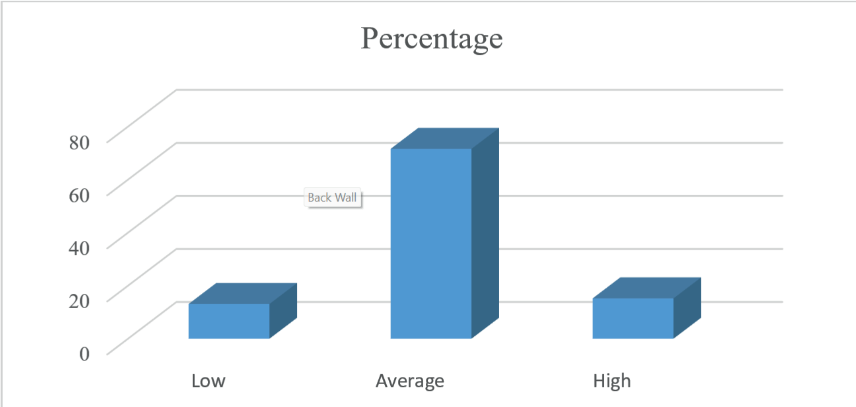
The obtained data have been analyzed by using frequency and percentage and the result is presented as Table 1.

Table-1: Digital Literacy Level of Prospective Teachers

	Frequency	Percentage
Low	113	13.1
Average	616	71.6
High	131	15.2
Total	860	100

Table 1 as well as Figure 2 indicate the digital literacy skills level of prospective teachers. From the Table 1, it is evident that the 13.1 per cent of prospective teachers have a low level of digital literacy skills, 71.6 per cent have average and 15.2 per cent have high level of digital literacy skills.

Figure-2: Digital Literacy Level of Prospective Teachers



Does the perception of digital literacy of the prospective teachers vary by their demographics?

To check whether mean scores of digital literacy skills differ among the prospective teachers based on their gender, type of institution they have enrolled, subject of specialization in their teacher education programme, locality they reside, and educational qualifications, hypothesis was formulated as there exists no significant difference in the mean scores of digital literacy skills among prospective teachers based on certain demographics. Independent sample t-test was carried out for the mean difference analysis and .01 levels of significance was fixed. The result is presented in Table 2.

Table-2: t-test Results of mean scores of Digital Literacy skills among Prospective teachers on Selected Demographic Variables

Variables	Group	N	Mean	SD	df	t	p	Remarks
Gender	Male	157	96.06	9.41	858	1.21	0.22	Not Significant
	Female	703	95.15	8.26				$p > 0.05$
Educational Qualification	UG	274	95.62	8.03	858	1.53	0.12	Not Significant
	PG	586	94.67	9.36				$p > 0.05$
Locale	Urban	463	95.44	8.89	858	0.47	0.63	Not Significant
	Rural	397	95.17	7.99				$p > 0.05$
Type of Institution	Govt.	359	95.70	8.35	858	1.11	0.26	Not Significant
	Private	501	95.05	8.58				$p > 0.05$

From the Table 2, it is found that mean scores of the prospective teachers for digital literacy skills on the basis of gender were 96.06 and 95.15 for male and female respectively. Furthermore, the independent sample 't' test value was 1.21 with the '*p*' value 0.22 which was not significant at 0.05 level of significance. Hence it is found that "there was no significant difference between male (*M*=96.06, *SD*=9.41) and female (*M*=95.15, *SD*=8.26) prospective teachers' scores of digital literacy skills *t* (858) =1.21, *p*=0.22". Furthermore, the mean scores of the prospective teachers for digital literacy skills on the basis of educational qualifications were 95.62 and 94.67 for undergraduates and postgraduates respectively. Furthermore, the independent sample 't' test value was 1.53 with the '*p*' value 0.12 which was not significant at 0.05 level of significance. Hence it is found that "there was no significant difference between undergraduates (*M*=95.62 *SD*=8.03) and postgraduates (*M*=94.67, *SD*=9.36) prospective teachers' scores of digital literacy skills *t* (858) =1.53, *p*=0.12". In the similar fashion, mean scores of the prospective teachers for digital literacy skills on the basis of locality were found to be 95.44 and 95.17 for urban and rural respectively. Furthermore, the independent sample 't' test value was 0.47 with the '*p*' value 0.63 which was not significant at 0.05 level of significance. Hence it is found that "there was no significant difference between urban (*M*=95.44, *SD*=8.89) and rural (*M*= 95.17, *SD*=7.99) prospective teachers' scores of digital literacy skills *t* (858) =0.47, *p*=0.63". Again, the mean scores of the prospective teachers for digital literacy skills on the basis of type of institution were found to be 95.70 and 9.05 for government and private institutions respectively. Furthermore, the independent sample 't' test value was 1.11 with the '*p*' value 0.26 which was not significant at 0.05 level of significance. Hence it is found that "there was no significant difference between government (*M*=95.70 *SD*=8.35) and private (*M*= 95.05, *SD*=8.58) prospective teachers' scores of digital literacy skills *t* (858) =1.11, *p*=0.26".

To find out whether there is any difference in the perception of digital literacy skills among the prospective teachers based on the subjects they have opted in their teacher education course, the hypothesis was formulated as there exists no significant difference in the mean scores of digital literacy skills among prospective teachers based on Subjects. Hence, to check whether the prospective teachers who have opted for Commerce, Languages, Mathematics, Science, and Social Science differ significantly in terms of mean scores of digital literacy skills, One-Way Analysis of Variance was applied and results are presented in Table 3.

Table-3: ANOVA test of Digital Literacy Skills and Subject Specialization of prospective Teachers

Sources of Variance	Sum of squares	df	Mean Square	F	Level of Significance
Between groups	443.728	4	110.93	1.54	.18
Within groups	61458.97	855	71.88		
Total	61902.70	859			

As shown in Table 3, the mean scores of perceptions of digital literacy skills prospective teachers belonging to various subjects opted such as Commerce, Languages, Mathematics, Science, and Social Science were compared using one-way ANOVA. The F (4, 855) = 1.543, p> .05, which is statistically not significant at 0.05 level. This suggested that there is no significant difference in the mean scores of digital literacy skills of prospective teachers belonging to various subjects.

How Far the Present Modes of Curriculum Transaction Enhance Digital Literacy Skills?

The investigators tried to identify how far the present modes of transaction is effective for enhancing digital literacy skills. The details are given below in Table 3.

Table-4: Percentage of Responses of Prospective Teachers for the Analysis of How Far the Present Modes of Transaction Effective for Developing Digital Literacy Skills

Sl.No.	Items	Yes (%)	No (%)
1.	Does the syllabus encourage the student to learn with the help of digital technology?	46	54
2.	Does the transaction mode create an atmosphere for e-learning in your classroom?	42	58
3.	Do you think that the present modes of transaction enhance the level of digital skills in the prospective teachers?	38	62
4.	Do the you able to apply various ICT tools and techniques used in today's classrooms?	57	53
5.	Do you get enough support from the teachers for making any ICT tools/ e-resources for learning	35	65
6.	Do you encourage others to make e-resources?	62	38
7.	Do the students get the opportunity to show their digital literacy Skills during classroom transaction?	51	49
8.	Do you think that whether the prospective teachers receive enough preparation for developing digital literacy skills through the syllabus?	55	45
9.	Do you think that teacher education curriculum stresses only the acquisition of specific facts, ideas, concepts related to teaching?	44	56
10.	Does the teacher education curriculum of your university provide activities for improving the digital literacy skills?	35	65

The feedback and the responses of the prospective teachers on the items in the questionnaire reveal that only 46 per cent were of the opinion that the syllabus encourages students to learn with the help of digital technology. Only 42 per cent of the teachers opinioned that the transaction modes create an atmosphere for e-learning in their classroom. Only 38 per cent of the prospective teachers think that the present modes of transaction enhance the level of digital skills in the prospective teachers. About 57 per cent of the prospective teachers opinioned that they are able to apply various ICT tools and techniques used in classrooms. Only 35 per cent of the prospective teachers opinioned that they get enough support from the teachers for making any ICT tools/ e-resources for learning. Around 62 per cent prospective-teachers opinioned that they encourage others to make e-resources and 51 per cent were of the opinion that they get the opportunity to show their digital literacy skills during classroom transaction. About 55 per cent of the prospective teachers feel that they receive enough preparation for developing digital literacy skills through the syllabus. Only 44 per cent of the prospective teachers feel that teacher education curriculum stresses only the acquisition of specific facts, ideas, concepts related to teaching. Around 35 per cent of the prospective teachers were of the opinion that teacher education curriculum of your university provides activities for improving the digital literacy skills.

Discussion and Recommendations

The results showed that the digital skills of the prospective teachers is average and they do have an average level of opinion about the current teacher education curriculum in enhancing digital competence. The present study also correlated with the literature stating that there is general view among the prospective teachers that they do have a low level of competence in the areas of digital literacy skill (Gutiérrez-Porlán & Serrano-Sánchez, 2016; Hinojo- Lucena et al., 2019). Unlike the studies of Keskin & Yazar (2015); Esteve-Mon et al. (2020); Casillas-Martín et al., (2019), and Guillén-Gámez et al. (2020), the present study state that there is no significant difference in the perception level of digital literacy skills among the prospective male and female teachers. It is, may be, and due to the equal educational and technological opportunity received by the students of Kerala irrespective of their gender.

The study recommends following suggestions and for enhancing the digital literacy skills of prospective teachers;

- The digital competency is a set of skills which need to be developed at early age and fostered throughout life. For providing the relevant training during the teacher education programme, the curriculum must encourage to learn with the help of digital technology.
- Along with the theory, the transaction mode must create an atmosphere for e-learning for fostering digital literacy skills of prospective teachers.
- Although, study reveals equal digital literacy levels among the prospective teachers in spite of their gender, educational qualifications, type of institutions they study, and the subject of specialization, the technology must be integrated contextually.
- There must be instructional strategies for the transaction of teacher education program which may develop the digital competency among prospective teachers.
- The educational planners and policy makers should make digital literacy skills as part of the requirements for teachers' employment at all levels and curriculum planners must make it as point to consider digital literacy into every subject in the curriculum at teacher education curriculum.
- There must be continuous training programme, workshops, and awareness programmes arranged for prospective teachers on digital literacy to understand and update digital competency among them.

Conclusion

Digital literacy skill is of great demand and an essential requirement for the present century education. Educationists who are interested in digital technologies have pointed the significance of using the potential of digital competency in the classroom practices in the 21st century. It is revealed from the findings that prospective teachers have an average level of digital literacy skills; however, it was observed in the questionnaire that they do have an average level of opinion about the curriculum transaction mode for enhancing digital competency among the prospective teachers.

References

Agyei, D. D., & Voogt, J. M. (2011). Exploring the potential of the will, skill, and tool model in Ghana: Predicting prospective and practicing teachers' use of technology. *Computers & Education*, 56(1), 91–100. https://doi.org/10.1016/j.compedu.2010.08.017.

Alarcón, R., del Pilar-Jiménez, E., & Vicente-Yagüe, M. I. (2020). Development and validation of the DIGIGLO, a tool for assessing the digital competence of educators. *British Journal of Educational Technology*. http://doi.org/10.1111/bjet.12919

American Library Association (1989). *Presidential committee on information literacy*: Final report. Available at http://www.ala.org/ala/mgrps/divs/acrl/publications/whitepapers/ALA

Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT–TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education*, 52(1), 154–168. https://doi.org/10.1016/j.compedu.2008.07.006

Chai, C. S., Koh, J. H. L., & Tsai, C. (2010). Facilitating preservice teachers' development of technological, pedagogical, and content knowledge (TPACK). *Journal of Educational Technology & Society*, 13(4), 63–73.

Eshet-Alkalai, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia*, 13(1), 93–106. https://www.learntechlib.org/primary/p/4793/.

Esteve-Mon, F. M., Ángeles Llopis, & Adell-Segura, J. (2020). Digital Competence and Computational Thinking of Student Teachers. International Journal of Emerging Technologies in Learn- ing (iJET), 15(02), 29–29. https://doi.org/10.3991/ijet.v15i02.11588

Finger, G., Jamieson-Proctor, R., & Albion, P. (2010). Beyond pedagogical content knowledge: The importance of TPACK for informing prospective teacher education in Australia. In N. Reynolds & M. Turgsanyi-Szabo (Eds.), *Key competencies in the knowledge society* (pp. 114–125). New York, NY: Springer.

George, D. & Mallery, M. (2010). SPSS for Windows Step by Step: A Simple Guide and Reference, 17.0 update (10a ed.) Boston: Pearson.

Guillén-Gámez et al. (2020). Analysis of Teachers' Pedagogical Digital Competence: Identification of Factors Predicting Their Acquisition. *Technology, Knowledge and Learning*, 1–18. https://doi.org/10.1007/s10758-019-09432-7

Gutiérrez-Porlán, J., & Serrano-Sánchez, J. L. (2016). Evaluation and development of digital compe- tence in future primary school teachers at the University of Murcia. *Journal of New Approaches in Educational Research,* 5(1), 51–56. https://doi.org/10.7821/naer.2016.1.152

Gutiérrez-Porlán, J., & Serrano-Sánchez, J. L. (2016). Evaluation and development of digital competence in future primary school teachers at the University of Murcia. *Journal of New Approaches in Educational Research*, 5(1), 51–56. https://doi.org/10.7821/naer.2016.1.152

Harris, J. et al. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education*, 41(4), 393–416.

Hinojo-Lucena, F. J., Aznar-Díaz, I., Cáceres-Reche, M. P., Trujillo-Torres, J. M., & Romero-Rodríguez, J. M. (2019). Factors Influencing the Development of Digital Competence in

Teachers: Analysis of the Teaching Staff of Permanent Education Centres. IEEE Access, 7, 178744–178752. http://doi.org/10.1109/ACCESS.2019.2957438

Instefjord, E. J., & Munthe, E. (2017). Educating digitally competent teachers: A study of integration of professional digital competence in teacher education. *Teaching and Teacher Education*, 67, 37–45. https://doi.org/10.1016/j.tate.2017.05.016.

Jang, S. (2010). Integrating the interactive whiteboard and peer coaching to develop the TPACK of secondary science teachers. *Computers & Education*, 55(4), 1744–1751.

Keskin, İ., & Yazar, T. (2015). Examining digital competence of teachers within the context of lifelong learning based on of the twenty-first century skills. *International Journal of Human Sciences*, 12(2), 1691–1691. https://doi.org/10.14687/ijhs.v12i2.3503

Lázaro-Cantabrana, J. L., Usart-Rodríguez, M., & Gisbert-Cervera, M. (2019). Assessing Teacher Digital Competence: the Construction of an Instrument for Measuring the Knowledge of Pre- Service Teachers. *Journal of New Approaches in Educational Research*, 8(1), 73–78. https://doi.org/10.7821/naer.2019.1.370

Li, Y., & Ranieri, M. (2010). Are 'digital natives' really digitally competent?-A study on Chinese teenagers. *British Journal of Educational Technology*, 41(6), 1029–1042. https://doi.org/10.1111/j.1467-8535.2009.01053.x

Maderick, J. A., Zhang, S., Hartley, K., & Marchand, G. (2015). Prospective Teachers and Self-Assessing Digital Competence. *Journal of Educational Computing Research*, 54(3), 326–351. https://doi.org/10.1177/0735633115620432

Ministry of Education. (2020*). National Education Policy 2020*. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Mishra, P., & Koehler, M. J. (2006). Technological edagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054.

Napal-Fraile, M., Peñalva-Vélez, A., & Mendióroz-Lacambra, A. (2018). Development of Digital Competence in Secondary Education Teachers' Training. *Education Sciences*, 8(3), 104–104. https://doi.org/10.3390/educsci8030104

Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education*, 59(3), 1065–1078. https://doi.org/10.1016/j.compedu.2012.04.016.

OECD. (2015). Students, computers, and learning: Making the connection. PISA: OECD Publishing. https://doi.org/10.1787/9789264239555-en. Retrieved from. List. A, Brante. E.W, & Klee H.L. (2019). A framework of prospective teachers' conceptions about digital literacy: Comparing the United States and Sweden. *Computers & Education*. 148. Pp. 1-20. doi.org/10.1016/j.compedu.2019.103788

Organisation of Economic Cooperation and Development [OECD]. (2017). Do new teachers feel prepared for teaching?, Teaching in Focus (Vol. 17). Paris: OECD Publishing. https://doi.org/10.1787/980bf07d-en.

Partnership for 21st Century Skills. (2009). Framework for 21stcentury learning. http://www.p21.org/documents/P21_FrameworkDefinitions.pdf

Research Article

Echoes of Change: 10 Bagless Days in a Technology-rich Educational Landscape

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Abstract

The education system is currently undergoing a series of reforms aimed at making education more meaningful, enjoyable, and experiential. The National Education Policy (NEP)-2020, a new policy concerning education, has provided numerous recommendations to enhance the quality of education, starting from the foundational level to higher education. One such recommendation is the introduction of 10 bagless days in schools for students in grades 6th to 8th. Students today are using technology to the optimum and have a great dependence on gadgets, too. During these days, students are encouraged to explore various vocational fields by interacting with local experts such as craftsmen, carpenters, gardeners, potters, and artists and explore various emerging avenues in the field of technology. Since the implementation of NEP-2020 is still in its early stages, it is important to gauge the knowledge and awareness of educational stakeholders regarding the concept of 10 bagless days. Therefore, the researchers aimed to gather opinions, thoughts, suggestions, and recommendations from these stakeholders to facilitate the implementation of this new initiative. In this process, the technology aided in reaching the stakeholders, including teachers and students, and getting their responses within the stipulated time. This paper focuses on discussing the concept of bagless days, the activities associated with them, the role of emerging technologies in 10-bagless days, the benefits of implementing bagless days in schools, and the potential limitations.

Keywords: 10 Bagless Days, Bagless schools, schools without bags, opinion of stakeholders.

Introduction

With the advancement of knowledge, the education system is also getting advanced and with time more focus is given to quality education rather than just teaching. National Education Policy (NEP)-2020 has given many recommendations to improve the quality of education at each educational level. It was already recommended in previous policies and various research to reduce the weight of the bag. Yashpal committee gave major emphasis on reducing the bag load from the students' shoulders. The NEP-2020 also recommended making suitable changes in curriculum and pedagogy to significantly reduce the weight of school bags and textbooks (NEP-2020, Para 4.33). The National Education Policy (NEP) 2020 also aims to overcome the social status hierarchy associated with vocational education and requires the integration of vocational education programmes into mainstream education in all educational institutions in a phased manner (PSSCIVE, 2022). In this line, the NEP-2020 has recommended 10 bagless days. According to the NEP-2020, every student should take a fun course during class 6th-8th, the purpose of which is to provide hands-on experiences in vocational crafts, like carpentry, electric work, metal work, gardening, pottery making, etc. These vocational experiences are according to the locally available vocations, that will keep the heritage of different Indian states and transfer the knowledge of folk culture to the next generation. The NEP-2020 also recommend preparing a centralized practice-based curriculum, which can be modified and adopted by the schools according to the state and local community and their skilling requirements. These 10 bagless days should be continued periodically throughout the year from 6th to 8th classes, holidays periods can also be used for this purpose. In these 10 bagless days, visits to places/ monuments of historical, cultural and tourist importance, meeting local artists and craftsmen and visits to higher educational institutions in their village/ Tehsil/District/State can be conducted (NEP-2020, Para 4.26).

As knowledge continues to advance, so does the evolution of the education system, which increasingly emphasizes quality education rather than mere instruction. The National Education Policy (NEP)-2020 has put forth numerous recommendations to enhance the quality of education across all levels of learning. Previous policies and committees, such as the Yashpal committee, have already stressed the importance of reducing the burden of heavy school bags on students. NEP-2020 also highlights the need for curriculum and pedagogical changes to significantly reduce the weight of school bags and textbooks (NEP-2020, Para 4.33).

Another objective of the National Education Policy (NEP) 2020 is to address the social hierarchy associated with vocational education and promote its integration into mainstream education across all educational institutions in a phased manner (PSSCIVE, 2022). In line with this, NEP-2020 introduces the concept of 10 bagless days. According to NEP-2020, every student from 6th to 8th grade should engage in a fun course that offers hands-on experiences in vocational crafts such as carpentry, electrical work, metalwork, gardening, pottery making, and more. These vocational experiences are tailored to the local vocations available, preserving the heritage of different Indian states and passing on folk culture knowledge to the next generation. Technology has also come to the aid of teachers and enhanced the implementation of 10 bagless days of schools by providing digital resources, online textbooks & curriculum materials. Technology can also enable schools to share activities and resources during 10 bagless days.

Some images of the activities on the Bagless day at schools

A child trying hand on the potter's wheel (Source: PSSCIVE, Bhopal)

Clay modelling (Source: PSSCIVE, Bhopal)

Fireless cooking on a Bagless day (Source: RBS MPS, Rewari)

Creative activity on a Bagless day (Source: RBS MPS, Rewari)

NEP-2020 also suggests the development of a centralized practice-based curriculum that can be adapted and implemented by schools based on the specific needs of states and local communities in terms of skill development. These 10 bagless days should be scheduled periodically throughout the academic year for classes from 6th to 8th, and holiday periods can also be utilized for this purpose. Activities during these days may include visits to historical, cultural, and tourist sites, interactions with local artists and craftsmen, and visits to higher educational institutions in the students' village, tehsil, district, or state (NEP-2020, Para 4.26).

As the NEP 2020 is being implemented, all educational institutes and stakeholders are regularly trying to understand the recommendations and figuring out the possible ways to implement recommendations. In order to get optimal benefit by implementing the recommendations effectively, it is the need of the hour to understand the possible ways of effective implementation, possible challenges, along with the experiences of the schools or states who have already implemented the NEP-2020. In this paper, a recommendation, i.e. 10 bagless days, is taken to understand it exclusively. In India, it is said that every two miles, the water changes, and every four miles, the speech. Similarly, according to the condition, climate, culture, etc., every school in India faces different challenges, whether they might be lack of attendance, lack of infrastructure, lack of teachers, awareness towards education, and many more are there. Keeping in mind these challenges and a few advantages faced by different schools, the present paper suggests some possible activities for 10 bagless days, possible limitations and the role of teachers and community in implementing this recommendation, based on a survey done by the researchers.

As the enchanting echoes of the NEP-2020 resound through the corridors of educational institutions, the diligent custodians of knowledge and learning find themselves immersed in a quest to unravel its profound recommendations. With a fervent desire to extract the utmost benefit from these directives, the pressing need of the hour lies in comprehending the nuances of effective implementation. It becomes imperative to explore the potential avenues of success, anticipate the obstacles that may lie in wait, and glean wisdom from the experiences of those schools and states that have already embarked upon the NEP-2020 journey.

Within the confines of this literary tapestry, we embark upon a focused exploration of a particular recommendation: the wondrous concept of 10 bagless days. In India, where every two miles bears witness to the metamorphosis of water, and every four miles heralds a transformation in speech, the idiosyncrasies of each school emerge like a symphony of diverse challenges. From the dearth of attendance to the lack of infrastructure, from the scarcity of teachers to the apathy towards education itself, these trials and tribulations vary with the cadence of climate, culture, and circumstance.

Mindful of these intricate webs of challenges, yet not oblivious to the few shining rays of advantage experienced by different schools, this opus sets forth a collection of possible activities for the 10 bagless days. It is an endeavour that seeks to illuminate the path forward, shedding light on the potential limitations that may lurk in the shadows. Moreover, the vital role played by teachers and the community in embracing and executing this recommendation finds solace in the pages that follow, their narratives woven together with the threads of a survey meticulously conducted by scholarly researchers.

Methodology

The current research employed a survey methodology to gather opinions from various stakeholders within the educational domain. The survey method is also used by Parida & Das (2021) and Sethy (2021). Convenience sampling was utilized as the sampling technique for this study. A self-developed opinionnaire was distributed to a total of 410 diverse educational stakeholders. Technology aided in reaching out to diverse stakeholders and collecting responses from them in a short span of time. The response rate yielded 213 completed opinionnaires; however, only 172 questionnaires were deemed fully completed, thus comprising the final sample for this study. Within the final sample, a gender distribution of 80 males and 92 females was observed. Additionally, in terms of occupational designations, the sample consisted of 16 principals, 93 primary school teachers, 51 secondary school teachers, and 12 teacher trainers. This comprehensive composition of the selected sample ensures representation across various educational roles.

The present study employed an opinionnaire comprising a variety of questions to explore different aspects related to the implementation of 10 bagless days in schools. The questionnaire was divided into two distinct parts. The first part aimed to assess the awareness levels of stakeholders regarding the 10 bagless recommendations across different contexts. The second part focused on capturing stakeholders' opinions concerning the recommendation of 10 bagless days. A total of 172 stakeholders provided their opinions on a comprehensive set of 35 questions.

Results and Discussions

The findings of the study indicate that 56.40 per cent of the stakeholders strongly agreed with the statement that the implementation of 10 bagless days in school education is a commendable step as recommended in NEP-2020. The subsequent sections of this article present the detailed results and discussions derived from the survey conducted to explore the feasibility and implications of implementing 10 bagless days in schools.

1. **Spread awareness among stakeholders about the recommendation of 10 bagless days:** After analysing the data it was found that 14.53 per cent of stakeholders reported that they were not aware of this recommendation whereas 85.47 per cent said that they were aware of the recommendation. This shows that there is a need to make all stakeholders aware of this recommendation. Which will directly help in the effective implementation of the recommendation.

2. **Clarity about the duration and mode should be provided:** Through the survey, it was found that there is no clarity about the duration and mode of the activities. Stakeholders are not clear about whether these 10 days were in the continuation or spread throughout the year. It was also reported by stakeholders that it is also not clear whether they conduct these days in hybrid mode or not. Many of them reported that in those areas where vocational courses are hard to reach or in distance they can conduct these activities through online interaction or not. Hence there is a need to

give some clarity regarding these activities.

3. **Give clarity about the activities to be conducted in 10 bagless days:** As the answer of activities that will be conducted in 10 bagless days, 64 per cent of stakeholders said that hands-on learning/ vocational experiences will be provided; Sethy (2021) also found the similar kind of responses. 10 per cent of stakeholders said that opportunities are given to intern with local vocational experts, whereas 22 per cent of stakeholders said that students will come to school without bags. 4 per cent of stakeholders gave some different opinions, which is the mix of all these activities. This analysis again shows that there is a need to provide clear guidelines about what needs to be done in these bagless days.

4. **Finding out activities to be held during 10 bagless days in schools:** Possible activities to be conducted in 10 bagless days were also asked by the stakeholders. As the underlying idea behind 10 bagless days is to make them an integral part of the teaching-learning process rather than as an add-on to the existing scheme of studies of education from Class VI to VIII (PSSCIVE, 2022). It was found through the survey that varied stakeholders have varied kinds of thoughts about the implementation activities. These are clubbed as follows:

   a. **Exposure to Performing Arts**: Exposure of different kinds of performing arts like dance, music theatre, magic, puppetry etc can be given by going to local artists or performing arts events. Some visits to related museums can also be organized. By which students get the real-life idea of different kinds of performing arts and can show their interest in future to learn them.

   b. **Vocational Craft:** Immerse the budding minds in the realm of vocational crafts, where carpentry becomes a dance of dexterous hands, dairy unveils its milky mysteries, and textile designing weaves tales of creativity. Let the students embark on an enchanting journey, exploring the realms of jewellery designing, embroidery, sewing, and the intricate art of weaving. Delight awaits them as they partake in the ethereal craft of kite making.

      Unleash their talents through immersive training programs, where each day unfolds as a vibrant canvas of learning. Planning visits to dairy plants, the students will witness the production of milk, while encounters with local craftsmen will unlock the treasures of indigenous artistry, reflecting the tapestry of local culture.

   c. **Knowhow of different Sports:** Knowhow of different sports can be provided by visiting different sports stadiums during sports events at local, state, national or international levels.

   d. **Entrepreneurial Activities:** Knowledge of entrepreneurial activities can be provided by visiting small-scale businesses like disposable cups and plates factories, paper bag-making factories or emerging new small-scale entrepreneurial ventures at the local level. They can get a first-hand experience of planning and management during the visit.

e. **Visit to a museum or other educational sites:** Local museum visits can be arranged to acquaint students in different areas like, sports, museums, art galleries, historical museums, etc. Visit the local newspaper printing unit, visit a few big factories like glass-making factories, biogas plants, steel plants, automobile manufacturing units, construction sites, etc., whichever are feasible and are in the vicinity may be planned. These visits can help the students to get a real feel of the working environment environment.

f. **Organization of school fete:** School fetes can be organized to provide a real-life learning and experimentation environment to students. From planning to execution is a practical lesson in collaboration, cooperation, teamwork, accountability, and interdependence. In which they can plan any activity to earn money. They can make some easy-to-sell small materials like key rings, embroidered handkerchiefs etc. They can plan theatre shows with token ticket amounts in which they can perform dance, music, theatre or magic activities. Students can voluntarily come up for their role in organizing or managing as per their interests.

g. **Environment-awareness or social activities:** Activities like plantation, cleaning of parks and rivers, care of ailing pets, etc., can be organized under the full security and supervision of experts, teachers, or elder volunteers. Medical camps can also be organized in which students perform different duties along with medical staff and teachers. These activities not only help society but students also develop a connect with the community which in turn may even be helpful in choosing a career in community health or social work.

h. **Exposure to new emerging domains of work:** Exposing the students to new emerging fields like Information and communication technology, social media influencers, content development, graphics designing, programming, artificial intelligence (AI), cyber security, robotics, space science, etc. can be done by showcasing related movies/ documentaries/lectures of experts of the field. This may be followed by discussions highlighting the pros and cons of the field.

Besides these activities, many more activities can be planned according to the feasibility of the school and teachers and the local needs of the community.

5. **Role of Emerging Technologies in 10-bagless days**

At once where our government emphasizes traditional culture, values and art forms, it also gives focus towards the use of emerging technologies in different fields. Emerging technologies also can be used efficiently to make these 10 days more fruitful and futuristic. Following are a few suggestions regarding that:

- Today, from a very early age, children get exposure to the online world. They get phones with full internet access, and they use them in the presence or absence of their elders; because of having less knowledge regarding dos and don'ts, they get stuck in miserable things. A few days out of 10 bagless days can be used to make them aware of how to safely use the internet and what precautions should be taken while suffering internet or using social media. For this purpose, a few related movies, dramas, etc., can be played in front of students, small talks with their parents can be organized, play way activities, worksheets completion, etc. can be organized to test the knowledge regarding safe surfing.

- These days, new occupations like Youtuber, Influencer, Gamer, Programmer, etc, are in the limelight. Today's children are looking at these options for their future very interestingly. Few of them even started to do work in this field at a very early age. But the biggest lack in this area is no standard course or coaching is available for this. Only the renowned names of the field are giving information on a free or paid basis. On one side of the coin, this is good that students are getting direct information from the experts, but the other side of the coin is that there are no criteria for being an "expert". So school administrations should identify experts in particular fields and call them either online or offline to interact with their students, to give a clear picture of these fields. These lectures can be organized as a part of a 10-bagless day, in which how to start working in these fields, what are the things to be focused on, how to be more successful and what precautions to be taken while working in these emerging fields to be discussed.
- As these days Artificial Intelligence has emerged like a boom, one or two lectures can be organized to give knowledge to use AI apps or platforms efficiently. Dos and don'ts should be discussed with logical justifications, to make everything clear to the young minds.
- Areas like data mining, natural language processing, augmented reality, virtual reality, and Artificial Intelligence are the present and future too. Knowledge of working in these areas is essential for the future as the knowledge of using the internet/computer basic demand these days. A few lectures as the introduction to these areas and what are the future possibilities, and what measures they can take if they want to choose these areas can be discussed.

These all are a few techno-oriented activities that can be planned for 10 bagless days. Besides this, technology can be used in the following ways to make 10-bagless days more reachable and economical.

- Diversity in India comes up with many drawbacks too. There are many schools available which are not easily accessible. For these, the recorded videos of some other schools during 10-bagless days can be used. Lectures can be organized in an online form with the experts.
- Travelling expenses of students, even at local places, cost a lot and can damage the financial planning of a school, especially

when no special funds are raised for these activities. To make these activities economically sound recordings or live interactions can be used to save expenses/funds at the place of calling experts or taking students out of the school.

- In unfavorable conditions like pandemics, unfavorable weather, etc. too recordings or synchronized sessions can be used. Also at times, it is not possible to determine whether taking students to a particular place is safe or not. Sometimes the large number of students also becomes a challenge to take them to a small craftsman shop. In these cases technology can be useful by recordings of live sessions .
- With the help of AI, language translation can be possible and becomes too easy. For those experts who only know a particular language that is not matched with the language of your students, a video can be recorded and translated according to the needs of your students or closed captions (CC) in the required language can be added.
- Besides these helpful measures and technology integration with 10-bagless days, many more activities can be planned according to the need of the school and creativity of teachers and the local needs of the community.

6. Benefits of implementing 10-bagless days

During the survey, participants were queried about the perceived advantages of implementing 10 bagless days in schools. An overwhelming majority of 87.80 per cent of stakeholders concurred with the notion that incorporating 10 bagless days is a commendable measure as recommended in NEP-2020. Furthermore, various stakeholders expressed and acknowledged the following benefits:

- 86.63 per cent of stakeholders agreed that the implementation of bagless days will reduce the burden of courses and academic stress on students.
- 88.95 per cent agreed with the statement that bagless days will help to connect knowledge to life outside school.
- 91.28 per cent said that it will enhance awareness and develop creativity and vocational skills among the students.
- 91.86 per cent of stakeholders agreed that it will help in connecting students with their local surroundings and local culture.
- 93.02 per cent said that it will boost the confidence of the students.
- 90.12 per cent agreed that it will help in value inculcation.
- 88.38 per cent of stakeholders considered it the best way of art-integrated learning.
- 90.12 per cent said that it will help in the holistic development of children.
- 92.44 per cent said that it will facilitate hands-on experiences in different fields.
- 90.12 per cent of stakeholders agreed that it is the best means to provide experiences in vocational crafts, such as carpentry, electric work, metal work, gardening, pottery making, etc. In the study

conducted by Sethy (2021), 60 per cent of stakeholders agreed with this idea.

- 91.86 per cent agreed that 10 bagless days will provide an idea to the students about their local skilling needs.

Besides these, by the review of the open-ended answers following possible benefits were identified:

- It will provide students with hands-on experiences of different kinds of vocational activities.
- As students try different work in a real situation then their social aspect will also improve. They learn cooperation, and collaboration and get an empathetic mindset towards the local craftsman or workers from different fields, who are somewhere considered below standard these days.
- These going out of-class activities make students burdenless and free from classroom pressure, which gives them a chance while learning and energises them to think beyond and to learn more.
- These bagless days will be helpful in providing concrete and practical knowledge rather than providing abstract information.
- With the help of exposure to different work areas, students may be able to find their real interest area, which helps them in making the right career choices and finding their passion.
- These activities might get the interest of those students who think learning is a boring task and a waste of time, as it will not give them bread. So both a needy student who aims to learn to earn and who aims to learn for enjoyment both kind of students will get benefit out of this.
- Students will feel connected and motivated through these activities and hence boredom will reduce automatically.
- They will start respecting the dignity of labour and develop a positive and respectful perception towards the craftsman and different skilled workers.
- These activities will be helpful in the development of observation-based learning capacity and provide scope for practice and learning by doing.
- The connectedness with the community and the local culture will be enhanced by these activities, which also develop interdependence among the community and students.

7. Possible drawbacks and limitations of implementing 10 bagless days

As we know every coin has two sides. Besides having many advantages and benefits of implementing the recommendation of 10 bagless days, there are lots of possible drawbacks. These are as follows-

- 46 per cent of stakeholders agreed that 10 days are not enough for these activities.
- It required rigorous planning for implementation according to the diverse needs of the diverse schools, cultures and locations. In January 2022, guidelines have been launched by PSSCIVE, but still, this recommendation requires rigorous planning.
- Difficulty to implement where no vocational activities are conducted in nearby areas.

- Maintaining discipline outside the school building is also a challenging task for teachers.
- All these activities require extra human and physical resources which will directly enhance the financial load on the school budget.
- It might be possible that to overcome the loss of teaching days due to these 10 bagless days, the extra burden will be added on normal days. Which will again add the load of extra books and make bags heavier.
- It can overburden the students who are already overwhelmed with the many major courses, extracurricular activities, project tasks and tuition work.
- Less significant to implement in village areas as most of the students have exposure to many vocational activities, and some of them play a significant role in those vocations too.
- It may also enhance the extra burden on school teachers. In those schools where every task has been done very sincerely and all staff members are hard-working, they also took these activities in their real sense which again enhance their workload. Because planning, implementing and testing its effectiveness required much effort and interest.
- There might be the possibility that teachers don't take much interest in such activities then it also remains just a piece of recommendation and the decided 10 days also become the only fun and free days for teachers.
- Some parents may show their lack of interest in these activities, they may not provide consent to take their ward to the local craftsman shop due to personal reasons. So making parents agree is also a challenge for the teachers and administration.
- Already due to many public holidays, winter vacations and summer vacations, teaching days are fewer as compared to the course; hence, decreasing 10 days has also become a challenge.
- This may also increase the dropout rate. Students may be started feeling more connected with the vocational course or activities and may feel that when after taking education they also have to do these courses which is nothing to do with classroom learning then they may directly opt to start a vocational career rather than taking education.
- There are many schools which are run by a single teacher. This will be another challenge for those schools.
- Catering varied interests of diverse students may also be a big challenge for teachers.
- These activities are also not so helpful for less active and introverted students.
- In the absence of proper guidance or planning for teachers, there is a risk of potential wastage of time, money, and resources. An inadequately planned implementation may yield unsatisfactory outcomes.
- Ensuring the seamless integration of children with special needs into these activities presents a formidable challenge. Planning and executing activities

that effectively cater to their unique requirements prove to be arduous, and the feasibility of accommodating them in all situations remains uncertain.

- The successful inclusion of children with special needs in these activities poses a challenge, as it is difficult to plan and implement activities that can adequately meet their specific needs and may not be feasible for all situations.
- There may be instances where these activities could disrupt the regular routine of craftsmen, resulting in potential financial setbacks for them.
- Craftsmen and vocational experts undoubtedly possess remarkable proficiency in their respective crafts, yet their understanding of child psychology may be limited, potentially leading to the emergence of behavioural challenges.
- Insufficient funding poses a significant obstacle to the execution of activities during the 10 bagless days.
- As of now, there has been no implementation strategy initiated by any pertinent organization, leading to a state of ambiguity and confusion among the stakeholders.

Conclusion

All recommendations given by NEP-2020 are related to providing quality education, developing employability, and transforming our country into a knowledge-driven society. This would be possible by using the student-centric approach in education making learning more experiential, and connecting it with the culture and daily life of the learners. The recommendation of 10 bagless days will prove a game changer in this direction if it will be implemented effectively and with proper planning. Related agencies and authorities should get active now and work on the implementation process. A set of guidelines has been launched by PSSCIVE in the first quarter of 2023. Still, there is a need for a clearer implementation procedure. Only then will effective implementation be possible. Besides the government organisation, teachers and school administration also take a few steps in its implementation; they have to think about the no or less budget activities, interesting activities with the local touch in them and plan the activities which don't take much time and resource but give a very fruitful experience to the students. They also have to think about how to cater for a large number of students in an optimum way. Parents and the community should also become more active now. As in the NEP-2020 much emphasis is given to community involvement and localised experience, which could not be possible without the active and voluntary involvement of the community members. Only the willing participation of the community members can make the implementation and outcome of this recommendation fruitful. So again, the task of government agencies, and teacher education institutes, become important in raising awareness about the recommendation of 10 bagless days for which they can organise workshops, faculty development programmes, conferences, discussion forums, etc, by which those who have great ideas and share their ideas with others and those who are facing issues can learn with others. All these measures can lead to the fruitful implementation of this recommendation and provide the desired outcome in an optimum way.

References

Govt. of India, Ministry of Education. (2023). National Curriculum Framework for School Education 2023. https://dsel.education.gov.in/sites/default/files/NCF2023.pdf

Govt. of India, Ministry of Human Resource Development. (2020). Draft National Education Policy 2019. https://www.education.gov.in/sites/upload_files/mhrd/files/Draft_NEP_2019_EN_Revised.pdf

Govt. of India, Ministry of Human Resource Development. (2020). National Education Policy 2020. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

https://timesofindia.indiatimes.com/city/kolkata/cisce-proposes-at-least-10-bagless-days-a-year-from-classes-vi-to-viii/articleshow/97389511.cms?from=mdr

https://www.nationalskillsnetwork.in/launch-of-guidelines-for-implementation-of-10-bagless-days-in-schools/

Parida, S. K. & Das, S. (2021). Perception of Prospective Teachers Towards Integration of Bagless Days in School Curriculum. *International Journal of Multidisciplinary Educational Research, 10*(5). 94-99. http://ijmer.in.doi./2021/10.10.115

PSS Central Institute of Vocational Education (2023) Guidelines for Implementation of 10 Bagless days in School. http://www.psscive.ac.in/storage/uploads/others/Guideline/pdf/english/guideline-for10Baglessdays-in-School%20in%20English.pdf

Sethy, R. (2021). Perception of Teachers on 10 Days Bagless Period for School Students of Chilika Block. *TechnoLearn: An International Journal of Educational Technology*, *11*(02), 129-136.

Research Article

MOOC-Based In-Service Training for the Professional Development of Teachers in India

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Abstract

The education system in India is pervasive, with 95 lakh teachers, 14.89 lakh schools, and 26 crores of students (UDISEI 2021-22). Lockdown during the COVID-19 epidemic resulted in a disruption to education that has never been seen. The government initiates NISHTHA training through MOOC for government teachers on the DIKSHA platform. A survey was conducted with the help of a questionnaire and group interviews at the end of the scheduled training for government teachers in Haryana using non-probability sampling to explore the learner's experience and challenges to suggest improvements. According to the findings of the study, educators are in support of the effort, and they hope that similar actions will be conducted in the future. Challenges like low internet connectivity and restricted ways of communication were mentioned, and to improve the overall quality of the training, several instructors recommend using a blended approach for in-service training for teachers.

Keywords: MOOC (Massive Open Online Course), In-service training, Professional Development, Teacher

Introduction

Teachers have a crucial role in nation-building by producing high-quality human resources in their classrooms; as the NEP 2020 emphasises, "Teachers truly shape the future of our children and, therefore, the future of our nation." The National Education Policy (NEP) 2020, recognizes teachers as essential participants in the education process and emphasizes the necessity of their recruitment, ongoing professional development, favourable working conditions, and satisfactory terms of service.

UNESCO launched the "State of the Education Report (SOER) for India: No Teacher No Class" in 2021which aims to serve as a reference for enhancing the implementation of the NEP and towards the realization of the "Sustainable Development Goal (SDG) 4 target 4c - Increase the supply of qualified teachers in developing countries."

In-Service Training of Teachers and Its Need

A teacher's in-service education consists of any appropriate coursework or professional development activities in which he or she may engage while employed. It includes all training and education programs that are provided to a teacher while they are actively engaged in instructing students.

Billing (1976) defines in-service education as staff development, which is "a deliberate and continuous process involving the identification and discussion of present and anticipated needs of individual staff for their job satisfaction and career prospects and of the institution for supporting its academic work and plans, and implementation of programs of staff activities designed for the satisfaction of these needs."

When it comes to education these days, the goal isn't just to impart knowledge; rather, it's to help students develop the ability to navigate an increasingly complex, unpredictable, and uncertain world. Since Google already knows everything, society no longer recognizes students for their knowledge alone; instead, it recognizes their ability to apply that knowledge. Today's teachers are tasked with fostering students' sense of self-awareness and their ability to work together and independently. Teachers are needed to have an in-depth understanding of the subject matter they teach the students to help them learn more effectively. To do this, teachers need specialized knowledge, such as understanding a discipline, curriculum, and how students learn. Additionally, teachers need to be knowledgeable about the professional practice to create a learning environment that leads to positive outcomes. Teachers' ability to learn and grow as lifelong learners and career aspirants needs to be enhanced by emphasizing their inquiry and research skills. It's unlikely that pupils will become lifelong learners if they don't see their teachers doing it so in-service training is a necessity for teachers.

To a large extent, schools place their faith in their educators. So, in-service education refers to post-graduate opportunities for educators to continue developing their expertise and passion for their field. The purpose of this type of training is to help a teacher who is already working in the field overcome whatever shortcomings they have in her professional abilities. It's a valid argument that the skills that were relevant a generation ago may not be adequate in preparing today's students for life after graduation. Today's students are expected to approach their daily tasks with more originality and consideration.

The goal of in-service training programs is to improve the school system's and the education industry's overall pool of qualified personnel. Teachers need training in new skills and contemporary methods if they are to fulfil their roles successfully and efficiently in the classroom. A country's educational standard rises with the average degree of education attained by its teachers. To keep up with the demands of the global economy's education system, it is crucial to provide high-quality in-service training for educators.

In-service training provides an opportunity to keep up with the latest trends and developments in the field, and a technique for teachers to improve their teaching and students' learning, ultimately leading to more productivity on the job. Teachers need professional development to keep up with the rapid pace of change in the educational system. In-service training is helpful for teachers to be able to put what they've learned into practice in the classroom. (Omar, 2014)

In-service training is essential to improve teachers' productivity and morale on the job. The "missing gaps" between expectations and student performance can't be closed without teacher development which is stunted without in-service training. Training and education can be provided to employees at any point of their employment, from hiring to retirement, through in-service education activities such as lectures, workshops, exhibitions, conferences, seminars, lectures, exhibitions, etc. (Osamwonyi, 2016)

Significance of Research

The most ambitious NISHTHA integrated training, which was supposed to be delivered in person to 42 lakh teachers of the government school from Classes 1 to 8, has come to a halt. This training was planned for participants from all States and UTs of India. In a country like India, where there is a tremendous cultural, geographical, and linguistic variation, time-bound scaling and reach of such training is still a difficulty. However, the learning continuum that teachers and students share cannot be constrained owing to a lack of readiness to face the lockdown, nor can it be constrained due to the diversity and large population. Every educator should make it a priority to enhance their pedagogical competencies to better handle the needs of their diverse student population. The COVID-19 pandemic has also revealed the fragility and uncertainty of the teaching community. To reach every single teacher, pupil-teacher, and student regardless of the board, affiliation, etc., the Ministry of Education, Government of India has planned to organize a series of online courses for these stakeholders through the DIKSHA portal and to extend its reach to teachers working in elementary schools, as well other stakeholders. The training programs for educators were introduced one after another and carried out in batches. The DIKSHA portal was utilized so that MOOCs can be used for in-service teacher training in Haryana efficiently. This project of MOOCs for teacher training was used for continuous learning during the COVID lockdown and for reaching every teacher in a time-bound manner by scaling up. Additionally, this may offer equitable access to professional development opportunities for educators. This Research was needed to determine the impact of in-service teacher education using the MOOC model to explore the teacher's experiences and provide suggestions to cater to the challenges faced by teachers during MOOC-based in-service training.

Objectives

1. To find teachers' perspectives about MOOC for in-service Training.
2. To find the problems faced by teachers while attending MOOC-based in-service training."
3. To explore the suggestions to improve the MOOC-based in-service training for teachers' professional development.

Research Questions

1. Is it helpful to use MOOC for in-service Training?
2. How MOOC was helpful for teacher training during COVID-19?
3. How satisfied and confident are the primary and secondary teachers in training online through MOOC?
4. What is the difference between MOOC-based training with traditional offline teacher training mode?

Research Methodology

The survey approach is highly versatile for collecting information. The study employed a descriptive methodology and utilized a qualitative survey. The research inquiries included in the survey have been specifically designed to align with the primary objectives and scope of the study.

Sample

The survey of 330 samples of government school teachers was conducted using Probability sampling techniques. A convenience sampling method was employed, and Samples included government school teachers of Haryana who are interested in being part of the research. Data has been collected from 3 districts of Haryana- Rohtak, Jhajjar, and Sonipat. 110 Samples were taken from each district.

Table-1: Sample distribution with their designation

Designation	Number of Participants
Primary Teacher (PRT)	**188**
Trained Graduate Teacher (TGT)	**142**
TOTAL	**330**

Table-2: Age-wise distribution of Samples

Age	Number of Participants
Less than and equals 30	89
31-40	172
41-50	40
More than and equals 51	29
Total	330

Tool

The data has been collected using a self-made structured questionnaire comprising questions relating to teachers' experience with their in-service training through MOOC on the DIKSHA platform. Questions include closed-type questions using Google Forum and open-ended discussions were used while conducting group interviews to understand their experience better.

Limitations of the Study

A limited number of the population (Haryana Government school teachers) participated as samples in this study so there is a chance that private teachers may have different opinions. Because of the COVID-19 epidemic aftereffects, a limited number of the population available were interested in answering the survey due to which restrictions were imposed on the researcher to collect samples across the State. The survey included participants who attended MOOC training on the DIKSHA platform which is a government-initiated national-level platform so there are chances that the experience can differ from the international MOOC platforms.

Literature Review

MOOCs are emerging educational technology for training and innovation. They have become distance education methods in response to the COVID-19 pandemic's new challenges, changes, and crises. (Pérez et al. 2022) In an online survey of students enrolled in at least one of the "University of Pennsylvania" 32 MOOCs offered on Coursera, Christensen et al. (2013) found that 44 per cent of respondents stated "Gain specific skills to do my job better" as reasons for studying, adding to the growing body of evidence indicating workers are using MOOCs for their self-directed learning. Therefore, MOOCs appear to play a pivotal role in the future education of knowledge workers.

Gonçalves et al. (2016), present a case study of the development and implementation of a MOOC to attract instructors to this new method of knowledge sharing. The analysis of the questionnaires reveals that the participants viewed the MOOC as a scientifically sound training course that has significantly contributed to their ongoing education. The study found that MOOCs can facilitate educators' access to education, eroding space barriers at a time when educators must be empowered for the 21st-century teaching and learning process. MOOCs can be effectively integrated into formal teacher training programs, with participants reporting high satisfaction and perceived value for their professional growth.

Research by Salmon et al. (2015) used a questionnaire on the use of MOOCs for professional development in education which was completed by an anonymous 155 participants. The research finds that massive open online courses (MOOCs) have the potential to give professors the professional development they need to improve their classroom techniques.

Taranto et al. (2021) investigate the impact of a MOOC on outdoor mathematics on the professional development of participating instructors. The study analyses the learning progress of 19 selected case studies from different nations and learning levels using their pre- and post-questionnaire answers and posts on a specific communication message board. The findings indicate that the examined teachers have benefited from professional development, as evidenced by the expansion/evolution of their content, pedagogical, and technological knowledge.

Alberto (2023) has shown that MOOCs can effectively address the need for continuous training in teaching skills, providing teachers with the necessary tools and resources to enhance their pedagogical practices. Padmavathy, 2023; and Smyrnova-Trybulska, 2022 accepted that institutions can promote excellence in education by integrating MOOC into teacher preparation programs. This improves both, teacher practices and student outcomes.

Carvalho et al. (2023) recognised that MOOC-based training programs can significantly enhance teachers' competencies particularly in adopting innovative teaching and improving digital literacy for online teaching-learning platforms. However, Jobe et al. (2014). Pointed out several challenges in implementing MOOCs for professional development. These include time constraints, difficulty integrating MOOC schedules into existing work commitments, and low completion rates. Additionally, employers may be reluctant to accept MOOC accreditation as equivalent to traditional professional development. To maximize engagement and course completion, careful consideration of MOOC design criteria and principles is necessary. Despite these MOOCs offer a scalable and sustainable approach to teacher education, potentially enhancing the quality of teaching and learning in various educational contexts (B. Oyo et al., 2017).

Result

"Is it helpful to use MOOC for in-service training?"

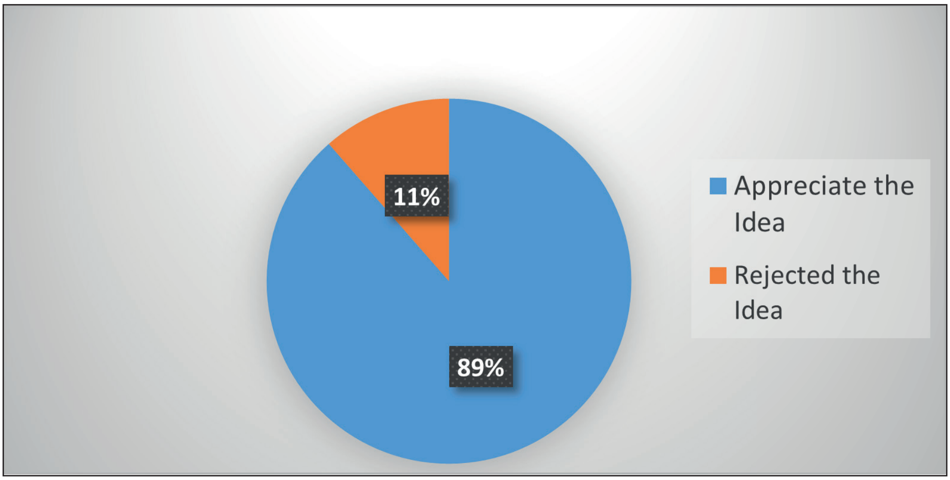
A lot of different things can affect how productive education systems can be in different parts of the world. The most fundamental components that determine the overall quality of education on a local or global scale are our teacher training programs. Teachers are required to keep themselves informed about innovations in pedagogy and technology. In addition, it is anticipated that the pupils will be guided based on the evolving educational requirements.

MOOCs are a great way to learn something new or expand the existing body of information and knowledge. Hence, educators can broaden their perspective on the role of technology in education.

Table-3: Teacher's perspective on using MOOC for in-service training

Appreciate the Idea	294
Rejected the Idea	38

Figure-1: Teacher's perspective on using MOOC for in-service training



Participants mentioned that during COVID online training seems to be the only option and MOOC is not only a viable option but a requirement of the time. About 89 per cent of participants appreciate the idea of using MOOCs for their in-service training but 38 per cent of participants rejected the idea and mentioned the challenges they faced while using MOOCs for training. Almost all the participants aged 50 and more rejected the idea and mentioned their inability to use the technology properly.

Table-4: Reason mentioned by participants for joining MOOC

Reason for joining MOOC	Number of participants
To get Certificate	297
For Subject Knowledge	214
Curiosity	175
Interest	82
Technical Enhancement	155

All the participants mentioned that the first and foremost reason to join in-service NISHTHA teacher's training through MOOC on the DIKSHA platform was that it was instructed by the Government authority (NCERT) and also provided them with a proper schedule. District and school authorities were considered responsible for ensuring teachers' participation and training completion. Most of them mentioned that after getting familiar with the MOOC platform, they started exploring different courses, and about 63 per cent of participants explored MOOC willingly. Most of them joined about 4 to 8 MOOCs on average but some participants joined more than 25 courses just to explore which shows that participants found the MOOC interesting which forced them to explore other courses that they were not compelled to join by authorities.

Participants have different reasons for joining MOOC-based training. More than 90 per cent of participants mentioned that they attend MOOC to get a certificate as they must submit it to the authorities as proof of the completion of the courses instructed but 25 per cent among them also mentioned that they like to get the certificate as it gives them a sense of accomplishment. Eighty-seven per cent of participants mentioned that they completed the MOOC and acquired the certificate. About 53 per cent of participants mentioned that they participated in a lot of MOOCs just to explore their content and satisfy their curiosity.

Sixty-five per cent of the people who took part in the survey indicated that they enrol in MOOCs to improve their overall level of subject knowledge (Batchelor & Lautenbach, 2015), and especially to gain an understanding of how they might be able to improve their teaching while they are leading their subject-related classes. They noted that it was beneficial for them to learn which strategy would assist teachers in connecting students online and conducting more interactive lessons so that students did not become bored and feel separated from the classroom. Making use of MOOCs and putting what they've learned into practice in the classroom is one way for educators to boost the academic performance of their pupils.

As all teachers were attending their training online mode so they were practically using and enhancing their technical knowledge which was mentioned by 47 per cent of participants. They mentioned that the knowledge they get from attending the training online and practising their technical knowledge while attending online training, facing new difficulties, interacting with fellow teachers, and learning something new from their peers helps them to develop professionally. When schools did not have any idea how to proceed further especially government schools where all the schools do not have computer teachers or any technical guide to help other teachers to conduct online classes. MOOC training provides exposure to the idea of students' difficulties which helps them to enhance their E-teaching skills. DIKSHA provide a platform where teachers can start their groups and interact with each other.

Offline versus MOOC-Based Training

The ability to critically analyze and improve one's techniques of teaching is an essential component of a teacher's professional development as well as their teaching profession (Zeichner,1999). On-campus professional development programs for educators mirror the core values and underlying principles that students want to embody in their personal and professional lives (Perraton, 2010). So, we need to explore how the MOOC system will affect existing teacher professional development programs.

The primary issue is how well MOOCs contribute to the growth of teacher training. There is skepticism among many veteran educators that online courses can deliver the same level of quality training for future educators as traditional classroom instruction, but there are a few benefits that seem possible only through MOOC-based teacher training, such as an unlimited number of participants can be enrolled, time and place flexibility but in offline mode, there are restrictions on the number of participants, time and place. It is challenging to train thousands of teachers offline all at once at the same time. MOOCs make it possible to bring together thousands of learners from all over the world on the same platform. Anyone, at any moment, can access any available courses, regardless of location, educators are no longer restricted to holding classes at specific times and locations.

Teachers have easier access to educational courses for free thanks to MOOCs which make them an economical option (Banwari, 2018) for enhancing educators' skills. When compared to traditional methods of teacher training, such as workshops, the amount of time spent on conducting training through MOOCs seems to be minimal.

Content on MOOC is accessible multiple times, which provides learners an opportunity to continue their training at their own pace, leading to individualized learning, but offline mode teachers are forced to attend the training whether they like it or not. Sometimes, they are not concentrated or interested, but they do not have a choice. There is no such restriction in online mode.

MOOCs on the DIKSHA app are prepared by leading professors, and experts in their fields to provide high-quality professional training programs in various disciplines. Different types of MOOCs offer online courses with varying pedagogical focuses and approaches. Where in offline mode, training teachers can provide good opportunities to engage in a group discussion, which forms a supportive learning community in the training. It provides a peer-learning opportunity and social learning which is quite lacking in MOOC. However, MOOCs provide an opportunity to contact learners in different places but most of the participants mentioned that they would like to prefer face-to-face discussion during offline training rather than MOOC discussion forum.

Educators can track their training with the use of MOOCs as it is mentioned in the course that what percentage of the course is completed which can be called a progress report of the learner in the course. This provides proper information about the learner's progress report in every course and helps them to properly analyze their progress but with the offline mode of training keeping track of each participant and sharing it with them regularly is difficult.

Teacher's Perspective: How MOOC Helps In Teachers' Professional Development

During the COVID lockdown, teachers faced a lot of problems keeping in touch with their students and most of the teachers mentioned that in the initial few months of lockdown when they came to know that schools were not going to open soon, they were confused without any plan and guidance of how to continue student's formal education and provide emotional support to them. Participants mentioned that MOOCs provided them with a planned curriculum that mentioned what to do and how to continue students' learning during the lockdown and after the lockdown. It helps them to enhance their teaching skill and develop the skills teachers need while reopening the schools after the COVID lockdown.

The goal of all professional development programs for educators is to ensure high-quality instruction by fostering educators' expertise in curriculum design, instructional strategies, and community context. Teacher professional development programs should allow for the acquisition of such specialized knowledge and expertise. As mentioned by participants MOOC-based teacher in-service training courses seem to help achieve the goals of professional development.

MOOCs encourage teachers to communicate and collaborate online by providing a secure online learning environment which shows the social potential of MOOCs for teacher professional development. MOOC helps teachers to network with like-minded professionals and share ideas, while also improving their communication with students and receiving more insightful feedback. Teachers mentioned that changes are needed to some aspects of online education to meet the objectives of teacher professional development. A few teachers mentioned that they skipped the course content and directly attempted the assessment with the help of the Google search engine which pinpointed that there is a great need to find how we can deal with this loophole to evaluate the learning to make sure that participant has achieved their professional development goals.

One of the foremost benefits of using the DIKSHA platform for in-service training is that courses are available in 12 languages (English, Hindi, Kannada, Bengali, Marathi, Tamil, Telugu, Urdu, Assamese, Gujarati, Odiya, and Punjabi) which ensures that courses become accessible to a large proportion of Indian population. Teachers can choose any language depending on their comfort and convenience.

Participants mentioned that MOOCs provide them with ideas leading to re-evaluating their lessons. The lectures, curriculum, and materials in a course are developed by experienced educators. Learners gain a fresh perspective by taking part in a MOOC. It demonstrates effective methods for teaching a given subject area. As a result, teachers get benefits in two ways: first, they gain insight into how their students learn best in an online class, and second, they gain insight into how to best plan their classes. Teachers explore different courses that have different methods and styles of teaching. They acted as a student in different courses which gave them insight into student's perspectives and learning styles. This helps them during the COVID lockdown period when they need all the help they can get to teach online.

By taking online classes teachers become able to improve the way to teach and become able to keep up with the latest advancements in technology. With this, they were able to improve the way of delivering lectures. MOOCs provide educators with the opportunity to gain practical expertise in the application of technology in the classroom and make it possible for them to participate in significantly more interactive classes during lockdown. A teacher or a decision-maker needs to keep up with the pace of technological advancement, know what your classrooms are missing, and be aware of how the rest of the world is utilizing technology to improve education. Therefore, MOOCs are the answer to their problems.

Challenges to Using MOOC for Teacher's Professional Development

MOOC-based training requires users to have access to fast internet connections to view the material that is presented in their courses, especially videos. However, the DIKSHA platform provides an option to download the course but with the large size of the training courses but participants mentioned that it is not easy to download and play High-definition videos with slow internet connectivity. The widespread implementation of MOOCs has been hampered by the restricted availability of the necessary infrastructure (Chatterjee& Nath, 2015).

The primary mode of communication in MOOCs, both between a teacher and a pupil and among learners themselves, is typically textual which gradually becomes monotonous. It leads to a lack of oral communication among the learners, and to gain these skills, they need to participate in a traditional program. Additionally, the student feels alone during the training. Because of this, the learner's motivation decreases, which ultimately leads to their dropping out of the training or completing it for the sake of formality.

Suggestions for Improving MOOC for In-Service Training

India is a very diverse nation, both in terms of the cultures that make up its society and the languages. There are 22 official languages mentioned in the eight schedules of the Indian constitution. Since English is recognized globally and Hindi is our mother tongue which is mostly the medium of MOOC this results in excluding a sizeable portion of the audience who do not have the required level of knowledge or acceptable proficiency in both languages (Chatterjee& Nath, 2015). However, it was mentioned that the DIKSHA platform provides courses in 12 languages, but only a very limited number of courses are available in languages other than Hindi and English. Therefore, one of the foremost challenges that learners face and that the providers of MOOCs need to address more practically is that they need to translate or develop the courses in different Indian languages.

The people of India must prioritize the need to have greater access to the internet and improve its connectivity.

MOOC-based teacher training has spurred innovative approaches to education, such as the Flipped Classroom and hybrid learning. Further, MOOCs offer an efficient and relatively inexpensive means of teacher professional development, which will in turn aid in the construction of a network of professionals with participants from all over the world. Incorporating both MOOCs and in-person instruction could be an effective strategy for improving the quality of education professionals. Incorporating MOOC in blended mode can reduce the expenses of training as traditional training requires a venue and participants need to travel long distances which are also borne by authorities and can be easily reduced by the training through blended mode (Online + Offline). Participants mentioned that both online and offline modes have their limitations, which can be overcome by the blended mode.

Discussion

The literature provides evidence to support the results of the survey. Numerous studies highlight the positive impact of using MOOC for in-service training for the professional development of teachers.

MOOCs have emerged as a promising platform for teacher professional development, offering flexible and accessible learning opportunities for both pre-service and in-service teachers (Vitor Gonçalves et al., 2016; T. Phan & Meina Zhu, 2020). The diverse pedagogical techniques that were presented in the MOOCs provided wonderful opportunities for experiential learning for K-12 pre-service and in-service teachers. These teachers were able to draw instructional lessons that they might use in their current and future professional activities. (Phan, & Zhu, 2020)

Teachers benefit from free, high-quality resources for professional growth and advancement thanks to MOOCs (Jobe et al., 2014). It can be a great alternative to the traditional ways of professional development that teachers have been taught at teachers' training centres.

This confidence is based on the idea that MOOCs can help train a lot of teachers because they are convenient, available, and easy to use. Also, training based on MOOCs is easy to use and can be changed to fit different cultures, languages, and educational settings. (Hilali & Moubtassime, 2021)

Gordon et al. (2015) also support the idea of using MOOC for training and mention it is not just a viable option but a requirement to train a large number of public personnel who require training at the local regional, and national levels.

Conclusion

All nations should place the utmost importance on elevating the standard of their educational systems. In recent years the Indian education system has made tremendous strides and notable attempts to improve and MOOC-based in-service training was one among them which lit the path by guiding teachers during lockdown. MOOC-based training provides benefits in terms of time, place, and budgetary costs. As a more advanced type of online education, MOOC is better in many ways, including 24x7 content access to all and objective evaluation of learning. As a result, it has the potential to contribute significantly to educators' ongoing professional growth compared to offline mode. Most teachers have positive attitudes and support for the initiative. Teachers mentioned that they only need the Internet and mobile devices to access the courses which saves their travelling time and provides them with the opportunity for independent, individualized learning and self-paced learning where teachers have the right to decide to schedule their time and choose their place of learning. With this, teachers also get to explore and satisfy their curiosity of getting answers to their queries. During COVID Lockdown where classes were conducted online, they got ideas for planning and conducting their classes in different and interactive ways. MOOC-based in-service training helps authorities supervise the training as they have to submit their course completion certificate to them. The survey shows that the completion rate of MOOCs is high, which shows that it helps achieve the objectives of the training. With this, the research concludes that MOOCs have the potential to fulfil the demands of professional growth among educators. However, there are a few challenges like internet speed issues and limited ways of communicating with fellow teachers so it was suggested that there is a need for a blended mode of training that will balance the limitations of both online and offline training.

References

Alberto, C., & Cano, G. (2023). The NOOCs as a training strategy for teachers in the use of technological tools in primary education. Región Científica, 2(1), 202362–202362. https://doi.org/10.58763/RC202362

Banwari, V. (2018). Role of MOOCs in Indian Higher Education. Journal of Emerging Technologies and Innovative Research, 5(12). https://www.jetir.org/papers/JETIR1812A54.pdf

Batchelor, J., & Lautenbach, G. (2015). Cultivating lifelong learning: Pre-service teachers and their MOOCs. 2015 IST-Africa Conference, IST-Africa 2015. https://doi.org/10.1109/ISTAFRICA.2015.7190557

Chatterjee, P., & Nath, A. (2015). Massive open online courses (MOOCs) in education - A case study in Indian context and vision to ubiquitous learning. Proceedings of the 2014 IEEE International Conference on MOOCs, Innovation, and Technology in Education, IEEE MITE 2014, 36–41. https://doi.org/10.1109/MITE.2014.7020237

Christensen, G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E. J. (2013). The MOOC Phenomenon: Who Takes Massive Open Online Courses and Why? SSRN Electronic Journal. https://doi.org/10.2139/SSRN.2350964

Gonçalves, V., Chumbo, I., Torres, E., & Gonçalves, B. (2016). Teacher Education Through MOOC: A Case Study. ICERI2016 Proceedings, 1, 8350–8358. https://www.researchgate.net/publication/311368541_TEACHER_EDUCATION_THROUGH_MOOC_A_CASE_STUDY

Hilali, E. el, & Moubtassime, M. (2021). Moroccan Teachers of English Acceptance and Readiness to Use MOOCs for Continuing Professional Development. Universal Journal of Educational Research, 9(5), 891–900. https://doi.org/10.13189/UJER.2021.090501

Ji, Z., & Cao, Y. (2016). A Prospective Study on the Application of MOOC in Teacher Professional Development in China. Universal Journal of Educational Research, 4(9), 2061–2067. https://doi.org/10.13189/ujer.2016.040917

Jobe, W., Master Östlund, C., & Svensson, L. (2014). (PDF) MOOCs for Professional Teacher Development. https://www.researchgate.net/publication/268153081_MOOCs_for_Professional_Teacher_Development

Omar, Che. (2014). Need for In-Service Training for Teachers and Its Effectiveness In School. International Journal for Innovation Education and Research. 2. 1-9. https://www.researchgate.net/publication/349136866_Need_for_In-service_Training_for_Teachers_and_It's_Effectiveness_In_School

Osamwonyi, E. F. (2016). In-Service Education of Teachers: Overview, Problems and the Way Forward. Journal of Education and Practice, 7(26), 83–87. https://www.iiste.org/Journals/index.php/JEP/article/view/33050

Padmavathy, R. D. (2023). Revolutionizing Teacher Preparation: Unleashing the Transformative Potential of MOOCs. www.ijfmr.com

Pérez, S., Almenara, J., Osuna, J., & Rodríguez, A. (2022). T-MOOC for Initial Teacher Training in Digital Competences: Technology and Educational Innovation. Frontiers in Education, 7, 289. https://www.frontiersin.org/articles/10.3389/feduc.2022.846998/full

Perraton, H. (2010). Teacher Education: the Role of Open and Distance Learning. www.col.org

Phan, T., & Zhu, M. (2020). Professional development journey in MOOCs by pre- and in-service teachers. Educational Media International, 148–166. https://doi.org/10.1080/09523987.2020.1786773

Salmon, Gilly & Gregory, Janet & Lokuge Dona, Kulari& Ross, Bella. (2015). Experiential online development for educators: The example of the Carpe Diem MOOC. British Journal of Educational Technology. https://www.researchgate.net/publication/272494055_Experiential_online_development_for_educators_The_example_of_the_Carpe_Diem_MOOC

Sanchez-Gordon, Sandra & Calle-Jimenez, & Tania &Luján-Mora, S. (2015). Relevance of MOOCs for Training of Public Sector Employees- Enrollment, Completion, and Web Accessibility Challenges | Request PDF. Retrieved December 6, 2022, from https://www.researchgate.net/publication/279783014_Relevance_of_MOOCs_for_Training_of_Public_Sector_Employees-_Enrollment_Completion_and_Web_Accessibility_Challenges

Smyrnova-Trybulska, E., Sekret, I., Morze, N., & McKay, E. (2022). Evaluation of the MOOCs Quality and Its Effectiveness for Teachers' Training in the Field of Digital Competences and Their Use in Education: A Case Study. International Journal of Research in E-Learning, 8(1), 1–34. https://doi.org/10.31261/IJREL.2022.8.1.03

Svoboda, P., & Mynaříková, L. (2021). MOOC Courses as a Tool for the Development of Digital Competencies of Teachers. Lecture Notes in Networks and Systems, 269, 243–251. https://doi.org/10.1007/978-3-030-80000-0_29

Taranto, E., Jablonski, S., Recio, T., Mercat, C., Cunha, E., Lázaro, C., Ludwig, M., & Mammana, M. F. (2021). Professional development in mathematics education—evaluation of a MOOC on outdoor mathematics. Mathematics, 9(22). https://doi.org/10.3390/MATH9222975

UNIFIED DISTRICT INFORMATION SYSTEM FOR EDUCATION. (2022).

Vaz de Carvalho, C., Andone, D., Mihaescu, V., Hakan Aydin, C., Toprak, E., Genc-Kumtepe, E., Zubikova, O., Brueggemann, T., Intveen, S., Butkiene, R., Gudoniene, D., & Dambrauskas, E. (2023). Using a MOOC to Train Teachers to Design and Deliver MOOCs. Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 13869 LNCS, 202–213. https://doi.org/10.1007/978-3-031-33023-0_18

Zeichner, K. (1999). The New Scholarship in Teacher Education. Educational Researcher, 28(9), 4–15.

Research Article

Exploring the Integration of Digital Pedagogy in Classroom Instruction among DoE Trained Graduate Teachers of Delhi State

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Abstract

The incorporation of digital pedagogy has become a revolutionary force in the ever-changing environment of modern education, redefining the conventional paradigms of classroom instruction. This study explores the field of educational innovation with a particular focus on the Digital Pedagogy methods that Graduate Teachers in Delhi, a bustling state, have embraced. These teachers were trained by the Department of Education (DoE). The job of educators is becoming more and more important in managing the junction between traditional teaching approaches and cutting-edge digital tools as technology continues to grow at a rapid pace. This study aims to provide important insights into the continuing conversation about digital education by closely examining the experiences and practices of DoE-trained graduate teachers.

In light of this, this study sets out to explore the complexities of integrating digital pedagogy into classroom instruction among Delhi State's graduate teachers who have received training from the Department of Education. This study aims to provide light on how teaching methods are changing in the digital age by exploring the perspectives and tactics used by these educators. Purposive sampling was done and the data was collected through google forms. Quantitative as well as qualitative technique was used for data analysis.

Findings reveals that rather than just implementing new technology, digital pedagogy is viewed as a whole revolution that alters teaching strategies, educational philosophies, and student engagement techniques. This study aims to stimulate meaningful discourse and action toward realizing the full potential of digital pedagogy for improving education in Delhi State and beyond through well-informed views and recommendations based on evidence.

Keywords: Digital pedagogy, DoE-trained graduate teachers, Digital Technology, Teaching-Learning Process, ICT.

Introduction

The integration of digital pedagogy has become a transformational force in the field of modern education, transforming classroom teaching dynamics globally. The integration of technology into teaching practices has emerged as a central theme for educational reform and development, as educators look for creative ways to engage students and adjust to the demands of a quickly changing digital era.

Every element of our lives, including education, communication, governance, finance, marketing, and health, is impacted by digital technologies. Since digital technologies are used in every aspect of life, new abilities and skills are required. Teachers have been educated to increase the amount of digital technology they use in the classroom in order to better prepare students for the demands of the twenty-first century. Information and communications technology (ICT) support for teachers may be provided via the training (Pongsakdi, Nonmanut & Kortelainen, Arto & Veermans, Marjaana. (2021).

According to a 2013 study by the European Union, teachers' operational ICT confidence levels may have an impact on how frequently they include ICT-based learning activities into their lessons. Teachers' confidence has been proven to be much enhanced by professional development programs and teacher training (Ertmer and Ottenbreit-Leftwich 2010). ICT-trained teachers typically have lower levels of anxiety, are more comfortable using ICT, and place a higher value on it (European Union 2013). Enhancing the use of digital technology for learning and evaluating these abilities has become imperative as a result of the school reform (Göçen et al. 2020). Teachers must incorporate digital competency into their work in order to implement digital learning, which also demands an appropriate pedagogical approach (Aslan and Zhu 2016). It encompasses not just the technological know-how of instructors but also their ability to appropriately use and apply technology in their own teaching. The degree to which educators think that utilizing technology could improve their ability to teach is known as the perceived utility of technology, according to Teo et al. (2016). Therefore, teachers' assessments of how much utilizing technology would enhance instruction and learning are referred to as perceived usefulness.

Previous research indicated that teachers are less inclined to incorporate technology into their everyday practices if they are not convinced of the benefits of technology on instructional efficiency (Kim et al. 2013).

When digital tools are deliberately and thoughtfully incorporated into educational activities, teaching and learning are improved. This approach is known as digital pedagogy. By recognizing the transformative potential of digital tools and technologies in the educational landscape, it signifies a paradigm shift away from traditional pedagogical methods. In order to engage students, encourage critical thinking, and create a more dynamic and interactive learning environment, educators use a variety of strategies, approaches, and techniques known as digital pedagogy.

Digital Pedagogy

Theory and practice in education are the focus of the field of regular pedagogy. It covers the content, delivery method, and social implications of education. ICT is used in digital pedagogy to improve instruction both within and outside of the classroom. Power point presentations in the classroom or the provision of online instruction are two examples. It facilitates dynamic, innovative, and successful learning. Also, it encourages accountability and distributive learning. Teaching with digital tools includes using web development, instructional design, collaborative maps, lecture recording, course blogs, multimedia assignments, online courses and journals, collaborative text, and visualization projects. The qualities that define digitally literate instructors include subject-matter understanding and relationships that facilitate learning. Regardless of level of education, digital pedagogy is now an essential component of education given the current post-pandemic environment. Given that every industry in the world is going digital, it is imperative right now. Technology has had a significant impact on education and led to the creation of digital pedagogy, which is now an essential component of modern society. It used to be limited to distant learning and higher education, but it is now a part of the entire educational system.

It is impossible to introduce any change without including instructors, who are the most crucial element in the process (Darling-Hammond et al., 2005). Teachers' behavior in the classroom is greatly influenced by their own opinions about the best ways to teach and learn (Albion & Ertmer, 2002). The degree to which educators embrace new digital teaching techniques and adjust to a new technology-based learning environment is also influenced by their fundamental beliefs (Clarke, Dede & Dieterle, 2008).

In the intense educational environment of Delhi State, where the Department of Education (DoE) has a significant influence on how pupils learn, graduate teachers' investigation of digital pedagogy is an important undertaking. Equipped with an abundance of pedagogical expertise and experience, these educators lead the way in educational advancement and are tasked with shaping the brains of future generations.

Delhi offers a fascinating backdrop for examining how teachers adjust to the demands of a digital learning environment because it is a center of technical innovation and educational variety.

As we proceed on this journey, the incorporation of digital pedagogy is seen as a comprehensive transformation that reshapes instructional methodologies, pedagogical philosophies, and student engagement tactics rather than just the adoption of technical instruments. This will ultimately lead to a greater comprehension of the dynamic changes occurring in the contemporary classroom. Through elucidating the viewpoints and experiences of graduate teachers trained by the Department of Education, this study seeks to educate practitioners, educational administrators, and policymakers about the changing face of education in the digital era.

In order to corroborate the present study a few of the researches were gone through, Ahuja & Yadav (2019) carried out a study to evaluate the impact of digital pedagogy interventions in rural areas. This study explores the impact of an interactive digital pedagogy model on students' academic progress and pedagogical satisfaction in remote places.

The findings show that when exposed to interactive digital pedagogy rather than traditional pedagogy, kids in remote areas fared better. It indicates that students are performing well academically. It was also shown that because interactive digital pedagogy allowed students to interface with the outside world of education, they were eager to learn and actively participated in their studies. The majority of pupils mentioned active learning and learner autonomy.

In continuation to it another study made by Wadmany, R., & Kliachko, S. (2014) titled "The Significance of Digital Pedagogy: Teachers' Perceptions and the Factors Influencing their abilities as Digital Pedagogues", investigated the perceptions of alumni of the Technology in Education master's program on the importance of digital pedagogy. This research was qualitative in nature.

This research strategy was chosen in order to thoroughly investigate the research questions and to get meaningful responses that can improve our comprehension of the program's student needs and the extent to which it satisfies those needs in the dynamic, ever-changing educational system.

There is a great increase in usage of digital tools and media by teachers in their professional responsibilities. This trend is also supported by Mohamad, Nurdin, and Sururi (2023) in their study which mapped the use of digital technologies in teachers' practice. The study highlighted a preference for smartphones, messaging apps, and text-based learning materials enriched with videos and images for teaching and assessment in hybrid learning environments. These results showed that 56.99 per cent of teachers use smartphones for learning tools whereas other 43.01 per cent use PC/laptop devices. Also, 48.39 per cent of teachers conducted digital learning through message apps, 19.35 per cent through LMS, and the rest through online meetings, social media, or all the types simultaneously.

Bentri A. & Hidayati A., (2022), made the study titled as- "The Developing of Digital Pedagogical Curriculum of Primary Education Teachers in Indonesia." The study has determined which curriculum goals, instructional resources, experiential learning opportunities, and assessment instruments are essential for fostering teachers' digital pedagogy competencies. The study's findings indicated that educators needed to be as knowledgeable as possible about identifying characteristics in order to create digital learning materials. They actively used social networking sites to share online content, and they were informed about the applications used to create digital learning tools. It also revealed that instructors' capacity to participate in online communities and communicate with peers effectively was a prerequisite for improving their digital analytical skills. Additionally, it was crucial to be proficient in using e-learning platforms.

Cowling, M. A., et. al., (2022) in their research titled as, "The EdTech difference: Digitalisation, digital pedagogy, and technology enhanced learning" examine the issue of the journal that focused on educational technology (EdTech). It has been discovered that the best online teaching and learning environment may entail the use of ICT technologies that encourage group projects, improve communication, and increase student interest in lectures. In closing, this editorial highlight how upcoming writers might contribute to educational technology research in a meaningful and productive way. For technology to be used effectively in teaching and learning, whether online or not, it is advised that it be used in context, that solid theory be used, and that learning be given more attention. In summary, assessing the efficacy and application of research on educational technology necessitates a careful examination of the interplay between people, technology, pedagogy, and learning.

There is a need for effective teacher training programs to enhance teachers' ICT competencies and align with the global trends in education. The main focus should be on providing competencies essential for online teaching, such as pedagogy, technology, content design, institutional management, communication, and social aspects. Akram & Alomari (2023) did a study for understanding multifaceted nature of teachers' competencies required for successful online teaching. They found a positive impact of training programs on enhancing teachers' competencies and highlighted the need for ongoing support and training initiatives in this area. It has provided a structured approach to assessing teachers' strengths and weaknesses in online education, benefiting educational institutions at all levels.

Teachers with high willingness to adopt digital technologies always remain more relevant in tough times than the reluctant ones. The same concern is shown in a study done by Pankaj et al. (2022) during the COVID-19 Pandemic. It examined the foremost determinants of teachers' perception, i.e. teachers' satisfaction, attitude and continuance intention towards adopting e-learning in during the COVID-19. The study found that the Teachers who perceived e-learning as useful were more satisfied with the online teaching-learning practices. Also, support from educational institutions plays a vital role in enhancing teachers' satisfaction with e-learning adoption in HEIs in India.

Sadiku, M. et. al. (2019) in their study titled as "Digital Pedagogy" mentioned that Digital pedagogy opens numerous possibilities for educators to leverage technology in enhancing teaching and learning. The proliferation of workshops, conferences, and publications indicates a significant growth in interest in digital pedagogy across the academic community. Effective teaching in the twenty-first century requires not just content knowledge but also technical proficiency. The use of instructional design, web development, collaborative mapping, course blogs, lecture capture, multimedia assignments, online courses, online journals, collaborative text, and visualization projects are all included in the field of digital pedagogy. Teachers with strong digital abilities show that they have a thorough comprehension of the material and can help students make connections.

The study made by Srivastava K. & Dey S. (2018) examined the Role of Digital Technology in the Teaching-Learning Process. Their paper explores the difficulties that come with using digital technology in the classroom and highlights how resolving these problems can promote successful technology adoption. The study's conclusions show that teacher educators' perceptions of the use of digital technology tools in the classroom are generally moderate. Although they realize the difficulties in using these tools, they also recognize how well digital technology supports teaching and learning.

The National Education Policy,2020 in India highlights the significance of mentoring and provides tools for tracking teachers' career progression. (Ministry of Human Resource Development, 2020). This suggests a systemic integration of mentor teachers into the state machinery to advocate for career advancement, ultimately scaling and sustaining quality Continuous Professional Development (CPD) in the education system. In line with this, a study by (Amina et al., 2022) emphasizes the importance of experienced and motivated mentors in offering online support to teachers to enhance equity, scale, and quality of education. The pandemic lockdown pushed many teachers, including rural teachers in India, to accept technology-enabled teaching, and the prior experience of CPD among mentor teachers significantly supported their transition into mentoring roles and motivated them to excel in the new context. This study emphasizes how critical it is to provide our teachers with the newest digital techniques to guarantee that the demands of the pupils are not compromised.

While integrating ICTs in teaching-learning practices, along with the prospective advantages a serious emphasis must also be given to willingness, attitudes, and challenges encountered by teachers. By understanding teachers' experiences and perceptions towards technology integration, the concerned authorities formulate policies which are much more effective for integrating ICTs in educational settings (Huma et al., 2022). Their study also sheds light on the barriers faced by teachers in integrating technology into their teaching practices, such as slow internet speed, load shedding, lack of infrastructure, online teaching experience, and training deficiencies.

Need and Rationale of the Study

The present paper tries to investigate the current status of the utilization of digital pedagogy by trained graduate science teachers. It explores the extent of utilization of various digital technological tools and their applications. This study also explores the perception of TGTs with regard to the use of digital pedagogies. The researcher aims to evaluate the extent of utilization of digital pedagogies in the classroom teaching-learning process. This study specifically focused on exploring the integration of digital pedagogy by trained graduate teachers (TGTs) in classroom instruction during 2023.

Objectives of the Study:

1. To identify the role of teachers as Mentor Teacher (MT), Academic Resource Team manager (ART) and Teacher Development Coordinator (TDC).
2. To study the extent of utilization of various digital technological tools by TGTs.
3. To study the extent and sources of webinars or workshops attended by TGTs.
4. To study the perception of TGTs with regard to the use of digital pedagogies.
5. To study the extent of utilization of digital pedagogies in the teaching-learning process.

Methodology

The present research was an investigation focused on eliciting the responses of the TGTs on exploring the integration of digital pedagogy in classroom instruction.

Population of the Study

All the middle-stage teachers (TGTs) from DoE schools of the North West district of Delhi state (GNCT of Delhi).

Sample, Sample Size and Sampling Technique

The purposive sampling technique was used to select the sample, and it consists of middle-stage science teachers who use ICT in their regular teaching and learning method during the year 2023. A sample size of the study was 240 teachers selected through random sampling. The study was done in October 2023.

Tool for Data Collection

The group of experts constructed and developed the tool in a workshop. A mixed questionnaire was developed, with the majority of the items being Likert-style closed-ended questions. The initial questions were about demographic data.

Procedure

The researcher used purposive sampling techniques for choosing the teachers. The questionnaire in Google Forms was sent to the teachers, so it did not require authorization from the school administration. The participant responses were recorded on the drive itself.

Data Analysis and Interpretations

Both quantitative and qualitative methods were used to analyze the data.

Delimitations of the Study

1. The study was delimited to DoE schools of North West district of Delhi.
2. The study was limited to TGTs science, who are using ICT in their regular teaching-learning method.

Results and Discussions:

The findings of the present study are discussed below-

Demographics:

In the demographics, the age, gender ratio, highest educational qualifications of teachers, and teaching experience were studied, which were represented in tables-1, 2, 3, 4.

Age Range

The age range of the respondents is shown in Table -1.

Table-1: Age Range

Age Range	Frequency	Percentage
25-30	28	12%
31-35	52	22%
36-40	58	24%
41-45	51	21%
46-50	25	10%
51-55	19	8%
56-60	07	3%

Table 1 shows that teachers' ages range from 25 to 60 years old. To facilitate the study, the teachers were divided into seven age-group groups. Figure 1 shows that almost half of the instructors were under 40 years old. The largest percentage of teachers (24 per cent) were between the ages of 36 and 40. Furthermore, Figure 1 shows that just 11 per cent of the teachers were between the ages of 51 and 60.

Gender Ratio:

Table 2 displays the gender ratio.

Table-2: Gender Ratio

Gender Ratio	Frequency	Percentage
Male	103	42.9%
Female	137	57.1%

Table-2 reveals that the female teachers were more than that of male teachers. It is clearly shown in figure-2. Female teachers were 57.1 per cent, and male teachers were 42.9 per cent.

Highest Qualifications of Teachers

The Highest Qualifications of teachers was shown in Table -3 and figure-1

Table-3: Highest Qualifications of Teachers

Qualifications	Frequency	Percentage
Graduate	47	19.5%
Post Graduate	193	80.4%
B.Ed.	168	70%
M.Phil.	3	1.25%
Ph.D	6	1.4%
NET-JRF	3	1.25%

Figure-1: Highest Qualifications of Teachers

Table 3 shows that postgraduate degrees were held by 80.4 per cent of the teachers. Additionally, it shows that 70 per cent of the teachers have a B.Ed. The table also shows that 19.5 per cent of the teachers were not masters in any field; instead, they were only graduates, including those with a B.Ed. A total of 1.4 per cent of the teachers held a Ph.D. A mere 1.25 per cent of educators held an M.Phil degree, and the same proportion of educators had NET/ JRF in their respective fields. Figure 3 shows the proportion of teachers according to their qualifications. It suggests that the majority of the sample population consisted of postgraduate teachers.

Teaching Experience:

The teaching experience of teachers is shown in Table -4 and figure-2.

Table-4: Teaching Experience

Teaching Experience (in years)	Frequency	Percentage
1 month -5 years	77	32%
6-10 years	59	24.5%
11-15 years	36	15%

Teaching Experience (in years)	Frequency	Percentage
16-20 years	27	11%
21-25 years	28	12%
26-30 years	11	4.5%
31-35 years	2	1%

Figure-2: Teaching Experience (in years)

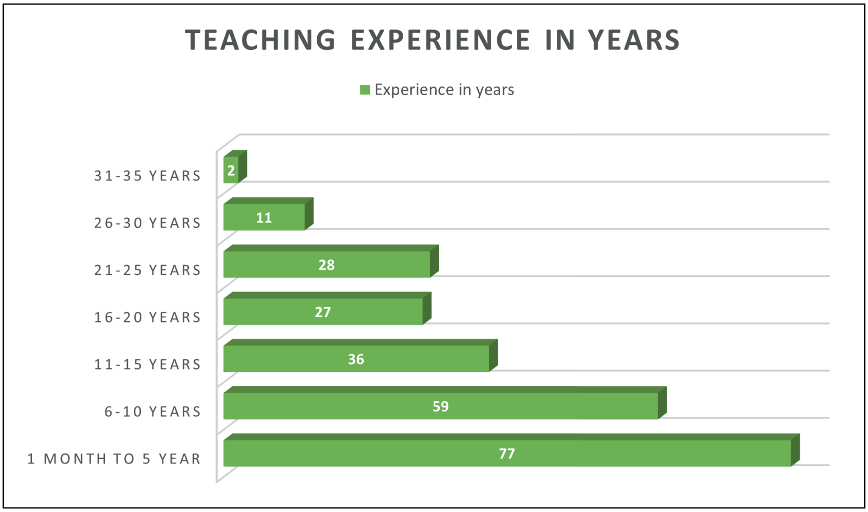


Figure 2 shows the largest number of teachers, or 77, had between one month to five years of teaching experience. Table 4 shows that 56.5 per cent of the teachers, or over 50 per cent of the total, had been in the classroom for up to ten years. Just 1 per cent of teachers had worked for between 31 and 35 years.

Findings for Objective 1: To identify the role of teachers as Mentor Teacher (MT), Academic Resource Team manager (ART) and Teacher Development Coordinator (TDC).

The role of teachers as MT, TDC, and ART is depicted in Table 5 and Figure 3.

Table-5: Role of Teachers

Role of Teachers	Frequency	Percentage
Mentor Teacher (MT)	30	12.5%
Teacher Development Coordinator (TDC)	98	40.8%
Academic Resource Team manager (ART)	112	46.7%

Table 5 represents the roles of teachers as Mentor Teachers, Teacher Development Coordinators, and Academic Resource Team Managers. Figure-5 indicates that the Academic Resource Team manager (ART) was at its maximum ratio, i.e., 46.7 per cent. Teacher Development Coordinator (TDC) was 40.8 per cent, and Mentor Teacher (MT) was the least in number and ratio, i.e., 12.5 per cent.

Findings indicate that TGTs prefer the role of an Academic Resource Team manager (ART) most; afterwards, the role of Teacher Development Coordinator (TDC) was preferred by them. Very few TGTs play the role of Mentor Teacher (MT). This may be due to the Teacher Development Coordinator (TDC) initiative being an extension of the Mentor Teacher (MT) program. Mentor Teachers are accountable for school-level implementation, Teacher Development Coordinators are responsible for running Academic Resource Team (ART) meetings, and Academic Resource Team are responsible for classroom-level implementation. Thus, the role of ART is at ground level and crucial, so preferred by most of the TGTs. To improve fairness, scale, and quality of education, a study by Amina et al. (2022) highlights the significance of mentors who possess expertise and motivation when providing online help to teachers.

Findings for Objective 2: To study the extent of utilization of various digital technological tools by TGTs.

The findings of these objectives revealed the outcomes presented in Table and Figure 3.

Table-6: Usage of various digital technological tools by TGTs

S. No.	Digital technologies	Always	Often	Sometimes	Rarely	Never
1.	Computers (Laptop/Desktop)	64	88	64	17	7
2.	Internet	157	63	15	3	2
3.	Microsoft Office Applications	65	75	64	20	16
4.	Smart boards	22	57	74	37	50
5.	Massive Open Online Courses	19	64	93	35	29
6.	Virtual Labs/Olabs	9	37	82	50	62
7.	Open Educational Resources	35	78	77	29	21
8.	Learning Management System	32	66	82	30	30
9.	Augmented Reality	10	46	81	41	62
10.	Artificial Intelligence	19	57	67	36	61
11.	Power Point Presentation	52	62	70	33	23
12.	Google Meet	58	98	53	28	03
13.	Microsoft Teams	21	58	70	40	51
14..	Zoom	58	83	67	21	11
15.	Facebook	73	62	54	19	32
16.	Google Form	108	81	33	15	3
17.	WhatsApp	176	48	12	4	0
18.	Telegram	62	60	50	33	35
19..	Google Classrooms	41	64	72	33	30
20.	Any other (please specify)	26	35	65	24	19

Figure-3: Usage of various digital technological tools by TGTs

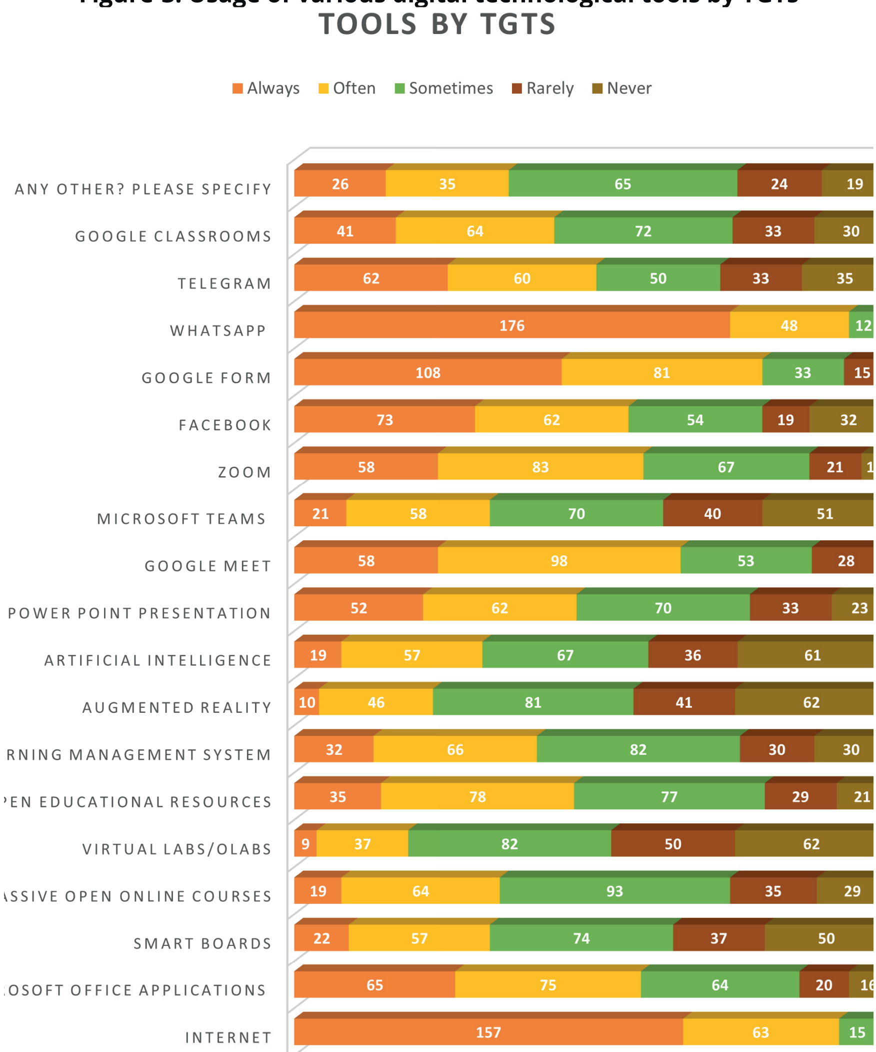


Table-6 represents that internet, what's app and google form were the most popular digital technological tools used always by the TGTs. On the contrary Virtual Labs/Olabs, Augmented Reality, and Artificial Intelligence were never used by more than 25 per cent of the teachers. More than 25 per cent of the teachers used Computers (Laptop/ Desktop), Microsoft Office Applications, Smart boards, Massive Open Online Courses, Virtual Labs/OLabs, Open Educational Resources, Learning Management System, Augmented Reality, Artificial Intelligence, Power Point Presentation, Microsoft Teams, Zoom, Google Classrooms and any other by more than 25 per cent of the teachers.

Findings show that TGTs effectively utilize very basic technological tools, which are quite common. Few of them like the internet and whats app popular even among non-academic persons. Google Classroom was used by 74 per cent of the TGTs from always to sometimes; this may be due to the reason that during and after the pandemic, they may use it for online classes. Telegram, zoom, Facebook, Microsoft Team, powerpoint, open educational resources, Massive Open Online Courses, and MS Office, were also used by more than 60 per cent of the TGTs. Findings reveals that teachers utilize digital technological tools but there is also need to encourage them to utilize these tools to the maximum and also to explore and utilize tools like Virtual Labs/OLabs, Augmented Reality, Artificial Intelligence which are not quite popular among them.

The findings can be corroborated with Mohamad, Nurdin, and Sururi's (2023) study, which mapped the use of digital technologies in teachers' practice and also supports the rise in the use of digital tools and media by teachers in their professional obligations.

Findings for Objective 3: To study the extent and sources of Webinar or workshops attended by TGTs

Findings of this objectives revealed the following outcomes which have been presented in table-7 and matrix of webinars/ workshop source reported by TGTs.

Webinar or workshop attended

Table-7 shows the webinar or workshop attended by TGTs. Out of 240 samples, 35.4 per cent of teachers confirmed that they had attended webinars or workshops to develop their digital competence, and 64.5 per cent of teachers did not.

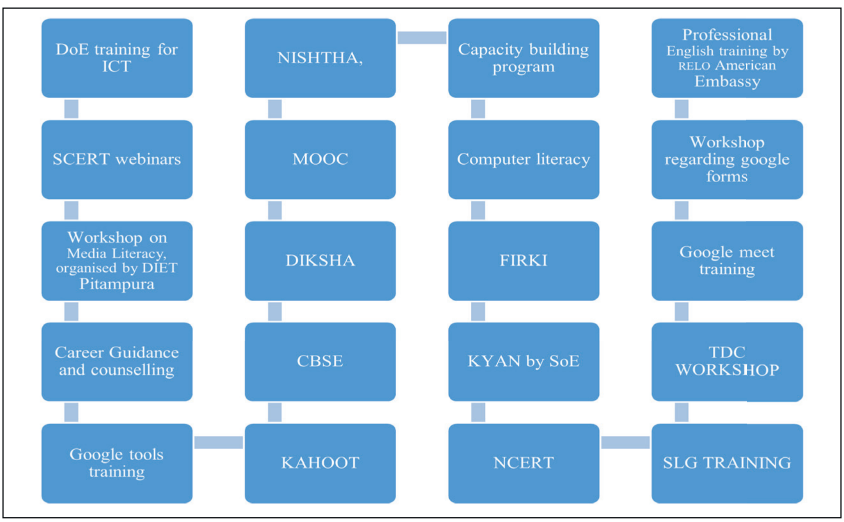
Table- 7: Webinar or workshop attended

Workshop attended	Frequency	Percentage
Yes	85	35.4%
No	155	64.6%

The above indicates that 64.6 per cent of TGTs did not attend any kind of webinar or workshop to develop their digital competence, which is a very large number of teachers. This may be due to a lack of devices or high-speed internet.

Findings reveal that TGTs are facing the digital divide. So, the extent of utilization of digital pedagogy affected, as only 35.4 per cent of TGTs were attended various workshops and webinars represented in the matrix below.

Figure-4: Matrix of webinars/ workshop source reported by TGTs.



The above matrix represents the sources through which the TGTs attended the webinar and workshop. DoE training for ICT was the main source. Others reported that SCERT has organised webinars related to digital pedagogy skills enhancement. Media literacy was organized by DIET. There was provision of a capacity building program also. Few reported training by major platforms like DIKSHA, NISHTHA, MOOC, CBSE, KYAN by SoE, FIRKI, etc. RELO American also provided training. The remaining other sources are also listed in the above matrix.

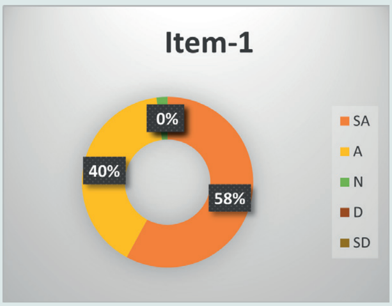
Webinar and workshop sources reported by only 35.4 per cent TGTs. Findings of this objective reveals a huge gap between the trained and untrained teachers. Akram & Alomari (2023), observed that teacher competency was improved through training programs and emphasized the necessity of continued support and training activities in this field.

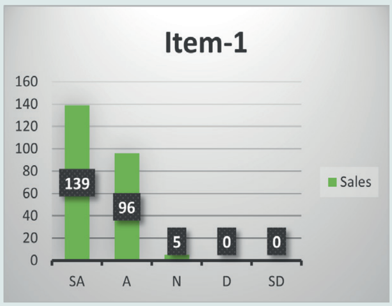
Findings for Objective -4: To study the perception of TGTs with regard to the use of digital pedagogies

The findings of these objectives revealed the following outcomes, which have been presented in Table figure- 5.

Table-8: Perception of TGTs with regard to the use of digital pedagogies

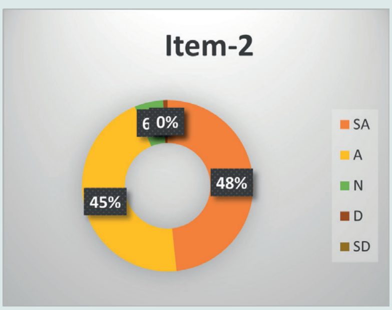
S.No.	Items	SA	A	N	D	SD
1.	Digital technologies help teachers to retain students' attention during the teaching learning process.	139	96	5	0	0

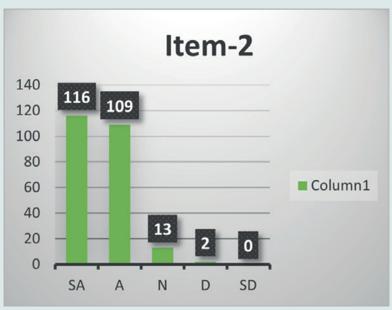




Findings for Item no. 1 indicates that 58 per cent of the total participants were strongly agreed that digital technologies help teachers to retain students' attention during the teaching learning process and 40 per cent were agreed to this. Which shows more than 90 per cent of the participants believe that digital technologies are helpful to retain students' attention.

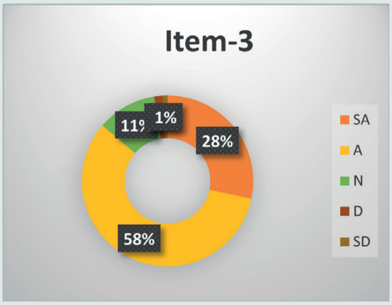
2.	Digital technologies encourage students to try innovative ideas for new situations.	116	109	13	2	0

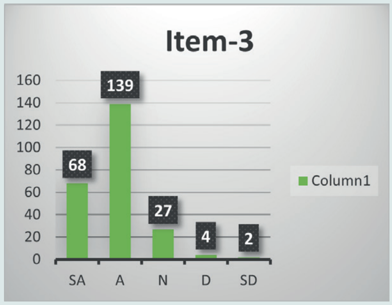




Findings for item no.2 reveal that 48 per cent of the participants strongly agreed and 45 per cent agreed that digital technologies encourage students to try innovative ideas for new situations. The remaining 5 per cent were neutral. Findings reveal the effectiveness of digital technologies for innovation.

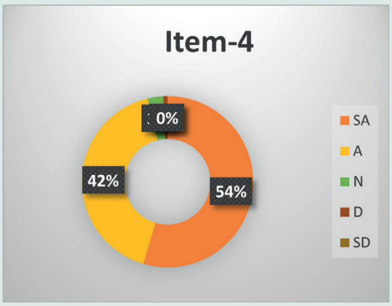
S.No.	Items	SA	A	N	D	SD
3.	I am well aware of the latest digital technologies developed and launched by DoE and GNCT of Delhi.	68	139	27	4	2

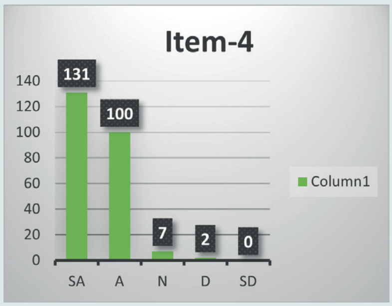




Findings for item no. 3 shows that 28 per cent of the participants were strongly agreed, 58 per cent were agreed, 11 per cent were neutral and 2 per cent disagreed and remaining 1 per cent strongly disagreed for their awareness of the latest digital technologies developed and launched by DoE and GNCT of Delhi. Findings shows that awareness level for latest digital technologies developed and launched by DoE and GNCT of Delhi among teachers is quite good.

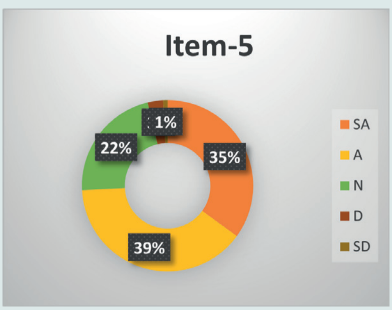
4.	Technology mediated teaching has increased post covid.	131	100	7	2	0

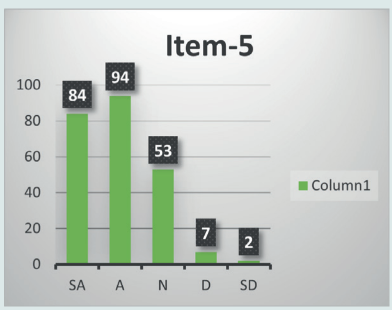




Findings for item no.4 indicate that 54 per cent of the participants strongly agreed that 42 per cent agreed that technology-mediated teaching has increased post covid. This may be due to the understanding of online learning and ICT-equipped instruction practice.

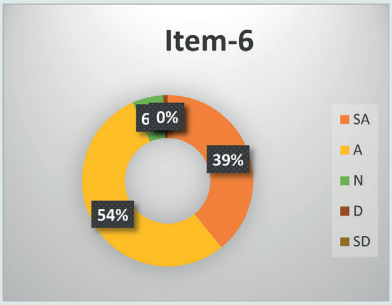
5.	Teachers who are not digitally competent will lag behind in today's era of digital advancement.	84	94	53	7	2

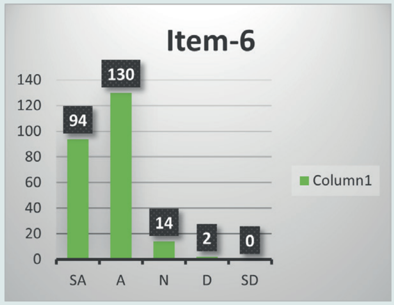




Findings for item no.5 indicates that teachers who were not digitally competent will lag behind in today's era of digital advancement. To this 35 per cent were strongly agreed, 39 per cent were agreed ,22 per cent were neutral ,3 per cent disagreed and 1 per cent strongly disagreed. The result indicates that TGTs understands the importance of integration of ICT, media and online learning.

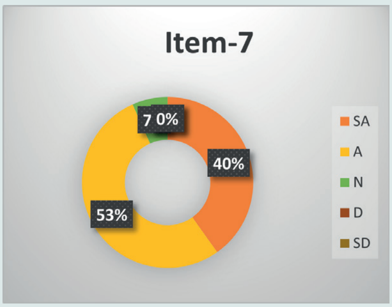
S.No.	Items	SA	A	N	D	SD
6.	I help my colleagues and provide advice when they use digital technologies.	94	130	14	2	0

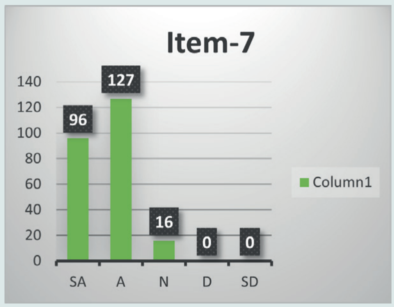




Findings for item 6 shows that 39 per cent were strongly agreed that they help their colleagues and provide advice when they use digital technologies 54 per cent respondents were agreed and 6 per cent were neutral.

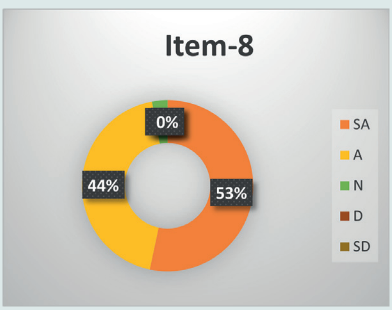
S.No.	Items	SA	A	N	D	SD
7.	I seek help from my colleagues when I face difficulty using digital technologies.	96	127	16	0	0

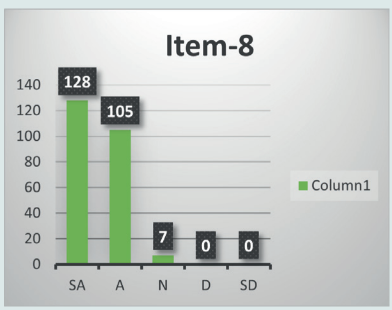




Findings for item no.7 show that 40 per cent of the participants strongly agreed, 53 per cent agreed, and 7 per cent were neutral about seeking help from their colleagues when they face difficulty using digital technologies. Findings indicate that collaborative learning is also possible.

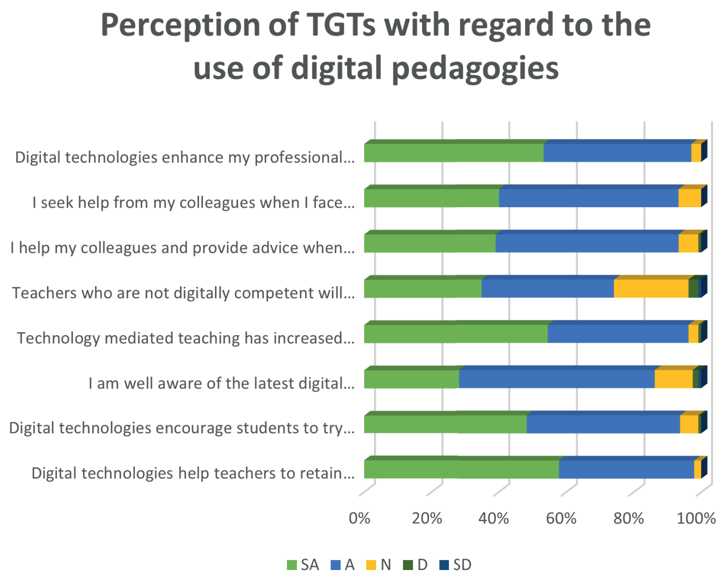
S.No.	Items	SA	A	N	D	SD
8.	Digital technologies enhance my professional development.	128	105	7	0	0





Findings for item no.8 show that 53 per cent of participants strongly agreed that 44 per cent of participants agreed that digital technologies enhance their professional development. The result indicates that teachers feel competent and confident by integrating digital technologies in the teaching-learning process.

Figure-5: Perception of TGTs with regard to the use of digital pedagogies



Findings of this objective suggested some of the remarkable responses which provided insight into the current practices of the same.

According to the findings, over 90 per cent of participants think that digital tools are essential for holding students' attention throughout instruction. Approximately the same proportion of respondents think that students are encouraged to try out novel ideas via digital technologies. This indicates that pupils' creativity is enhanced by digital tools. Developing their independence as learners is beneficial.

The majority of participants were aware of the most recent advancements in digital technological tools created by Delhi's GNCT and the Department of Education. Over 90 per cent of the participants thought that after COVID, the use of technology in education has risen. This demonstrates that the majority of participants thought the epidemic had increased the amount of teaching and learning mediated by technology. The majority of participants believe that in order to maintain digital advancement, digital competence is vital.

This has developed into a crucial tool for education and pedagogical improvement. Participants in the process learn on their own and offer or receive assistance as needed. Not to mention, one of the most significant benefits of using digital technology is that it helps participants improve professionally, which is crucial for their professional development.

In challenging times, teachers who are very willing to embrace technological advances always have a greater impact than those who are not. The primary factors influencing teachers' perceptions during the COVID-19 pandemic were studied by Pankaj et al. (2022) and included their attitude, contentment, and intention to continue implementing e-learning. The study discovered that teachers were happier with online teaching and learning techniques when they thought e-learning was beneficial.

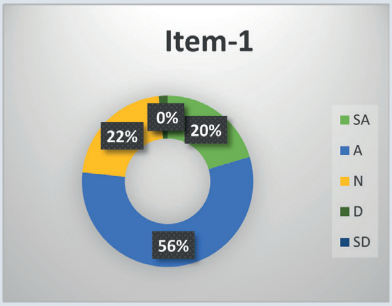
Findings for Objective -5

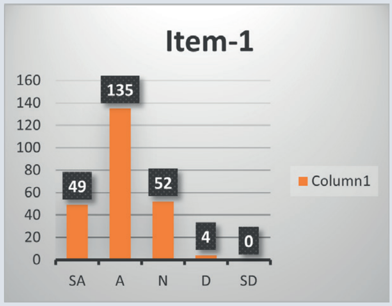
Objective -5: To study the extent of utilization of digital pedagogies in classroom teaching learning process.

The findings of these objectives revealed the outcomes which have been presented in Table figure- 6.

Table-9: Extent of utilization of digital pedagogies in classroom teaching-learning process.

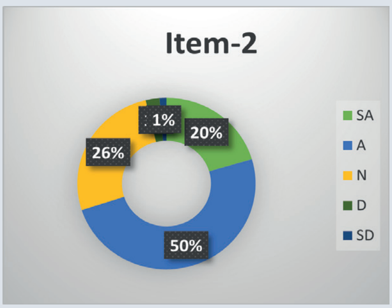
S.No.	Items	SA	A	N	D	SD
1.	I design various digitally-enabled learning activities allowing students to use problem-solving skills.	49	135	52	**4**	0

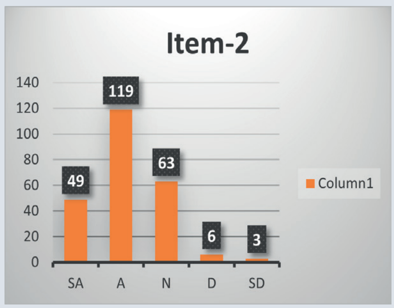




Findings for item 1 show 20 per cent of the participants were strongly agreed ,56 per cent were agreed that they design various digitally-enabled learning activities allowing students to use problem solving skills.

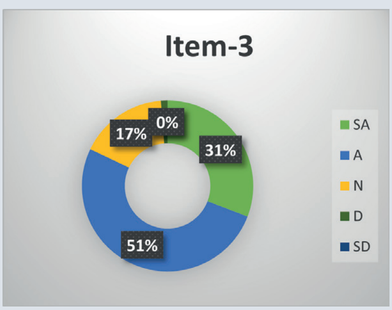
2.	I develop technology integrated lesson plans as per the TPACK Framework.	49	119	63	6	3

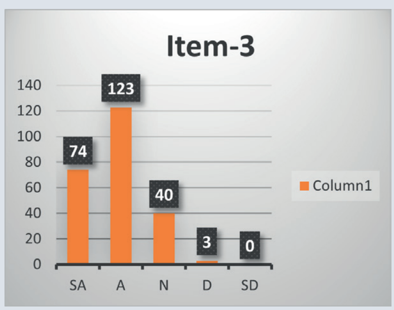




Findings foitem 2 show 20 per cent of the participants strongly agreed, 50 per cent of the participants agreed, and 26 per cent were neutral, 3 per cent disagreed, and the remaining 1 per cent strongly disagreed about the statement.

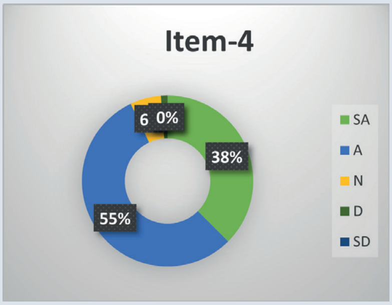
3.	I am confident in using digital technologies.	74	123	40	3	0

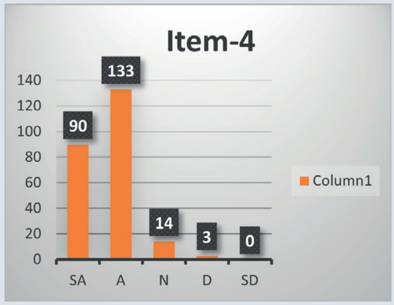




Findings for item no.3 indicates that 31 per cent of the participants were strongly agreed 51 per cent of the participants were agreed 17 per cent participants were neutral remaining 2 per cent of the participants were disagreed about using digital technologies confidently.

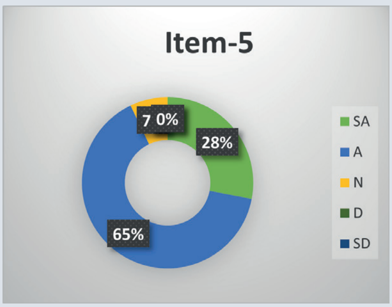
S.No.	Items	SA	A	N	D	SD
4.	I use digital technologies to communicate with colleagues.	90	133	14	3	0

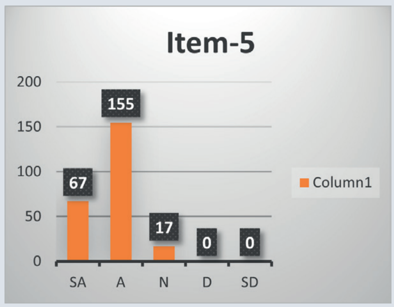




Findings for item no.4 indicate that 38 per cent strongly agreed, 55 per cent agreed, and 6 per cent were neutral about using digital technologies to communicate with colleagues.

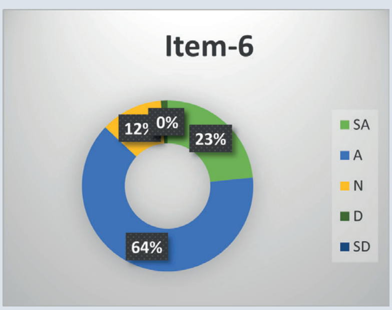
S.No.	Items	SA	A	N	D	SD
5.	I use digital technologies to communicate with learners.	67	155	17	0	0

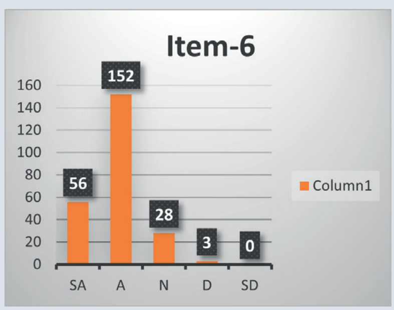




Findings for item no.5 show that 28 per cent strongly agreed, 65 per cent of the participants agreed, and 7 per cent were neutral about using digital technologies to communicate with learners.

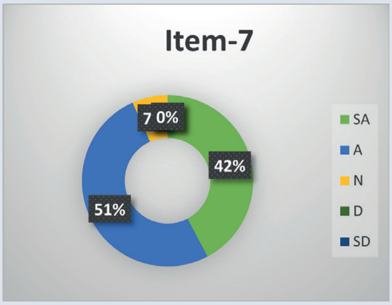
S.No.	Items	SA	A	N	D	SD
6.	I use digital technologies to communicate with parents.	56	152	28	3	0

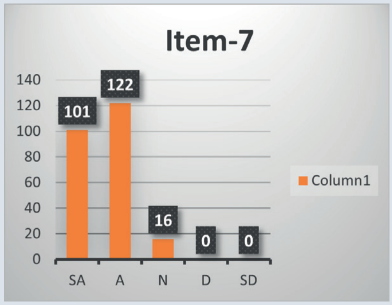




Findings for item no.6 show that 23 per cent strongly agreed, 64 per cent of the participants agreed, and 12 per cent of the participants were neutral about using digital technologies to communicate with parents.

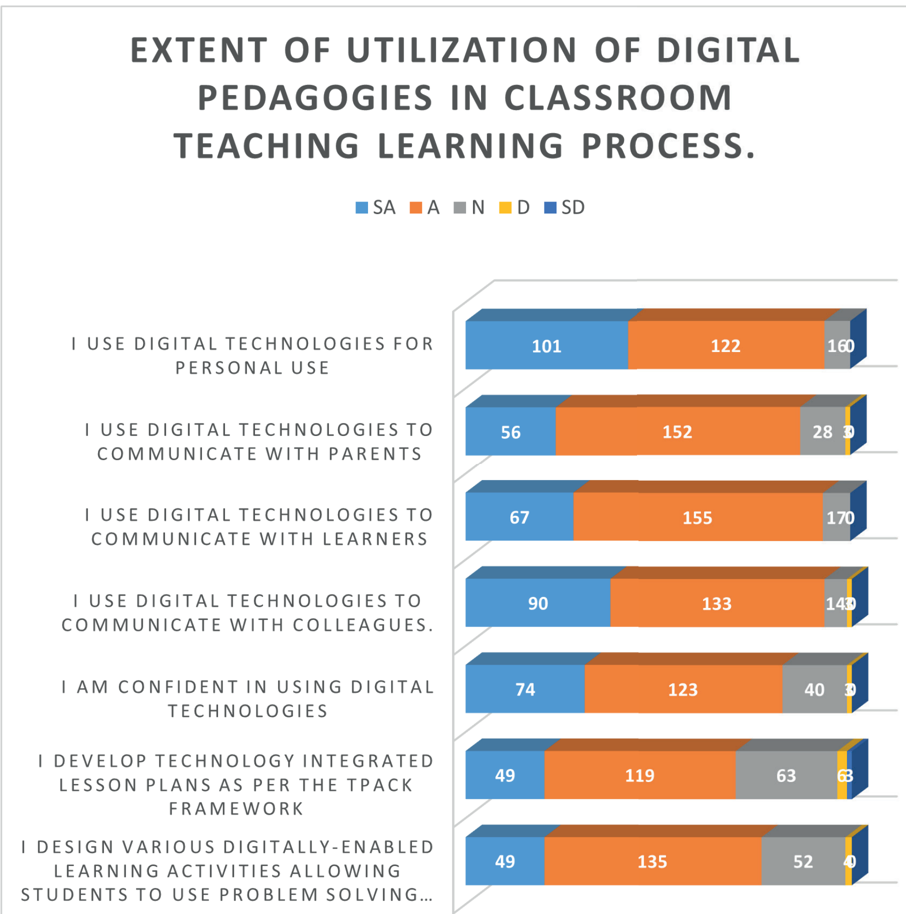
S.No.	Items	SA	A	N	D	SD
7.	I use digital technologies for personal use.	101	122	16	0	0





Findings for item no.7 show that 42 per cent of the participants strongly agreed, 51 per cent of the participants agreed, and 7 per cent were neutral about using digital technologies for personal use.

Figure-6: Extent of utilization of digital pedagogies in classroom teaching-learning process.



The objective-wise findings indicated some of the noteworthy responses that shed light on the current state of the use of digital pedagogies in the classroom and the extent to which they are being used. The data suggested that not only students, it provides an opportunity for the teachers to design digitally-enabled learning activities according to the TPACK framework for the students. Which encourages students' problem-solving skills.

The majority of the participants were aware of the latest developments in digital technological tools developed by DoE and GNCT of Delhi. They feel confident in using those tools in the teaching-learning process.

The majority of the participants think digital competence is the need of the hour to sustain digital advancement. A very prominent feature of digital technology is revealed by the data that it has become a very important medium of communication with colleagues, parents and students. This has become an important tool for learning and upgradation of pedagogies. During the process, participants learn independently and give advice or seek advice when there is a need.

A framework for teachers to ensure the efficient application of digital pedagogy is outlined by Bed, Prasad, and Dhakal (2023). This study underlines how important it is to give our teachers access to the most recent digital tools in order to ensure that the needs of the students are met.

Last but not the least a very important feature of utilization of digital technologies is that it is very helpful for the professional development of the participants which is essential for their professional growth.

Conclusion

In order to determine the degree of its use, this study examined how Trained Graduate Teachers (TGTs) incorporate Digital Pedagogy into their classroom instruction. The results highlight how important digital tools are becoming in learning environments, and TGTs are being adopted in different ways. A more guarded engagement was shown by some teachers, while others showed a smooth incorporation of digital pedagogical practices.

The study emphasizes the necessity of focused professional development initiatives to improve TGTs' digital competencies and promote a more consistent and efficient application of digital pedagogy in a range of educational contexts. The report also highlights how crucial it is to provide TGTs with continuous support and resources in order to solve any obstacles or worries they may have when embracing digital technologies.

Understanding and improving the integration of Digital Pedagogy among Trained Graduate Teachers becomes essential as education continues to change in the digital age in order to provide a dynamic, inclusive, and technology-driven learning environment. The present study provides significant contributions to the current discussion regarding the efficient utilization of digital tools in teaching-learning, thereby opening the door for further developments in instructional design.

References

Ahuja S, & Yadav D. (2019), "Effect of Digital Pedagogy in Interventions in Rural Areas". *MIER Journal of Educational Studies Trends and Practices*, vol. *9*, no. 2, pp. 227–240. DOI: https://doi.org/10.52634/mier/2019/v9/i2/1385

Akram, M., Alomari. (2023). Teachers' Digital Technology Competencies for Use in Distance Education in Schools. *International journal of technology in education and science*, 7(1):57-70. doi: 10.46328/ijtes.435

Albion, P. R. & Ertmer, P. A. (2002). Beyond foundations: The role of vision and belief in teachers' preparation for integration of technology. *TechTrends*, Vol. 46(5), pp. 34-38

Amina, Charania., Freda, Wolfenden., Durbasree, Sarkar., Simon, Cross., Sohini, Sen., Sumegh, Paltiwale., Lina, Adinolfi. (2022). The Formation of Mentor Teachers and their Role in Professional Development of Rural Teachers at Scale in the COVID Lockdown Period in India. doi: 10.56059/pcf10.650

Aslan, A. & Zhu, C. (2016). Influencing factors and integration of ICT into teaching practices of pre-service and starting teachers. *International Journal of Research in Education and Science (IJRES),* 2(2), 359-370. doi:https://doi.org/10.21890/ijres.81048

Bed, Prasad, Dhakal. (2023). Digital Pedagogy: An effective Model for 21st Century Education. *Academic Journal of Mathematics Education*, 5(1):1-9. doi: 10.3126/ajme.v5i1.54534

Bentri A. & Hidayati A., (2022), The Developing of Digital Pedagogical Curriculum of Primary Education Teachers in Indonesia, *Journal of Physics: Conference Series*, DOI: https://doi.org/10.1088/1742-6596/2309/1/012097

Clarke, J., Dede, C. & Dieterle, E. (2008). Emerging technologies for collaborative, mediated, immersive learning. In: J. Voogt& G. Knezek (Eds.), *The international handbook of technology in primary and secondary education* (pp. 901-910). New York: Springer-Verlag.

Darling-Hammond, L. & Bransford, J. (Eds.). (2005). Preparing teachers for a changing world: What teachers should learn and be able to do. San Francisco, CA: Jossey-Bass.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research and Technology in Education*, 42, 255–284

European Union. (2013). Survey of schools: ICT in education. In Benchmarking access, use and attitudes to technology in europe's schools. Belgium: European Union.

Göçen, A., Eral, S. H., & Buçuk, M. H. (2020). Teacher perceptions of a 21st century classroom. *International Journal Of Contemporary Educational Research*, 7(1), 85–98. https://doi.org/10.33200/ijcer.638110.

Huma, Akram., Abbas, Hussein, Abdelrady., Ahmad, Samed, Al-Adwan., Muhammad, Ramzan. (2022). Teachers' Perceptions of Technology Integration in Teaching-Learning Practices: A Systematic Review. *Frontiers in Psychology*, 13 doi: 10.3389/fpsyg.2022.920317

Kim, C., Kim, M. K., Lee, C., Spector, J. M., & DeMeester, K. (2013). Teacher beliefs and technology integration. *Teaching and Teacher Education*, 29, 76–85. https://doi.org/10.1016/j.tate.2012.08.005.

Ministry of Human Resource Development. (2020). National education policy 2020. Government of India. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Mohamad, Zaenuri, Arif., Diding, Nurdin., Sururi, Sururi. (2023). Mapping the use of digital learning tools and methods for increasing teachers' digital competence*. Jurnal Pendidikan Glasser*, 7(2):226-226. doi: 10.32529/glasser.v7i2.2528

Pankaj, Kumar., Parveen, Kumar., Ramesh, Kumar, Garg., Manoj, Kumar, Panwar., Vaibhav, Aggarwal. (2022). A study on teachers' perception towards E-learning adoption in higher educational institutions in India during the COVID-19 pandemic. Higher Education, Skills and Work-based Learning, doi: 10.1108/heswbl-03-2022-0052

Pongsakdi, N., Kortelainen A. & Veermans M. (2021), The Impact of Digital Pedagogy Training on In-service Teacher's Attitude towards Digital Technologies. *Education and Information*

Technologies (2021) 26:5041–5054 DOI: https://doi.org/10.1007/s10639-021-10439-w

Pongsakdi, Nonmanut & Kortelainen, Arto & Veermans, Marjaana. (2021). The impact of digital pedagogy training on in-service teachers' attitudes towards digital technologies. *Education and Information Technologies*. 26. 10.1007/s10639-021-10439-w.

Sadiku, M., Omotoso A., & Musa S.M. (2019), Digital Pedagogy, *International Journal of Trends in Scientific Research and Development,* vol. 3 issue-2

Srivastava K. & Dey S. (2018), Role of Digital Technology in Teaching-Learning Process. *IOSR Journal Of Humanities And Social Science,* vol. 23, Issue 1, Ver. 5 DOI: https://doi.org/10.9790/0837-2301057479

Teo, T., Milutinović, V., & Zhou, M. (2016). Modelling Serbian pre-service teachers' attitudes towards computer use: A SEM and MIMIC approach. *Computers & Education*, 94, 77–88. https://doi.org/10. 1016/j.compedu.2015.10.022

Wadmany, R., & Kliachko, S. (2014). The Significance of Digital Pedagogy: Teachers' Perceptions and the Factors Influencing their abilities as Digital Pedagogues. *i-manager's Journal of Educational Technology*, 11(3), 22-33. https://doi.org/10.26634/jet.11.3.3007

Research Article

Exploring the Integration of Artificial Intelligence in Lesson Planning for Pre-service Teachers

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Abstract

The use of artificial intelligence (AI) in pre-service teachers' lesson planning is covered in detail in this abstract. With the revolutionary changes in education, artificial intelligence has become a useful tool for improving instructional design. Pre-service instructors can gain from the examination of student performance data by utilizing AI tools, which enable customized and adaptive lesson plans. In addition to streamlining the planning process, the AI-driven strategy makes it easier to implement focused interventions that are tailored to each learner's needs. The combination of AI and pre-service teacher education has the power to upend established paradigms and create a dynamic, adaptable learning environment. The need to integrate AI into pre-service teacher preparation is emphasized in this abstract, which also highlights how it might improve student outcomes and better equip teachers for the intricacies of contemporary classrooms.

Keywords: Artificial Intelligence, Lesson Planning, Pre-service Teachers

Introduction

Artificial Intelligence has many definitions .AI is a machine that thinks, understands languages, solves problems, and diagnoses medical problems. AI is often defined as a computer system. Nowadays, AI has become a very crucial part of our education system. If we want our k -12 learners to become AI-friendly, we need to train our teachers. This research project aims to explore the integration of lesson planning in pre-service teachers. Here, AI integration means how a teacher can make his or her lesson planning easy with the help of AI. When teachers will deliver this lesson plan, what kind of changes will they find? AI assistants reduce routine teaching burdens, AI provides teachers with recommendations for their student's needs and extends their work with students and AI that helps teachers to reflect, plan, and improve their practice.

Integration of AI in Lesson Planning

Examples of AI tools for lesson planning include Gooru, Edmentum, and Carnegie Learning. These tools utilize algorithms to analyze student data, develop personalized learning paths, and produce insightful reports for teachers. By leveraging AI, teachers can create and deliver more effective lessons tailored to each student's unique learning style.AI is a helpful tool for lesson planning. It can provide ideas, write lesson goals, suggest activities, and save you time. However, AI doesn't replace your creativity, judgment, and expertise. Always review and adjust any AI-generated content to fit the needs. The incorporation of Artificial

Intelligence (AI) has started to transform the way educators produce educational materials. Artificial Intelligence is being used by a lot of schools to assist streamline administrative work and improve productivity. In order to guarantee that every student is engaged and receives an education that is more tailored to their abilities and learning style, others are using it to design more customized lesson plans.

Research Questions

The basic research questions for the present study were:

- How does the integration of artificial intelligence (AI) in lesson planning impact the effectiveness of pre-service teachers' instructional strategies?
- What are the perceived benefits and challenges of using AI in lesson planning among pre-service teachers?

Significance of Research

First, pre-service teachers are at the center of their education, transforming from learners to teachers. Understanding how to effectively integrate lesson plans at this stage lays the foundation for their future teaching practices. This topic is important because it directly affects the quality of education of these future teachers. Well-designed lesson plans are essential to creating interesting and effective learning experiences for students. Pre-service teachers who are able to integrate lesson plans are better equipped to provide well-structured and organized instruction that promotes a positive and effective learning environment. In addition, research into the integration of AI into lesson plans touches on the evolving landscape of teaching methods. As educational approaches continue to incorporate technology and innovative pedagogy; pre-service teachers must be familiar with modern lesson planning techniques.

Brief Literature Review

A plan of action is only a course's draft. For instructors to use in their classes, lesson plans are essential (Ball & Cohen ,1996). Learning objectives, which outline what participants should learn; learning activities, which describe how teaching and learning are done; and materials, which are resources used during instruction, should all be included in these drafts. Another study conducted about implementing technology in lesson plans shows that pre-service teachers expect to get support on what they need to learn for their future careers (Janssen & Lazonder,2015), the development of web technologies, there are websites and software that provide lesson plans for teachers. Cairncross and Mannion (2001) noted that the utilization of technology proved beneficial for aspiring educators in addressing the challenges encountered during the process of crafting lesson plans.

Similarly, Pratiwi et al. (2020) discovered that lesson planning software was beneficial for both novice and seasoned educators across different types of educational institutions. Furthermore, a cursory online search reveals the existence of paid websites offering lesson plans, including powerschool.com, commoncurriculum.com, and planbook.com. AI has the potential to transform special education by offering students customized learning experiences and helping teachers address each student's unique needs. However, it's crucial to remember that AI cannot replace human interaction and support. Teachers, parents, and caregivers will remain essential in assisting students with special needs (Li et al., 2021; Yufeia et al., 2020; Pedro et al., 2019).

Gaps in the Literature

While considerable research has been conducted on the effectiveness of AI in the teaching and learning process and its integration with various disciplines, there is a notable gap in the literature regarding the use of AI by pre-service teachers, specifically in the context of lesson planning. Current studies do not adequately address whether pre-service teachers are utilizing AI in their lesson plans or the type of training they receive, if any, to support this integration. This research project aims to fill this gap by investigating the extent to which pre-service teachers incorporate AI into their lesson planning and examining the nature of the training they receive to use these technologies effectively.

Methodology

Research design

This study used a mixed methods research design to collect both quantitative and qualitative data. This approach allows for a holistic understanding. Quantitative data were collected through google form, while qualitative data were collected through a google forms survey, while qualitative data were gathered via semi-structured interviews.

Sample selection

D. El. Ed. Pre-service teachers have been selected for this data collection

Tools

- Closed-ended questionnaire

Closed-ended Questionnaire: Designed to capture quantitative data on the familiarity, usage, and perceptions of AI in lesson planning.

- Semi-structured interview schedule

Semi-structured Interviews: Conducted to obtain qualitative insights into the experiences and opinions of pre-service teachers regarding AI integration in lesson planning

Results

- **Data analysis and interpretation**

There are 49 responses obtained from Google Forms, and 91.8 per cent of pre-service teachers are familiar with the term AI. The data indicates a high level of familiarity with AI among pre-service teachers, with 91.8 per cent recognizing the term. This widespread awareness suggests that AI is a well-known concept within the educational community. Interestingly, 67.3 per cent of pre-service teachers have actively used AI tools in their lesson planning. This significant adoption rate implies that many pre-service teachers see value in leveraging AI technology for educational purposes, reflecting a trend towards integrating advanced technologies in teaching practices. 67.3 per cent have used this tool in their lesson plans. Despite the high adoption rate, only 40.8 per cent of respondents believe that AI is very effective in enhancing the learning experience for students. This disparity suggests that while many pre-service teachers are willing to use AI, there is some scepticism or uncertainty about its overall impact on education quality. It could indicate a need for more effective AI tools or a better understanding of how to utilize these tools optimally. 40.8 per cent have this belief that it is a very effective tool in enhancing the learning experience for students. A notable 83 per cent of pre-service teachers report improved student engagement since incorporating AI tools in lesson planning. This significant majority highlights one of the key benefits of AI integration: its potential to make lessons more interactive and engaging for students. Enhanced engagement is a crucial factor in effective learning, suggesting that AI can positively influence the educational experience. 83 per cent of Pre-service teachers believe that there has been an improvement in students' engagement since incorporating AI tools in lesson planning. Despite the benefits, 53 per cent of pre-service teachers express concerns about using AI tools, primarily related to privacy and security. This highlights an important barrier to widespread AI adoption. Addressing these concerns through robust data protection measures and clear privacy policies will be essential to gaining the full trust of educators.53 per cent of people have concerns related to AI tools which is majorly related to privacy and security concerns. 73.5 per cent of pre-service teachers didn't get any professional training during their teaching program. A significant finding is that 73.5 per cent of pre-service teachers did not receive any professional training on using AI tools during their teaching programs. This lack of formal training is a critical gap that needs to be addressed. Effective integration of AI in education requires that teachers are adequately trained to use these tools confidently and effectively.

Discussion

According to the study results, AI-generated lesson plans were found to be adequate for classroom use. These lesson plans effectively met desired learning objectives, incorporated suitable activities, outlined teachers' roles, and included appropriate assessment methods. Specifically, the learning objectives and activities aligned well with the course topics, demonstrating that AI can satisfactorily produce lesson plans. This supports previous findings by Tlili et al. (2023), indicating that AI tools can match classroom applications in these aspects. Teachers should get proper training in AI integration so that they will be able to solve the problem of privacy-related concerns. Pre-service teachers are using it, but still, they have some issues. The lesson plan-making process can be easy and effective with the use of AI. Most of the pre-service teachers also observed it.

Comparison with Existing Literature

The existing literature primarily discusses the role of artificial intelligence in enhancing the teaching and learning process. However, there is a lack of research focusing specifically on how pre-service teachers utilize AI-integrated lesson plans to improve their teaching practices. This research aims to address this gap by examining how pre-service teachers incorporate AI into their lesson plans and the effectiveness they observe in the teaching and learning process as a result. The study will explore the specific ways in which AI integration influences lesson planning and identify any noticeable improvements in educational outcomes when these AI-enhanced lesson plans are employed.

Implications and Limitations of the Study

The teacher educator able to know all those challenges which are pre-service teachers are facing, and after knowing it policymakers will able to do something regarding the same and teacher education program teacher educators may come to know about the challenges pre-service teachers face in their lesson plans and they will come to know the importance of the AI training AI based integrated training which are the essential part of the today's learning, and it can be implied only the research studies only just related to D. El. Ed. trainees. The area can be broader, and we can be very specific about the tool, but in spite of these limitations, it plays a significant role in teacher education programs.

Conclusion

Summary of key findings

The integration of AI in lesson planning significantly improved the efficiency of pre-service teachers, reducing the time spent on routine tasks and allowing for more focus on pedagogical considerations. AI-powered tools demonstrated a notable impact on personalizing learning experiences. The adaptability of lesson plans based on individual student needs resulted in increased engagement and improved comprehension across diverse learning. The study revealed challenges related to bias in AI algorithms, emphasizing the need for careful consideration and continuous monitoring to avoid reinforcing stereotypes and inequalities in educational content.

Contribution to the field

This research is an excellent guide for teacher education programs, highlighting the need for comprehensive training in AI tools. This gift addresses a gap in teacher preparation and ensures that teachers have the skills and knowledge to take advantage of AI while meeting its challenges. This study, which focuses on issues related to bias in AI algorithms, highlights the need for more ethical considerations in the development and implementation of AI tools in education. This contribution informs policymakers and developers of the importance of technology design that promotes fairness and equity.

Recommendation for future teacher

Future recommendations include expanding and improving teacher training programs to include comprehensive AI integration modules. These programs should address not only the technical aspects of using AI tools but also ethical considerations and strategies to mitigate potential biases.

References

Ball, D.L. & Cohen, D.K. (1996). Reform by the book: What is-or might be—the role of curriculum materials in teacher learning and instructional reform? *Educ Researcher*, 25(9), 6-14.

Cairncross, S., & Mannion, M. (2001 Interactive multimedia and learning: Realizing the benefits. *Innovations in Education and Teaching International*, 38(2), 156–164. https://doi.org/10.1080/14703290110035428

Janssen, N., & Lazonder, A.W. (2015). Implementing innovative technologies through lesson plans: What kind of support do teachers prefer? *J. Sci Educ Technol*, 24, 910–920. https://doi.org/10.1007/s10956-015-9573-5

Li, Y., Li, S., & Wang, L. (2021, August). The integration development of artificial intelligence and education. *In 2021 16th International Conference on Computer Science & Education* (ICCSE) (pp. 994-997). IEEE.

Pedro, F., Subosa, M., Rivas, A., & Valverde, P. (2019). Artificial intelligence in education: Challenges and opportunities for sustainable development. Paris: UNESCO.

Pratiwi, D., Susilo, H., & Rohman, F. (2020). Teacher competency and perception in lesson planning using a software prototype. *International Journal of Innovation, Creativity and Change*, 13(3), 811-828.

Tlili, A., Shehata, B., Adarkwah, M.A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. Smart Learn. *Environ*, 10, 15. https://doi.org/10.1186/s40561-023-00237-x

Yufeia, L., Salehb, S., Jiahuic, H., & Syed, S. M. (2020). Review of the application of artificial intelligence in education. *Integration (Amsterdam*), 12(8), 1-15.

Review Article

Post-Pandemic Research on Students Perception towards Online Education Environment

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Abstract

After the Right to Education was passed in 2009, India is continuously working on strengthening its education sector, offering free and compulsory education and this progress is significantly affected by the outbreak of Covid-19 pandemic. Education during Covid-19 was totally dependent on the digital infrastructure that include internet, laptops and smartphones along with the edtechs'. This change brings an opportunity for every stakeholder of education system to adopt new and innovative techniques to rebuild and reshape education system. Digital format of education system did not stop post Covid-19, however it has an addition to the traditional teaching pedagogy. During the pandemic it was a forced implementation and post pandemic it has become the New Normal. This research paper tries to identify the post COVID perception of students toward online teaching learning environment of the B-Schools. Six factors of B-Schools environment are considered in this research and the factors are teaching and learning through online mode and its effectiveness, evaluation process, institutes administration, teacher as a facilitator and extracurricular activities. The descriptive study is conducted and data was collected from 430 management students of various B-Schools of Madhya Pradesh. Hypothesis has been framed keeping in loop all the six factors of B-School environment. The research concludes the positive perception of students toward online teaching learning environment of the B-Schools thus irrespective of pandemic the online education system could be implemented in the New Normal.

Keywords: Online Education, Technology, Covid-19, B-Schools, Education Environment

Introduction

Education is the basic human right and foundation to build peace and sustainable development. Several exciting trends and technologies have been introduced in the 21st century's education ecosystem. This renewal is the result of Covid-19 outbreak. Technology driven education has enabled communication, collaboration & learning to the distant location too. The Covid-19 has impacted each and every sector & so on the education sector as well. Unexpected influx of this pandemic shut down the institute & forced to transit from contact to online learning. In a diminutive period, every industry is exposed to the online platform as per the demand of prevailing circumstances.

Many of the education institutes begun to offer education remotely (Kamanetz 2020). Learning cannot be stopped so, irrespective of the outcome massive adoption and innovation is done by the educators and into the education system. As a consequence, a lot of innovation & creativity has stimulated into the education sector. Reach of the technology to the weaker section of the society is the major concern of this modern ecosystem.

COVID-19, in other ways, can be considered an opportunity for real changes. The pandemic was global & affected severely to all parts of the world. This provides an opportunity for educators & learners to rethink & reshape the education opposite to the outdated model. Without taking much time, everything was implemented in a short span of time & with rapid adoption. This crisis-driven opportunity should bring significant transformation in all aspects of education, such as teacher, learner, assessment, location, platforms, and so on.

Due to the pandemic educators & learners both were not available at contact places so, the E-education imparted in synchronous and asynchronous mode (Agarwal et al. 2020). In the synchronous mode, teachers and students meet online at the same time and on the same platform, ignoring the geographical distance. The systematic time table is followed and teaching learning process takes place with real time knowledge sharing and immediate access to all the information and queries (Amiti, F. 2020). Asynchronous mode is more flexible in comparison to synchronous mode. In this mode of E-learning ready to study material is provided to the students in form of video lectures, articles & ppt's on various online platform like Moodle. This material is accessible anytime anywhere. Along with the ready to study material, assessment is also conducted through giving a submission time frames by using e- assessment platforms such as Testmoz & Google Doc. Questionnaires. To cope with these changes were not easy at early stages of E-education implementations. However, with guidance & mentoring from the experts and practicing these platforms made the path easy & comfortable (Bashir et al. 2021).

Covid-19 has significantly changed the entire ecosystem. A rare opportunity of implementation of tech-based education has been seen during these circumstances. Fundamental changes are instigated in school & college education so as the behaviour of educator & learner has also changed. Covid-19 was first identified December 2019 in Wuhan, China as a respiratory infection disease. Gradually the Covid-19 outbreak outstretched all over the world & complete lockdown is ordered by the Government of India as well. The situation was under controlled and slowly the lockdown was open in phases however the education institutes were still on an online mode.

In April 2021 again a new variant of Covid-19 i.e., delta variant has been found, a complete lockdown in declared in India and it lasted till June 2021 after the vaccination drive started for 18 & above citizens. However, the vaccination for below 18 years was started from Jan. 2022. The colleges have been started with 50 per cent capacity at a time and 50 per cent on online platform & the same is implemented for senior secondary school students. Finally, the academic session July 2022 started with contact classes for school & college students. These fluctuations in education sector have changed the mindset of educators and learners. The entire system such as teaching & learning, evaluation process, filed visits, practical session witnessed the changes during Covid-19 & post Covid-19 too. Thus, this study is an attempt to understand the students' perception towards B-School education environment in post Covid-19 scenario. The study identified certain factors such as teaching and learning through online mode and its effectiveness, evaluation process, institutes administration, teacher as a facilitator and extracurricular activity; students' perceptions on these factors of education environment is analysed.

The paper discusses the most recent experiences of transition period of education system due to Covid-19. These tech-based changes could not get a grip if implemented before this pandemic.

Literature Review

To find the research gap & to uphold the objective of current research, the review of literature is conducted. The study of previous researches helped to identify the impacting factors of Covid-19 on education environment. The review is summarised and discussed in this section of the study.

Covid-19 & Education Environment

India, the country has immense opportunity in each and every domain & to grab the opportunities special set of skills to be inculcated in an individual through proper education. Education environment includes school, colleges, teachers, learners, courses, extra-curricular activities etc (Lawrence et al. 2021). Unpredictable changes in educational environment have been seen that have been proposed before COVID-19 but were never executed completely (Zhao & Watterston 2021). Due to number of factors the new regimes in education system are not completely implemented especially in India.

Significant changes are reflected during Covid-19 and post Covid-19 in education scenario and conclusion can be drown that socio-economic factor is playing important role in the tech-based education system. Deprived segment of the society may be under stressed due scarcity of the tech-based resources (Di Pietro et al. 2020). Reimagining education & executing the same has been only possible with this pandemic. However, this technology driven education should not undermine the privacy & shall connect to all corners of the planet ignoring the caste, gender, economic status etc. (Zhao & Watterston 2021). As the rise of digital world in education sector has removed all the geographical barriers so, this age of smart machines requires more dynamic and creative students to meet the global competencies (Zhao 2012).

Education environment as a whole has several aspects and together these aspects complete the entire education of a student. As already discussed, that a significant change in education system has been seen during Covid-19 and these changes are to be continued post Covid-19 as well to some extents.

So, to analyses the students' perception on education environment several aspects such as teaching and learning process, online mode and its effectiveness, evaluation process, institutes administration, teacher as a facilitator and extracurricular activity have been studied in the literature review.

Three major developments have been seen over traditional teaching learning process i.e. Distance learning, E-learning & Online learning (Moore et al., 2011).E-Learning and Online teaching & learning is elaborated as a paradigm of education based on technology. The teaching fraternity is eager to know the impact & outcome of the modern methodology on academic achievements of the students.

Covid-19 did not give enough time to teachers and learners to shift from offline to the online mode. Teachers had not use the technical pedagogical tools frequently before this pandemic (Rice & Deschaine, 2020). Several challenges emerged due to abrupt digital renovation in the education and some of the prominent were lack of technological infrastructure, lack of digital competency, inequality in education and compatibility with some of the subjects such as sports, music &

dance (Adedoyin and Soykan, 2020).

Effectiveness of online teaching could be evaluated with the students' academic performance. More authentic learning of the students can be evaluated through various assessments that includes formative and summative both (Arella, 2016). So, the process of the assessment shall include during the course assessment (formative assessment) to monitor the gradual performance of the student and at the end (summative assessment) to evaluate the entire learning of the student to measure the attainment of learning outcomes of the educational programme (Rust, O'Donovan, & Price, 2005). The online evaluation process has become a concern due to its significant role in the education system. In the absence of physical interaction between teachers and students, limited options for assessing the students online are left in the hand of teachers (Abduh 2021). Learning interest influences the performance of the student in the assessment process and educator plays a pivotal role to make the teaching and learning interesting be it online or offline. Thus, online evaluation becomes one of the strong parameters which influence students' perception for online education environment.

The satisfaction in the e-learning process is also influenced by the service quality, which is measured by some specific elements such as institute administration on the entire process & supporting services, instructor quality & accuracy of the teaching process, course material quality & newness, security & privacy (Phem et. al., 2018).

The teacher or the instructor is the core element of teaching and learning process. Their role has become more difficult in online education as it needs a lot of effort to involve students in participative learning. Teacher self-efficacy, i.e., the teacher's belief that he/she can affect student success plays a significant role in students' active involvement. Teachers' command over technology & digital tools will encourage students to learn actively (Corry & Stella, 2018).

A variety of activities outside the formal curriculum are referred to as extracurricular activities (Keen and Hall, 2009). Many researches have shown evidence of the positive influences of extracurricular activities towards students' development and academic affairs (NG. 2021). Even though extracurricular activities are not considered for academic performance, they play an important role in intellectual skill development and holistic grooming of the learner. Therefore, it has become an important element of the education system (Samat et al. 2020). Social networking sites & artificial intelligence platforms were used to involve students in such kind of activities during Covid-19. Students have also participated actively in such platforms due to several reasons, such as the topic being interesting, being a technology enthusiast, teachers' recommendations & zeal to learn about digital platforms or AI-based knowledge (NG. 2021).

Rationale of the Study

The most significant impact of Covid on the education industry was a loss of classroom teaching. Online teaching learning was becoming the only option for the situation. During the pandemic, online learning is considered a temporary way of teaching. But, the forceful implication of online learning during the pandemic become the choice of today. In my experience, E- platforms were found to be very creative, flexible and comfortable for learning. After the pandemic, the question was whether online teaching would be able to replace classroom teaching and whether there was a need to redesign the teaching and learning by the education industry. The paper tries to identify the answer to these questions from the student's perspective. This research paper tries to identify the perception of college students toward the COVID education environment in college.

Objective of the Study

1. To study the various components of education environment of b-schools of India.
2. To study the students' perception towards post COVID-19 education environment of b-schools.

Research Methodology

Research Methodology provides a road map to any research. Research is vast area of study and therefore making a smooth roadmap is always makes journey easy. Present research tries to define view points and attitude of management students towards online education environment post covid and so based on descriptive type of research design.

With the help of literature review six factors are extracted to conduct the research further on online education environment. These six factors are:

1. Online Mode and its Effectiveness
2. Teaching and Learning Process
3. Evaluation Process
4. College Administration
5. Extracurricular Activities
6. Teachers as a facilitator

Above factors are considered as the components of education environment and were again divided into various sub-factors. There were 8 sub-factors of Teaching and Learning Process, 7 sub-factors of College Administration, 6 sub-factors were considered for online mode and its effectiveness and also for evaluation process, and 5 sub-factors were in to the consideration for extracurricular activities and teachers as a facilitator.

Students of various management colleges of undergraduate and post graduate courses of Madhya Pradesh were taken as a population for the study. Sample from this population is selected with the convenient sampling method. Primary data was collected with the help of questionnaire method. Questionnaire was constructed on the basis of 5 pointer Likert Scale. Before colleting the final data pilot study was also done. Total 42 questions were constructed in questionnaire. These questions were constructed on the basis of sub-components of education environment. For pilot study questionnaire were circulated among 50 students, out of which 47 responses were received. On the basis of pilot study 6 questions were omitted and 36 questions were considered for final questionnaire. Questionnaire was then circulated among 500 management students out of which got responses from 430 students only. Reliability was tested for each and every component of college environment.

Hypothesis were framed to identify the analytical differences between the perceptions of students towards the components of education environment. Total six hypothesis were formed and checked statistically with the help of one sample t- test. One sample t – test was used to found the mean difference between the perception of students with the population. Before applied the one sample t test reliability of data was checked with the help of Cronbach.

Data Analysis & Interpretation

Table-1: Reliability Table

S. No.	Item	Value of Cronbach Alpha	No. of Items
1.	Online mode and its effectiveness	0.98	6
2.	Teaching and learning process	0.88	8
3.	Evaluation process	0.89	6
4.	Institute's administration	0.76	7
5.	Extracurricular activities	0.78	5
6.	Teacher as a facilitator	0.84	5

Reliability of data measures to obtain the consistency of data set. Research used primary data set and hence the reliability check helps to prove that how much extent data will provide stable and consistent result. Table 1 shows the value of reliability for different components of education environment. The value of Cronbach Alpha obtained for components Online mode and its effectiveness is 0.98, for teaching and learning process it is 0.88, for evaluation process is 0.89, Institute's administration it is 0.76, extracurricular activities it is 0.78 and for teachers as a facilitator it is 0.84. All the values of Cronbach are greater than 0.75 which shows the high reliability of data.

Hypothesis:

Ho1: There is no significant difference between the perceptions of students towards Effectiveness of Online classes.

Ho2: There is no significant difference between the perceptions of students towards Teaching and Learning Process.

Ho3: There is no significant difference between the perceptions of students towards Evaluation Process.

Ho4: There is no significant difference between the perceptions of students towards Institute's Administration.

Ho5: There is no significant difference between the perceptions of students towards extracurricular activities.

Ho6: There is no significant difference between the perceptions of students towards Teacher as a facilitator

Table 2: T-Test: Online Class Effectiveness

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Online Classes Effectiveness	430	3.891219891219992	.491921885825524	.023722579850884

One-Sample Test						
	Test Value = 3					
	t	Df	Sig. (2-tailed)	Mean Difference Lower	95% Confidence Interval of the Difference	
					Upper	
Online Classes Effectiveness	37.568	429	.000	.891219891219992	.844592944102778	.937846838337205

Interpretation: Hypothesis Ho1 is tested with the help of one sample t test. The value of t obtained is 37.568 at 5 per cent level of significance. The p value for the test is 0.00 < 0.05 which shows that null hypothesis Ho1 is rejected. There is a significant difference exist for the perception of students towards online classes. Mean value shows that students are having positive perception toward the online classes.

Table 3: T-Test: Teaching and learning Process

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Teaching and learning Process	430	3.537878787878888	.632461465325176	.030500000195340

One-Sample Test						
	Test Value = 3					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Teaching and learning process	17.635	429	.000	.537878787878888	.477930759244412	.597826816513363

Interpretation: Hypothesis Ho2 is tested with the help of one sample t test and rejected at 5 per cent level of significance. The t value obtained for one sample t test is 17.635 and p value is 0.00 < 0.05. This shows that Ho2 is rejected, i.e. there is a significant difference between the perception of students towards teaching and learning process. Since the mean value is higher than 3 it also shows post COVID positive perception of students towards teaching and learning process.

Table 4: T-Test: Evaluation process

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Evaluation process	430	4.019813519813618	.335939410728378	.016200436950887

One-Sample Test						
	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Evaluation process	62.950	429	.000	1.019813519813618	.987971413190669	1.051655626436566

Interpretation: Table shows that the p value is less than 0.05 at 5 per cent level of significance. Ho3 is rejected on the basis of p value. We can conclude that the perception of students towards evaluation process of online classes is having significant difference. Mean value obtained is 4.019 which show positive perception of students towards online evaluation system.

Table 5: T-Test: Institute's administration

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Institute's administration	430	3.577422577422679	.590235176148368	.028463667709099

One-Sample Test						
	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference Lower	95% Confidence Interval of the Difference	
					Upper	
Institute's administration	20.286	429	.000	.577422577422679	.521476978867320	.633368175978038

The mean value for the component Institute's administration is 3.577 which is greater than 3 shows that post pandemic Institute's administration plays a very significant role towards education environment. The p value obtained from one sample t test is 0.00 < 0.05, hence the result of one sample t test rejected the H04 which shows that perception of students on the component is significantly different than the average perceptions towards Institute's administration. This tends towards the rejection of hypothesis H04

Table 6: T-Test: Extracurricular activities

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Extracurricular activities	430	3.131468531468632	.612734280060209	.029548670845774

One-Sample Test						
	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference Lower	95% Confidence Interval of the Difference	
					Upper	
Extracurricular activities	4.449	429	.000	.131468531468632	.073390349349682	.189546713587583

The p value obtained from one sample t test is 0.00 < 0.05, hence the result of one sample t test shows that perception of students on component is significantly different than the average perceptions towards extracurricular activities. This means that the null hypothesis H05 is rejected. Mean value obtained is 3.13 shows the positive perception of students towards extracurricular activities after COVID.

Table 7: T-Test: Teacher as a facilitator

One-Sample Statistics				
	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
Teacher as a facilitator	430	3.177156177156277	.599253868894511	.028898587693318

One-Sample Test						
	Test Value = 3					
	T	**Df**	**Sig. (2-tailed)**	**Mean Difference**	**95% Confidence Interval of the Difference**	
					Lower	**Upper**
Teacher as a facilitator	6.130	429	.000	.177156177156277	.120355739404172	.233956614908383

The mean value for the component Teacher as a facilitator is 3.577 which is greater than 3 shows that during pandemic Teacher plays a very significant role towards education environment. The p value obtained from one sample t test is $0.00 < 0.05$, hence the null hypothesis H06 is rejected, resulted that the perception of students on this component is significantly different than the average perceptions towards Teacher as a facilitator.

Findings, Conclusion & Limitations

For the betterment of the educational system and approaches of institutions need changes. To maintain continuity in learning and to share the knowledge with the students, it is recommended to the institutions to adopt the technology and engage the students in learning The contribution of technology in education during Covid-19 is remarkable and even after post Covid-19 there will be a pivotal role of technology in this field.

Institutions need to change positively for the betterment of the educational system. With the help of technology sharing of knowledge and continuity of learning become easy. Technology alone will not be able to bring the desirable changes but using it at the right time, for the right purpose and with the right people will certainly change the education system of the country. The present study concludes that students have positive perceptions towards various factors of education environment in online mode such as teaching and learning process, online mode and its effectiveness, evaluation process, institutes administration, teacher as a facilitator and extracurricular activity.

During the pandemic, the entire education system shifted to the virtual world, and institutes tried their best to perform well in this online teaching-learning process. The education environment faced the challenges however worked hard to overcome. The quick shift from offline to online mode of teaching learning process is also given the same importance along with all the other supporting activities. The research concludes that there is a positive change in the perception of the students toward the new dimension of education environment. And from the discussion it can be recommended that hybrid mode of teaching shall be adopted as the students and teachers both are now adjusted with the online classes. This modern system of teaching learning process will surely bring tremendous changes in the Indian education environment. The government must take initiatives for the successful implementation of tech-based education to connect with the remote area population as well and create new ray of hopes.

The study examines the pre and post COVID 19 education environments with a special focused on online education system. The sample drawn for this study is the management students of Madhya Pradesh however, further expansion of this research can be done to pan India students of various streams. The further research can be conducted on future of online education considering the various parameters of education environment which are included in this research.

Reference

Abduh, M. Y. M. (2021). Full-time online assessment during COVID-19 lockdown: EFL teachers' perceptions. Asian EFL Journal, 28 (1.1), 26-46.

Adedoyin, O. B., & Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities. Interactive learning environments, 31 (2),1-13.

Agarwal, J., Maheshwari, S., Agrawal, A., Pant, M., Chaudhary, Y. and Naithani, M. (2020). Impact of COVID 19 lockdown on the study of medical students: a cross sectional survey. Acta Medica International, 7, 86-89.

Amiti, F. (2020). Synchronous and asynchronous E-learning. European Journal of Open Education and E-Learning Studies, 5 (2), 60-69.

Arella, F. (2016). Formative vs summative vs diagnostic assessment. Teaching in Education. Retrieved from https://www.youtube.com/watch?v=JI-YgK-l4Sg.

Bashir, A., Bashir, S., Rana, K., Lambert, P. and Vernallis, A. (2021). Post-COVID-19 Adaptations; the Shifts Towards Online Learning, Hybrid Course Delivery and the Implications for Biosciences Courses in the Higher Education Setting. Frontier in Education, 6, 1-13.

Corry, M., and Stella, J. (2018). Teacher self-efficacy in online education: a review of the literature. Research in Learning Technology, 26, 1-12.

Di Pietro, G., Biagi, F., Costa, P., Karpiński, Z., and Mazza, J. (2020). The likely impact of COVID-19 on education: reflection based on the existing literature and recent international datasets. Joint Research Centre, Luxembourg: Publications Office of the European Union, 2-45. doi:10.2760/126686.

Kamanetz, A. (2020). Panic-gogy': Teaching online classes during the coronavirus pandemic. NPR Special Series: The Coronavirus Crisis.Keen, C., and Hall, K. (2009). Engaging with difference matters: Longitudinal student outcomes of co-curricular service-learning programs. The Journal of Higher Education, 80 (1), 59-79.

Lawrence, S. A., Garcia J, Stewart C, Rodriguez C (2021) The mental and behavioural health impact of COVID-19 stay at home orders on social work students. Social Work Education, 41, 1-15.

Moore, J. L., Dickson-Deane, C., & Galyen, K. (2011). E-learning, online learning, and distance learning environments: Are they the same? Internet Higher Education, 14 (2), 129–135.

NG, T. K. (2021). New interpretation of extracurricular activities via social networking sites: A case study of artificial intelligence learning at a secondary school in Hong Kong. Journal of Education and Training Studies, 9(1), 49-60.

Pham, L., Williamson, S., and Berry, R. (2018). Student perceptions of e-learning service quality, e-satisfaction, and e-loyalty. International Journal of Enterprise Information Systems, 14 (3), 19-40.

Rice, M. F., and Deschaine, M. E. (2020). Orienting toward teacher education for online environments for all students. The Educational Forum, 84 (2), 114–125.

Rust, C., O'Donovan, B., and Price, M. (2005). A social constructivist assessment process model: how the research literature shows us this could be best practice. Assessment & Evaluation in Higher Education, 30 (3), 231-240.

Samat, M. F., Awang, N. A., Hussin, S. N. A., and Nawi, F. A. M. (2020). Online Distance Learning amidst COVID-19 Pandemic among University Students: A Practicality of Partial Least Squares Structural Equation Modelling Approach. Asian Journal of University Education, 16 (3), 220-233.

Zhao, Y. (2012). Flunking innovation and creativity. The Phi Delta Kappan, 94 (1), 56-61.

Zhao, Y., and Watterston, J. (2021). The changes we need: Education post COVID-19. Journal of Educational Change, 22, 3-12.

E-Resources

https://www.igi-global.com/article/blended-learning/291980

https://www.outlookindia.com/website/story/opinion-education-in-india-during-covid-19-challenges-faced-and-solutions-for-a-post-pandemic-era/400485

https://www.tandfonline.com/doi/full/10.1080/07294360.2021.2002828

Review Article

Contributions of Physics to the Information and Communication Technology: Connecting Science, Technology, and Society- A Chronology of Technological Advancements

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Abstract

Science and technology have impacted all walks of society and therefore, all are interlinked. The development of cutting-edge technology is driven by the needs and demands of the rapidly changing modern society and science is the backbone of every technology. We interact with various communities of practices, technologies, and general peoples throughout our life in our highly technological and information-based society. A qualitative knowledge of science and roles played by it is, therefore, necessary from the viewpoint of technology, community, and society as a whole. This can be achieved by discussing qualitatively the scientific and technological contributions made by various scientific fields to society. One such combination is Physics, Information and Communication Technology (ICT), and society. Physics is one of the fundamental science subjects. Its concepts, principles, laws, and techniques contribute and strengthen the progress of all other branches of science including cross-, interdisciplinary-, and multidisciplinary-sciences, the innovation and development of various technologies, and the sustainable development of society. Here, we have briefly and systematically discussed the contribution of physics to the various components of Information and Communication Technology (ICT).

Keywords: Physics, ICT, Science, Technology, Society.

Introduction

Science and technology have been contributing immensely to our rapidly changing technology and information-based modern society (Gonzalez, 2005; Kumar et al, 2012; Standke et al, 1980; Bauchspies et al, 2005). Changes around ourselves can be observed when we compare today's (post) modernized world with earlier (medieval/dynasty) ages. There has been a continuous development of science & technology, owing to the demands of modern society such as communication, transportation, environment, entertainment, disaster management, health and welfare (medicine and diagnostic tools), (technology-enhanced) learning/ education and many more - the society that we live in today is largely shaped and influenced by science & technology (Gonzalez, 2005; Kumar et al, 2012; Standke et al, 1980; Bauchspies et al, 2005). For example, the invention and innovation of the radio, telephone, mobile/smartphones, & internet services have broadened communication and impacted almost all walks of life - we can communicate with anyone living in any part of the world in seconds through emails, faxes, mobile phones, texting services, video conferences, and social media channels and networks for various purposes (e.g., business, education, health, and social life) (Freeman, 1999; Haddon, 2004). Alternative and pollution-free modes of transport (e.g., electronic railway lines, cars, and buses) have significantly benefited society by reducing the carbon emission (Ercan et al, 2022). Effectively, every place is touched by humans – from the bed of the ocean to the interplanetary space, that is to say, human society has become very dependent on science and technology or vice-versa – a confluence of science, technology, and society (STS) (Gonzalez, 2005; Kumar et al, 2012; Standke et al, 1980; Bauchspies et al, 2005).

A qualitative discussion of various roles played by the sciences to the discovery and growth of technologies is necessary to generate and promote scientific literacy, awareness, and attitude among common peoples (public) as well as to integrate science, technology, and society (peoples) as common peoples of technology-based modern societies use technologies throughout their lives without knowing or understanding the science behind it (Scheufele, 2013; Turney, 1996; Stilgoe et al, 2014; Laugksch, 2000; Keith et al, 2017; Sarnoff, 1937). Physics, one of the fundamental subjects, has been playing a pivotal role in numerous areas of innovations and technological development vis-à-vis the progress of society (Gonzalez, 2005; Kumar et al, 2012; Standke et al, 1980; Bauchspies et al, 2005; Walker et al, 2016; Young et al, 2012; Gershenfeld, 2011; Wolf 2008; Deák, 2017; Fraden, 2004; Barlett, 2014; Davidovits, 2008; Colicchia et al, 2015; Tegmark, 2014; Hush, 2017; Biamonte et al, 2017; Dunjko et al, 2018; Kreupl, 2013; Shulaker et al, 2013). The various concepts and laws of physics have been used time and again to make the life of humans simple and comfortable - from walking, running, playing football to pushing and pulling of things; from the airplane that we see flying up high in the sky, satellites in space to the ships and submarines moving underwater; from everyday science and experience to the modern technology; and from individual to the society at large (Gonzalez, 2005; Kumar et al, 2012; Standke et al, 1980; Walker et al, 2016; Young et al, 2012; Rajaraman 2018). Physics also extends and enhances our understanding of other cross-, inter-, and multi-disciplinary scientific disciplines, which are directly or indirectly related to the society (e.g., biophysics, geophysics, astrophysics, nano-science & - technology, materials sciences, medical physics, engineering, technology, and environmental science) (Walker et al, 2016; Young et al, 2012; Mitchell et al, 2007; Hush, 2017; Neamen 2003; Mukhanov 2005; Ahrens, 2011). Even there are fields of study like econophysics and sociophysics (Chakrabarti et al, 2007).

Information and communication technology (ICT) is one such technology, which has impacted nearly all aspects of our modern society and has a close relation with physics (Haddon 2004; Gershenfeld 2011; Rajaraman 2018). In this article, we have presented a concise introduction of ICT and qualitatively discussed the contribution of physics to the historical development of various components of ICT from very beginning to the most recent one without mathematical nitty-gritty to link science, technology, and society.

What is ICT?

Information and Communication Technology (ICT) has become an integral part of our modern lives over the years with the advent and advancement of technologies (Haddon 2004; Gershenfeld 2011; Rajaraman 2018; Samuel et al, 2008). Our ways of communication have adopted different forms and formats with the evolution of mankind over thousands of years, for example, language-based communication over symbolic/art/painting, as we are social animals and communication is an important part of everyone's life (Christiansen et al, 2003). When we look around ourselves and compare the situation of today's world with the medieval period, there has been a drastic change in the field of information and communication. Briefly, ICT integrates or combines communications (audio, visual/audio-visual), necessary/required hardware (electronic components and modules) and software, data storage devices, and adheres some standard protocols to facilitate peoples (users) throughout the world to store, share, transmit, and retrieve (encrypted and sensitive) data (classified message), distant communication (presentation/conference, social interaction), and various online services (e.g., public outreach, reservation, shopping, sports and entertainment, educational broadcasting, and many more) (Haddon 2004; Rajaraman 2018; Samuel et al, 2008; Voogt et al, 2008; Anderson et al, 2002; Goodyear, 2010; Weert, 2004; Field, 2001; Tipton, 2008) Examples of some ICT components are radios, telephones (landline, cell, and smartphones), computers (desktop PCs, laptops and supercomputers), internet (cable and Wi-Fi), optical fibers, cloud computing, satellite communication, TVs, robots, teaching, social networking, etc., and the list is growing (Haddon, 2004; Rajaraman 2018; Charlton, 2009; Voogt et al, 2008; Anderson et al, 2002; Goodyear, 2010; Weert et al, 2004). ICT has revolutionized the teaching-learning process of the education system and as a result, a new field, technology-enhance-learning (TEL), has evolved and gained momentum over the years (Voogt et al, 2008; Goodyear 2010; Anderson, 2002). ICT is taking lifelong learning and lifelong education to a new dimension since peoples can take various online formal and non-formal degrees/courses to enhance their knowledge at their own pace for their careers and other purposes (Weert et al, 2004; Field, 2001). With every day that passes by, it is harder to imagine our work, business, transportation, education, pleasure/entertainment, security, communication, private/social life, and many more without ICT (Gershenfeld, 2000; Rajaraman 2018; Tipton 2008). ICT offers a wealth of information and knowledge to our society. Consequently, 'information society' and 'knowledge society' have evolved slowly but steadily over the years due to the tremendous advancement of ICT (Webster, 2006; Gritzalis et al, 2007; Phillips et al, 2017).

The contribution of physics to the development of ICT

Physics has been consistently contributing to the development of ICT. In this section, we briefly discuss the relation between physics and ICT.

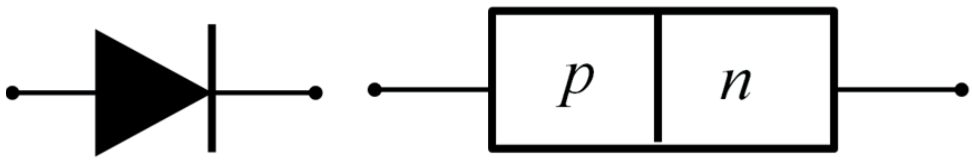
Telephone: The invention of the telephone (phone) has made communication more efficient and faster as it replaced the Telegraph (Freeman 1999; Haykin et al, 2009; Haykin, 2014; Haykin et al, 2007; Proakis, 2002). A telephone is a telecommunication device that permits two users to talk (communicate) directly when they are far apart (Freeman 1999). A telephone has two main parts - transmitter and receiver. When a person speaks (sound) in the telephone (here the transmitter), his voice is picked up by the microphone and is converted into electric signals; the signal is transmitted via cables and other communication channels to another telephone (here the receiver), which transforms the electronic signal into sound and the receiving person receives the voice (audio). Landlines, cell phone/mobile phones, and smartphones are typical examples (Freeman 1999; Haykin et al, 2009; Haykin, 2014; Haykin et al, 2007; Proakis, 2002).

Radio: Radio is the technology of using radio waves to carry information (in the form of sound energy) by systematically modulating and transmitting various properties (amplitude, frequency, phase, or pulse width) of electromagnetic waves through space from one place to another without a direct connection (Haykin et al, 2007; Proakis et al, 2002). The equipment that sends out a radio wave is known as the transmitter and equipment, which receives the signals, is known as the receiver (Haykin et al, 2007; Haykin et al, 2009; Proakis et al, 2002).

Television (TV): A TV plays a very important role in our society (Gulati, 2004; Kompare, 2006). It is a source of information or a medium of communication since through a TV we can see an event occurring in any part of the world - entertainment, local/ world news or information, opinion, debate, education, etc. A TV combines radio (audio) with video (moving pictures) - when radio transmits a sound signal through the air, television also sends a picture signal. These signals are carried by radio waves (electromagnetic waves) that propagate through the air and are received by the receiver. Paul Julius Gottlieb Nipkow, a German student, developed the first prototype of a TV in the year 1800 (Encyclopaedia Britannica, 2008): He sent images through wires with the help of a rotating metal disc. The invention was a three-step process: the camera that turned a picture and sound into a signal; a transmitter that sent the signal through the air; and a receiver that captured the signal and turned it back into picture and sound. Scientists and engineers used the concept light and developed color TV that could have a camera to capture red, green, and blue signals separately; transmission system to send color signals through the air; and a TV set that could turn them back into moving, multicolored images (Gulati, 2004).

Semiconductor and Nano Electronics and Technology: Unique properties (physical, chemical, etc.,) of semiconductors have revolutionized the electronics and technology (Kittel, 2004; Sze et al, 2012; Yu et al, 2010; Moutanabbir et al, 2010). Materials can be broadly classified into three categories - metals, semiconductors, and insulators (Sze et al, 2012). The physical principle which separates them is the 'band gap' (or band structure or energy band) (Kittel, 2004; Sze et al, 2012; Yu et al, 2010). For example, the electrical conductivity of semiconductor material is between a metal and an insulator. Semiconductors are used in detectors, diodes, transistors, light-emitting diodes (LED), high-power lasers, power electronics, high-gain amplifiers, integrated circuits (ICs), detectors, sensors, optical and magnetic storages, and many more high efficiency electronic and quantum devices for numerous applications including the secured storage and transmission/ communication of data (Fraden, 2004; Kittel, 2004; Sze et al, 20012; Yu et al, 2010; Moutanabbir et al, 2010). Properties (electrical, magnetic, thermal, chemical, etc.,) of a semiconductor can be tailored by doping one or more elements into it (Kittel, 2004; Sze et al, 2012; Yu et al, 2010; Moutanabbir et al, 2010). There are various types of semiconductors – intrinsic (Silicon, Si, and Germanium, Ge), extrinsic (*p*- and *n*-type), and compound (Kittel, 2004; Sze et al, 2012). If the charge carriers are holes (positive), it is *p*-type, and if the charge carriers are electrons (negative), it is an *n*-type (Sze et al, 2007). A pure (or intrinsic) semiconductor (Si or Ge) can be converted into a *p*-or *n*-type by doping suitable elements into it (Sze et al, 2012; Yu et al, 2010). A junction between two different semiconductors is known as *p-n* junction diode as shown in Fig. 1. A diode exhibits signal rectification and amplification property, generates voltage and optical signals under proper conditions (biasing and recombination of electron and hole) (Sze et al, 2007; Yu et al, 2010). A few examples of compound semiconductors are cadmium sulfide (CdS), lead sulfide (PbS), lead telluride (PbTe), indium antimonide (InSb), gallium arsenide (GaAs), and indium phosphide. In addition, there are several alloys such as gallium indium arsenide (GaInAs), mercury cadmium telluride (HgCdTe), and gallium arsenide phosphide (GaAsP) (Kittel, 2004; Sze et al, 2012; Yu et al, 2010; Moutanabbir et al, 2010).

Figure-1: Schematic diagram of a *p-n* junction diode

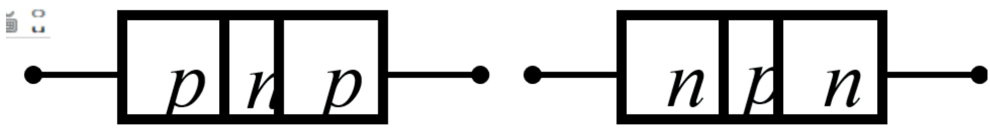


Various types of nanostructures (1 nm = 10^{-9} m), e.g., thin films, nanoparticles, quantum dots, nanorods, nanotubes, and nanoflowers have been used for numerous technological applications due to their unique physical and chemical properties (Wolf, 2006; Kreupl, 2013; Shulaker et al, 2013; Brink, 2007; Friedman et al, 2017; Morkoç 2009). Carbon nanotubes and nanorods, silver and gold nanoparticles, zinc oxide nanoparticles and nanorods are a few examples (Brink, 2007; Friedman et al, 2017; Morkoç et al, 2009). Numerous physical and chemical techniques (sol-gel, hydrothermal, molecular beam epitaxy, microwave, pulsed laser deposition, etc.,) have been used to fabricate them on various materials (substrates) in order to tailor their properties and to achieve the desired applications (such as solar cells, light-emitting diodes, high-power electronics, photonic and optoelectronic devices) (Wolf, 2006). Scientists are working on graphene for future ICT components and other technological applications (Kinaret et al, 2011; Choi et al, 2010; Khorasani et al, 2017; Rana et al, 2014). Graphene is a single hexagonal honeycomb plane of carbon atoms and the building block of full three-dimensional graphite (Choi et al, 2010). It exhibits unusual electronic properties (almost transparent, flexible, stronger than steel, and excellent conductor), which makes it one of the most promising materials for nano-technology over carbon nanotubes (Khorasani et al, 2017; Rana et al, 2014).

Computers: The first electronic digital computer was built by Prof. John Atanasoff, a theoretical physicist, and his physics graduate student Clifford Berry at the Department of Physics at Iowa State University (Henderson, 2009; Morley, 2009; Wang, 2020). The second electronic digital computer, called ENIAC (Electronic Numerical Integrator and Computer) and based on Atanasoff's pioneering work, was proposed, designed and completed in 1945 by physicists J.W. Mauchly and J.P. Eckert (Henderson, 2009; Rojas et al, 2000). This first generation of computers was slow, bulky, and unreliable as vacuum tubes were used to store & retrieve the information (Henderson, 2009; Morley, 2009; Rojas, 2000). They were later replaced by transistors - building blocks of all modern electronic devices (Wang, 2020).

Transistors, developed by J. Bardeen, W. Brattain, and W. Shockley, were the heart of the second generation of computers (Henderson, 2009; Boylestad, et al, 2013; Morley, 2008). They significantly reduced the size of computers and made them more efficient and reliable (Morley, 2008). Transistors form the foundation of digital logic gates and are crucial for memory storage and processing in microprocessors. Transistors can be broadly classified into two categories – bipolar junction transistors (BJTs) and field-effect transistors (FETs) (Boylestad et al, 2013). A BJT consists of three semiconductor layers: the emitter (E), the base (B), and the collector (C). These layers are either of P-type (positively charged carriers, also denoted as *p*-type) or N-type (negatively charged carriers, also denoted as *n*-type) semiconductor materials. There are two types of BJTs: NPN and PNP, depending on the arrangement of the layers as depicted in Fig. 2. The NPN (or, *npn*) transistor consists of a thin P-type base layer sandwiched between two N-type layers: the emitter and the collector (Boylestad, et al, 2013). The PNP (or *pnp*) transistor has the opposite arrangement, with a thin N-type base layer sandwiched between two P-type layers: the emitter and the collector (Boylestad, et al, 2013). It is to be noted that J. Bardeen was awarded twice the Nobel Prize in physics – transistor, and theory of superconductivity.

Figure-2: Schematic diagram of a *p-n-p* and *n-p-n* BJT. Emitter (E), base (B), and collector (C) are also shown



Integrated Circuits (ICs), developed by J. Kilby and R. Noyce, were used in the third generation of computers (Denning, 1971; Gray et al, 2009; Henderson, 2009; Wang, 2020). An IC is an assimilation of several transistors, resistors, and capacitors (Gray et al, 2009). ICs greatly enhanced efficiency, reliability, and storage capacity; lowered maintenance cost; and reduced the size of the computers in comparison to the earlier generations (Denning, 1971).

Microprocessors were used in the fourth generation of computers (Henderson, 2009; Sedra et al, 2015; Balch, 2003; Wang, 2020). They have made the fourth generation of computers more compact, powerful, reliable and affordable (Henderson, 2009). Artificial intelligence, discussed below, will become an integral part of the higher generation of computers (McCarthy, 2007; Narasimha, 1986; Wang, 2020).

Therefore, the generation of computers can be broadly divided into five categories over the years based on the type of hardware used in manufacturing these computers: First generation (~1940 ~ 1950) – vacuum tube (Fig. 3); Second generation (~1950 ~ 1960) – transistor; Third generation (~1960 ~ 1970) – integrated circuit (IC); Fourth generation (~1970 ~ present) – microprocessor; and Fifth generation (present ~ future) – artificial intelligence based (Henderson, 2009; Morley, 2009; Rojas et al, 2000; Denning, 1971; Narasimha, 1986; Wang, 2020;).

Figure-3: A first generation computer

World Wide Web (www) and Internet: World Wide Web (www) and internet work on some protocols and allow creating, organizing, transferring, publishing, sharing/communicating, uploading/downloading, purchasing, and browsing the information/documents for various purposes, and many more (The birth of the web; History of the world wide web; Soldatos, 2017; Lee et al, 1992). They have completely changed our daily lives – communication, education, research, entertainment, and business, just to name a few (Haddon, 2004; Rajaraman, 2018). Tim Berners-Lee, a graduate of Oxford University with an Honors degree in Physics, invented the World Wide Web (www) at CERN to fulfill the demands of scientists of Particle Physics Lab. for sharing the data and disseminating the results among various participating institutes/universities across the world (The birth of the web; history of the world wide web). He further developed URL (Uniform Resource Locator) and HTTP (Hyper Text Transfer Protocol, HTTP).

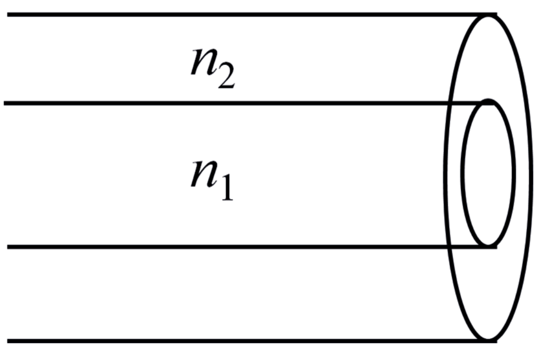
Satellites: Satellites are the astronomical (celestial) objects or bodies that revolve around the planets (Roddy, 2006). Their orbits are close as well as stable and are generally categorized as natural such as moon around the Earth and artificial (manmade). Artificial satellites are launched from the surface of the Earth through a complicated maneuver in order to put them in desired orbits to perform a specific task with a pre-defined life span under the gravitational attraction of the Earth (Roddy, 2006). Artificial satellites receive the signal (radio waves) from the Earth and send them back to the Earth via uplink and downlink processes. Geostationary satellites are placed in orbits in the plane of the equator, which move in the same sense as the Earth with the time period of revolution of 24 hours (i.e., Earth's rotation). This is why they always appear to be stationary with respect to an observer on the Earth (Roddy, 2006). These satellites are useful for weather forecasting (flood, tsunami, storm, etc.,), landscape, communication, and many more. Global Positioning System (GPS) is a navigational system that provides the precise location of an object as well as an accurate time (El-Rabbany, 2002). Concepts of the atomic clock and relativity are used in these navigation systems (El-Rabbany, 2002).

RADAR: It stands for Radio wave Detection And Ranging (Skolnik, 1980). It detects any nearby object (ship or plane) according to its range/efficiency. The radar sends out a signal (radio wave, i.e., electromagnetic wave) through its transmission antenna (transmitter), the radio wave is reflected by the coming object, which is recaptured by the receiving antenna and is processed by the detector of the radar system. Radar is a vital component of national security/interest (Skolnik, 1980). Another similar type of surveillance/remote sensing system is LiDAR, which is the acronym of Light Detection and Ranging that uses short laser pulses for the detection of nearby objects (Dong et al, 2017).

Smartphones: Smartphone has significantly impacted and changed our modern society – health, education, business, entertainment, communication, and personal/social lives (Woyke, 2014; Traxler et al, 2005; Colicchia et al, 2015). The touch screens of smartphones are either capacitive or resistive and physics has played an important role at every stage of the development of the phone (Nam et al, 2021; Ibrahim et al, 2019). Smartphones are equipped with camera, GPS, software, video calling facility (video conferencing), various applications, and many more necessary things (e.g., online booking/reservation, internet banking, file/photo sharing, and gaming) (Woyke, 2014). The touch screens phones that we carry in our pockets are called capacitive touch screens which respond to human skins since our skins conduct electricity and this is the reason that why we cannot operate these screens while wearing gloves (Nam et al, 2021; Ibrahim et al, 2019).

Optical Fiber Communication: Fiber optic, since its invention in the 1970s, has revolutionized the technology of communication – from electrical to optical (electromagnetic waves) due to the advancement of physics of optical materials (Ghatak et al, 1998; Senior, 2009). The advantages of optical fiber communication systems are low transmission (data, video, voice, internet, etc.,) loss, high bandwidth, lightweight, small diameter, and non-expensive. Optical fiber communication has made voice and video conferencing much easier (Firestone et al, 2007). In general, an optical fiber is made of core of refractive index n_1, which is surrounded (supported) by cladding of slightly lower refractive index n_2 (i.e., $n_2 < n_1$). Light travels through the fiber due to the phenomenon of total internal reflection (Ghatak et al, 1998; Senior, 2009). A simple diagram of an optical fiber is shown in Fig.4. There are various types of optic fibers such as glass/plastic, step-/grade-index, and single-/multi-mode for various applications in science, technology, and communication (Ghatak et al, 1998; Senior, 2009).

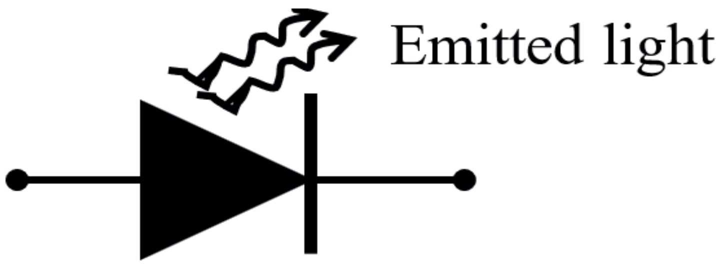
Figure-4: Schematic diagram of an optical fiber with core of refractive index n_1 and cladding of refractive index n_2.



Liquid-Crystal Display (LCD): Nowadays, we are very much familiar with thin and flat LCD monitors (TVs and PCs) (Boylestad et al, 2013; Chen 2011). As the name suggests, its underlying principle is the physics of liquid crystal. Liquid crystals move freely (i.e. flow like a liquid) under suitable electrical conditions but still maintain the structure of a crystal. LCD consumes less power than a light-emitting diode (LED). However, unlike LED, discussed below, it requires an external/internal light source to generate light (Boylestad et al, 2013).

Light Emitting Diode (LED): There are various types of LEDs (e.g., ordinary LED, organic LED, and quantum dot LED, which are widely used in various places (cell phone, street light, traffic signal, a display device, flash lamp, large advertising display boards, TVs, PCs, etc.) due to their small sizes and energy efficiencies (Boylestad et al, 2013; Planinšič et al, 2015; Chen et al, 2018; Qasim et al, 2013; Wood et al, 2010; Geffroy et al, 2006; Jang et al, 2023). The fundamental principle is the physics of semiconductor devices (Boylestad et al, 2013; Geffroy et al, 2006). A LED is a semiconductor (*p*–*n* junction diode) light source that gets activated and emits light (photons) by electron-hole recombination when a suitable excitation/voltage is applied to it as shown in Fig. 5 (Sze et al, 2007). An electron-hole pair is created when an electron moves from one energy level (band) to another one and leaves a hole in its initial energy level (Boylestad et al, 2013). Thus, a hole is a void of an electron and considered as positive. Light is emitted when the electron jumps back to the hole (known as electron-hole recombination) and the color of the emitted light (red, green, blue, etc.,) is determined by the energy band-gap of the semiconductor (i.e., the difference between the two energy levels) (Planinšič et al, 2015; Boylestad et al, 2013).

Figure-5: A sketch of a light emitting diode



Organic compounds are used as emissive (light-emitting) layers in Organic LEDs (OLEDs), which emit light under a suitable electric current (Chen et al, 2018; Geffroy et al, 2006). Though the working principle of an OLED is the same as LED, it uses organic layers (materials) to generate electrons and holes instead of *p*- or *n*-type materials (Geffroy et al, 2006; Boylestad et al, 2013). A simple OLED is made up of several layers – top (seal) and bottom (substrate) layers of protective glass or plastic, negative (cathode) and positive (anode) terminals between top and bottom layers, two emissive layers of organic molecules (where the light is produced), and the conductive layer sandwiched between the cathode and the anode (Geffroy et al, 2006). Various applications of OLEDs are television screens, computer monitors, mobile phones, handheld game consoles, Personal Digital Assistants (PDAs), etc. (Geffroy et al, 2006). Quantum dot LED (QD-LED or QLED), which uses the principle of quantum mechanics, will soon become a reality (Qasim et al, 2013; Wood et al, 2010).

Artificial Intelligence (AI), Machine Learning, Quantum Computer, and Quantum Cryptography: Scientists/ technologists are working vigorously to develop AI-based higher (future) generations of computers, software, robot, and other devices using the principle of quantum mechanics (McCarthy, 2007; Narasimha, 1986; Lemaignan et al, 2017; Eaton, 2007; Russel et al, 2010; Tegmark, 2014; Rajaraman, 2014;). According to Prof. John McCarthy, the founding figure of AI, it is "The science and engineering of making intelligent machines, especially intelligent computer programs" (McCarthy, 2007; Rajaraman, 2014). Machine learning, covering the domains of AI, computer science, and physics, has gained tremendous attention from the scientific community in recent years due to its capability of processing a large amount of data/information and make a future prediction/trend based on the fed data (Sarma et al, 2019). The main idea of AI and machine learning is to make a system to learn, think, behave, perform, analyze, recognize, and do many more in a fashion similar to human brains (Flasińki, 2016; Lemaignan et al, 2017; Tegmark, 2014; Sarma et al, 2019). Quantum computer and quantum cryptography rely on quantum mechanical phenomena (entanglement and superposition of quantum states) to store and analyze the input data/information (Spiller, 2002; Zeilinger, 1998; Menon et al, 2014; Tittel, 1998; Gisin, 2002; Ying, 2010; Keyl, 2002). Stephen J. Wiesner conceptualized the application of photons (a quantum mechanical particle, also known as quanta of light) in cryptography in 1970s to establish a secured connection/communication (transmission of data) between two persons at distant locations in such a way that if a third person tries to interfere the communication/steal the data (known as eavesdropping) it would alter the state of the particle and stop the communication (Montanaro, 2016; Gisin, 2002; Ying, 2010). Charles Bennett and Gilles Brassard proposed the well-known BB84 scheme for Quantum Key Distribution (QKD) in 1984 (Montanaro, 2016; Diamanti et al, 2016). Physics (quantum mechanics) also has been contributing significantly to the (quantum) neural network, quantum tensor flow, quantum machine learning, hybrid quantum-classical machine learning, and artificial neural network (Huang et al, 2021; Gebhart et al, 2023; Huggins et al, 2019; Ihunde, 2022; Gupta et al, 2001; Schuld, 2019; Sierra-Sosa et al, 2020). All these technologies are interconnected and have been extensively used in various domains and fields - basic and applied sciences, information and communication technology, manufacturing, business, finance, health care system, agriculture, mining, commerce, security/defense, robotics, computer games, and transportation, image processing, speech recognition, and many more – that is to say that they are getting deeply embedded in our modern lives/ societies and are becoming more and more relevant as we move on (Erl, 2013; Han et al, 2012; Chaminade et al, 2009). It is pertinent to note that Physics plays a crucial role in the development and functioning of self-driving cars (also known as autonomous vehicles, AVs) (McCormick, 2019). Several fundamental principles of physics are applied to ensure the safety and efficiency of these vehicles. Self-driving cars rely on various sensors and algorithms, with physics principles governing the behavior of these sensors. For example, the reflection, refraction, and absorption of light and sound waves enable the vehicle to perceive its environment, detect obstacles, pedestrians, and other vehicles. The data are continuously feed to the car's computer, enabling it to make informed decisions.

Virtual Reality: Virtual reality (VR) is a technology that uses computer graphics, sensors, and displays to create an interactive and lifelike simulation of a three-dimensional (3D) environment (Radianti et al, 2020). With specialized VR headsets or devices, users are fully immersed in an artificial world, where their head and body movements are tracked to give them a sense of being present within the virtual environment. The ultimate goal of VR is to achieve a feeling of presence, making users believe they are physically part of the simulated world while still being in the real world. Virtual reality has numerous applications, including gaming, training and simulations, education, architectural and engineering visualizations, therapy and rehabilitation, entertainment, and media (Uriel et al, 2020; Cipresso et al, 2018). Over the years, VR technology has rapidly progressed and gained popularity, becoming more accessible to both consumers and industries (Cipresso et al, 2018; Hamad et al, 2022). As the technology continues to advance, it opens up exciting possibilities in various fields.

Physics plays a significant role in creating realistic and immersive VR experiences (Neroni et al, 2021; Harun et al, 2020). By accurately simulating the laws of physics within virtual environments, developers can enhance the sense of presence and interactivity for users. VR can be used to teach and learn physics concepts that are difficult to visualize or experience in the real world, such as electrostatics, quantum mechanics, relativity, etc. VR can also provide feedback and guidance to the learners through sounds, vibrations, or other instruments. Thus, by leveraging the power of physics simulations, VR experiences can provide users with a more immersive, interactive, and realistic world, expanding the potential of VR in entertainment, education, training, and various professional fields (Cipresso et al, 2018; Hamad et al, 2022).

ICT and education

ICT has revolutionized education, bringing a multitude of benefits to the learning process (Bansa et al, 2020; Fu, 2013; Weber et al, 2023; Martínez-Soto et al, 2023). One of the key advantages of ICT in education is enhanced access to information. With the internet, students can access a vast array of knowledge, resources, and educational materials from around the world, promoting independent and self-directed learning (Traxler et al, 2005). ICT also fosters interactive and engaging learning experiences through multimedia tools, simulations, and virtual reality, catering to different learning styles and making complex concepts easier to understand (Martínez-Soto et al, 2023; Uriel, 2020; Schindler et al, 2017). Additionally, ICT enables effective communication and collaboration among students and educators, breaking down geographical barriers and promoting global connections (Kumar et al, 2012). Furthermore, the integration of ICT in education has streamlined administrative tasks, improving efficiency and reducing paperwork. Overall, embracing ICT in education not only enriches the learning process but also equips students with essential digital literacy skills, preparing them for the challenges of the modern world (Schindler et al, 2017). However, it should be noted that other infrastructure are also required with ICT to improve the teaching-learning process (Lomos et al, 2023).

Conclusion

In summary, we have briefly introduced the concept of ICT and portrayed qualitatively contribution of physics to the various components of ICT. Our discussion has shown how science (physics), technology (ICT), and society are connected. ICT has drastically influenced how people work, communicate, learn, and live. We believe that with the advent of new components of ICT, the influence of physics will continue to grow.

References

Ahrens, C.D. (2011). Essential of Meteorology: An Invitation to the Atmosphere, *Brooks/Cole*; ISBN: 0840049331.

Anderson, J. & Weert, T. (2002). Information & Communication Technology in Education – A Curriculum for Schools & Programme of Teacher Development, *UNESCO*.

Balch, M. (2003). *Complete Digital Design- A comprehensive guide to digital electronics and computer system architecture*, McGraw Hill; 10.1036/0071433473.

Bansa, Y.A. & Asrini (2020). The Use of ICT in Teaching: Lecturers' Perceptions, Obstacles, and Expectations, *Journal of Physics*: Conf. Series 1464, 012037; 10.1088/1742-6596/1464/1/012037.

Bartlett, R. (2014). Introduction to Sports Biomechanics – Analysing Human Movement Patterns, *Routledge*; ISBN: 9780415632423.

Bauchspies, W.K., Croissant, J., & Restivo, S. (2005), Science, Technology, and Society: A Sociological Approach, *Wiley-Blackwell*; ISBN: 978-0-631-23210-0.

Biamonte, J., Wittek, P., Pancotti, N., Rebentrost, P., Wiebe, N., & Lloyd, S. (2017). Quantum machine learning, *Nature*, 549, 195-202; 10.1038/nature23474.

Boylestad, R. & Nashelsky, L. (2013). Electronic Devices & Circuit Theory, *Pearson*; ISBN: 978-0-13-262226-4.

Brink van den, J. (2007). From strength to strength, *Nature Nanotechnology*, **2**, 199-201; https://doi.org/10.1038/nnano.2007.91.

Chakrabarti, B.K., Chakraborti, A., & Chatterjee. A., (Ed.) (2007), Econophysics and Sociophysics – Trends and Perspectives, *Springer*-VCH; ISBN: 978-3-527-60958-1.

Chaminade, T., & Cheng, G. (2009). Social cognitive neuroscience & humanoid robotics, *Journal of Physiology-Paris*, 103(3-5), 286-295; https://doi.org/10.1016/j.jphysparis.2009.08.011.

Chen, R.H. (2011). Liquid Crystals Displays – Fundamental Physics and Technology, *Wiley*; 10.1002/9781118084359; ISBN: 9780470930878.

Chen, H-W., Lee, J-H., Lin, B-Y., Chen, S. & Wu, S-T. (2018). Liquid crystal display & organic light-emitting diode display: present status & future perspectives, Light: Science & Applications, 7, 17168; https://doi.org/10.1038/lsa.2017.168.

Choi, W., Lahiri, I., Seelaboyina, R., & Kang, Y.S. (2010). Synthesis of Graphene and Its Applications: A Review, *Critical Reviews in Solid State and Materials Sciences*, 35(1), 52-71; https://doi.org/10.1080/10408430903505036.

Christiansen, M.H. & Kirby, S. (Ed.) (2003). Language Evolution, *Oxford University Press*; ISBN: 0199244839.

Cipresso, P., Alice, I., Giglioli, C., Raya, M.A., Riva, G., (2018). The Past, Present, and Future of Virtual and Augmented Reality Research: A Network and Cluster Analysis of the Literature, *Frontiers in Psychology*, 9, 2086; 10.3389/fpsyg.2018.02086.

Colicchia, G. & Wiesner, H. (2015). Looking into the Eye with a Smartphone, *The Physics Teacher*, 53, 106-108; 10.1119/1.4905811.

Davidovits, P. (2008). Physics in Biology and Medicine, *Academic Press*; ISBN: 978-0-12-369411-9.

Deák, P. (2017). Essential Quantum Mechanics for Electrical Engineers, *Wiley-VCH*; ISBN: 978-3-527-41355-3.

Denning, P. J. (1971). Third Generation Computer Systems, *Computing Surveys*, 3(4), 175-216; https://doi.org/10.1145/356593.356595.

Diamanti, E., Lo, H-K., Qi, B., & Yuan, Z. (2016). Practical challenges in quantum key distribution, npj *Quantum Information*, 2, Article Number: 16025; 10.1038/npjqi.2016.25.

Dong, P. & Chen, Q. (2017). LiDAR Remote Sensing and Applications, *CRC Press*; ISBN: 9781138747241.

Dunjko, V. & Briegel, H.J. (2018). Machine learning & artificial intelligence in the quantum domain: a review of recent progress, *Reports on Progress in Physics*, 81(7), 074001; 10.1088/1361-6633/aab406.

Eaton, M. (2007). Evolutionary Humanoid Robotics: Past, Present and Future in Lungarella, M., Iida, F., Bongard, J., Pfeifer, R. (Ed.) 50 Years of Artificial Intelligence. *Lecture Notes in Computer Science*, volume 4850. *Springer*, Berlin, Heidelberg; https://doi.org/10.1007/978-3-540-77296-5_5; ISBN: 978-3-540-77295-8.

El-Rabbany, A. (2002). Introduction to GPS - Global Positioning System, *Artech House*; ISBN: 1-58053-183-1.

Ercan, T., Onat, N.C., Keya, N., Tatari, O., Eluru, N., & Kucukvar, M. (2022). Autonomous electric vehicles can reduce carbon emissions and air pollution in cities, *Transportation Research Part D: Transport and Environment*, 112, 103472; https://doi.org/10.1016/j.trd.2022.103472.

Erl, T., Mahmood, Z., & Puttini, R. (2013). Cloud Computing – Concepts, Technology & Architecture, *Prentice Hall*; ISBN: 978-0-13-338752-0.

Field, J. (2001). Lifelong education, *International Journal of Lifelong Education*, 20(1-2), 3-15; 10.1080/02601370010008291.

Firestone, S., Ramalingam, T., & Fry, S. (2007*). Voice and Video Conferencing Fundamentals*, *Cisco Press*; ISBN-10:1-58705-468-X.

Flasiński, M. (2016*).* Introduction to Artificial Intelligence, *Springer*; 10.1007/978-3-319-40022-8; ISBN: 978-3-319-40020-4.

Fraden, J. (2004). Handbook of Modern Sensors: Physics, Designs, and Applications, *Springer*; ISBN 978-3-319-19302-1; 10.1007/978-3-319-19303-8.

Freeman, R.L. (1999). Fundamentals of Telecommunications, *Wiley*; ISBN 0-471-22416-2.

Friedman, J.S., Girdhar, A., Gelfand, R.M., Memik, G., Mohseni, H., Taflove, A., Wessels, B.W., Leburton, J-P., & Sahakian, A.V. (2017). Cascaded spintronic logic with low-dimensional carbon, *Nature Communications*, 8, 15635; https://doi.org/10.1038/ncomms15635.

Fu, J.S. (2013), ICT in Education: A Critical Literature Review and Its Implications, *International Journal of Education and Development using Information and Communication Technology*, 9(1), 112-125.

Gershenfeld, N. (2011). The Physics of Information Technology, *Cambridge University Press*, ISBN: 0521210224.

Ghatak, A. & Thyagarajan, K. (1998). Introduction to fiber optics, *Cambridge University Press*; https://doi.org/10.1017/CBO9781139174770; ISBN: 9781139174770.

Gebhart, V., Santagati, R., Gentile, A.A., Gauger, E.M., Craig, D., Ares, N., Banchi, L., Marquardt, F., Pezzè, L., Bonato, C. (2023). Learning quantum systems, *Nature Review Physics* 5, 141–156; https://doi.org/10.1038/s42254-022-00552-1.

Geffroy, B., Roy, P.I. & Prat, C. (2006). Organic light-emitting diode (OLED) technology: materials, devices, and display technologies, *Polymer International*, 55, 572-582; https://doi.org/10.1002/pi.1974.

Gisin, N., Ribordy, G., Tittel, W., & Zbinden, H. (2002). Quantum cryptography, *Reviews of Modern Physics*, 74, 145-195.

Gonzalez, W.J. (Ed.) (2005). Science Technology and Society: A Philosophical Perspective, *Netbiblo*; ISBN: 0-9729892-2-6.

Goodyear, P. & Retails, S. (Ed.) (2010). Technology-Enhanced Learning: Design Patterns and Pattern languages, *Sense Publishers*; 10.1163/9789460910623; ISBN: 9789460910616.

Gray, P.R., Hurst, P.J., Lewis, S.H., & Meyer, R.G. (2009). Analysis and design of analog integrated circuits, *Wiley*; ISBN: 978-0-470-24599-6.

Gritzalis, D., Brunnstein, K., & Berleur, J. (2007). *Roles of ICT in the Information Society*, 75-95 in Shrum, W., Benson, K.R., Bijker, W.E., & Brunnstein, K.(Ed.) Past, Present and Future of Research in the Information Society, *Springer*; https://doi.org/10.1007/978-0-387-47650-6_6; ISBN: 978-0-387-47650-6.

Gulati, R.R. (2004). Monochrome & Colour Television, *New Age International Publishers*; ISBN: 978-81-224-2489-8.

Gupta, S. & Zia, R.K.P. (2001). Quantum Neural Network, *Journal of Computer and System Science* 63, 355-383; 10.1006/jcss.2001.1769.

Haddon, L. (2004) Information and Communications Technologies in Everyday Life: A Concise Introduction and Research Guide (New Technologies/New Cultures), *Berg Publishers*; ISBN:1859737986.

Hamad, A. & Jia, B. (2022). How Virtual Reality Technology Has Changed Our Lives: An Overview of the Current and Potential Applications and Limitations, *International Journal of Environmental Research and Public Health*, 19, 11278; 10.3390/ijerph191811278.

Han, J., Kamber, M., & Pei, J. (2012). Data Mining – Concepts and Techniques, *The Morgan Kaufmann Series in Data Management Systems, Elsevier*.

Harun, Tuli, N., & Mantri, A. (2020). Experience Fleming's rule in Electromagnetism Using Augmented Reality: Analyzing Impact on Students Learning, *Procedia Computer Science*, 172, 660; 10.1016/j.procs.2020.05.086.

Haykin, S. (2014). Digital Communication System, *Wiley*; ISBN: 978-0-471-64735-5.

Haykin, S. & Moher, M. (2009). Communication Systems, *Wiley*; ISBN: 978-0-471-69790-9.

Haykin, S. & Moher, M. (2007*).* Introduction to Analog and Digital Communications, *Wiley*; ISBN-10: 0-471-43222-9.

Henderson, H. (2009). *Encyclopedia of Computer Science and Technology*, Facts on File, Infobase Publishing; ISBN: 0-8160-6382-6.

History of the World Wide Web, Wikipedia; en.wikipedia.org/wiki/History_of_the_World_Wide_Web,.

Huang, H-Y., Broughton, M., Mohseni, M., Babbush, R., Boixo, S., Neven, H., & McClean, J. R. (2021). *Power of data in quantum machine learning,* Nature Communication, 12, 2631; https://doi.org/10.1038/s41467-021-22539-9.

Huggins, W., Patil, P., Mitchell, B., Whaley, K. B., & Stoudenmire, E. M. (2019). *Towards quantum machine learning with tensor networks*, Quantum Science and Technology, 4, 024001; 10.1088/2058-9565/aaea94.

Hush, M.R. (2017). *Machine learning for quantum physics*, Science, 355(6325), 580; 10.1126/science.aam6564.

Ibrahim, T.M., Abdulamid, S.M., Alarood, A.A., Chiroma, H., Al-garadi, M.A., Rana, N., Muhammad, A.N., Abubakar, A., Haruna, K., & L.A. Gabralla (2019), Recent advances in mobile touch screen security authentication methods: A systematic literature review, *Computer & Security*, 85, 24; https://doi.org/10.1016/j.cose.2019.04.008.

Ihunde, T.A. (2022). The Application of Physics Informed Neural Networks to Compositional Modeling*, LSU Master's Theses*, 5492.

Jang, E. & Jang, H. (2023*),* Review: Quantum Dot Light-Emitting Diodes*, Chemical Review*, 123(8), 4663-4692; https://doi.org/10.1021/acs.chemrev.2c00695.

Keith, S.T. & Akpan, B. (Ed.) (2017). *Science Education-An International Course Companion - New Directions in Mathematics and Science Education*, Sense Publishers; ISBN: 978-94-6300-747-4.

Keyl, M. (2002). Fundamentals of quantum information theory, *Physics Reports*, 369, 431-548.

Khorasani, S. & Koottandavida, A. (2017). *Nonlinear graphene quantum capacitors for electro-optics*, npj 2D Materials and Applications, 1, 7; 10.1038/s41699-017-0011-9.

Kinaret, J., Ferrari, A.C., Fal'ko, V., & Kivioja, J. (2011). Graphene-Driven Revolutions in ICT and Beyond, *Procedia Compute Science,* 7, 30-33; https://doi.org/10.1016/j.procs.2011.12.013.

Kittel, C. (2004). *Introduction to Solid State Physics,* John Wiley & Sons; ISBN 0-471-41526-X*.*

Kompare, D. (2006). *Publishing Flow: DVD Box Sets and the Reconception of Television*, Television & New Media, **7**(4), 335; https://doi.org/10.1177/1527476404270609.

Kreupl, F. (2013). *The carbon-nanotube computer has arrived*, Nature, 501, 495-496;

https://doi.org/10.1038/501495a.

Kumar, D.D. & Chubin, D.E. (2012). Science, Technology, and Society (Book subtitle:A Sourcebook on Research and Practice; Series title: Innovation in Science Education and Technology), *Springer*; ISSN: 1873-1058; https://doi.org/10.1007/978-94-011-3992-2; ISBN: 978-94-011-3992-2.

Laugksch, R.C. (2000). Scientific Literacy: A Conceptual Overview, *Science Education*, 84(1), 71-94.

Lee-Berners, T., Cailliau, R., & Groff, J-F. (1992). *World-Wide Web,* Computer Networks and ISDN Systems, 25, 454-459.

Lemaignan, S., Warnier, M., Sisbot, E.A., Clodic, A., & Alami, R. (2017). *Artificial cognition for social human–robot interaction: An implementation*, Artificial Intelligence, 247, 45-69; https://doi.org/10.1016/j.artint.2016.07.002.

Lomos, C., Luyten, J. W. (Hans), & Tieck, S. (2023). Implementing ICT in classroom practice: what else matters besides the ICT infrastructure?, *Large-scale Assessments in Education (2023)* 11(1); https://doi.org/10.1186/s40536-022-00144-6.

Martínez-Soto, T. & Prendes-Espinosa, P. (2023). A Systematic Review on the Role of ICT and CLIL in Compulsory Education, *Education Sciences*, 13, 73; https://doi.org/10.3390/educsci13010073.

McCarthy, J. (2007). *What is artificial intelligence?*; www-formal.stanford.edu/jmc.

McCormick, C. (2019). *Self-driving cars find their way in the world*, Physics Today, 66.

Menon, P.S. & Ritwik, M. (2014). *A Comprehensive but not Complicated Survey on Quantum Computing*, Procedia IER (2014 International Conference on Future Information Engineering), 10, 144-152; 10.1016/j.ieri.2014.09.069.

Mitchell, T.N., & Costisella, B. (2007). NMR-From Spectra to Structures – An Experimental Approach, *Springer*; ISBN 978-3-540-72195-6.

Montanaro, A. (2016). *Quantum algorithms: an overview*, npj Quantum Information 2, Article Number: 15023; 10.1038/npjqi.2015.23.

Mukhanov, V. (2005). *Physical foundations of cosmology*, Cambridge University Press; ISBN: 0521563984.

Morkoç, H., and Özgür, Ü. (2009) *Zinc Oxide-Fundamentals, Materials and Device Technology*, Wiley-VCH, Weinheim; ISBN: 978-3-527-40813-9.

Morley, D. (2009). *Fundamentals of Computers*, Cengage Learning; ISBN-10:8131509230.

Moutanabbir, O. & Gösele, U. (2010). Heterogeneous Integration of Compound Semiconductors, *Annual Review of Materials Research*, 40, 469-500; https://doi.org/10.1146/annurev-matsci-070909-104448.

Nam, H., Seol, K-H., Lee, J., Cho, H., & Jung, S.W. (2021). Review of Capacitive Touchscreen Technologies: Overview, trends, and Machine Learning Approaches, *Sensors*, 21, 4776; https://doi.org/10.3390/s21144776.

Narasimha, R. (1986). Artificial intelligence in fifth generation computers, *Sādhanā*, 9, 71-84.

Neamen, D.A. (2003). *Semiconductor Physics, and Devices: Basic Principle*, McGraw-Hill; ISBN: 978-0-07-352958-5.

Neroni, M. A., Oti, A., & Crilly, N. (2021). Virtual Reality design-build-test games with physics simulation: opportunities for researching design cognition, *International Journal of Design Creativity and Innovation*, 9, 139; https://doi.org/10.1080/21650349.2021.1929500.

Paul Gottlieb Nipkow – German Scientist (2008). Encyclopaedia Britannica; britannica.com/biography/Paul-Gottlieb-Nipkow,

Phillips, F., Yu, C-Y., Hameed, T., & Akhdary, M.A.E. (2017) The knowledge society's origins and current trajectory, *International Journal of Innovation Studies*, 1(3), 175-191; https://doi.org/10.1016/j.ijis.2017.08.001.

Planinšič, G. & Etkina, E. (2015). Light-Emitting Diodes: Learning New Physics, *The Physics Teacher*, 53, 212-218; https://doi.org/10.1119/1.4914558.

Proakis, J.G., & Salehi, M. (2002). *Communication Systems Engineering*, Prentice-Hall; ISBN 0-13-061793-8.

Qasim, K., Lei, W., & Li, Q. (2013). Quantum Dots for Light Emitting Diodes, *Journal of Nanoscience and Nanotechnology*, 13, 3173-3185; 10.1166/jnn.2013.7146.

Rajaraman, V. (2018). *Introduction to Information Technology,* PHI Learning Private Limited, ISBN: 978-93-87472-29-7.

Rajaraman, V. (2014). John McCarthy – Father of Artificial Intelligence, *Resonance*, 19(3), 198-207.

Radianti, J., Majchrzak, T.A., Fromm, J., Wohlgenannt, I. (2020). *A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda,* Computers & Education,147, 103778; https://doi.org/10.1016/j.compedu.2019.103778.

Rana, K., Singh, J., & Ahn, J.-H. (2014). *A graphene-based transparent electrode for use in flexible optoelectronic devices*, Journal of Materials Chemistry C, **2**(15), 2646-2656; https://doi.org/10.1039/C3TC32264E.

Roddy, D. (2006). *Satellite Communication*, McGraw Hill; ISBN: 0-07-146298-8.

Rojas, R. & Hashagen, U. (Ed.) (2000). *The First Computers: History and Architectures*, MIT Press; ISBN: 0-262-18197-5.

Russel, S.J. & Norvig, P. (2010). *Artificial Intelligence – A Modern Approach*, Prentice Hall; ISBN: 978-0-13-604259-4.

Samuel, T.M. & Samuel, M. (2008). *A Handbook of Information Technology*, Commenwealth Publishers; ISBN: 9788131101131.

Sarma, S.D., Deng, D-L., & Duan, L-M. (2019). Machine learning meets quantum physics, *Physics Today*, 72(3), 48-54; https://doi.org/10.1063/PT.3.4164.

Sarnoff, D. (1937). Science and Society, *Journal of Applied Physics* 8, 373-379; https://doi.org/10.1063/1.1710309.

Scheufele, D.A. (2013) *Communicating science in social settings*, Proceedings of the National Academy of Science of the United States of America (PNAS), 110, Suppl. 3, 14040-14047; www.pnas.org/cgi/doi/10.1073/pnas.1213275110.

Schindler, L.A., Gary J. Burkholder, G.J., Morad, O.A., & Marsh, C. (2017). Computer-based technology and student engagement: a critical review of the literature, *International Journal of Educational Technology in Higher Education*, 14, 25; 10.1186/s41239-017-0063-0.

Schuld, M., Sinayskiy, I., & Petruccione, F. (2019). *Neural Networks Take on Open Quantum System*, Physics 12, 74.

Sedra, A.S. & Smith, K.C. (2015). *Microelectronic Circuits*, Oxford University Press; ISBN: 978–0–19–933913–6.

Senior, J.M. (2009). *Optical Fiber communications – Principles & Practice*, Pearson; ISBN: 978-0-13-032681-2.

Shulaker, M.M., Hills, G., Patil, N., Wei, H., Chen, H-Y., Wong, P. H.-S., & Mitra, S. (2013). *Carbon nanotube computer*, Nature, 501, 526-530; https://doi.org/10.1038/nature12502.

Sierra-Sosa, D. & Telahun, M. (2020). *Tensor Flow Quantum: Impacts of Quantum State Preparation on Quantum Machine Learning Performance*, IEEE Access, 8, 215246; 10.1109/ACCESS.2020.3040798.

Skolnik, M.I. (1980). *Introduction to Radar System*, McGraw-Hill; ISBN: 0-07-057909-1.

Soldatos, J. (Ed.) (2017). *Building Blocks for IoT Analytics – Internet-of-Things Analytics*, River Publishers; ISBN: 978-87-93519-03-9.

Spiller, T. (2002). *Quantum Information Technology*, Trusted E-Services Lab., HP Lab. Bristol, HPL-2002-319, Elsevier Science.

Standke, K-H. & Anandakrishnan, M. (1980). *Science, Technology and Society – Needs, Challenges and Limitation*, Peramon Press; ISBN: 0-08-025947-2

Stilgoe, J., Lock, S.J., & Wilsdon, J. (2014). Why should we promote public engagement with science, *Public Understanding of Science*, 23 (1) 4-15; 10.1177/0963662513518154.

Sze, S.M. & Lee, M.K. (2012). *Physics of Semiconductor Devices*, John Wiley & Sons; ISBN: 978-0470-53794-7.

Tegmark, M. (2014). *Friendly Artificial Intelligence: The Physics Challenge*, in proceedings of the AAAI 2015 Workshop on AI and Ethics, Toby Walsh (Ed.) 87-89; arXiv:1409.0813v2; https://doi.org/10.48550/arXiv.1409.0813.

The birth of the web; https://home.web.cern.ch/science/computing/birth-web.

Tittel, W., Ribordy, G., & Gisin, N. (1998). *Quantum cryptography*, 11(3), 41; 10.1088/2058-7058/11/3/30.

Tipton, H.F. & Krause, M. (2008). *Information Security Management Handbook*, Auerbach Publications, CRC Press; ISBN: 1-4200-6708-7.

Traxler, J. & Hulme A.K. (2005). Mobile Learning- A Handbook for Educators and Trainers, *Routledge*. https://doi.org/10.4324/9780203003428; ISBN: 9780203003428.

Turney, J. (1996) *Public understanding of science*, The Lancet, 347(9008), 1087-1090;

https://doi.org/10.1016/S0140-6736(96)90283-4.

Uriel, C., Sergio, S., Carolina, G., Mariano, G., Paola, D., & Martín, A, (2020). *Improving the understanding of Basic Sciences concepts by using Virtual and Augmented Reality*, Procedia Computer Science 172, 389; 10.1016/j.procs.2020.05.165.

Voogt, J. & Knezek, G. (Ed.) (2008). *International Handbook of Information Technology in Primary and Secondary Education*, Series title: Springer International Handbooks of Education, Springer; ISBN-13: 978-0-387-73314-2; https://doi.org/10.1007/978-0-387-73315-9.

Walker, J., Halliday, D., & Resnick, R. (2016). Principles of Physics, *Wiley*; ISBN: 978-1-119-45549-3.

Wang, M. (2020). *Key Concepts of Computer Studies* (https://opentextbc.ca/computerstudies/) BC Campus. Used under a CC by 4.0 License (http://creativecommons.org/licenses/by/4.0/). Download for free from the B.C. Open Collection (https://collection.bccampus.ca/).

Weber, A.M. & Greiff, S. (2023). ICT Skills in the Deployment of 21st Century Skills: A (Cognitive) Developmental Perspective through Early Childhood, *Applied Sciences*, 13, 4615; https://doi.org/10.3390/ app13074615

Webster, F. (2006). Theories of the Information Society, *Routledge*; https://doi.org/10.4324/9780203962824; ISBN: 9780203962824

Weert, T.J. and Kendall, M. (Ed.) (2004), Lifelong Learning in the Digital Age, *Springe*r; https://doi.org/10.1007/b109540; ISBN: 978-1-4757-7987-5.

Wolf, E.L. (2008). *Nanophysics and Nanotechnology – An Introduction to Modern Concepts in Nanoscience*, Wiley-VCH; ISBN: 978-3-527-61898-9.

Wood, V. & Bulović, V. (2010). *Colloidal quantum dot light-emitting devices*, Nano Reviews, 1, 5202;

https://doi.org/10.3402/nano.v1i0.5202.

Woyke, E. (2014). *The Smartphone – Anatomy of an Industry*, The New Press; ISBN: 1595589635.

Ying, M. (2010). *Quantum computation, quantum theory and AI*, Artificial Intelligence, 174, 162-176; 10.1016/j.artint.2009.11.009.

Young, H.D., Freedman, R.A. & Ford, A.L. (2012). *Sears and Zeemansky's University Physics with Modern Physics*, Pearson; ISBN: 978-0-321-69686-1.

Yu, P.Y. & Cardona, M. (2010). *Fundamentals of Semiconductors – Physics and Materials Properties*, Springer; 10.1007/978-3-642-00710-1; ISBN: 978-3-642-00709-5.

Zeilinger, A. (1998). Fundamentals of quantum information, *Physics World*, 11(3), 35; 10.1088/2058-7058/11/3/29.

Review Article

Peeragogy: A Nascent Approach of Digital Age

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Abstract

The advancement of technology has motivated and empowered learners all over the world to connect and collaborate with other learners to co-construct knowledge and co-learn. These connections among peers have made it possible for the learners to self-direct their learning process by creating, delivering learning and teaching together an agreed curriculum. Peeragogy is one such approach for learning and knowledge production with the help of peers through reflection, critical thinking and thoughtful discussions. It is a collaborative strategy that has its foundation in the behaviourism, cognitivism, constructivism and connectivism theories of learning. Peeragogical interactions among a group of people or community with similar interests called "paragogues" lead to online exchange of ideas in order to influence one another's perceptions and also help in building digital skills and social skills. This paper focuses on the newest educational approach, i.e., Peeragogy, which accentuates self-regulated student-centred learning and focuses on collaborative learning through online networks. It also highlights the difference between pedagogy, andragogy, heutagogy and peeragogy. Designing peeragogy's learning activities based on the tenets of peeragogy and the role of a peeragogue is also discussed in this paper to exhibit how this potential approach of learning can assist students in gaining the knowledge and skills necessary to thrive in the twenty-first century by employing digital media to connect, co-construct, and co-learn.

Keywords: Paragogy, peeragogy, pedagogy, andragogy, heutagogy, connectivism, peer- learning,

Introduction

"If we teach today as we taught yesterday, we rob our children of tomorrow."

-John Dewey

With a paradigm shift in the process of education, the approaches of education have also evolved over time to meet the requirements of society – from pedagogy to other approaches of education, that are andragogy, heutagogy and peeragogy. The practice of sharing knowledge and learning informally from each other has been witnessed for ages. The roots of peer-based learning lie in peer interaction. Formally, it actively engages learners in discussions and group work and mutually benefits them through collaboration. It aims to develop a sense of collective responsibility and self-management among peers. It can be defined as "the acquisition of knowledge and skill through active helping and supporting among status equals or matched companions. It involves people from similar social groupings who are not professional teachers helping each other to learn and learning themselves by so doing" (Topping, 2005). It engages pupils with one another in order to attain educational objectives, thus, making them move from an independent learner to an interdependent and collaborative learner. The process of peer learning assigns responsibilities to both the faculty and the students towards the successful completion of tasks and the development of various skills such as communication skills, self-management and organisational skills, interpersonal skills, collaborative skills and problem-solving skills. It also fosters the ability to enquire, think and reflect critically. The fundamentals of a person's cognitive growth are social contacts, and the sharing of ideas and experiences, and student interactions lower the task's complexity. Peer learning is seen to be a good strategy to improve learning outcomes.

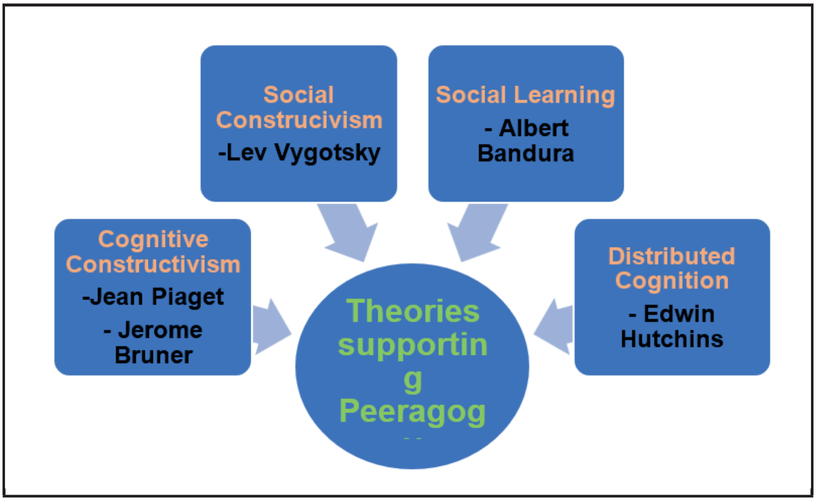
Education has witnessed numerous revolutions through research for the last three decades to study how learning and teaching must be carried out (Kenyon & Hase, 2001). Education 4.0 is a recent paradigm that elucidates the notions of learning in light of Industry 4.0, which focuses on web-driven e-learning and knowledge construction through connections. It encourages learning in a new way, mostly via the use of technology-based tools and resources. Technology has a substantial influence on educational growth. The learners are encouraged to collaborate digitally and co-create knowledge. Connectivism, a learning theory propounded by George Siemens and Stephen Downes in 2005, contributes uniquely to the digital era, helping learners with diverse opinions to collaborate through a variety of networks beyond formal educational settings to find solutions to their questions. It proposes that the knowledge accessed by virtue of one's connections with other individuals or peers is as worthy as the information possessed by the individual minds. According to Siemens and Tittenberger (2009), Connectivism refers to "knowledge and cognition are distributed across networks of people and technology, and learning is the process of connecting, growing, and navigating those networks." The social networks so formed provide ways to move from individual sets of knowledge towards a more relevant and futuristic way of learning.

Peeragogy is a nascent approach which allows recognition of the value of these connections and uses digital media to connect, co-construct and co-learn in the digital era, which helps in building 21st-century skills and competencies. Charles Jeffrey Danoff (2012) assumes the *Context of learning, Timing and sequence, Social reinforcement and experiential awareness are* the key factors of adapting peeragogy and thus expanding knowledge and skills of each peeragogue. P2PU was one of the first online peer learning communities, and its courses have sparked the creation of a slew of new online alternatives to traditional institutions in recent years.

Theoretical Framework: Learning Theories Supporting Peeragogy

The proponents of Cognitive Constructivism – Piaget (1972) and Bruner (1990) and Social Constructivism -Vygotsky (1978) laid the foundation for peer teaching and learning. Piaget's theory of Cognitive Development (1985) emphasises the active interaction and involvement of peers in the process of knowledge construction. Peer interactions also encourage cognitive improvement and enhance learning outcomes as compared to individual efforts. Bandura's (1977) Social Learning theory advocates that observational learning significantly impacts human behaviour by transforming the information into cognitive representations. The relevance of the social environment in learning new behaviours was underlined by Bandura in particular. He proposed that people learn to respond to others' behaviours by observing their own conduct. The Sociocultural theory of Learning developed by Vygotsky (1978) emphasises the involvement of more knowledgeable others (MKO) - teachers, adults or peers to aid the learner in the construction of knowledge. According to Vygotsky, "Every function in the child's cultural development appears twice: first, on the social level and, later on, on the individual level; first, between people (inter-psychological) and then inside the child (intra-psychological). This applies equally to voluntary attention, logical memory, and the formation of concepts. All the higher functions originate as actual relationships between individuals". According to Vygotsky, learning takes place in the Zone of Proximal Development. With the help of adults or children who are more knowledgeable, students can understand concepts and ideas that they cannot grasp on their own. During the 1990s, Edwin Hutchins propounded the theory of Distributed Cognition, which states that knowledge exists not just within the person but also in the individual's social and physical surroundings. It believes that cognition processes are the result of social interactions among the members of a social group and their environment.

Figure-1: Theories supporting Peeragogy



Literature Review

The evolving theory of paragogy is deeply rooted inside peer-learning and came into existence due the challenges faced while undertaking peer learning. The term 'Paragogy' was coined by Joe Corneli and Charles Danoff in 2011. Literally, '*Para*' means *alongside and 'Gogy'* means *leading.* The term 'Peeragogy' coined by Howard Rheingold in 2012 and advocated integration of social media and paragogy. 'The Peeragogy Handbook' illustrates how ongoing Wikimedia projects and the design of a future university manifest peeragogy which is embedded in the values and ways and means of peer production. It is a peer-based learning approach where students teach and learn from one another utilizing digital tools to develop connections and a common knowledge base. It allows students to learn together by encouraging and supporting one another as they acquire cognizance, adeptness and capabilities through the use of ICT required in 21st century (Alexander et al., 2012; Antipuesto & Tan, 2020; Chan et al., 2019; Corneli et al., 2015). The behaviourism, cognitivism, constructivism, and connectivism theories of learning provide the foundation for the peeragogy, a collaborative approach that accentuates student-centered learning and enables self-regulated learning (Zhang & Bayley, 2019).

A systematic literature review technique was used by Bizami et al. (2022) to investigate the mapping of the principles of three Education 4.0 innovative pedagogies, namely heutagogy, peeragogy, and cybergogy, with the capabilities of three technological learning tools, namely Facebook (FB), Learning Management System (LMS), and Blog. The findings reveal that the cognitive element is the most closely associated pedagogical principle to the four key capacities of technological learning tools, namely time, self-related, learning task, and learning community-related. This mapping is important for instructors to plan learning and teaching by selecting technological learning tools that align with relevant Education 4.0 pedagogies for optimising immersive blended learning practices. Amirrudin et al. (2023), in their study found that the heutagogic, peeragogic, and cybergogic approaches in the classroom are significantly impacted by the andragogic approach. The study also reveals that the pupils' ability to study independently is also strongly impacted by the use of peeragogic, heutagogic, and cybergogic approaches. By allowing for student autonomy in the classroom, peeragogy, heutagogy, and cybergogy techniques also enable students to create their own self-regulated learning. This method of practice has a sizable impact on enhancing pupil self-regulated learning.

NEP 2020 (para 4.5) focuses on fostering critical thinking skills, discussion-based and collaborative learning environments that resonate strongly with peeragogy's emphasis on collaborative peer-based learning. Peeragogy learning can help students become more critical thinkers by introducing them to technology, helping them collaborate in groups to solve problems set by the teacher, and encouraging them to voice their opinions more actively (Prasetya, Nuraeni & Shabir, 2022). Li and Salleh (2023) identified that the student needs to be capable, self-aware, proactive in communicating their opinions, well-organized, and eager to assist during online Peeragogy. Baskoro et al. (2023) developed a model that integrates the peeragogy learning strategy, the 7E learning cycle, and the newest AI tools as a tool and found that the cognitive domain in the peeragogy learning system can function more effectively with the application of AI.

Peeragogy is relatively nascent approach to learning and knowledge production. However, it shows potential to address contemporary learning requirements, there is a dearth of research in this area.

Research Methodology

In this study, the investigators used qualitative research design and employed content analysis as the research technique to deduce the valid inferences by interpretation and coding of the textual material as available in the related research works.

How is Peeragogy different from Pedagogy, Andragogy, Heutagogy?

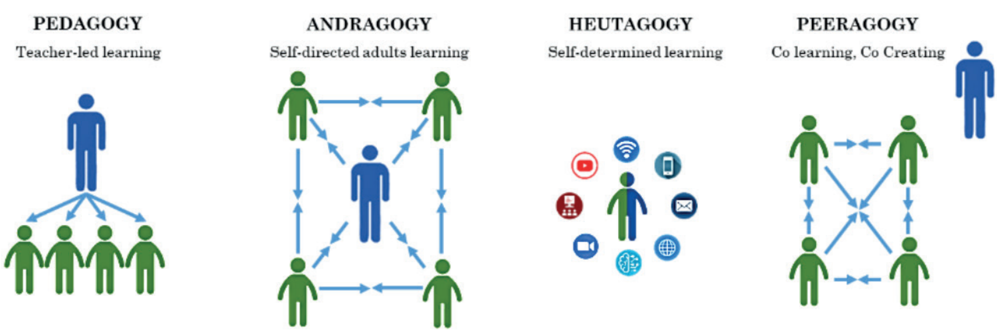
Azevedo et al. (2012), Matsuyama et al. (2019), and Wangid (2014) corroborated that student-centered learning has good effects on learning outcomes and the manner in which learning is imparted to increase students' skills. Changes from teacher-centered learning to student-centered learning are encouraged by using andragogic, peeragogic, heutagogic, and cybergogic approaches (Chan et al., 2019; Hase, 2016; Muresan, 2014). The progression in approaches of education from pedagogy to andradogy, heutagogy and peeragogy depicts paradigm shift from Education 1.0 to 4.0. These approaches differ from each other in various aspects- nature, scope, principles, techniques and methods, the role of the teacher and the learner.

'Pedagogy' deals with the knowledge transmission from teachers to students. According to Merriam-Webster Dictionary Online (2014), it is "the art, science or profession of teaching". It is derived from two Greek words - 'paidos'(child) and 'agogus'(leader) which means leader of a child (Holmes & Abington-Cooper, 2000).

The term 'Andragogy' was pioneered by a German teacher Alexander Kapp in 1833 to portray the teaching style of Plato who solemnized Socratic principles. According to Merriam Webster Dictionary Online (2014) it is defined as "the art and science of teaching adults." Malcolm Knowles defined Andragogy as, "the art and science of helping adults learn."

The heutagogical method may be understood as a progression from pedagogy through andragogy to heutagogy, with learners maturing and becoming self-sufficient (Canning, 2010). It is rooted inside andragogy and focuses on metacognition. Stewart Hase and Chris Kenyon first coined the term 'Heutagogy' in 2000 and described it as "the study of self-determined learning which is independent of formal teaching." According to Hase, S., & Kenyon, C. (2000) heutagogy is "the study of self-determined learning, may be viewed as a natural progression from earlier educational methodologies—in particular from capability development- and may well provide the optimal approach to learning in the twenty-first century." It is a learner-centred approach which perceives the learner as a driving force in their own learning. It believes that learning occurs as an outcome of personal experiences (Hase & Kenyon, 2007). Canning (2010) explains that the advancement from pedagogy to andragogy, then to heutagogy requires more learner's maturity and less instructor's control and course structuring.

Figure-2: Approaches of Education – Pedagogy, Andragogy, Heutagogy and Peeragogy



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Peeragogy is different from pedagogy, andragogy and heutagogy on the basis of the learning process.

Table-1: Learning process of different Educational Approaches

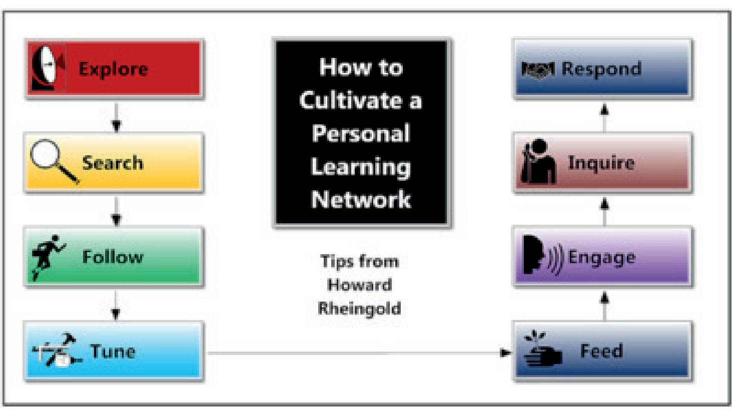
Educational Approach	PEDAGOGY	ANDRAGOGY	HEUTAGOGY	PEERAGOGY
Learning Process	**Unidirectional Instructor- led**	**Bi-directional Self- directed**	**Multi-directional Self- Determined**	**Decentralised- Peer to peer**

The theory of peeragogy (also referred as paragogy), is a contemporary theory of peer-to-peer (P2P) teaching and learning that "addresses the challenge of peer-producing a useful and supportive context for self-directed learning" (Corneli and Danoff, 2011). Peeragogy is about peer learning and peer production together as well as making each other in the group learn in their own way. Each peeragogue's contribution depends on their metacognition, i.e., the self-awareness of one's own thinking process. It deals with what people use for producing and applying knowledge together through online networks. It asserts that peer learning observes collaborative power sharing, co-creating and co-learning with co-responsibility. Longfellow, May, Burke, and Marks-Maran (2008) profess the importance of peer learning as "whilst teachers may be experts in their subject area, students are experts at being students, and thus are arguably better placed to lead novice students towards becoming expert students". This peeragogical approach revolutionises the reigning educational paradigm by injecting peer learning through collaborative efforts of teachers and students, and also among students. Peeragogical interactions require the refinement of various skills such as critical thinking, reflective thinking, collaboration, decision-making, mindfulness, patience, compassion, social skills, digital skills and negotiation skills. Alexander et al. (2012) elucidated that peeragogy is "peers learning together and helping each other learn." Every member of the group contributes and participates in his/her own unique way. It enriches the process of learning through horizontal associations between people who have diverse goals that can be carried out separately through communication.

Personal Learning Network and Peer Learning Network

The Peeragogy Handbook by Howard Rheingold defines Personal Learning Networks as "the collections of people and information resources (and relationships with them) that people cultivate in order to form their own public or private learning networks — living, growing, responsive sources of information, support, and inspiration that support self-learners" and Peer Learning Network as " A network of people who share their profiles and experiences, and collaboratively work, learn, teach, and communicate." Developing and sharing peeragogical profiles plays a significant role in the course of peer – based online teaching and learning.

Figure-3: Tips to cultivate Personal Learning Network

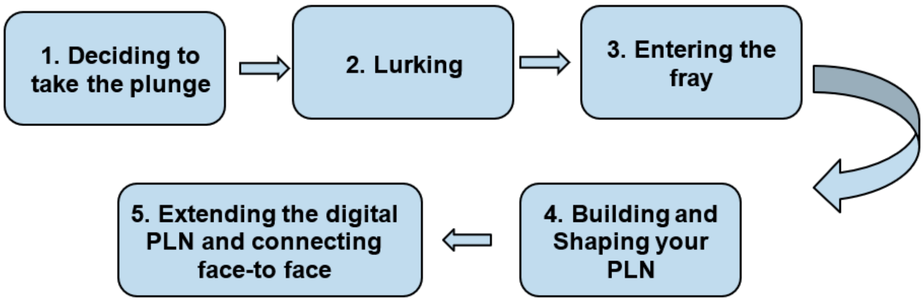


Source: https://en.wikibooks.org/wiki/Peeragogy_Handbook_V1.0/Print_version

Becoming a Peeragogue – Connected/ Networked Learner

With the advent of ICT, a research expert Stephen Downes witnesses, "the expectations of teachers have grown from being expert in the discipline of teaching and pedagogy...[to needing to have] up-to-date and relevant knowledge and experience in it. Even a teacher of basic disciplines such as science, history or mathematics must remain grounded, as no discipline has remained stable for very long, and all disciplines require a deeper insight in order to be taught effectively." Peeragogy is extremely beneficial for educators as they are expected to be primed and must have relevant knowledge, skills and expertise in the field. The Peeragogy Handbook, 3rd Edition, identifies the following phases to become a connected/network learner.

Figure-4: Phases to become a connected/network learner



Phases to become a connected/network learner

In the first phase, investing time necessary in meta-learning and sharing in an open, connected world is important for the learner. In the second phase, the lurker needs to make a digital presence via blogs or wikis and twitter and following other users and observing their educational conversations and seek other information in blogs, Facebook, Edmodo, and LinkedIn groups. Once a lurker decides to engage in a discourse with another user, he or she begins to evolve into a networked educator-learner in the third phase. A personal blog post, involvement in an educational blog or wiki, or a Twitter conversation is useful for this purpose. Relationships may emerge as a result of this interchange, and work on establishing a Personal Learning Network begins. In the fourth phase, the active sharing and open learning are demonstrated by the learner to attract peeragogues with similar interests to shape their Personal Learning Network (PLN). Face-to-face interactions with other networked learners can aid to develop network relationships and increase their long-term viability. Thus, in the fifth phase the peeragogue or the networked educator-learner may decide to move their learning into physical settings and connect with each other through 'unconferences'.

Tenets of Peeragogy

Corneli et al. stated five paragogical principles which are as follows:

i. Decentralised center- Interaction by decentralising the center i.e., changing the space: In a collaborative learning setting, students are expected to participate as individuals, the learner develops an understanding of their own self-concept.

ii. Meta-learning as a source of knowledge- Interaction by changing one's own style of learning: Within their learning community, each learner chooses and designs their own curriculum.

iii. Peers provide feedback- Interaction involves different but equal perspectives: Regular feedback is provided by the peeragogues (or paragogues) to the learners for reflection.

iv. Learning is distributed and non-linear- Interaction by changing the ways of connecting with members of the group: The learner uses an open online platform to co-create knowledge with other members of the learning community.

v. Realise the dream then wake up! - Interaction by changing one's own perspectives: If the learner has achieved the objectives, he can move on and join new knowledge community and if he is unable to finish it, he should act to complete the learning and achieve objectives.

Above mentioned working principles, make peeragogues entitled certain rights. They are: Right to speak, Right to be heard, Right to listen, Right to cooperate in proliferation of other options and Right to co-lead.

Group work and Potential Roles of Peeragogues in Peeragogy

Peers involved in peeragogical learning contribute in group. A group consensus must be established for learning objectives, media, technology and social contract of the course. A process for communication with one another must be formulated w.r.t responding, timely feedback and performance evaluation at course completion. Changes to the learning environment must be implemented.

Figure 5: Potential Role of Peeragogues

Potential Motivations of Peeragogy

The Peeragogy Handbook V1.0 alludes the following potential motivations for peeragogues.

1. Attaining required training or support related to the topic or field;
2. Fostering relationships with other people interested in the field;

3. Locating professional prospects and opportunities through other members;
4. Establishing or strengthening a personal network;
5. Developing organizational and rational thinking skills through discourse and debate;
6. Receiving feedback regarding his/her own performance and comprehending of the topic.

Wiki: A good tool for peeragogy projects

A wiki is a good tool for collaboration, co-facilitation, self-election, communication, documenting changes by keeping some rules without constraining creativity. It is especially suitable for ongoing work as changes can be tracked easily by comparing or rolling back the previous versions. According to Wikipedia "a wiki is a website whose users can add, modify, or delete its content via a web browser using a simplified markup language or a rich-text editor." It also helps in reducing the complications in coordination, making links between wiki pages, dealing with the work in progress and capturing an on-going work. It also supports transparency as one can easily see what other members of the community are doing. *'Appropedia', 'Teahouse' and 'News on wiki'* are exemplars of peeragogy projects running on wikis.

Illustration: Designing Peeragogy's Learning Activity through e-learning

Course's Name: Educational Technology Foundation & Research

Topic: Research Trends in Educational Technology

Table-2: Design of Peeragogy's Learning Activity

Instructions	Learning Tools	Peeragogy's Principles	21st Century Learning Skills
1. You have to create an online community of 2 of your course mates and others experts that you think suitable. Assign a Task to take every member; such as facilitators, learners, contributors, experts etc.	Facebook's Group	Co-learning	Critical Thinking Collaboration
2. In the Facebook's group, discuss the issues related to our class topics. Prepare required teaching notes/learning materials that are needed Make sure the learning materials have been verified by your class instructors	Internet Powerpoint Prezi Blog Facebook's group	Co- Creation of Knowledge	Critical Thinking Life- Long Learning

Instructions	Learning Tools	Peeragogy's Principles	21st Century Learning Skills
3. Prepare 2-3 essay questions that you would like the members of the community to answer related to issues that have been discussed before.	Facebook's group	Self-determined questions that will be answered	Reflective Thinking
4. Share the answers with experts and mark the answers and give appropriate scores based on 10%.	Facebook's group	Self- Assessment	Critical Thinking
5. Wrap up session...			

Source: https://www.youtube.com/watch?v=ZV80vsgq1ec&t=7646s

Conclusion

Peeragogy has its foundation in the behaviourism, cognitivism, constructivism and connectivism theories of learning. It offers a critical focus on peer learning through social connections using technology to connect, co-construct, and co-learn in the digital era and assist in the development of 21st century skills and competencies. It provides an outline for techniques and practices aimed at peer learning and peer knowledge production characterised by flexibility and scalability. Teachers, students or any interested community can become peeragogues. Educators benefit greatly from peeragogy since they are expected to be up-to-date and have appropriate information, skills, and competence in the subject. It offers numerous advantages, including assisting students in gaining their own grasp of a subject, boosting self-esteem, honing critical thinking abilities, fostering interpersonal relationships, and taking charge of their own education. Peers learn and teach together using technology outside or inside the formal institution by co-working towards facilitating, researching, observing, creating, developing, originating, curating, mapping, aggregating, refining, designing, writing, converting, editing and formatting. Metacognition, or self-awareness of one's own cognitive process, determines each peeragogue's contribution. It is concerned with how people produce and apply knowledge via internet networks.

References

AlDahdouh, Alaa and Osorio, Antonio and Caires, Susana (2015). Understanding Knowledge Network, Learning and Connectivism. *International Journal of Instructional Technology and Distance Learning,12*(10).

Alexander, B., Allison, P., Barondeau, R., Breitbart, D., Burroughs, S., Corneli, J., & Walker, G. (2012). *The Peeragogy Handbook* (Version 0.98). https://www.academia.edu/1977604/The_Peeragogy_Handbook CC0.

Arenas, M. (2012, January 28). What is peeragogy? http://arenastudies.wordpress.com/2012/01/28/what-is-peeragogy/

Amiruddin., Baharuddin, F. R., Takbir., Setialaksana, W., & Nurlaela. (2023). Andragogy, peeragogy, heutagogy and cybergogy contribution on self-regulated learning: A structural equation model approach. *International Journal of Instruction*, 16(3), 551-572. https://doi.org/10.29333/iji.2023.16330a

Antipuesto, J. L., & Tan, D. A. (2020). Enhancing Student Performance and Engagement in Mathematics Via Peeragogy. *Science International (Lahore), 32(2)*, 159–164.

Azevedo, R., Behnagh, R. F., Duffy, M., Harley, J. M., & Trevors, G. (2012). Metacognition and self-regulated learning in student-centered learning environments. In *Theoretical foundations of learning environments* (pp. 171–197). Routledge.

Baskoro, G., Mariza, I., & Sutapa, I. N. (2023). Innovation to Improve Critical Thinking Skills in the Generation Z using Peeragogy as a Learning Approach and Artificial Intelligence (AI) as a Tool. *Jurnal Teknik Industri: Jurnal Keilmuan dan Aplikasi Teknik Industri*, 25(2), 121-130.

Bizami, N.A., Tasir, Z., Kew, S.N. (2022) . Innovative pedagogical principles and technological tools capabilities for immersive blended learning: a systematic literature review. *Educ Inf Technol (Dordr). 2023;28(2):*1373-1425. doi: 10.1007/s10639-022-11243-w

Blaschke, L. M. (2012). Heutagogy and Lifelong Learning: A Review of Heutagogical Practice and Self-Determined Learning. *International Review of Research in Open and Distance Learning*, *13*, 56-71.

Boud, D., Cohen, R., & Sampson, J. (1999). Peer Learning and Assessment. *Assessment & Evaluation in Higher Education,24*. 413-426.

Boud, D., Cohen, R., & Sampson, J. (Ed.) (2001) Peer Learning in higher education: Learning from and with each other (London, Kogan Page).

Canning, N. (2010). Playing with heutagogy: Exploring strategies to empower mature learners in higher education. *Journal of Further and Higher Education*, *34*(1), 59-71. http://dx.doi.org/10.1080/03098770903477102

Chan, C. G., Embi, M. A. Bin, & Hashim, H. (2019). Primary school teachers' readiness towards heutagogy and peeragogy. *Asian Education Studies, 4(1),* 11.

Corneli, J., & Danoff, C.J. (2011). Paragogy: Synergizing individual and organizational learning. *https://upload.wikimedia.org/wikiversity/en/6/60/Paragogy-final.pdf*

Corneli, J., Danoff, C. J., Pierce, C., Ricaurte, P., & MacDonald, L. S. (2015). Patterns of peeragogy. *Proceedings of the 22nd Conference on Pattern Languages of Programs,* 1–23

Government of India. (2020). National Education Policy 2020.Ministry of Human Resource Development.https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Hase, S. (2016). Self-determined learning (heutagogy): Where have we come since 2000? Southern *Institute of Technology Journal of Applied Research*, Special Ed(May),*1–21. https://sit.ac.nz/Portals/0/upload/documents/sitjar/Heutagogy*

Hase, S., & Kenyon, C. (2000). *From andragogy to heutagogy* (Vol 5, pp. 1-10). Ultibase

Hollan,J., Hutchins, E.,& Kirsh D (June 2000). Distributed cognition: toward a new foundation for human-computer interaction research. *Transactions on Computer-Human Interaction (*TOCHI), **7** (2), 174–96. *https://doi.org/10.1145/353485.353487*

Holmes, G., & Abington-Cooper, M. (2000). Pedagogy vs. andragogy: A false dichotomy. *Journal of Technology Studies, 26*, 2. http://scholar.lib.vt.edu/ejournals/JOTS/Summer-Fall-2000/holmes.html

Keerthirathne, W.K.D. (2020) Peer Learning: An overview. *International Journal of Scientific Engineering and Science. 4*(11), pp. 1-6. ISSN (Online): 2456-7361 *https://www.academia.edu/45110352/Peer_Learning_an_Overview*

Kenyon, C., & Hase, S. (2001). *Moving from Andragogy to Heutagogy in Vocational Education*. https://files.eric.ed.gov/fulltext/ED456279.pdf

Kijkuit, B., & Van Den Ende, J. (2007). The organizational life of an idea: Integrating social network, creativity, and decision-making perspectives. *Journal of Management Studies, 44*(6), pp. 863-882.

Knowles, M. (1973). The adult learner: A neglected species. Houston: Gulf.

Li, L., & Salleh, S. B. M. (2023). The Effects of Online Peeragogy on University Students' Critical Thinking. *International Journal of Membrane Science and Technology* , 10(2), 2796-2804.

Longfellow, E., May, S., Burke, L., & Marks-Maran, D. (2008). "They had a way of helping that actually helped": A case study of a peer-assisted learning scheme. *Teaching in Higher Education,* 13(1), 93–105.

Matsuyama, Y., Nakaya, M., Okazaki, H., Lebowitz, A. J., Leppink, J., & Van Der Vleuten, C. (2019). Does changing from a teacher-centered to a learner-centered context promote self-regulated learning: a qualitative study in a Japanese undergraduate setting. *BMC Medical Education, 19(1)*, 1–12.

Moraes, E.B., Kipper, L.M., Hackenhaar Kellermann, A.C., Austria, L., Leivas, P., Moraes, J.A.R. and Witczak, M. (2023), "Integration of Industry 4.0 technologies with Education 4.0: advantages for improvements in learning", *Interactive Technology and Smart Education, 20(2),* pp. 271-287. https://doi.org/10.1108/ITSE-11-2021-0201

Muresan, M. (2014). Using Cybergogy and Andragogy Paradigms in Lifelong Learning. *Procedia - Social and Behavioral Sciences, 116,* 4722–4726. https://doi.org/10.1016/j.sbspro.2014.01.1015

Nottingham Andragogy Group. (1983). *Towards a developmental theory of Andragogy*. Nottingham, Malaysia: University Park, Notthingham. University of Nottingham, Department of Adult Education.

Prasetya, E. P., Nuraeni, N., & Shabir, M. (2022). Teachers' Perception of Peeragogy in Online Learning during the COVID-19 Pandemic*. Journal of English Educational Study (JEES*), 5(2), 141-151.

Ratnani I, Fatima S, Mithwani A, et al. (2020) Changing Paradigms of Bedside Clinical Teaching. *Cureus 12*(5): e8099.

Rheingold, H. et al. (2014) *The peeragogy handbook* (3rd ed.) PubDomEd and Pierce Press.

https://en.wikibooks.org/wiki/Peeragogy_Handbook_V1.0

Siemens, G. & Tittenberger, P. (2009). Handbook for emerging technologies for learning. https://www.academia.edu/2857175/Handbook_of_emerging_technologies_for_learning

Smidt, H., Thornton, M., & Abhari, K. (2017): The future of social learning: a novel approach to connectivism*. Sciences, Hawaii*, pp. 2116–2125. http://hdl.handle.net/10125/41410

Tasir,Z.(2021, February 26). *Designing Online Learning Activities Based on Innovative Pedagogies: Heutagogy and Peeragogy* [Video File]. YouTube. https://www.youtube.com/watch?v=ZV80vsgq1ec&t=7646s

Topping, K. (2005). Trends in peer learning. *Educational Psychology, 25*(6), 631–645.

Velez, J. J., Cano, J., Whittington, M. S., & Wolf, K. J. (2011). Cultivating change through peer teaching. *Journal of Agricultural Education*, *52*(1), 40-49.

Wangid, M. N. (2014). Student-centered learning: Self-regulated learning. *International Conference on Fundamentals and Implementation of Education (ICFIE), 161–165.*

Zhang, Z., & Bayley, J. G. (2019). Peer Learning for University Students' Learning Enrichment: Perspectives of Undergraduate Students*. Journal of Peer Learning, 12(5),* 61–74.

https://www.iimb.ac.in/sites/default/files/inline-files/CTL-Peer%20Learning-Students.pdf

General Article

Augmented Reality in Teaching-Learning: An Innovative Digital Tool for the Twenty-First Century Classrooms

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Abstract

Innovative technical tools like augmented reality (AR) and virtual reality have been made possible by technological advancement and device computational power. AR is a technology tool with amazing pedagogic potential that enables the creation of innovative learning environments. The successful use of AR in the classroom can assist students in several ways and result in fruitful learning experiences. The use of AR technology can also be used to design more interesting and appealing educational experiences. Technology such as augmented reality may immediately produce learning experiences for students, which makes it a highly helpful tool for the execution of educational activities. The use of augmented reality in the classroom has tremendous potential, and it can be successfully integrated with existing teaching and learning methods. It is necessary to deploy innovative pedagogies that blend formal and casual learning and enable individualized learning. Education professionals need to reconsider how they employ conventional pedagogies to support the development of skills and competencies for lifelong learning. The education industry could be transformed with the effective and on-going use of digital learning tools.

Keywords: Technology, Augmented Reality, Digital Learning, Innovative Technologies, Teaching-Learning

Introduction

Education has been forced to adapt new learning models as a result of the development of innovative educational approaches as a result of the advent of information technology and digitization. Additionally, all educational institutions were compelled to make the changeover to online learning right away due to pandemic limitations and to aid in containing the virus's (COVID-19) spread (Criollo-C et al., 2021). These educational models should support current learning processes and encourage the distribution of digitized instructional information (Criollo-C et al., 2021). Our needs for education in the future cannot be met by the conventional, constrained competency-based approach (David, 2017). Education's primary goal today is to prepare students for the complicated and ever-changing nature of the workforce. The ability to adjust educational content for students to enhance their practical abilities using augmented reality technology emphasizes that while theoretical knowledge is the foundation, skills acquired in a practical setting are always required (Criollo-C et al., 2021). By encouraging students' abilities to explore, create, interact, connect, reflect, and share knowledge inside online contexts, digital tools in the form of social media further expand the possibilities for developing learner-centered spaces (Blaschke & Hase, 2019). Utilizing technology is hoped that it would encourage students' imagination and creativity in the subject matter and enable them to take charge of their learning at their speed and along their course (Bistaman, Idrus, & Rashid, 2018a). The current state of technology advancement makes it possible to apply innovative learning aids in a variety of sectors, particularly in education. To improve the teaching and learning process, several technologies have been adopted in the educational sector. The use of augmented reality (AR) in education offers fresh approaches and has a lot of pedagogical potential (Bistaman et al., 2018a). To effectively teach students and provide better techniques to enhance their learning experiences, instructors must choose the best strategy (Bistaman et al., 2018a). The adoption of augmented reality in education has grown, and stakeholders are increasingly drawn to it because it is unique and has the potential to raise educational standards. The use of augmented reality (AR) media as a supplement or intermediary tool has become commonplace. The use of augmented reality (AR) media as a tool or an intermediate in daily life is now widespread (Rusli, Nalanda, Tarmidi, Suryaningrum, & Yunanda, 2023). As an emerging technology, augmented reality (AR) has shown a wide range of benefits for teaching foreign languages, including fostering motivation, content memorization, and contextualised learning (Manna, 2023).

Technology in Teaching-Learning: Technology Integration in Education

The twenty-first century provides a boundary-less existence, globalization, internationalization, and the explosive growth of information and communication technologies (Nurhasanah, Abdurrahman, Andra, & Herlina, 2021a). Technology advancements and device computing power have made it possible to produce cutting-edge technological tools like augmented reality (AR) and virtual reality (VR) (Criollo-C et al., 2021). During the fourth industrial revolution, technology advanced very quickly, which led to changes in the educational system and other advances worldwide (Nurhasanah et al., 2021a). The results of current technological integration into education reveal a positive impact on learning and teaching outcomes. One of the pillars of contemporary society is education, which attempts to equip students with the skills necessary to participate fully in a society that is currently more focused than ever on technological advancement (Criollo-C et al., 2021). Teachers now have a unique opportunity to assist students in acquiring lifetime learning abilities thanks to the trends of learner-centered teaching and pervasive classroom technology use (Blaschke & Hase, 2019). There has been a movement towards more learner agency in both formal and informal educational settings as a result of the substantial improvement in learning affordances brought about by technological advancements. With the learner at the center of the learning process and as an active agent of learning rather than a passive user of information, this has presented a challenge to educators regarding how they navigate the learning process (Blaschke & Hase, 2019). Emerging technologies should be used in educational settings to present course content that is compatible with human cognition since they are aware of how important it is for students today to acquire, store, and apply information (Bistaman et al., 2018a).

Dealing with digital natives presents issues for teachers in the modern world. The demand for adopting technology in education is rising as a result of the explosion and quick growth of information technologies that can be used in instruction. This is done to encourage students to engage in active learning and motivate them to achieve an effective learning process (Alkhattabi, 2017). To integrate innovative and new technologies into classes, which have the potential to significantly improve student learning and engagement, teachers must devote a significant amount of personal time to becoming familiar with them. The current rate of technological advancement, which is boosting the web's interactivity and media content and raising the caliber of distribution platforms, gives the perfect conditions for a rise in the use of e-learning tools and solutions (Alkhattabi, 2017).

Augmented Reality: The Concept and Meaning of Digital Innovative Tool

The definition of augmented reality (AR), a concept that has been in development since the turn of the 20th century, is the superimposition of virtual elements in a real environment (Criollo-C et al., 2021). The term "augmented reality" (AR) refers to a set of tools that enable a person to observe one or more virtual items in a real-world setting. Instead of being a specific technology, augmented reality might be thought of as a concept. The idea of augmented reality (AR) should be imagined beyond technology alone and should not be limited to any one form of technology. The use of augmented reality (AR) technology enables people to perceive objects in their natural environments, something that is otherwise impossible (Bistaman et al., 2018a). An artificial layer is placed on top of real-world photographs using augmented reality (AR), a new technology that is also applied in the field of education (Karagozlu, 2021). For all educational applications and possibilities, augmented reality (AR) is the best option. The advancements in technology nowadays make me conscious of the need to better educational sectors through efficient means. According to the studies, AR can engage, stimulate, and inspire students to examine the course material from several perspectives (Bistaman et al., 2018a). The term "augmented reality" (AR) refers to a live, direct, or indirect view of a physical, real-world environment, with computer-generated sensory input such as sound, video, graphics, or GPS data enhancing some aspects of the environment. Virtual and real worlds can seamlessly interact with each other thanks to augmented reality (AR) interfaces, which also provide a tangible interface metaphor and a way to switch between them (Bistaman et al., 2018a). Virtual Reality (VR), also known as Mixed Reality, is an extension of augmented reality (AR). The use of computer-generated images or objects blended with real-world surroundings is known as augmented reality (AR). Numerous industries, including engineering, industrial design, the military, medical science, and education, have already used this technique (Bistaman et al., 2018a). Technology that uses augmented reality can directly create learning experiences for students, which is particularly helpful for the execution of educational activities (Hidayat, Sukmawarti, & Suwanto, 2021). With the development of numerous gadgets and smart device apps, augmented reality (AR) technology has been expanding alongside different kinds of hardware (Hanid, Haruzuan, Said, & Yahaya, 2020). The use of augmented reality (AR) in the classroom can promote student engagement, improve communication between teachers and students, and support learning activities (Nurhasanah, Abdurrahman, Andra, & Herlina, 2021b). As Industrial Revolution 4.0 takes hold, the learning environment is undergoing fast change. In education, augmented reality is one of the hottest technologies. The usage of virtual objects that are seamlessly integrated into the actual world and appear in the same location in real-time is made possible by the technology known as augmented reality

(Hanid et al., 2020). The success of augmented reality (AR), particularly in the sphere of education, has led to a considerable increase in the use of new technologies in recent years (Alkhattabi, 2017). Technology is advancing in today's world across many industries, including education, even at the primary level. The application of technology in elementary schools, including Augmented Reality, is still being refined. With the aid of augmented reality technology, virtual items in 2D and 3D can be seen in real-time (Hidayat et al., 2021).

This technology tool is useful in the classroom since it promotes learning by making it more interactive and dynamic. Additionally, studies have demonstrated how powerfully successful employing augmented reality in educational settings is at enhancing student learning (Criollo-C et al., 2021). With the use of this application, teachers can assist students in teaching subjects in which they are not currently able to obtain first-hand experience in the actual world and improve communication between them (Bistaman et al., 2018a). Augmented reality (AR) is a technology that alters reality by fusing real-world visuals with digital elements and enhances how reality is perceived. Regarding augmented reality techniques, both pupils and teachers express generally favorable opinions (Karagozlu, 2021). The utilization of things in the real-world environment is made possible by computer-generated technology known as augmented reality (AR) (Bistaman et al., 2018a). Both positive and bad effects may result from teaching basic education students with augmented reality technologies. The demands and preparation of the pupils, as well as the readiness of the current infrastructure and instructor skills, must still be taken into account when using augmented reality in the classroom (Hidayat et al., 2021). By utilizing proper instructional strategies, AR may provide students with numerous benefits and lead to effective learning experiences. The AR technology also gives the opportunities to create educational experiences that are more engaging and attractive. The application of augmented reality improves motivation, engagement, and interaction with the environment and other people while also speeding up conceptual learning and memorization (Mozaffari & Hamidi, 2023).

Augmented Reality in Teaching-Learning: Employing Advanced Innovative Technology in Classroom

The use of augmented reality (AR) in education offers many advantages, including improved engagement and interaction, and it can lessen the negative impacts of the interruption of face-to-face instruction (Criollo-C et al., 2021). Several elements need to be available for the AR application to be used in education successfully for both teaching and learning (Bistaman et al., 2018a). The use of augmented reality in the educational field has grown, and stakeholders are increasingly drawn to its novelty as a way to raise educational standards (Hidayat et al., 2021). Higher education uses AR to help students become more proficient and knowledgeable in disciplines like electrical theory, agronomy, chemistry, biology, geometry, and technological themes (Criollo-C et al., 2021). Since theoretical knowledge is the foundation, but practical skills are constantly required, augmented reality technology allows for the adaptation of educational content targeted at students to develop their practical skills (Criollo-C et al., 2021). AR can help to promote student-centered learning, pique students' interests and curiosities, improve their cognitive, emotional, and psychomotor processes, and increase their involvement in the information-seeking process. Augmented reality has successfully improved students' visualisation skills and fostered a better grasp of content. Hence, it is advised that educators incorporate it in their teaching and learning (Ali, Johari, & Ahmad, 2023). Since it enables the student to move beyond a tool connected to a virtual classroom and towards immersion in surroundings with high contextual fidelity, augmented reality (AR) has been able to establish itself as a learning resource that goes beyond a tool linked to a virtual classroom (Chamorro-Atalaya et al., 2023). An application created using augmented reality serves as a teaching tool for elementary school pupils to understand the different parts of the hand. With this educational tool, it is believed that instructors will benefit from having an application that serves as a teaching tool for primary school pupils learning about the human body's parts (Rusli et al., 2023).

Augmented reality employs interactive learning, game-based learning, collaborative learning, and experiential learning for the learning process (Hanid et al., 2020). The teachers and students agreed that implementing AR techniques had a beneficial impact on how well they understood science concepts, provided a visual introduction to the subject, and facilitated in-class discussion (Karagozlu, 2021). Audio elements would make the program more appealing and simpler to use, according to both the students and the professors (Karagozlu, 2021). The usage of computer-generated systems for augmented reality (AR) enables users to observe real-world surroundings with virtual things composited onto them (Bistaman et al., 2018a). The utilization of innovative educational tools like augmented reality is made possible by the development of technology. A subset of virtual reality is augmented reality (AR). Users of AR can view the actual environment with virtual things superimposed or blended in with it (Bistaman et al., 2018a).

Although augmented reality (AR) has the potential to improve educational outcomes, its practical implementation in the classroom must take into account domain-specific, pedagogical, and psychological factors. When creating and incorporating an AR learning environment, tactics like collaborative learning were taken into account. Collaboration is the act of working together from one party to another, where they can speak with each other to learn and gain from one another (Bistaman et al., 2018a). Teachers must take into account integrating this cutting-edge technology to support and improve learning by utilizing computers, multimedia resources, the internet, simulation games, and immersive technology like 3D virtual worlds and Augmented Reality (Bistaman et al., 2018a).

In comparison to other forms of technology like multimedia, gaming, and online learning, augmented reality technology offers more promise. Even though augmented reality has created new potential to improve the educational system, it is up to educators to recognize emerging technologies and ensure that education is getting better (Bistaman, Idrus, & Rashid, 2018b). Augmented Reality (AR) is an interactive media that combines developments in image processing, tracking technology, and natural human-computer interaction. To create the educational application utilizing this methodology for actual use in classrooms, domain-specific, pedagogical, and psychological issues must be taken into consideration (Bistaman et al., 2018a).

Due to its capacity to engage pupils in lifelike experiences, augmented reality is attracting scientific interest (Alkhattabi, 2017). To have an impact on raising the standard of the learning process, the technologies being utilized, especially Augmented Reality, must be integrated with the proper learning methodologies.

The success and usefulness of the technology support utilized, such as augmented reality in education, can be influenced by the choice of appropriate learning methodologies (Hanid et al., 2020). An emerging technology is augmented reality. AR-based programs are employed more and more in education and training due to their flexibility in fusing real-world and virtual worlds. Different ways of distributing educational material and improving student experiences are made possible by the usage of this technology.

Advantages of Augmented Reality in Teaching-Learning

The usability results demonstrate that NetAR is well-liked by users and has a beneficial impact on education (Criollo-C et al., 2021). The employment of a tactile interface metaphor for object manipulation could be made possible by AR, which could provide seamless interaction between real and virtual environments (Alkhattabi, 2017). AR systems layer other useful 3D virtual items onto the real world so that users can interact with them. With augmented reality, one may interact with all of the virtual information that is overlaid while never losing sight of the real world (Criollo-C et al., 2021). The use of augmented reality in teaching facilitates the transfer of new concepts to students, cuts down on class planning time, and enhances teacher-student engagement (Karagozlu, 2021). Due to its advantages, augmented reality (AR) and mobile learning could be the solution to this modern instructional model, facilitating understanding of instructional content and boosting students' enthusiasm and interest (Criollo-C et al., 2021). Due to its variety of applications for various educational levels and disciplines, augmented reality is attracting a lot of attention from educational institutions and professionals in the field of education (Criollo-C et al., 2021). In the field of mobile technology, augmented reality has become increasingly significant in recent years due to its ability to make teaching and learning processes easier. An augmented reality prototype has been successfully developed, and this will help to improve instruction at the Universidad de Ciencias y Humanidades because this augmented reality prototype is appropriate for classes in biology, human anatomy, human physiology, microbiology, and parasitology that are part of the professional school of nursing because it teaches through cognitive processes (Morales, Andrade-Arenas, Delgado, & Huamanı, 2022).

Applications for numerous academic fields, including mathematics, mechanics, physics, and urban planning, among many others, have proliferated thanks to the adaptability with which this technology is being created (Criollo-C et al., 2021). The augmented reality application promotes learning, provides a visual topic introduction, increases the permanence of the topics taught, adds to learning through enjoyment, and positively influences attitudes toward the subject. In their learning process, students get more enthusiastic (Karagozlu, 2021).

Numerous efforts in the fields of augmented reality and mobile learning have been created to create cutting-edge teaching and learning approaches for a variety of academic fields and levels (Criollo-C et al., 2021). The professors and students agreed that AR techniques enhanced the learning of science concepts, provided a visual topic introduction, and facilitated in-class discussion (Karagozlu, 2021). The use of augmented reality applications will transform the way that education is delivered, allowing for the creation of real-world learning environments that are conducive to a variety of learning preferences (Bistaman et al., 2018a).

An emerging technology is augmented reality. AR-based programs are being utilized more frequently in education, particularly medical education and training, because of their versatility in merging physical and virtual environments. This technology is used to deliver educational material and improve student experiences in a variety of ways (Dhar, Rocks, Samarasinghe, Stephenson, & Smith, 2021).

Learning advancements in augmented reality applications develop into fully functional tools that can serve both teachers and students (Criollo-C et al., 2021). The integration of augmented reality applications in the classes was beneficial for grabbing students' attention and maintaining it throughout the lesson (Karagozlu, 2021). The potential of augmented reality technology to increase student interest and motivation while also supporting the teaching and learning process in a classroom (Bistaman et al., 2018a). Using Augmented Reality (AR) apps in education, in particular, offers a great deal of promise to improve teaching and learning while also fostering collaborative tasks between teachers and students (Bistaman et al., 2018a). Primary school teachers have a high acceptance rate for AR and are willing to employ it. The findings also showed that strong motivators might be created by establishing a solid human infrastructure, a suitable ICT infrastructure, and IT skills (Alkhattabi, 2017). In order for students to compete worldwide and keep up with the times, teachers must be able to increase the quality of the learning process in a variety of ways, one of which is by implementing AR-based learning techniques (Nurhasanah et al., 2021b).

(Ropawandi, Halim, & Husnin, 2022) indicated that augmented reality technology increased students in the experimental group's knowledge of electrical principles compared to the control group, with a significantly substantial difference between the two groups. This study helps advance augmented reality (AR) technology in education, particularly as it relates to the teaching and understanding of abstract physics ideas.

Conclusion

The twenty-first century brings with it the possibility of living in a world without borders, globalization, internationalization, and the quickening development of information and communication technologies. Technology such as augmented reality (AR) makes it possible to create innovative learning environments and has enormous pedagogic potential. Teachers now have a unique chance to help students develop skills for lifetime learning thanks to the trends of learner-centred teaching and pervasive technology use in the classroom. It has a great deal of promise to improve teaching and learning while also fostering collaboration between teachers and students when Augmented Reality (AR) applications are used in education. Innovative learning tools are now possible thanks to technological advancements in education. Numerous elements, especially conventional teaching techniques and technological approaches using AR, must be taken into account to ensure the use of this technology in education is done more successfully. AR technology has matured to the point where it can be applied to a much wider range of application domains, and education is an area where this technology could be especially valuable. AR can assist students in many ways and result in productive learning experiences when used with the right educational strategies. Another opportunity provided by AR technology is to design more interesting and appealing teaching experiences. The use of augmented reality in education has great potential since it can be successfully integrated into both teaching and learning. The implementation of new pedagogies, which promote personalization of learning and integrate both formal and informal learning, is crucial. As they work to encourage the development of skills and competencies for lifelong learning, educators must re-evaluate their use of traditional pedagogies. The education industry may undergo reform if digital learning tools are used effectively and consistently. Augmented reality (AR) is revolutionizing teaching and learning by enhancing traditional educational methods with interactive, immersive experiences. AR technology overlays digital content, such as 3D models, animations, or information, onto the real world through devices like smartphones or AR glasses. This dynamic integration of digital elements into the physical environment enables students to engage with complex concepts in a more visual and interactive manner, making learning more engaging and effective. AR can be used in various subjects, from history to science, and offers opportunities for hands-on exploration and problem-solving, ultimately fostering deeper understanding and retention of knowledge.

References

Ali, D. F., Johari, N., & Ahmad, A. R. (2023). The effect of augmented reality mobile learning in microeconomic course. *International Journal of Evaluation and Research in Education*, *12*(2), 859–866. https://doi.org/10.11591/ijere.v12i2.24943

Alkhattabi, M. (2017). Augmented reality as e-learning tool in primary schools' education: Barriers to teachers' adoption. *International Journal of Emerging Technologies in Learning*, *12*(2), 91–100. https://doi.org/10.3991/ijet. v12i02.6158

Bistaman, I. N. M., Idrus, S. Z. S., & Rashid, S. A. (2018a). The Use of Augmented Reality Technology for Primary School Education in Perlis, Malaysia. In *Journal of Physics: Conference Series* (Vol. 1019). Institute of Physics Publishing. https://doi.org/10.1088/1742-6596/1019/1/012064

Bistaman, I. N. M., Idrus, S. Z. S., & Rashid, S. A. (2018b). The Use of Augmented Reality Technology for Primary School Education in Perlis, Malaysia. *Journal of Physics: Conference Series*, *1019*(1), 0–9. https://doi.org/10.1088/1742-6596/1019/1/012064

Blaschke, L. M., & Hase, S. (2019). Heutagogy and digital media networks: Setting students on the path to lifelong learning. *Pacific Journal of Technology Enhanced Learning*, *1*(1), 1.

Chamorro-Atalaya, O., Morales-Romero, G., Quispe-Andía, A., Quispe-Guía, S., Guía-Altamirano, T., Auqui-Ramos, E., Arévalo-Tuesta, J. A. (2023). Contribution of Augmented Reality in Teaching and Learning, in the Midst of COVID-19: Systematic Review. *International Journal of Learning, Teaching and Educational Research*, *22*(2), 302–322. https://doi.org/10.26803/ijlter.22.2.17

Criollo-C, S., Abad-Vásquez, D., Martic-Nieto, M., Velásquez-G, F. A., Pérez-Medina, J. L., & Luján-Mora, S. (2021). Towards a new learning experience through a mobile application with augmented reality in engineering education. *Applied Sciences (Switzerland)*, *11*(11). https://doi.org/10.3390/app11114921

David, S. (2017). Practical heutagogy: Promoting personalised learning in management education. *Adult Learning*, *31*(4), 161–174. https://doi.org/https://doi.org/10.1177/1045159520905364

Dhar, P., Rocks, T., Samarasinghe, R. M., Stephenson, G., & Smith, C. (2021). Augmented reality in medical education: students' experiences and learning outcomes. *Medical Education Online*. https://doi.org/10.1080/10872981.2021.1953953

Hanid, M. F. A., Haruzuan, M. N., Said, M., & Yahaya, N. (2020). Learning strategies using augmented reality technology in education: Meta-analysis. *Universal Journal of Educational Research*, *8*(5 A), 51–56. https://doi.org/10.13189/ujer.2020.081908

Hidayat, Sukmawarti, & Suwanto. (2021). The application of augmented reality in elementary school education. *Research, Society and Development*, *10*(3), e14910312823. https://doi.org/10.33448/rsd-v10i3.12823

Karagozlu, D. (2021). Creating a sustainable education environment with augmented reality technology. *Sustainability (Switzerland)*, *13*(11), 1–15. https://doi.org/10.3390/su13115851

Manna, M. (2023). Teachers as augmented reality designers: A study on Italian as a foreign language teacher perceptions. *International Journal of Mobile and Blended Learning*, *15*(2), 1–16. https://doi.org/10.4018/IJMBL.318667

Morales, S. A. H., Andrade-Arenas, L., Delgado, A., & Huamanı, E. L. (2022). Augmented Reality: Prototype for the Teaching-Learning Process in Peru. *International Journal of Advanced Computer Science and Applications*, *13*(1), 806–815. https://doi.org/10.14569/IJACSA.2022.0130194

Mozaffari, S., & Hamidi, H. R. (2023). Impacts of augmented reality on foreign language teaching: a case study of Persian language. *Multimedia Tools and Applications*, *82*(3), 4735–4748. https://doi.org/10.1007/s11042-022-13370-5

Nurhasanah, S., Abdurrahman, A., Andra, D., & Herlina, K. (2021a). Augmented Reality (AR) in Physics Learning: Opportunities to Improve Teacher and Student Interaction in Online Learning. *Indonesian Journal of Science and Mathematics Education*, *4*(2), 145–157. https://doi.org/10.24042/ijsme.v4i2.8486

Nurhasanah, S., Abdurrahman, A., Andra, D., & Herlina, K. (2021b). Augmented Reality (AR) in Physics Learning: Opportunities to Improve Teacher and Student Interaction in Online Learning. *Indonesian Journal of Science and Mathematics Education*, *4*(2). https://doi.org/10.24042/ijsme.v4i2.8486

Ropawandi, D., Halim, L., & Husnin, H. (2022). Augmented Reality (AR) Technology-Based Learning: The Effect on Physics Learning during the COVID-19 Pandemic. *International Journal of Information and Education Technology*, *12*(2), 132–140. https://doi.org/10.18178/ijiet.2022.12.2.1596

Rusli, R., Nalanda, D. A., Tarmidi, A. D. V., Suryaningrum, K. M., & Yunanda, R. (2023). Augmented reality for studying hands on the human body for elementary school students. *Procedia Computer Science*, *216*(2020), 237–244. https://doi.org/10.1016/j.procs.2022.12.132

General Article

The Ethics of Artificial Intelligence: A Critical Examination of Moral Responsibility and Autonomy

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Abstract

The present article aims to critically examine the ethical considerations surrounding artificial intelligence (AI) with respect to moral responsibility and autonomy. The authors illustrate the development of AI requiring careful recognition of its potential impact on society and the demand for considerable accountability and transparency in the design and utilization of AI systems for addressing the ethical issues persisting regarding the implementation of AI. The paper further discusses the crucial role of AI ethical frameworks and guidelines built on moral obligations and autonomy for contemporary society and the necessity of collaboration between different stakeholders to ensure the safe use of AI that promotes the well-being of the people. The article also mentions the various initiatives of the Indian government taken to develop and implement ethical AI in the country and specifies the indispensable task of NEP 2020 in promoting AI ethically in the Indian education system. Moreover, the current study suggests the prerequisite research and dialogue on this salient study area of AI to ensure its ethical development and application for the social security and digital safety of the individual as well as the community as a whole.

Keywords: Artificial Intelligence (AI), Ethics, Moral Responsibility, Autonomy, Transparency.

Overview

Artificial Intelligence (AI) is a common expression that pertains to the making of computer-based systems efficient in executing activities that specifically necessitate the intelligence of humans, including acquiring knowledge, resolving problems, and making decisions. Russell and Norvig (2010) defined AI as "the study of agents that receive percepts from the environment and take actions that affect that environment". They manifested AI as a sub-discipline of computer science that centres making intelligent agents capable of reasoning, perceiving, and acting autonomously. Domingos (2015) provides a more general definition of AI, describing it as "the quest to build machines that can think like humans", whereas, Goodfellow et al. (2016) expounded it as "the ability of machines to perform tasks that would normally require human intelligence, such as visual perception, speech recognition, decision-making, and language translation". Therefore, AI can be described as the exploration of developing intelligent agents that have the ability to autonomously reason, perceive, and take action.

Artificial intelligence has its period of development from the early days of computer science. The concept of machines that can simulate human intelligence has fascinated researchers and scientists for decades, leading to the development of various approaches and techniques for creating AI systems. The earliest developments in AI can be dated back to the 1950s, when researchers began exploring the possibility of creating machines that could "think" like humans (Russell & Norvig, 2010). In the beginning, AI systems were created with the intention of carrying out elementary tasks like playing games and resolving predicaments related to mathematics. These mentioned systems were founded on rule-based algorithms that were programmed to follow a set of predefined rules. In the 1960s and 1970s, researchers began exploring new approaches to AI, including machine learning and neural networks (Jordan & Mitchell, 2015). The 1980s and 1990s saw significant advancements in AI, including the development of expert systems, which were designed to mimic the decision-making abilities of humans (Russell & Norvig, 2010). These mechanisms were utilized in a vast array of implementations, encompassing everything from medical diagnosis to economic prediction. In the early 2000s, researchers began exploring new approaches to AI, including deep learning and natural language processing (Floridi & Cowls, 2019). Today, artificial neural networks are utilized by deep learning algorithms for learning and improving their performance over time, making them exceptionally skilled in tasks like image and speech recognition. Processing of Natural language algorithms is designed to understand and interpret human language, enabling machines to interact with humans more naturally and intuitively. Today, AI is a rapidly growing field with applications in a wide range of industries, including healthcare, finance, and transportation, which has been driven by advancements in computing power and data analytics, as well as increased interest and investment from industry and the government (Brynjolfsson & McAfee, 2014)

The advent of AI has been influencing almost every sphere of life. Experts have been concerned about the drastic impact of AI on individuals and society regarding its various issues, including ethical concerns. The realm of ethics in artificial intelligence (AI) is multifaceted and swiftly evolving, as its creation and implementation bring up a broad spectrum of ethical dilemmas. The foremost ethical concern in AI pertains to partiality and inequity. It can learn from data, and if that data contains biases, the resulting AI systems can perpetuate and even amplify those biases (Crawford & Calo, 2016). For instance, AI systems employed in recruitment or lending assessments may exhibit discrimination against particular groups based on attributes like race, gender, or age. Additionally, transparency and accountability are also ethical concerns that are significant in AI. AI systems are frequently complicated and obscure, which can make it challenging to comprehend how they reach their decisions. This lack of transparency can make it difficult to identify and correct biases or errors in it (Floridi & Cowls, 2019). Additionally, it can be challenging to allocate the responsibility for the actions of AI systems, particularly in cases where the system's decision-making processes are not transparent. In addition, another ethical issue concerning AI is how it affects human autonomy and decision-making. As these systems become more sophisticated, they might be utilized to make choices that can have substantial consequences on individuals' lives, such as decisions regarding healthcare or criminal justice. This raises questions about the extent to which humans should be involved in these decisions, and whether AI systems can be trusted to make fair and ethical decisions (Selbst et al., 2019). A variety of ethical frameworks and principles have been proposed to address these and other ethical concerns in AI. These include approaches based on principles such as transparency, accountability, and fairness (Floridi & Cowls, 2019), as well as principles such as beneficence, non-maleficence, and respect for autonomy (Taddeo & Floridi, 2018) while some researchers have proposed the development of ethical codes of conduct and regulations for the development and deployment of AI systems (Bostrom & Yudkowsky, 2014). Thus, ethics in artificial intelligence is a complicated area of study with a wide range of ethical problems and concerns including issues of bias and discrimination, transparency and accountability, and the impact of AI on human freedom for making decisions.

Moral responsibility in the context of Artificial Intelligence

Moral responsibility is a central concept in discussions of ethics and artificial intelligence (AI). As AI systems gradually evolve and become independent, they are able to make decisions that can greatly affect people's lives. This raises concerns about who should be held accountable for the actions of these systems and how accountability should be assigned. One of the challenges in assigning moral responsibility in the context of AI is the fact that these systems are often designed to learn and make decisions on their own, without direct human intervention. This raises questions about whether responsibility for the actions of an AI system should rest with the humans who created or deployed the system, or with the system itself (Dastani & Yazdanpanah, 2022). Additionally, there may be multiple factors involved in the development and deployment of AI, further complicating questions of responsibility. Another challenge is the fact that these systems can be opaque and hard to understand. This can make it difficult to identify and correct biases or errors in the system's decision-making processes, and can also make it strenuous to assign responsibility for the actions of the system (Floridi & Taddeo, 2016). To deal with these challenges, some researchers have suggested the development of new ethical frameworks and principles regarding moral responsibility with respect to AI. One approach is to consider the degree of control that humans have over an AI system, with greater control implying greater moral responsibility (Gianni et al., 2022). Others have proposed the development of new legal frameworks that would clarify the allocation of responsibility for the actions of AI systems. Apart from these technical and legal remedies, certain experts have contended that a more extensive cultural transformation may be required to guarantee that AI systems are created and utilized in a moral and reliable way. This could involve promoting a greater awareness of the ethical implications of AI, as well as encouraging greater collaboration between experts in AI and ethics (Floridi & Taddeo, 2016).

Artificial intelligence Autonomy in the context of AI

Artificial intelligence (AI) autonomy means the ability of an AI system to make decisions and take actions without direct human input or supervision. The level of autonomy in these systems can vary widely, ranging from simple rule-based systems that make decisions based on predefined criteria, to more sophisticated machine-learning systems that can adapt and learn from experience. As AI systems become more autonomous, it becomes increasingly important to ensure that they act in ways that are consistent with ethical and legal norms and that those responsible for these systems are held accountable for their actions (Floridi, 2019). In order to address these challenges, some researchers have proposed the use of "explainable" AI, which allows users to understand how AI systems arrive at their decisions and makes it easier to identify and correct errors or biases (Doshi-Velez & Kim, 2017).

Moral Responsibility and AI Autonomy for Ethical AI

The relationship between autonomy and moral responsibility in connection with artificial intelligence (AI) is intricate and has many aspects. As AI systems gain more independence, they can make decisions and execute actions in the absence of human intervention or supervision. This growing autonomy brings up critical ethical inquiries about the moral responsibility of those engaged in their creation and implementation. One way to think about the relationship between autonomy and moral responsibility is through the concept of "explainability". As AI systems grow more autonomous, they also become more difficult to understand and explain. This can make it challenging to determine who is responsible when an AI system makes a decision that has negative consequences (Bostrom & Yudkowsky, 2014). To address these problems, some researchers have proposed the development of new ethical and legal frameworks that are better suited to the unique challenges posed by autonomous AI systems (Bryson, 2018). Others have suggested the use of explainable AI, which allows users to understand how AI systems arrive at their decisions and makes it easier to identify and correct errors or biases (Doshi-Velez & Kim, 2017). Besides these technical solutions, it is also crucial to contemplate the societal and organizational factors that can influence the moral responsibility of those involved in AI design and deployment. For example, the incentives and pressures faced by developers and organizations may influence their willingness to prioritize ethical considerations (Floridi, 2019). Thus, it can be illustrated that autonomy and moral responsibility with respect to artificial intelligence are intertwined concepts. As AI systems grow more self-reliant, it becomes progressively crucial to guarantee that they behave in a manner that aligns with ethical and lawful standards and that those accountable for these systems are held answerable for their conduct.

Implications of Autonomy and Morality in AI

The artificial intelligence (AI) autonomy for moral development is significant and has important implications for society as a whole. With the increasing independence of AI systems, they can now make decisions that carry significant ethical implications. This raises crucial inquiries regarding the part AI plays in shaping ethical progress and the effects of these systems on both individuals and the community. One potential implication of AI autonomy for moral development is the potential for these systems to shape our moral beliefs and values. As these systems become more ubiquitous, they may become a major source of moral guidance for individuals and society. This raises important concerns about who is responsible for the development and programming of these systems, and how we can ensure that they reflect our shared values and beliefs (Bostrom & Yudkowsky, 2014). Another potential implication of AI autonomy for moral development is the potential for these systems to exacerbate existing moral biases and inequalities. AI systems are only as impartial and unbiased as the data they are trained on, and if this data reflects existing societal biases and inequalities, then the decisions made by these systems will also reflect these biases (Crawford et al., 2018) giving rise to concernments about how we can ensure that AI systems are designed and trained in a way that is fair and unbiased. In addition to these issues, there are also important questions about how AI autonomy will impact our capacity for moral reasoning and decision-making. As AI systems become more autonomous, they may become a crutch for our own moral reasoning, leading to a decline in our own capacity for moral judgment and decision-making (Gunkel, 2018). Therefore, the implications of AI autonomy for moral development are significant and important for society as a whole. As we progress in the development and implementation of AI systems, it is crucial to take into account their implications and adopt measures to ensure that they align with our collective principles and attitudes. They should be created and trained impartially and equitably and should not compromise our ability to exercise moral reasoning and decision-making.

Transparency and Explainability: Road to Ethical AI

Transparency and explainability play an important role in promoting ethical artificial intelligence (AI) by increasing accountability, trust, and understanding of AI systems. Transparency implies having the capability to obtain data about the internal operations of AI systems, which encompasses the data utilized to instruct the model, the algorithms employed, and the process of decision-making. It is essential for accountability and trust in AI systems, particularly in sensitive areas such as healthcare, finance, and criminal justice (Burrell, 2016). Lack of transparency can also lead to biases and discrimination in AI systems, as it can be difficult to identify and correct errors or biases in the system (Mittelstadt et al., 2019). Explainability is another crucial factor to create ethical AI systems which pertains to the capability of comprehending the process and rationale behind the decisions or suggestions made by AI systems. This is specifically important in instances where the consequences of the decision are significant. Explainability allows for increased accountability and trust in AI systems, as it allows stakeholders to understand the rationale behind the decision (Lipton, 2018). Lack of explainability can also lead to a lack of trust in AI systems, particularly if they operate as "black boxes" with no clear explanation of how they arrived at their decision (Mittelstadt et al., 2019). Hence, several approaches have been proposed to increase transparency and explainability in these systems. One approach is to develop explainable AI (XAI) systems, which are designed to be transparent and provide explanations for their decisions (Adadi & Berrada, 2018). This can be achieved through techniques such as rule-based systems, decision trees, or visualizations of the decision-making process. Another approach is to develop post-hoc explainability techniques, which provide elucidation of the decisions made by the black-box system of AI. This can be achieved through techniques such as feature importance analysis or perturbation analysis (Ribeiro, Singh, &Guestrin, 2016). Thus, transparency and explainability are important for promoting ethical AI by increasing accountability, trust, and understanding of AI systems through approaches such as XAI systems or post-hoc explainability techniques which can help to enhance transparency and explainability in AI systems.

Initiatives for Developing Ethical AI in India

The government of India has proposed manifold initiatives for developing and implementing ethical AI in the country. These initiatives aim to ensure that AI systems are outlined and used in ways that promote human welfare, respect human dignity, and are guided by fairness, justice, and equality principles. Some of the key initiatives and frameworks proposed by the government are as follows:

- **National Strategy for Artificial Intelligence (NSAI):** The NSAI was launched in 2018 to mentor the development and implementation of AI in the country. The strategy includes a focus on developing ethical AI systems that are transparent, accountable, and fair.
- **National Program on AI:** The National Program on AI was launched in 2020 to promote the development, growth, and deployment of AI in India. The program includes a focus on developing ethical AI systems that align with national values and ethics.
- **Responsible AI for all**: Niti Aayog, the planning commission of the Government of India, has published Responsible AI approach documents in collaboration with the World Economic Forum Centre for the Fourth Industrial Revolution. These documents aim to establish elaborated ethics doctrines for the design, development, and implementation of AI in India.
- **Standards Setting Bodies:** Various standards setting bodies, such as the IEEE Global Initiative on Ethics and Autonomous and Intelligent Systems and Ethically Aligned Design, have developed ethical frameworks for guiding the development and use of AI.
- **AI FOR ALL - Approach Document for India:** Niti Aayog has also released an approach document for responsible AI, which provides comprehensive AI ethics principles to mentor the overall planning, development, and execution of AI in the country.
- **FAT/FATE Principles:** AI regulations in India are designed to include FAT (fairness, accountability, transparency) or FATE (fairness, accountability, transparency, and ethics) principles to assure accountable, ethical, safe, and responsible implementation of AI tools.
- **National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS):** The launch of NM-ICPS in 2018 opened the doors to promote research and development in interdisciplinary areas such as robotics, AI, and automation, focussing on developing ethical AI systems that are socially accountable as well as sustainable.
- **Data Protection Bill:** The Data Protection Bill, which is currently under consideration, includes provisions for protecting the privacy and personal data of individuals in the development and use of AI systems (NitiAyog, 2018).

These initiatives and frameworks aim to ensure that AI technologies are established and used in a manner that coordinates with ethical principles, respects human rights, and fosters the welfare of the society. By incorporating ethical considerations into AI development and deployment, India is taking steps towards responsible and ethical AI use responsibly as well as sustainably.

NEP 2020 and Ethical AI

NEP2020 is a comprehensive policy framework for education in India. While it primarily focuses on transforming the education system, it also recognizes the importance of integrating technology into education. As a component of this incorporation, the NEP 2020 accentuates the significance of ethical considerations when creating and employing AI. Ethical considerations with regard to AI simply ensure that the construction and operation of AI systems are directed by doctrines such as openness, liability, impartiality, and confidentiality. The NEP 2020 recognizes these principles and states that the use of AI in education must be based on ethical considerations. For this, the National Education Policy (NEP) 2020 recommends several measures regarding ethical AI in education. Here are some of the key recommendations:

- **Incorporating ethical AI principles in the curriculum:** The NEP 2020 proposes that the curriculum should include ethical deliberations during the creation and use of AI. This will guarantee that students have the required expertise and knowledge to build and utilize AI systems ethically and responsibly.
- **Encouraging research on ethical AI:** The NEP 2020 recommends that research on ethical AI be encouraged and supported. This will facilitate the creation of AI systems that possess fairness, transparency, and accountability.
- **Developing guidelines for AI in education:** The NEP 2020 recommends that guidelines for developing and using AI in education be developed. These guidelines should incorporate ethical considerations and ensure that AI systems are responsibly and sustainably used and build.
- **Ensuring transparency and accountability in AI systems:** The NEP 2020 recommends that AI systems used in education be transparent in making decisions and using data. This will ensure accountability and fairness in developing and using AI systems.
- **Developing a framework for privacy protection:** The NEP 2020 recommends the development of a framework for protecting the privacy of students and other stakeholders in developing and using AI systems in education (India, Ministry of Education, 2020).

Therefore, NEP 2020 acknowledges the significance of ethical AI in education and proposes suggestions to guarantee the responsible and sustainable creation and utilization of AI systems.

Benefits of AI in Education

The emergence of Artificial Intelligence in Education (AIEd) has completely revolutionized every aspect of the educational system. According to Baker and Smith (2019) the AI technologies implemented in educational settings can be categorized as learner-facing, teacher-facing, and system-facing AIEd approaches. These approaches have immense advantages that have been discussed below:

- **Learner-facing AIEd approach:** It uses AI tools such as Intelligent Tutoring Systems (ITS) that are beneficial for students in learning the subject matter. These adaptive learning systems simulate one-to-one personalized tutoring (such as MOOCs) which provides an edge for making decisions regarding the learning path of every individual learner, providing cognitive scaffolding, and engaging students in dialogue. These systems have extensive potential to promote distance education via the implementation of modules in the instructional process, where one-to-one human interaction is negligible. Based on learner models, ITS fosters an online collaborative and interactive learning environment. Virtual reality, a form of ITS, can be helpful in engaging and guiding students in authentic virtual reality and game-based learning environments. The real-time feedback mechanism of AI applications provides learners with guidance and prompts when they get confused and stuck during their learning process.

- **Teacher-facing AIEd approach:** It uses AI tools that are helpful in supporting and reducing the workload of teachers regarding attendance, administration, assessment, feedback, and detection of plagiarism via automation. Studies have proven that AI systems such as Intelligent Agents save time for teachers teaching online by leaving the most repetitive tasks on the system. This, in turn, encourages teachers to focus on more creative works. AI tools can also help in providing teacher feedback without intervening in the privacy of the feedback provider, thus providing insights to teachers into their teaching methods and strategies. The adaptive systems help in extracting information regarding the performance of students that can help teachers perform diagnostic tasks for presenting proactive guidance to the students in need.
- **System-facing AIEd approach:** It uses AI tools that are used by managers and administrators at the institutional level. AI applications can be helpful in simplifying the work and managing the time of the administrative staff by accurately predicting the admission decisions, student retention and drop-out, maintain e-portfolios, perform automated grading, keeping a record of students' credentials etc.

Conclusion

The significance of ethics in the realm of AI has grown significantly in recent times due to the widespread use of AI in divergent fields. Thus, it is crucial to scrutinize the moral responsibility and independence of those involved in creating and deploying AI systems. The article provides a thought-provoking analysis of the ethical considerations surrounding the development and utilization of AI by exploring the issues of moral responsibility and autonomy in the context of AI and examining the challenges and opportunities that arise with the advancement of this technology. The authors argue that the development of AI requires careful consideration of its potential impact on society and that there is a requirement for considerable transparency and accountability in the design and use of AI systems. The authors suggest that this can be acquired with the development of ethical frameworks and directives that prioritize the principles of fairness, accountability, and transparency. Furthermore, the article highlights the need for greater collaboration between varied stakeholders, including legislators, industrial leaders, and the public, to ensure that the development of AI is mentored by ethical contemplations that prefer the interests of society as a whole. Finally, the researchers underscore the need for continued research and dialogue on this important topic to ensure that AI is made to evolve and used in a form that promotes the greater good of humanity.

References

Adadi, A., &Berrada, M. (2018). Peeking Inside the Black-Box: A Survey on Explainable Artificial Intelligence (XAI). *IEEE Access*, *6*, 52138–52160. https://doi.org/10.1109/access.2018.2870052

Baker, T., & Smith, L. (2019). *Educ-AI-tion rebooted? Exploring the future of artificial intelligence in schools and colleges.*Nesta Foundation. Retrieved August 14, 2023, from https://media.nesta.org.uk/documents/Future_of_AI_and_education_v5_WEB.pdf

Bostrom, N., &Yudkowsky, E. (2014). The ethics of artificial intelligence. In *Cambridge University Press eBooks* (pp. 316–334). https://doi.org/10.1017/cbo9781139046855.020

Brynjolfsson, E., & McAfee, A. (2015). The second machine age: work, progress, and prosperity in a time of brilliant technologies. *Choice Reviews Online*, *52*(06), 52–3201. https://doi.org/10.5860/choice.184834

Bryson, J. J., Diamantis, M., & Grant, T. D. (2017). Of, for, and by the people: the legal lacuna of synthetic persons. *Artificial Intelligence and Law*, *25*(3), 273–291. https://doi.org/10.1007/s10506-017-9214-9

Burrell, J. (2016). How the machine 'thinks': Understanding opacity in machine learning algorithms. *Big Data & Society*, *3*(1), 205395171562251. https://doi.org/10.1177/2053951715622512

Crawford, K., &Calo, R. (2016). There is a blind spot in AI research. *Nature*, *538*(7625), 311–313. https://doi.org/10.1038/538311a

Dastani, M., &Yazdanpanah, V. (2022). Responsibility of AI systems. *AI & Society*, *38*(2), 843–852. https://doi.org/10.1007/s00146-022-01481-4

Domingos, P. (2016). The master algorithm: how the quest for the ultimate learning machine will remake our world. *Choice Reviews Online*, *53*(07), 53–3100. https://doi.org/10.5860/choice.194685

Doshi-Velez, F., & Kim, B. (2017). Towards A Rigorous Science of Interpretable Machine Learning. *arXiv (Cornell University)*. https://doi.org/10.48550/arxiv.1702.08608

Floridi, L. (2018). Soft ethics and the governance of the digital. *Philosophy & Technology*, *31*(1), 1–8. https://doi.org/10.1007/s13347-018-0303-9

Floridi, L., & Cowls, J. (2019). A unified framework of five principles for AI in society. *Harvard Data Science Review*. https://doi.org/10.1162/99608f92.8cd550d1

Floridi, L., & Taddeo, M. (2016). What is data ethics? *Philosophical Transactions of the Royal Society A*, *374*(2083), 20160360. https://doi.org/10.1098/rsta.2016.0360

Gianni, R., Lehtinen, S., &Nieminen, M. (2022). Governance of responsible AI: From ethical guidelines to cooperative policies. *Frontiers in Computer Science*, *4*. https://doi.org/10.3389/fcomp.2022.873437

Goodfellow, I., Bengio, Y., &Courville, A. (2016). Deep learning. In *MIT Press eBooks*. https://dl.acm.org/citation.cfm?id=3086952

Gunkel, D. J. (2017). The other question: can and should robots have rights? *Ethics and Information Technology*, *20*(2), 87–99. https://doi.org/10.1007/s10676-017-9442-4

Jordan, M. I., & Mitchell, T. M. (2015). Machine learning: Trends, perspectives, and prospects. *Science*, *349*(6245), 255–260. https://doi.org/10.1126/science.aaa8415

Joshi, K. (2022, October 14). *AI Regulations & Laws In India: A Step Towards Ethical AI Use*. XAI. Retrieved August 14, 2023, from https://xai.arya.ai/article/ai-regulations-laws-in-india-a-step-towards-ethical-ai-use#:~:text=The%20planning%20commission%20(Niti%20Aayog,sectoral%20regulatory%20guidelines%20encompassing%20privacy%2F

Lipton, Z. C. (2018). The mythos of model interpretability. *Communications of the ACM*, *61*(10), 36–43. https://doi.org/10.1145/3233231

National Education Policy. (2020). Retrieved August 13, 2023, from https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

NitiAayog. (2018). *National Strategy for Artificial Intelligence*. Retrieved August 13, 2023, from https://niti.gov.in/sites/default/files/2019-01/NationalStrategy-for-AI-Discussion-Paper.pdf

Rakesh, D. (2023, February 7). *Ethics for AI | Challenges & Resolution. INDIA Ai*. Retrieved August 14, 2014, from https://indiaai.gov.in/article/ethics-for-ai-challenges-resolution

Ribeiro, M. T., Singh, S., &Guestrin, C. (2016). "Why Should I Trust You?" *Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*. https://doi.org/10.1145/2939672.2939778

Roy, A. (2022, September 13). *Why India needs to talk more about AI Ethics. INDIA* Ai. Retrieved August 14, 2023, from https://indiaai.gov.in/article/why-india-needs-to-talk-more-about-ai-ethics

Russell, S. J., &Norvig, P. (2010). *Artificial Intelligence: A Modern Approach* (3rd ed.). Prentice Hall.

Selbst, A. D., Boyd, D., Friedler, S. A., Venkatasubramanian, S., &Vertesi, J. (2019). Fairness and Abstraction in Sociotechnical Systems. *Proceedings of the Conference on Fairness, Accountability, and Transparency*. https://doi.org/10.1145/3287560.3287598

Taddeo, M., &Floridi, L. (2018). How AI can be a force for good. *Science*, *361*(6404), 751–752. https://doi.org/10.1126/science.aat5991

Whittaker, M., Crawford, K., Dobbe, R., Fried, G., Kaziunas, E., Mathur, V., ...& Schwartz, O. (2018). *AI now report 2018* (pp. 1-62). New York: AI Now Institute at New York University

General Article

Revolutionizing Open Schooling: A NEP-2020 Perspective on ICT Integration

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Abstract

Information and Communication Technology (ICT) is an integral aspect of daily life across the globe. ICT tools, such as computers, the internet, and mobile devices, have revolutionised the education landscape by providing unrestricted access to educational resources. The recent developments in ICT and the emergence of disruptive technologies have supported the accessibility, equity, and quality of education. This article delves into the need of integrating ICT in Open and Distance Learning (ODL), highlighting its ability to bridge geographical barriers, offer diverse learning opportunities, and enhance the quality of education. The article focuses on the ICT initiatives undertaken by the National Institute of Open Schooling (NIOS), a pioneer organisation of Open Schooling in India. NIOS is the world's largest open schooling system which benefitted about 4.08 million learners in the last five years (NIOS, 2021-22). NIOS has embraced various platforms like DIKSHA, PMeVidya, SWAYAM, and web radio to expand access to teaching-learning resources, ensuring an engaging and personalized learning environment. QR code integration in Self Learning Materials (SLMs) and the DEEP Library access further enrich the learning experience. This article underscores the pivotal role of ICT in shaping the future of education in the perspective of NEP-2020.

Keywords: NEP-2020, ICT, Open and Distance Learning (ODL), Open Schooling, School, Education

Introduction

Information and Communication Technology (ICT) has become an inseparable part of daily lives worldwide. It is shaping the way people communicate, work, and learn. ICT refers to the variety of tools and resources based on technology which are 'used to transmit, store, create, share or exchange information' (UNESCO, 2009). The computers, internet, television, radio are the ICT tools to share resources viz. text, graphics, videos, audios, podcasts, animations, live and recorded broadcast/telecast etc.

In the context of education, ICT practices have a transformative impact. Over the years, ICT played an important role in transforming the access and delivery of education. It is not just about formal education; both in- formal and non-formal education have been equally or more influenced by ICT. In particular, Open and distance education institutions, both in developed and developing nations, have promptly recognized the possibilities of ICT (Rahman, 2014). Thus, ICT is increasingly considered as a means to improve the quality of ODL (Kadada & Tshabalala, 2019). In the ODL system, learners often face the challenge of being geographically separated from the conventional educational institution. In such a scenario, it is difficult for learners to interact with tutors, fellow learners, and access study materials (Arinto, 2016) at distance mode.

Despite geographical barriers, various ICT tools like computers, mobile phones, social media, radio, and television hold immense potential to connect learners with facilitators and content (Vasudevaiah, 2016). Studies such as the one on Mozambique's Open Schooling project using Aptus devices (Cossa, Nakala, & Cherinda, 2021) demonstrate the promise of ICT in expanding access to learning materials offline. However, successful implementation requires ongoing technology updates, compatible devices, increased user capacity, and broader content coverage (Cossa, Nakala, & Cherinda, 2021). This aligns with Rahman and Yeasmin's (2019) research on India's National Institute of Open Schooling (NIOS), which highlights their use of ICT (Wi-Fi, smartboards) for courses and exams, online/TV broadcasts, and virtual learning for students. NIOS is even expanding its ICT infrastructure to meet the growing demand for on-demand examinations. While Das (2019) emphasizes the potential of ICT in education, particularly its ability to transcend borders and provide access to top educators, he also acknowledge challenges like resource limitations, lack of trained personnel, and infrastructure issues. However, Das (2019) also proposed solutions like raising awareness, community involvement, and infrastructure development, which offer a roadmap for overcoming these barriers. By integrating ICT into the open schooling system with these considerations in mind, learning gap could be bridged. This aligns with India's existing policy initiatives for ICT integration in school education. The National Policy on ICT (2012) aimed to utilise ICT in school education to enhance access, quality, and equity in education. It emphasises the need for digitising educational resources to make them widely available and extensively used. In 2015, the 'Digital India' program was launched by the Ministry of Electronics & Information Technology, Government of India. It focused on transforming the country into a digitally empowered society and knowledge economy. It covered initiatives related to infrastructure, governance, and services, utilising technology to bring about positive change in the country. Additionally, the '*Samagra Shiksha*' (2018), a flagship program on education also emphasises the use of ICT for access to quality education, aligning with the motto "*Sabko Shiksha Achhi Shiksha*" (MoE, 2021). ICT@School scheme is being implemented under *Samagra Shiksha* to support digital infrastructure and pedagogy in school education.

Finally, the National Education Policy (NEP, 2020) can be seen as a torch bearer to recognise the significant role of ICT in shaping the future of education. NEP (2020) recommended that all States and reputable institutions like NCERT, CBSE, and NIOS should develop teaching-learning resources in various regional languages. It will ensure the accessibility of quality educational resources to the learners. The developed resources should be uploaded on the DIKSHA (Digital Infrastructure for Knowledge Sharing) platform which fosters learning and eliminates language barriers. Moreover, NEP (2020) advocated that the platforms of DIKSHA and SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) shall be integrated to enrich the learning experience for school students by providing user-friendly and quality resources. The policy further recognised the concern of digital divide. Hence, it supported the use of existing mass media like television, radio, and community radio for telecasts and broadcasts of educational content. These platforms can be used to access resources in different languages in offline mode. It supports resources to reach the unreached and caters to the diverse needs of learners. NEP (2020) also acknowledged the necessity of investing in open, interoperable, and evolvable digital infrastructure in education. It will support multiple platforms and solutions, considering India's scale, diversity, and device penetration. By building a robust digital infrastructure, the ICT-based solutions will remain relevant and effective amid rapid technological advances including disruptive technologies. Overall, the policy guided towards making education more resilient and future-ready.

By leveraging ICT initiatives, we can empower our society with inclusive, equitable, and quality education. This aligns with policy recommendations and helps bridge the digital divide while enriching the learning experience. Prior to delving into ICT initiatives for open schooling, it is important to explore the need of ICT integration in the ODL system.

Need of ICT integration in ODL system

The integration of ICT in the ODL system has emerged as a game-changer, revolutionising access to learning and educational resources worldwide. ODL systems are designed to provide flexible and inclusive learning opportunities to diverse learners. Sustainable Development Goal 4 also emphasised on access to inclusive and quality education that can be achieved through integrating ICT (Muyinda, Mayende, Maiga, & Oyo, 2019).Emerging technologies, as noted by Mbatha (2014), have significantly impacted the methods of teaching and learning in ODL systems.

One of the most significant advantages of incorporating ICT in ODL is the unrestricted access to a vast repository of educational resources available globally. ICT has become a significant platform for enhancing access to education and the delivery of educational resources and services in educational systems worldwide (Isuku, 2018). Open Educational Resources (OERs), MOOCs (Massive Open Online Courses) and other online resources, have made high-quality educational materials freely accessible to learners, as advocated by Gaba and Li (2015). These resources offer a plethora of learning opportunities for both informal and formal education, bridging gaps in accessibility (Hoosen & Butcher, 2017). The integration of ICT has significantly contributed to overcoming geographical barriers between educators and learners, making education accessible worldwide (Fozdar, 2015). Kant (2020) stresses the importance of utilising ICT as an asset in conjunction with other resources to efficiently and effectively deliver education.

The ODL system has evolved as a flexible teaching approach in recent decades, enabling learning and teaching anywhere and anytime with multimedia and technology support (Faridi and Ouseph, 2014). Letseka and Karel (2015) highlighted that the ODL system enables quality teaching and learning experiences through modern technologies. Emerging iterations of ICT promote the sharing of information, resources, and experiences, creating networking opportunities that connect students, tutors, and institutions (Fozdar, 2015). Learners can access digital libraries and multimedia content to gain exposure to diverse perspectives. The advantages of an adaptable educational environment made possible by ICT are becoming increasingly evident, with many ODL institutions, especially in developed nations, adopting ICT-supported or ICT-based instruction (Fozdar, 2015). ICT effectively addresses challenges related to expenses, teacher shortages, quality, and obstacles associated with time and distance (McGorry, 2002). Awadhiya, Miglani, and Gowthaman (2014) observe that ODL institutions worldwide are adopting ICT-based teaching and learning methods, distributing quality education to widely dispersed learners. They suggest that ICT, particularly the integration of smartphones, holds potential for delivering learner support services and educational content, thereby enhancing the retention of Open and Distance Learning (ODL) students.

Content designers and educators benefit from ICT integration as it allows them to adapt existing content to fit their curricula, expediting SLM development (Hoosen & Butcher, 2017). Teachers lacking expertise in certain subjects can rely on professionally designed learning materials to bridge the learning gaps. ICT simplifies access to academic materials, streamlines course registration processes, and eliminates the need for physical travel to access information (Isuku, 2018). Kant (2020) emphasised the role of ICT in adopting a learner-centric approach and how it can be harnessed to enhance the capacity, cost-effectiveness, and quality of education. Simulations, as noted by Herd and Mead Richardson (2015), provide learners with access to laboratory experiments even when physical laboratories are unavailable. ICT transmits content, accommodates diverse learning preferences, ensures convenient access, and provides valuable feedback (Kadada & Tshabalala, 2019). ICT elevates the quality of education, introduces new educational resources, enables 24/7 learning, and grants students access to a multitude of online resources (Shan Fu, 2013). These technologies liberate students from the constraints of time and location, enabling communication with educational institutions through email, smartphones, and Skype (Kadada & Tshabalala, 2019). Furthermore, ICTs enable students to submit assignments for online evaluation and retrieve graded assignments and results (Kadada & Tshabalala, 2019).

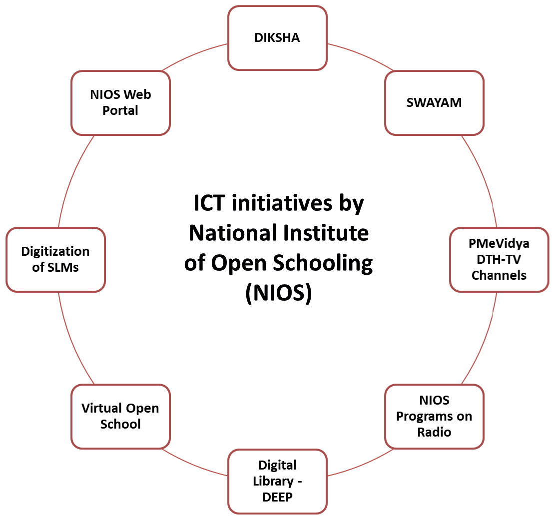
To sum up, the ICT integration has brought forth a multitude of advantages, from global access to educational resources and flexible learning opportunities to customised content delivery and enhanced quality in education. As we move forward, exploring initiatives like those undertaken by the National Institute of Open Schooling (NIOS) in harnessing ICT potential becomes paramount. NIOS, along with other institutions, can build upon the foundation of these advantages to further democratise education, bridge divides, and foster a culture of lifelong learning.

ICT initiatives by National Institute of Open Schooling (NIOS)

Established in November 1989, the National Institute of Open Schooling (NIOS), formerly known as National Open School (NOS), operates as an autonomous organisation under the Ministry of Education, Government of India. NIOS offers a diverse range of courses, including vocational, life enrichment, community-oriented, general, and academic programs at both secondary and senior secondary levels. Additionally, it provides elementary-level courses through its Open Basic Education Programs (OBE). NIOS has the authority, as per a government gazette notification, to examine and certify learners registered with it for pre-degree level courses, encompassing academic, technical, and vocational disciplines (MoE, 2021).

The National Institute of Open Schooling (NIOS) has embraced ICT initiatives to enhance the quality and accessibility of education. As a pioneering institution in the field of open and distance learning, NIOS has made significant strides in leveraging ICT in the open schooling system across the country. Following the NEP (2020) recommendations and ICT initiatives of Govt. of India, NIOS has embarked on a journey to reach the unreached in open schooling system. Following are the ICT initiatives related to multiple platforms of content delivery through which NIOS envisions to bridge geographical barriers, expand learning opportunities, and foster an engaging learning environment that caters to the diverse needs of learners across the nation. The ICT initiatives taken up by NIOS, mainly focused on multiple approaches to access to teaching learning resources are as follows:

Figure-1: ICT initiatives of NIOS



DIKSHA (Digital Infrastructure for Knowledge Sharing)

DIKSHA, the Digital Infrastructure for Knowledge Sharing, was officially launched in 2017. DIKSHA is a national platform under the Ministry of Education, GoI, that provides access to educational resources in multiple languages. It is known as 'One Nation, One platform' to access a variety of digital resources, including teaching-learning e-content, teacher professional development modules, and resources for remote learning. DIKSHA platform is available as a mobile app on Android as well as iOS devices. This app features engaging interactive educational resources aligned with school curricula.

As a stakeholder, NIOS actively contributed quality educational resources to DIKSHA. NIOS provides digital resources, including textbooks, videos, audio and interactive resources, which are accessible to learners, tutors and parents across the country through DIKSHA platform. The SLM based on courses of secondary, senior secondary and vocational levels are available on DIKSHA. When learners access the NIOS vertical on DIKSHA, a pivotal step involves selecting their relevant class level. This action provides them with instant access to SLMs tailored to that specific subject and standard. By simply choosing their class & subject and confirming their selection, learners initiate the process of retrieving the relevant SLMs, ensuring a personalised learning experience.

Hence, open schooling resources are widely available through the DIKSHA platform. It enhances the learning experience by linking physical materials to digital resources, enabling learners to delve deeper into topics and engage with multimedia content.

SWAYAM (Study Webs of Active Learning for Young Aspiring Minds)

SWAYAM platform facilitates the hosting of courses ranging from Class 9 to post-graduation, making them accessible to anyone, anywhere, at any time. These courses, created by top educators in the country, are freely available to all learners. Notably, more than 1,000 carefully selected faculty members and teachers from across the nation have contributed to their development. The courses on SWAYAM are organised into four sections: (1) video lectures, (2) specially developed downloadable/ printable reading materials, (3) self-assessment tests, and (4) an online discussion forum for addressing queries. To enhance the learning experience, audio, video, multimedia, and advanced pedagogies and technologies are incorporated. To ensure the delivery of high-quality content, nine National Coordinators have been appointed, including NIOS (SWAYAM Portal).

NIOS's engagement with SWAYAM showcases its commitment to open learning for a diverse audience. NIOS contributes by offering open schooling courses on SWAYAM, broadening access to quality education. In this platform, there are different parts for the learners viz. E-tutorial and multimedia instructions and lectures by best tutors, E-contents, self assessment, Discussion Forum etc. The course materials of NIOS are uploaded in e-pub, PDF format along with QR code. NIOS delivers its curriculum through the SWAYAM platform, catering to secondary, senior secondary and vocational courses for learners and individuals seeking to upskill or enhance their knowledge across various domains. NIOS coordinates 18 subjects at the secondary level and 20 subjects at the senior secondary level, consistently addressing learner inquiries and engaging in interactions with them.

PMeVidya Direct To Home - Television (DTH-TV) Channels

PMeVidya DTH-TV channels were launched in 2020 to provide continuous learning support during the COVID-19 pandemic. They offered a remote learning platform of television, bridging the gap caused by lockdowns and enabling students to study from home.

NIOS offered many live sessions and recorded video lectures through the PMeVidya DTH-TV channels. This initiative ensures that learners can continue their education remotely and mitigate learning gaps, irrespective of challenging circumstances. NIOS is managing the coordination of PMeVidya channels #17, #18, #19, and #20. Both pre-recorded video programmes and live interactive PCP sessions are being transmitted on these channels. The PCPs for learners cover all the subjects at secondary and senior secondary levels. In addition, vocational and sign language-based content is also transmitted regularly. Vocational programs provide practical training and sign language-based courses are beneficial for learners who are hearing impaired or have difficulty hearing. These sessions provide interactive learning achievement and give a platform to connect with the subject experts.

NIOS Programs on Radio

Recognizing the significance of audio-based learning, NIOS's radio programs on interactive web radio of Mukta Vidya Vani play a pivotal role in reaching learners who have limited access to digital platforms.

Mukta Vidya Vani, an internet based service by NIOS, facilitates live interactive audio PCPs and audio programs, which are web-streamed daily. Subject experts and course coordinators utilise this platform to conduct real-time PCPs and provide academic support to learners. These PCPs' recordings are accessible 24/7 on the NIOS website (www.nios.ac.in) and its YouTube channel.

Besides, NIOS operates a Community Radio Station named Radio Vahini FM 91.2 MHz, where it broadcasts programs covering a wide range of social topics, including education, issues related to children with special needs (CwSN), yoga, adolescence education, physical and mental health, meditation, youth and women empowerment, sanitation and cleanliness awareness, voter's rights, and more. This audio content can also be found on the YouTube channel @NIOSRadioVahini.

These educational broadcasts cover subjects spanning the NIOS curriculum and provide an alternative mode of academic support. NIOS ensures that its radio programs are informative, engaging, and aligned with the needs of diverse learners.

Digital Library - DEEP (Digital Education and E-Resources Platform)

DEEP (Digital Education and E-Resource Platform) is a collection of material such as eJournals, eBooks, eDatabase, magazines, and newspapers. DEEP is available on an ePortal i.e. https://digitallibrary.nios.ac.in/. DEEP is an initiative to build digital infrastructure in alignment with the vision of NEP, 2020.

The DEEP Library aimed to address key challenges related to access to education. It serves as a tool in combating knowledge scarcity, particularly for individuals who are not enrolled in regular schools or those facing limitations in accessing learning resources due to socio-economic constraints. Importantly, the DEEP Library extends its benefits beyond NIOS learners, encompassing other students, teachers and researchers.

It hosts content in multiple languages, making it accessible to a broader audience. With interfaces available in eight widely spoken Indian languages, including Kannada, Punjabi, Marathi, Bhojpuri, Urdu, Maithili, Awadhi, and English, the DEEP Library ensures that individuals from various linguistic backgrounds can seamlessly explore its extensive eResources.

Moreover, the DEEP Library is equipped with a range of user-friendly features, including options for printing and saving content. It goes a step further by providing a repository of valuable reference materials, encompassing dictionaries, encyclopaedias, and directories. The impact of the DEEP Library is evident in its remarkable outreach, with over 2,20,000 visitors accessing its invaluable resources. This underscores its significance for knowledge dissemination through access to quality resources to diverse learners, at anytime, anywhere.

Virtual Open School (VOS)

The Virtual Open Schooling initiative of NIOS provides an online platform where learners can access SLMs, supplementary educational resources, and multimedia content. NIOS's VOS ensures that learners have a self-paced, interactive, and engaging learning experience, enabling them to study at their convenience.

The VOS encompasses a range of features for enhancing the learning experience. These include the provision of job-oriented courses, enabling live and interactive sessions that foster active engagement and participation of the learners. Additionally, VOS incorporates online Tutor Marked Assignments (TMAs) and evaluation processes to streamline the assessment and feedback mechanisms. Moreover, it offers remote proctored assessments, ensuring that evaluations can be conducted efficiently and securely in an online environment.

QR (Quick Response) Code Integration and Digitization of SLMs

Integration of QR codes in SLMs of NIOS elevates the learning process. By scanning QR codes, learners gain access to additional digital resources related to their self learning materials. This enriches the learning experience, enabling learners to explore videos, audios, and interactive content that augment their understanding of the subject matter.

QR codes have evolved to become highly versatile, capable of storing extensive information, including video, audio, and text components. NIOS has created QR codes at the Secondary and Senior Secondary Level, both in Hindi and English, providing a rich multimedia experience for learners.

NIOS Web Portal

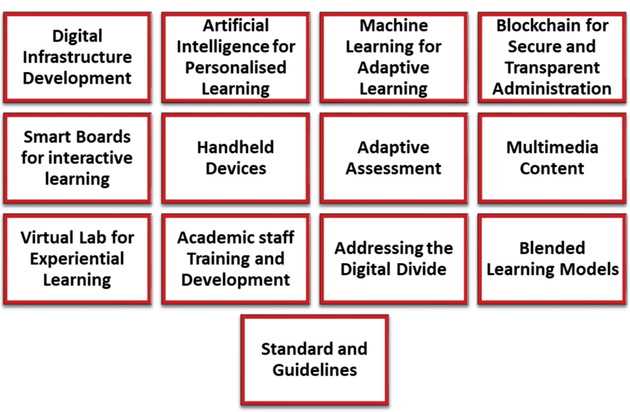
The NIOS website provides an online repository of educational resources, including freely downloadable PDF versions of Self Learning Materials (SLMs). These digital resources are readily accessible at all levels viz. Secondary, Sr. Secondary, Vocational, Indian Knowledge tradition, Open Basic Education, and more. Learners, teachers, and anyone interested in NIOS educational materials can easily obtain these SLMs from the NIOS website at no expense, thereby fostering widespread access to valuable learning materials.

NIOS's active involvement in these initiatives underscores its dedication to providing quality, inclusive, and equitable education through ICT integration. These contributions collectively position NIOS as a transformative force in the open schooling system.

Way Forward

NEP 2020 presented a visionary framework for integrating ICT into education. In this regard, the emphasis is on open schooling to democratize education, enhance accessibility, and improve quality of school education. Leveraging innovative and disruptive technologies such as artificial intelligence (AI), machine learning (ML), blockchain, smart boards, handheld computing devices, adaptive assessment, and various educational software and hardware, NEP-2020 envisions a transformative shift in how education is delivered and experienced. The key themes are identified to provide a strategic roadmap for revolutionising open schooling as per NEP-2020 recommendations:

Figure-2: Key themes under NEP-2020 for Integrating ICT in education



Investing in robust digital infrastructure is crucial for scaling ICT-based educational solutions in ODL. Creating open and, interoperable public digital infrastructure can support multiple platforms and solutions, addressing India's scale, diversity, and complexity. This infrastructure is essential for NIOS to provide seamless access to educational resources across the country. Secondly, AI can revolutionize personalized learning in ODL by analyzing student data to provide customized educational content. AI-driven adaptive learning platforms can offer real-time feedback and personalized learning paths, addressing individual student needs. This ensures that each learner can progress at their own pace, maximizing their potential. Furthermore, AI can help educators to identify learning gaps and provide targeted interventions at open schooling. Gautam and Dua (2021) suggested to ODL institutions to embrace AI to improve pedagogy and program development. Thirdly, Machine learning (ML) can further enhance personalized learning experiences by predicting learning difficulties and recommending customised resources. ML algorithms can analyze patterns in student performance, helping educators design effective instructional strategies. Furthermore, Blockchain technology can ensure secure and transparent record-keeping for student credentials and performance. Implementing blockchain at ODL can streamline administrative processes and enhance trust in the educational system, crucial for open schooling where physical presence is minimal.

In terms of instructional transection, Smart boards can facilitate interactive and engaging learning experiences in ODL environments through live or recorded video streaming. Providing ODL learners with handheld devices pre-loaded with educational content can ensure continuous learning without relying solely on internet connectivity. Incorporating multimedia content such as 3D/7D VR, AR, simulations, and educational games can make learning more engaging and effective. VR and AR can offer immersive learning experiences, allowing learners to explore complex concepts interactively. For instance, virtual labs can provide practical hands-on experience in a controlled digital environment, overcoming the limitations of physical lab infrastructure, which is particularly beneficial for ODL learners. However, adaptive assessment can provide a more accurate assessment of learners abilities by adjusting the difficulty of questions in real-time based on the learner's performance. This approach can offer more personalized and fair assessments.

To overcome challenges in ODL, Academic Staff at NIOS need rigorous training to become effective online educators. Professional development programs should focus on learner-centric pedagogy, digital content creation, and the use of online instructional tools. Digital divide is also a notable challenge in integrating ICT in ODL system. To ensure equitable access to digital education in ODL, concerted efforts such as the Digital India campaign and the provision of affordable computing devices are essential. Leveraging mass media like television and radio can also reach ODL learners with limited digital access. Educational content should be available in all major Indian languages to cater to diverse linguistic groups. Additionally, effective blended learning models should be developed and replicated, combining online and offline methods to provide a holistic educational experience for open schooling learners. Finally, the most important aspect is setting up the standards and guidelines for content, technology, and pedagogy for maintaining the quality of digital education.

Thus, the integration of ICT in open schooling, guided by NEP-2020, promises to transform education by enhancing access, equity, and quality. By leveraging disruptive technologies and innovative approaches, an inclusive, engaging, and effective educational ecosystem within the ODL framework can be created, which will further empower learners across India to reach their full potential.

Conclusion

In conclusion, the integration of ICT in the ODL system has opened up transformative possibilities in education. ICT has redefined the way learners' access, engage with, and benefit from educational resources. It has not only made quality education accessible but has also democratised learning by eliminating various socio-economic barriers and enhancing the learning experience. ICT in Open schooling has transformed school education, breaking down the confines of the traditional four-wall classroom and ushering in an era of boundary less quality learning.

As we look forward, it's imperative to recognize the critical role ICT plays in shaping the future of education, particularly in open schooling systems like that of the National Institute of Open Schooling (NIOS). NIOS has embraced a range of ICT initiatives, aligning with NEP-2020 recommendations, to bridge geographical divides through reaching the unreached and provide accessible, equitable and quality education to learners across India.

The journey ahead involves continued collaboration and innovation in utilizing platforms like DIKSHA, PMeVidya, SWAYAM, and NIOS Radio platforms to ensure quality learning experience for students. The integration of QR codes and the DEEP Library further ensures access to educational resources and facilitates knowledge dissemination. Incorporating ICT into open schooling not only empowers learners but also strengthens the foundation of inclusive, equitable, and quality education. NIOS and similar institutions are at the forefront of this transformation, working towards a future where education knows no boundaries, access is universal, and the pursuit of knowledge is lifelong.

References

Arinto, P. B. (2016). Issues and challenges in open and distance e-learning: Perspectives from the Philippines. *The International Review of Research in Open and Distributed Learning*, 17(2).

Awadhiya, A. K., Miglani, A., & Gowthaman, K. (2014). ICT usage by distance learners in India. *Turkish Online Journal of Distance Education (TOJDE)*, 15(3), 242-253. Retrieved from https://www.researchgate.net/publication/276839578_ICT_usage_by_distance_learners_in_India

Cossa, S.P., Nakala, L., & Cherinda, N.A. (2021). Open and Innovative Schooling: An Implementation Experience in Fifteen Secondary Schools across Mozambique. *Journal of Learning for Development*, 8(3), p. 601-610. Retrieved on 6 June 2024 from https://www.semanticscholar.org/reader/4a4dcf0437fd0b1f227ea6e17c32ee71439e845e

Das, K. (2019). The role and impact of ICT in improving the quality of education: An overview. *International Journal of Innovative Studies in Sociology and Humanities*, 4(6), 97-103. Retrieved 2 June 2024 from https://ijissh.org/storage/Volume4/Issue6/IJISSH-040611.pdf

DIKSHA (n.a.). *DIKSHA (Digital Infrastructure for Knowledge Sharing). National Informatics Centre*. Retrieved from https://pmevidya.education.gov.in/diksha.html

Faridi, M. R., & Ouseph, S. N. (2014). New directions and challenges for ODL: building collaborative business approach. *European Scientific Journal*, *1*(Special), 217-223. Retrieved from https://www.researchgate.net/profile/Kujtim-Bytyqi/publication/263661555_Principles_of_State-Building_The_case_of_Kosovo/links/0f31753b9889103c56000000/Principles-of-State-Building-The-case-of-Kosovo.pdf#page=228

Fozdar, B. I. (2015). Open and Distance Learning (ODL): A Strategy of Development through its Potential Role in Improving Science & Technology Knowledge. *International Journal of Emerging Technologies in Learning*, *10*(2). 9-16. Retrieved from https://online-journals.org/index.php/i-jet/article/view/4176

Gaba, A. K., & Li, W. (2015). Growth and development of distance education in India and China: A study on policy perspectives. *Open Praxis*, *7*(4), 311-323. Retrieved from https://search.informit.org/doi/pdf/10.3316/informit.663822364460364

Gautam, A., & Dua, A. (2021). Applications of artificial intelligence in open and distance learning. *TechnoLEARN: An International Journal of Educational Technology*, 11(2), 59-66. https://doi.org/10.30954/2231-4105.02.2021.1

Herd, G., & Mead Richardson, A. (2015). *World report on TVET — The promise and potential of ICT in TVET.* Retrieved from http://oasis.col. org/bitstream/handle/11599/824/UNESCO%20World%20Report%20-%20ICT%20in%20TVET%20-%20Herd%20%2B%20Mead%20 Richardson.pdf

Hoosen, S., & Butcher, N. (2017). *Considerations in Costing ODL and ICTs in TVET. Using ICTs and blended learning in transforming TVET*, 185. Retrieved from https://www.nba.co.za/sites/default/files/2021-04/2017_Latchem_Using-ICTs-and-Blended-Learning.pdf#page=200

Isuku, E. J. (2018). Challenges and prospects of ICT facilities in improving access to the open distance learning programme of African universities: Research evidence from Nigeria. *US-China Education Review A*, *8*(6), 259-266.

Kadada, C., & Tshabalala, T. (2019). Information and Communication Technologies'(ICTs) Enhancing Teaching and Learning in ODL. *International Journal of Social Sciences & Educational Studies*, *6*(2), 14.

Kant, N. (2020), "*Blockchain: a resource of competitive advantage in open and distance learning system*", in Sharma, R.C., Yildirim, H. and Kurubacak, G. (Eds), *Blockchain Technology Applications in Education, IGI Global*, pp. 127-152, doi: 10.4018/978-1-5225-9478-9.ch007.

Letseka, M and Karel, K. (2015). Pass Rates in Open Distance Learning. In M. Letseka (ed.), Open Distance Learning (ODL) in South Africa (pp. 65-75). New York: Nova Publishers.

Mbatha, B. (2014). Global Transition in Higher Education: From the Traditional Model of Learning to a New Socially Mediated Model, the Case of the University of South Africa. *International Review of Research in Open and Distance Learning*, 12(2), 25– 36.

McGorry, S.Y. (2002), Online, but on target?, Internet-based MBA Courses - A Case Study. *Internet and Higher Education*, Vol. 5 No. 2, pp. 167-175. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S1096751602000891

MHRD (2012). *National Policy on ICT in School Education. Government of India*. Retrieved from https://www.education.gov.in/sites/upload_files/mhrd/files/upload_document/revised_policy%20document%20ofICT.pdf

MoE (2020). *National Education Policy 2020. Govt. of India*. Retrieved from https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

MoE (2021). *National Institute of Open Schooling (NIOS). Department of School Education and Literacy.* Retrieved form https://dsel.education.gov.in/nios

MOE (2021). *Samagra Shiksha.* Retrieved from https://samagra.education.gov.in/docs/samagra_shiksha.pdf

Muyinda, P. B., Mayende, G., Maiga, G., & Oyo, B. (2019). Widely Acclaimed but Lowly Utilized: Congruencing ODL Utilization with Its Wide Acclaim. *Universal Journal of Educational Research*, 7(2), p. 400 - 412. DOI: 10.13189/ujer.2019.070213.

NIOS (2021-22). *NIOS Academic Prospectus 2021-22*. Retrieved from https://www.nios.ac.in/media/documents/prospectus/2021/Academic_Prospectus-2021-22-final.pdf

Rahman, H. (2014). *The Role Of ICT In Open And Distance Education. Turkish Online Journal of Distance Education*, 15(4). Retrieved from https://www.researchgate.net/publication/273898911_The_Role_Of_Ict_In_Open_And_Distance_Education

Rahman, M. M., & Yeasmin, S. (2019). *Dynamics of Peer-to-Peer (P2P) Quality Review: a case of National Institute of Open Schooling (NIOS) of India. Commonwealth of Learning*. Retrieved 2 June 2024 from https://oasis.col.org/server/api/core/bitstreams/a2a5ffed-ad5e-448d-8fe5-4c362720518a/content

Shan Fu, J. (2013). ICT in education: A critical literature review and its implications. *International Journal of Education and Development using Communication and Information Technology (IJEDICT)*, 9(1), 112-125. Retrieved from https://www.researchgate.net/publication/285059779_ICT_in_education_A_critical_literature_review_and_its_implications

SWAYAM (2023). About SWAYAM. MoE, Govt. of India. Retrieved from https://swayam.gov.in/about

UNESCO (2009). *Guide to measuring information and communication technologies (ICT) in education. UNESCO Institute for Statistics.* ISBN: 978-92-9189-078-1. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000186547

Vasudevaiah, G. (2016). Promoting usage of ICT in Open and Distance Education Programs. *The International Journal of Indian Psychology*, 3(3), 77-79.

General Article

Crafting Products for the Masses: A stakeholder feedback-based approach for identifying key factors for product development

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Introduction

Software development can be challenging, especially when catering to a large consumer base. Developing a well-conceived product can be a time-consuming process, spanning from several months to a few years, contingent upon market dynamics and team size. Designing and developing a product for a large population requires an understanding of the diverse user needs, strong design principles, robust infra and well-managed communication strategies between the different people working on it. It requires delving deeper into each of these areas to deliver a strong product for a wide-ranging audience. This article identifies key factors for product development based on expert feedback through structured research among key stakeholders.

Literature survey

Product development is a dynamic process vital for businesses seeking to introduce new offerings or improve existing ones. Literature on this topic encompasses various perspectives, methodologies, and considerations.

The early stages of product development involve idea generation and conceptualization. Researchers emphasize the importance of creativity and market analysis to identify opportunities and meet customer needs (Biemans et al., 2018). Concurrently, scholars highlight the significance of feasibility studies, emphasizing technical, economic, and operational viability (Koen et al., 2001).

As the process progresses, attention shifts towards design and prototyping. Design thinking, a human-centred approach, is often advocated for fostering innovation and user-centricity (Brown, 2008). Additionally, rapid prototyping techniques facilitate iterative refinement and validation of concepts (Gibson et al., 2015).

Effective collaboration among cross-functional teams emerges as a critical success factor throughout product development (Dahan & Hauser, 2002). Literature underscores the role of communication, shared goals, and interdisciplinary expertise in overcoming challenges and accelerating progress.

Moreover, considerations extend beyond the development phase to encompass aspects like marketing, distribution, and sustainability (Bellini et al., 2019). Sustainable product development frameworks emphasize environmental and social responsibility alongside economic objectives (Schaltegger & Burritt, 2018).

In summary, literature on product development offers insights into a multifaceted process, encompassing ideation, design, collaboration, and sustainability, vital for achieving competitive advantage and meeting evolving market demands

Research objective

The key objective of this research is to identify factors that contribute to product development.

Research Methodology

Research methodology for identifying the most important factors for product development typically involves a structured approach combining qualitative and quantitative methods. Here's an outline of such a methodology:

Literature Review: Conduct a comprehensive review of existing literature on product development to identify potential factors influencing the process. This helps in understanding the current state of knowledge and provides a foundation for the study.

Expert Interviews: Interview experts in product development, including practitioners, academics, and industry professionals, to gather insights on key factors they perceive as critical. These

Surveys: Develop a structured survey questionnaire based on insights from the literature review and expert interviews. The survey should be distributed to a representative sample of stakeholders involved in product development, such as product managers, engineers, designers, and marketers. Quantitative data collected through surveys can help in identifying the relative importance of different factors.

Data Analysis: Analyze the survey data using appropriate statistical techniques such as factor analysis, regression analysis, or importance-performance analysis. These analyses can help in identifying the most significant factors influencing product development and understanding their interrelationships.

Case Studies: Conduct case studies of successful and unsuccessful product development projects to explore how different factors contributed to their outcomes. Case studies provide rich qualitative data that can complement the quantitative findings and offer in-depth insights into real-world experiences.

Delphi Method: Consider using the Delphi method to reach a consensus among a panel of experts on the most important factors for product development. This iterative process involves multiple rounds of structured communication and feedback until convergence is achieved.

Validation: Validate the identified factors through additional rounds of expert interviews or focus groups to ensure their relevance and applicability in different contexts**.**

Documentation and Reporting: Document the findings of the study, including the identified factors, their importance rankings, and any insights gained from the analysis. Prepare a detailed report outlining the research methodology, findings, implications, and recommendations for product development practitioners and researchers.

For the purpose of this research, expert interviews have been used as a methodology. By following this research methodology, an attempt has been made to systematically identify and prioritize the most important factors influencing product development, thereby informing decision-making, and improving the effectiveness of product development process.

Hypothesis

The following factors play an important role in product development: Market research, infrastructure and technology, pilot testing, Localization, scalability, user interface, performance optimization, community outreach, performance measurement, security, and privacy.

Research Design

This qualitative research is based on interviewing experts in product design and requesting them to identify the contribution of the factors identified, or any other factors they might identify in terms of their impact on quality of product development.

Data Collection

The responses to a structured interview questionnaire were collected from over 35 experts from the field of product development, and the data was analysed using factor analysis.

Data Analysis

The interview response data suggests that the factors impacting product development fall under the following 3 clusters:

Cluster 1: Market research, pilot testing, Localization, community outreach, user interface

Cluster 2: Infrastructure and technology, security and privacy, scalability

Cluster 3: Performance optimization, performance measurement

The first cluster could be referred to as the user-alignment cluster since it deals with understanding the customer and trying to make the product as per the preferences, demands, needs and feedback of the customer.

The second cluster could be referred to as the technology cluster since it deals with infrastructure and technology aspects of making the product scalable, secure, and safe.

The third cluster could be referred to as the outcome cluster since it deals with understanding the results and performance of the product.

This research finds that the first cluster is the most important in terms of its contribution to product development with 80 per cent of the experts identifying this as the most important factor followed by cluster 3 and 2 which find support from 15 per cent and 5 per cent of the experts.

Analysis and Conclusion

This analysis and conclusion section discusses the importance of each of the factors that were considered in this research. Also included are some market practices.

Market research is the most important step of the process of product development and usually happens during the ideation phase itself. There is a need to conduct thorough market research through surveys, interviews, and data analytics in order to identify user features like demographics, preferences, behaviours and pain points. These qualitative and quantitative methods provide some insight into the user's demands and expectations. After this phase, there is a need to study the users to identify different user groups. These groups can be based on the demographics/behavioural patterns but can help identify features in our product to target different user groups. This also provides an idea about whether the product would succeed in the target market or not or what features would need to be modified in order to find a product-market fit.

To build products for millions/ billions, there is also a need to focus on the infrastructure powering the product. There is a need to build an easily scalable infrastructure that is capable of handling high traffic as well as data inflows/outflows and to estimate the maximum traffic for the product and build the infrastructure accordingly.

With the advent of cloud technologies, this step has been made much easier since technologies like AWS, Google Cloud and Microsoft Azure provide low-cost solutions for scalable, reliable, and robust cloud infrastructure. Other than traffic management, there is also a need to focus on database designing and error-proof backend systems. For that, there is a need to have strong functional database designs that help in the quick retrieval of data, as well as backend systems that can handle edge cases and exceptions. This step is important since no one likes a product that breaks down frequently and more often than not, people would end up switching to other products because of this unreliability.

Experience (UX) and User Interface (UI) attract a customer and play an important role in customer acquisition. There is a need to prioritize product designing in order to create intuitive, accessible and engaging designs for the product. This is another area where market research would come in handy as research data can be used to design interfaces/experiences that cater to all the diverse user groups being targeted.

User testing (beta-testing) can also be used to iterate the designs based on feedback from the users. This would help to get feedback from a neutral population without launching the product to the entire target population. Based on the feedback, UI/UX challenges can be addressed and make it more usable.

To reach a wide population, there is a need to also include accessibility features for differently abled groups and other diverse user groups. There is a need to also understand the importance of each and every flow/design piece of their product and not undermine any colour, font style, and content change feedback. Even the slightest UI change has the potential to impact millions positively or negatively. Figma is the most common tool used by companies to design their products before even implementing them so using it to gain some initial design feedback would help the product development process a lot.

Localization is the process of making something local in character. From a product development perspective, the process of customizing the product to suit the different cultural and linguistic requirements of the target audience is referred to as localization. This can also include the regulatory requirements (UI has a lot of requirements that the other regions may not have).

Translating content in different languages is the most common form of localization major products provide. It can also be in the form of cultural adaptation and regional customization. This should play a part in product design to have products that can expand into new markets without any significant design and engineering overhead.

As it has been mentioned before, there is a need to develop content and features while keeping in mind the different user groups and their preferences. Even while developing the product, there is a need to make sure it is scalable in terms of engineering efforts. This means that scalability and flexibility need to be prioritized to accommodate future enhancements, such as new features and product updates.

There is a need to keep on iterating on the product and use data-driven insights and feedback to develop new offerings. The product should continuously be refined, and different versions should be launched as new insight comes in and new features are developed. There are many development technologies that provide scalable frameworks like React, Angular and Dart. These provide the component's architecture and allow the re-use of the code as much as possible.

Nobody likes a super slow product that takes hours to load. Performance optimization is another in which the product can score big and get loads of customers.

In order to gain more customers, there is a need to identify the devices, platforms and network capabilities of the target population and optimize the product's performance accordingly. This means that the product shouldn't be computationally heavy if the target area is a hilly region with limited connectivity. There is also a need to estimate the maximum traffic expected and try to work on solutions to minimize loading times.

Performance testing is another way to identify loopholes and fix them before launching the product to the public. Error handling is also important in this field, as the product should be stable enough to handle edge cases as well as exceptions thrown. A good example of this is the launch of the FBLite product by Meta Inc. The product helps Meta tap into the lower-tier markets and is a very efficient product that stores everything on the server and renders everything using that. This makes sure that the app size itself is small and can be used on older and outdated devices. Cloud services like AWS offer tools like load-balancing in order to optimize resource allocation as well as loading times, so try to find out-of-the-box solutions in order to minimize the development times.

Since the product may work with a large customer base, it also needs to implement robust security measures to safeguard user data, data privacy and confidentiality. There is a need to be aware of the different industry and regulatory requirements such as DMA, GDPR or HIPAA in order to meet industry standards for security and ensure compliance with the legal authorities. Conducting internal audits, network vulnerability assessments and bug bounties are other effective ways to de-risk product launches. There are also many online tools that provide security to products, such as Cloudflare, which can be made use of to develop security and data privacy features.

Just having a strong product wouldn't help reach a wide consumer base; there would be a need to develop effective strategies to reach and engage with the target population. There is a need to make the most of online platforms like social media and cold emails to meet people and acquire new customers. Organizing events such as hackathons or bug bounties can also help reach out to a wider group and potential collaborators. It would also help to support community engagement through user groups and efficient customer service. Using AI tools like AI-powered chatbots here can help reduce costs while internal teams are hired for customer engagement and customer service.

It would be very rare that a product is launched without any future iterations if the aim is to reach a large population. This means that there will be continuously iterating of the product and working with other people to develop new features and improve the existing features based on customer feedback. As the team grows, this process can slow down the work and can affect product launch cycles. In order to mitigate this, proper project tracking and management must be adhered to.

It can help to make use of agile methodologies like Scrum and project tracking tools like Jira to facilitate rapid development cycles and frequent releases. These can be hard to ramp up at first but in the long term, they can really help with the development issues of the product. Continuously updating the product would make sure the product doesn't become obsolete and matches the market dynamics. It would also allow to continuously provide great customer experience. There is a need to encourage innovation and experimentation in the team to keep on continuously improving the product and to focus on maintaining a strong as well as diverse team in order to gain unique insights and also to have experts focused on different parts of the product.

There is also a need to establish key metrics for the product and use them to form product decisions. These metrics can help acquire new users, retain old users, and also understand user satisfaction with the product. These indicators could be anything ranging from product performance to user impressions on different parts of the products. There is a need to make the most of data logging in order to log important features that would help with the next iteration of the product. All this data must be standardized by using data analytics tools like Power BI or by making their own dashboards. Data can be analysed to monitor user behaviour and identify the latest trends in order to pivot the product accordingly. There is also a need to use this data to do research studies and highlight any positive impact as part of the community outreach efforts.

To conclude, building a product for a large population requires a mix of many different facets as mentioned before. This is not an exhaustive list of factors but prioritizing these should definitely help the organization develop products that resonate with diverse audiences, continuously grow and acquire new customers and are able to deliver value at scale. By inculcating these features in the product development lifecycle, the product development team would be setting itself up for success and launching an effective product.

References

- Biemans, W. G., et al. (2018). From Idea to Product: A Market-Pull and Technology-Push Perspective. *Journal of Product Innovation Management, 35*(3), 422-440.
- Koen, P. A., et al. (2001). Fuzzy Front End: Effective Methods, Tools, and Techniques. *Journal of Product Innovation Management, 18*(3), 211-224.
- Brown, T. (2008). Design Thinking. *Harvard Business Review, 86*(6), 84-92.
- Gibson, I., et al. (2015). Rapid Prototyping: Principles and Applications. *John Wiley & Sons*.
- Dahan, E., & Hauser, J. R. (2002). The Virtual Customer. *Journal of Product Innovation Management, 19*(5), 332-353.
- Bellini, E., et al. (2019). Product Design for Marketed Sustainability: From Green Design to Social Innovation. *Sustainability, 11*(3), 592.
- Schaltegger, S., & Burritt, R. (2018). Business Cases and Corporate Engagement with Sustainability: Differentiating Ethical Motivations. *Journal of Business Ethics, 147*(2), 241-259.

General Article

Designing Classroom Learning Experiences for Optimal Pedagogical-Technological Integration: Unifying Universal Design for Learning and User Interface/User Experience Principles

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Abstract

This paper focuses on the integration of Universal Design for Learning (UDL) and User Interface/User Experience (UI/UX) principles in education. It outlines strategies for applying these principles in various educational contexts to create inclusive learning environments that cater to diverse student needs. The integration focuses on adaptable content delivery, incorporating interactive learning experiences, and ensuring the accessibility of digital resources. A comprehensive checklist is provided to help educators assess and improve their practices, aiming for a smooth integration of technology that enhances the learning experience. This checklist covers different classroom technology scenarios, including presentations, videos, educational games, and platforms such as DIKSHA. By following these guidelines, educators can effectively blend UDL and UI/UX principles, ensuring that all students benefit from an enriched and supportive educational environment.

Keywords: Universal Design of Learning, User Interface/User Experience (UI/UX), Student engagement, DIKSHA, Cognitive Load

Introduction

In today's rapidly evolving educational landscape, the seamless integration of pedagogy and technology has become paramount. As educators strive to create engaging and effective learning environments, utilizing the synergy between Universal Design for Learning (UDL) and user interface/user experience (UI/UX) principles is helpful. The collaboration between Universal Design for Learning (UDL) and user interface/user experience (UI/UX) principles can foster student engagement and ensure inclusivity in the learning process. By aligning these approaches, educators can create intuitive interfaces and personalized learning experiences, providing all students with the chance to actively participate in and benefit from the teaching-learning process.

Theoretical Framework

The theoretical framework serves as both the metaphorical and literal cornerstone upon which ideas are framed and postulated (Grant and Osanloo, 2014) The selection of a theoretical framework in a research study often mirrors the researcher's viewpoint regarding the nature of being (ontological) and one's perspective on the theory of knowledge (epistemological)(Heale and Noble, 2019). The subsequent theoretical constructs are pertinent in this context:

Neuroscience for Classroom Practitioners

Educational neuroscience, an emerging field, has gained attention for its potential to inform theorybacked classroom instruction through insights from neuroscience. The neural network hypothesis of learning and memory, rooted in the work of Canadian Psychologist Donald Hebb, posits a fundamental mechanism for the strengthening or weakening of connections between brain cells over time. This process, termed synaptic plasticity, forms the basis for knowledge formation. Synaptic plasticity forms the foundation for learning, storing memories in and retrieving them from the set of synapses linked to the acquired object, skill, or experience (Kandel, 2009).

The cognitive processes of memory essential for learning are believed to be rooted in the brain's capacity to generate, reinforce, and eliminate connections. Shulman (1987) categorized teachers' knowledge into seven areas: content knowledge, general pedagogical knowledge, pedagogical content knowledge, curricular knowledge, knowledge of students and the teacher's characteristics, knowledge of educational systems and contexts, and knowledge of educational theories and philosophy. The interplay of these various knowledge domains significantly influences the teacher's lesson design process. Content knowledge serves as the foundational understanding of the subject matter, while pedagogical knowledge encompasses general teaching strategies. Pedagogical content knowledge combines these aspects, emphasizing the specific teaching methods relevant to a particular subject. Curricular knowledge directs the alignment of the curriculum with teaching strategies. Understanding students' characteristics aids in tailoring lesson plans to students' learning styles and needs, fostering effective learning experiences.

Teachers mindful of neuroscience while designing lessons witness increased self-efficacy, motivation, and self-responsibility, deemed crucial components of teacher competency (Brick et al., 2021). Elsewhere, Brick et al., 2021 report that teachers who underwent professional development programs in neuroscience were better equipped in recognizing and aiding students with social, emotional, and behavioural issues – aspects essential for creating meaningful learning experiences for students.

Universal Design for Learning

Ron Mace is credited to have coined the term universal design as a way of *"designing all products and the built environment to be aesthetic and usable to the greatest extent possible by everyone, regardless of their age, ability, or status in life"* (Center for Universal Design, 2010). Literature uses universal design of instruction (UDI) and universal instructional design (UID) as other terms to designate frameworks that aim at providing accessibility to learners. Rao et al.,2014 present a descriptive analysis of thirteen research studies from pre-kindergarten through 12th grade and higher education settings, where they explored the application and assessment of Universal Design (UD) in educational contexts. The Center for Applied Special Technology (CAST) delineates nine guidelines and thirty-one specific checkpoints across three principles, illustrating the incorporation of flexible options and learner supports into lesson design and implementation. The three principles are:

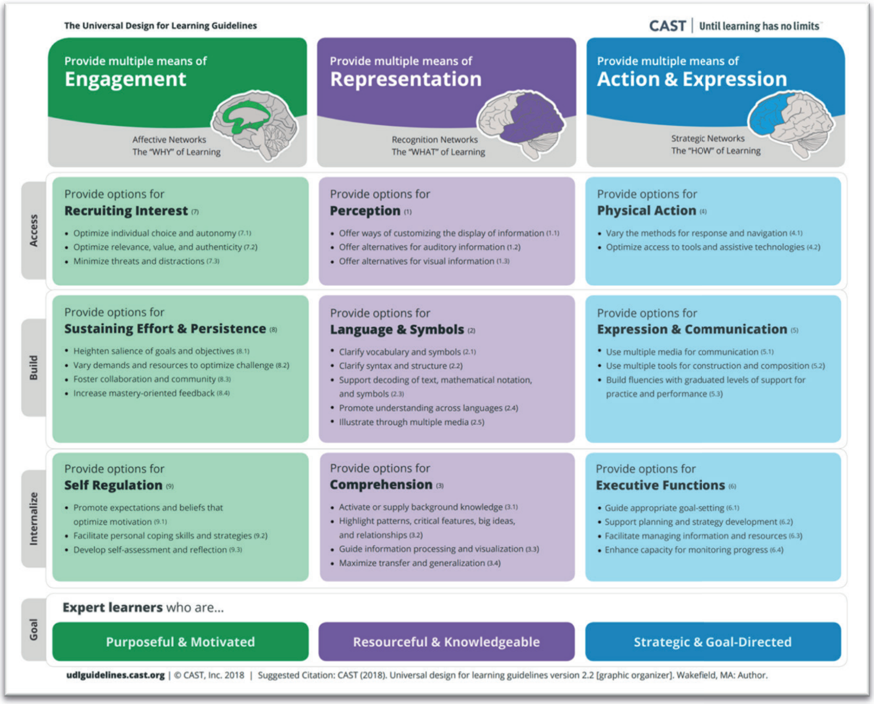
Principle I: Provide multiple means of representation

Principle II: Provide multiple means of action and expression

Principle III: Provide multiple means of engagement

Figure 1 is a graphic representation of the Universal Design for Learning guidelines version 2.2

Figure 1: CAST (2018) Universal Design for Learning Guidelines



Cognitive Load

Cognitive load refers to the mental effort required for learning. Cognitive load research aims to craft instructional techniques that align with the working memory's capacity, fostering optimal learning conditions. Its goal is to develop recommendations conducive to effective learning by adapting to the limitations and capabilities of working memory. Teachers must be mindful of cognitive load as excessive information or complex tasks can overwhelm students, impeding comprehension. Simplifying content, breaking tasks into manageable steps, and employing instructional techniques that reduce cognitive load can enhance learning retention and understanding. Teachers adopting explicit instruction methods can alleviate the cognitive load by presenting information in manageable steps, facilitating better learning retention and understanding. Hattie summarises explicit instruction as an approach in which: The teacher decides the learning intentions and success criteria, makes them transparent to the students, demonstrates them by modelling, evaluates if they understand what they have been told by checking for understanding, and retelling them what they have been told by tying it all together with closure. (Hattie 2009, p. 206). Paas & van Merriënboer (2020) explore how instructional design decisions can effectively manage the learner's working memory resources by considering the attributes of the learning task, the learner, and the learning environment.

UI/UX Principles

The "10 Usability Heuristics for User Interface Design" by Nielsen (2000) are a gold standard in the field of user experience (UX) design due to their universal applicability and ease of use. These heuristics serve as general guidelines that can be applied across a variety of user interfaces, which makes them incredibly versatile. These heuristics are straightforward and can be quickly leveraged to evaluate and enhance usability, offering a cost-effective way to identify and rectify design issues early in the development process. The principles cover a broad spectrum of design aspects, from error management to aesthetic minimalism, providing a comprehensive toolkit for designers, educators and technology developers. These heuristics are given below:

System Status Visibility: Designs should continuously update users about what's happening through timely and appropriate feedback. This ensures Intuitive navigation and multimedia content and consistent design and clarity.

System-World Realism: The design must use familiar terms and phrases, reducing technical jargon. It should reflect real-world order and conventions. This further ensures clear instructions and immediate feedback are accessible to the user

User Autonomy: Users need clear options to undo actions without going through complex processes, akin to an "emergency exit." This ensures clear navigation and structure of all programs.

Consistency and Norms: The design must ensure consistency in terminology and actions, aligning with the general platform and industry standards. This ensures there is uniformity in design, colour palate and interface.

Error Prevention: The best designs pre-empt issues. It's crucial to either eliminate or check error-prone conditions, offering a verification step before actions are finalized. This ensures immediate feedback is available to the user.

Recognition over Memory: The design should minimize the need for memory recall by making elements and options clearly visible. This ensures the user doesn't always need to decode the symbols and icons used.

Flexible Efficiency: Designs should offer shortcuts that cater to both novice and experienced users, enhancing efficiency for all. This heuristics dictates the need for ensuring clear navigation and bread-crumbs are always available within the environment so as to ensure ease of navigation and accessibility.

Minimalist Aesthetics: Interface design should be simple, only containing necessary information to avoid overwhelming the user. This ensures the design is clutter free and there is little redundancy.

Error Management: Messages should plainly communicate errors and offer constructive recovery steps without technical codes. This ensures the user is engaged within the system.

Documentation Accessibility: While the ideal system is self-explanatory, sometimes supplementary guidance is necessary for user task completion.

Based on these theoretical constructs, the suggestive checklists are designed to integrate the principles of Universal Design for Learning (UDL) and User Interface/User Experience (UI/UX) across various classroom scenarios.

Suggestive Checklist for Integrated UDL and UI/UX Principles across Classroom Technology Scenarios

Effective utilization of Universal Design for Learning (UDL) and User Interface/ User Experience (UI/UX) principles enhances accessibility and cultivates an inclusive learning environment. A structured suggestive checklist assists teachers in seamlessly integrating these principles across diverse classroom scenarios of commonly used technology interventions like presentations, videos from platforms like YouTube, educational games like Kahoot, and educational apps such as DIKSHA. This adaptable framework empowers educators to skilfully merge technology into teaching practices, addressing varied student needs and optimizing the educational journey. It serves as a flexible guide, enabling teachers to align technology with individual classroom dynamics and student requirements for an enriched learning experience.

Suggestive Checklist - Scenario 1: Using Presentations in the Classroom.

Presentations serve as powerful pedagogical tools, aiding teachers in delivering structured content, visualizing complex concepts, and fostering student engagement. They facilitate interactive learning, stimulate discussions, and cater to diverse learning styles, enhancing comprehension and retention within the classroom setting. They enhance learning by fostering a deeper comprehension of the subject matter while also fuelling student motivation (Lari, 2014). Table 1 presents an Integrated UDL and UI/UX Principles checklist for teachers using presentations in the classroom.

Table-1: Integrated UDL and UI/UX Principles checklist for teachers using presentations in the classroom

Clatstroom Scenario	UDL Principles	Correspond-ing UI/UX Principles	Checklist for Classroom Practitioners
Teachers use presentations to deliver content in the classroom.	Offer content in diverse formats to cater to varied learners. Remove barriers and ensure equal opportunities for participation. Plan accessible learning experiences that benefit all learners.	Intuitive navigation and multimedia content User-centred design and inclusivity Consistent design and clarity	• Provide information in multiple formats (text, visuals, multimedia). • Ensure the presentation navigation is user-friendly with clear structures (Like demarcation of headings and sub-headings) • Organize content into clear sections for a structured presentation. • Implement easy-to-use navigation tools for seamless movement between slides (Clear next, previous/ back buttons) • Maintain consistent slide layouts for uniformity and easy comprehension (prefer using a consistent theme and design elements) • Include interactive elements for active engagement – like using action buttons and hyperlinks, • Use captivating visuals to reinforce key concepts and sustain attention. • Conduct usability tests to ensure smooth navigation and content comprehension. • Seek feedback from peers or students for continuous improvement. • Regularly assess presentation accessibility to cater to diverse learners.

Clastsroom Scenario	UDL Principles	Correspond-ing UI/UX Principles	Checklist for Classroom Practitioners
	Provide flexible and diverse learning experiences.	Engagement and interactive design	• Incorporate interactive videos, quizzes, or polls to actively engage students. • Explore different presentation styles (e.g., storytelling, case studies, debates) to cater to diverse learning preferences. • Deliver information using diverse formats (images, infographics, audio clips) to accommodate various learning styles. • Utilize captivating visuals, infographics, and multimedia content to reinforce key concepts and enhance understanding. • Implement adaptable navigation structures to allow students to navigate according to their pace and preferences. • Infuse gamification elements (e.g., challenges, rewards) within the presentation to boost engagement and motivation. • Offer choices within the presentation (e.g., optional activities, branching scenarios) to tailor learning experiences. • Vary the duration of the presentation to accommodate attention spans and learning objectives. • Introduce collaborative activities or group discussions within the presentation to encourage peer learning. • Provide options for students to select learning paths or topics according to their interests or needs. • Include real-life examples or case studies to illustrate practical applications of the content. • Update and refresh presentation content regularly to keep it relevant and current. • Use inclusive language and a conversational tone to ensure the content is relatable and understandable. • Incorporate feedback mechanisms (sur-veys, discussion forums) for students to share their thoughts or questions. • Provide supplementary resources or further reading materials for students to explore beyond the presentation.

Clatsroom Scenario	UDL Principles	Correspond-ing UI/UX Principles	Checklist for Classroom Practitioners
	Allow multi-ple ways for students to demonstrate understand-ing.	Clear instructions and immediate feedback	• Effective feedback involves targeting specific areas, communicating progress, ensuring timeliness, and allowing students the opportunity to implement received feedback. In a broader context, this encompasses understanding the student's status, evaluating their progress, and determining the subsequent steps forward. Therefore, • Targeting specific areas for feedback. • Communicating progress effectively. • Ensuring timeliness in providing feedback. • Allowing students to practice and implement received feedback. • In a broader context, understanding the student's current status. • Evaluating the student's progress. • Determining the subsequent steps forward.
	Create an adaptable and inclusive learning environment.	Accessibility features and customiza-tion	• Maintain the same font type throughout the presentation for readability. • Use different font sizes to emphasize key points while ensuring readability from a distance. • Ensure sufficient contrast between text and background for better visibility. • Avoid overcrowding slides with text; use concise phrases or bullet points. • Use subtle animations sparingly to highlight important content without distraction. • Choose color combinations that are easy on the eyes and aid readability. Some examples of Readable Color Combinations: • Black Text on White Background: • Dark Gray Text on a Light Gray Background – this combination offers a softer contrast, maintaining readability without straining the eyes. • Navy Blue Text on Beige Background: Provides a pleasant contrast while maintaining readability for prolonged viewing. • Organize content using varying font sizes and colors to signify importance and hierarchy. Some ideas include

Clastsroom Scenario	UDL Principles	Correspond-ing UI/UX Principles	Checklist for Classroom Practitioners
			• Title in Bold and Larger Font Size: The main title stands out as the most prominent element, drawing attention. • Subtitles in Slightly Smaller Font: Subtitles or headers are slightly smaller but still larger than the main text, indicating sections or themes. • Bullet Points or Key Information in Bulky Fonts or Colors: Key points or bullet lists in bold or different colors to highlight essential content. • Conduct tests to ensure the presentation is accessible to individuals with visual impairments or disabilities.

Suggestive Checklist - Scenario 2: Using Videos (from YouTube) etc in the classroom

Carmichael, et. al (2018) reveals students' strong inclination towards video-based learning, empowering their independent and flexible educational pursuits. As a result, students actively seek online video content in their courses, indicating a bright and promising future for this instructional format and instilling confidence in educators, librarians, and stakeholders. Table 2 presents an Integrated UDL and UI/UX Principles checklist for teachers using videos in the classroom. This is in continuation of the points mentioned in the previous tables.

Table-2: Integrated UDL and UI/UX Principles checklist for teachers using videos in the classroom

Class Scenario: Using Video Resources (YouTube)	UDL Principles	Corresponding UI/UX Principles	Checklist for Classroom Practitioners
Teachers incorporate YouTube videos for educational purposes.	Offer content in diverse formats to cater to varied learners.	Intuitive navigation and multimedia content	• Ensure the video content has subtitles or transcripts for accessibility. • Enable easy navigation through chapters or timestamps.
	Provide flexible and diverse learning experiences.	Engagement and interactive design	• Use interactive features like quizzes or pause points to reinforce learning. • Offer various video styles (animations, documentaries).

	Allow multiple ways for students to demonstrate understanding.	Clear instructions and immediate feedback	• Provide discussion prompts or reflection tasks after viewing the videos. • Clarify objectives and follow-up activities related to videos.
	Create an adaptable and inclusive learning environment.	Accessibility features and customization	• Ensure videos have proper closed captions and audio descriptions. • Optimize video resolution for diverse device compatibility.
	Remove barriers and ensure equal opportunities for participation.	User-centered design and inclusivity	• Curate a range of videos to address various learning styles and preferences. • Encourage active participation during video sessions.
	Plan accessible learning experiences that benefit all learners.	Consistent design and clarity	• Provide supplementary resources or related materials for deeper understanding. • Maintain consistency in video structure and format.

Suggestive Checklist - Scenario 3: Using Educational Games like Kahoot, Quizzes etc in the classroom

Educational games like Kahoot and quizzes serve as engaging teaching aids, fostering interactive learning experiences. These tools enhance student participation, reinforce key concepts, and provide real-time assessment opportunities for educators. They promote active engagement, stimulate critical thinking, and offer an enjoyable approach to reinforce academic material. Leveraging educational games in classrooms has the potential to reduce distractions, enhancing the quality of both teaching and learning experiences beyond traditional classroom settings (Licorish, 2018).

Research from Forssell, et al. (2023) suggests much like younger demographics, older adults exhibit enthusiasm to participate in educational games, particularly when designed appropriately with tailored features and suitable facilities.

Table 3 presents an Integrated UDL and UI/UX Principles checklist for teachers using online educational games in the classroom. This is in continuation of the points mentioned in the previous tables.

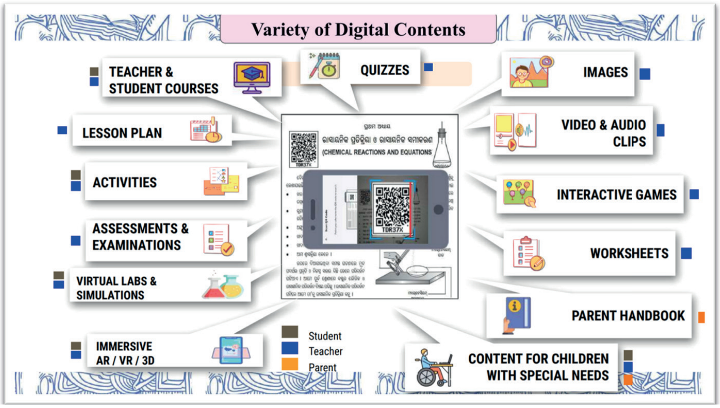
Table-3: Integrated UDL and UI/UX Principles checklist for teachers using online educational games in the classroom

Class Scenario: Playing Online Educational Games (Kahoot, etc.)	UDL Principles	Corresponding UI/UX Principles	Checklist for Classroom Practitioners
Teachers integrate online educational gaming platforms like Kahoot into lessons.	Offer content in diverse formats to cater to varied learners.	Intuitive navigation and interactive design	• Ensure game instructions are clear and accessible to all students. • Allow easy navigation and interaction within the gaming interface.
	Provide flexible and diverse learning experiences.	Engagement and interactive elements	• Include interactive features that engage students actively during gameplay. • Offer various game modes or difficulty levels for learners.
	Allow multiple ways for students to demonstrate understanding.	Immediate feedback and progress tracking	• Provide immediate feedback on answers and track students' progress in the game. • Offer options for students to review their performance.
	Create an adaptable and inclusive learning environment.	Accessibility features and customization	• Ensure gaming platforms are accessible for students with diverse abilities. • Provide audio descriptions or transcripts if necessary.
	Remove barriers and ensure equal opportunities for participation.	User-centered design and inclusivity	• Encourage participation from all students by making games inclusive and fair. • Cater to different learning styles and preferences.
	Plan accessible learning experiences that benefit all learners.	Consistent design and clarity	• Design games with a consistent and user-friendly interface for seamless gameplay. • Offer supplementary materials for post-game review.

Suggestive Checklist- Scenario 4: Using educational platforms like DIKSHA etc, in the classroom

DIKSHA (Digital Infrastructure for Knowledge Sharing) is a digital infrastructure for school education in India, developed by the National Council of Educational Research and Training (NCERT). It's an e-learning platform designed to facilitate teachers' access to quality teaching resources, aiding in lesson planning and providing interactive content for students. The app offers digital content for K-12 education across various subjects, including textbooks, lesson plans, assessments, and teacher training resources. DIKSHA aims to promote interactive learning and improve the overall quality of education in India by leveraging technology. As an app, DIKSHA not only has static e-learning content but also interactive e-learning content like AR/VR/ Virtual Labs, etc. Figure 2 showcases the varied digital content available in the DIKSHA Platform

Figure-2: DIKSHA (Digital Infrastructure for Knowledge Sharing Infrastructure) – Types of Digital Content



(Accessed from: https://ciet.nic.in/upload/DIKSHA%20Policy%20Perspective%20and%20Scope%20in%20Education.pdf)

The advantage of using platforms is that teachers can direct students to varied levels of content and learning material that are accompanied by exercises and content checklist points. In its present state DIKSHA is yet to help teachers create personalized learning pathways for students, but teachers can direct students to relevant portions of the platform to strengthen classroom experiences. Table 4 presents an Integrated UDL and UI/UX Principles checklist for teachers using educational platforms like DIKSHA in the classroom. This is in continuation of the points mentioned in the previous tables.

Table-4: Integrated UDL and UI/UX Principles checklist for teachers using educational platforms like DIKSHA in the classroom

Class Scenario: Using Educational platforms like (DIKSHA.)	UDL Principles	Corresponding UI/UX Principles	Checklist for Classroom Practitioners
Teachers utilize educational apps for flipped classroom approaches / backward design planning or as a scaffold	Offer content in diverse formats to cater to varied learners.	Intuitive navigation and multimedia content	Ensure app content is available in various formats (text, audio, video) for different learning styles. Enable easy navigation within the app.

	Provide flexible and diverse learning experiences.	Engagement and interactive design	Include interactive features like quizzes or interactive sections for engagement. Offer varied activities to suit different preferences.
	Allow multiple ways for students to demonstrate understanding.	Clear instructions and immediate feedback	Clearly outline tasks and expectations within the app. Provide immediate feedback or progress tracking.
	Create an adaptable and inclusive learning environment.	Accessibility features and customization	Ensure app accessibility for students with different abilities. Provide adjustable settings for personalized use.
	Remove barriers and ensure equal opportunities for participation.	User-centered design and inclusivity	Encourage participation from all students through inclusive app features. Accommodate various learning styles in the app.
	Plan accessible learning experiences that benefit all learners.	Consistent design and clarity	Maintain a consistent interface for easy navigation. Provide supplementary resources within the app.

The presented checklist offers a practical framework, empowering educators to navigate diverse technological scenarios while prioritizing student engagement and inclusivity. As pedagogy continues to evolve alongside technological advancements, the synergy between UDL and UI/UX principles remains instrumental in shaping vibrant, accessible, and personalized learning experiences. By embracing these principles, educators can effectively bridge the gap between theory and practice, ensuring a dynamic and enriched educational journey for all learners.

Reference

Ambrose, Susan A., Michael W. Bridges, Michele DiPietro, Marsha C. Lovett, and Marie K. Norman (2010). "What kinds of practice and feedback enhance learning?" *In How Learning Works: Seven research-based principles for smart teaching* (pp. 121–152). San Francisco, CA: Jossey-Bass.

Benassi, V. A., Overson, C. E., & Hakala, C. M. (2014). *Applying science of learning in education: Infusing psychological science into the curriculum*. Retrieved from the Society for the Teaching of Psychology web site: http://teachpsych.org/ebooks/asle2014/ index.php

Brick, K., Cooper, J. L., Mason, L., Faeflen, S., Monmia, J., and Dubinsky, J. M. (2021a). Tiered neuroscience and mental health professional development in liberia improves teacher self-efficacy, self-responsibility, and motivation. Front. Hum. Neurosci. 15:664730. doi: 10.3389/fnhum.2021.664730

Brick, K., Cooper, J. L., Mason, L., Faeflen, S., Nonmia, J., and Dubinsky, J. M. (2021b). Training-of-trainers neuroscience and mental health teacher education in liberia improves self-reported support for students. Front. Hum. Neurosci. 15:653069. doi: 10.3389/fnhum.2021.653069

Carmichael, et. al (2018) Assessing the Impact of Educational Video on Student Engagement, Critical Thinking and Learning: The Current State of Play. *Sage White Papers*. Accessed from https://us.sagepub.com/sites/default/files/hevideolearning.pdf

CAST (2018). *Universal Design for Learning Guidelines version 2.2*. Retrieved from http://udlguidelines.cast.org

Forssell, et. al (2023) Accessibility of Kahoot! And Quizizz: Utilizing educational games with Elderly Students. C&T '23: Proceedings of the 11th International Conference on Communities and TechnologiesMay 2023Pages 75–84 https://doi.org/10.1145/3593743.3593760

Goodwin, Bryan and Miller, Kirsten (2012). "Good Feedback is Targeted, Specific, Timely". Educational Leadership: Feedback for Learning, Vol. 70, No. 1.

Grant, C. and Osanloo, A. (2014) Understanding, selecting, and integrating a theoretical framework in dissertation research: Developing a 'blueprint' for your "house" January 2015 Administrative Issues *Journal Education Practice and Research* 4(2) DOI:10.5929/2014.4.2.9

Hattie, J. (2009). Visible learning: A synthesis of over 800 meta-ana lyses related to achievement. London: Routledge.

Heale, R., & Noble, H. (2019). Integration of a theoretical framework into your research study. *Evidence Based Nursing*, 22(2), 36–37. https://doi.org/10.1136/ebnurs-2019-10307

Kandel, E. R. (2009). The biology of memory: A forty-year perspective. *The Journal of Neuroscience*, 29(41), 12748–12756. https://doi.org/10.1523/jneurosci.3958-09.2009

Lari, Fateme Samiei. (2014) The Impact of Using PowerPoint Presentations on Students' Learning and Motivation in Secondary Schools, *Procedia - Social and Behavioral Sciences*, Volume 98, Pages 1672-1677, https://doi.org/10.1016/j.sbspro.2014.03.592.

Licorish, S.A., Owen, H.E., Daniel, B. et al. Students' perception of Kahoot!'s influence on teaching and learning. *RPTEL* 13, 9 (2018). https://doi.org/10.1186/s41039-018-0078-8

Nielsen, J., 2020. *Ten usability heuristics for user interface design*. Available from: https://www.nngroup.com/articles/ten-usability-heuristic

Paas, F., & van Merriënboer, J. J. G. (2020). Cognitive-Load Theory: Methods to Manage Working Memory Load in the Learning of Complex Tasks. *Current Directions in Psychological Science*, 29(4), 394-398. https://doi.org/10.1177/0963721420922183

Rao, K., Ok, M. W., & Bryant, B. R. (2014). A Review of Research on Universal Design Educational Models. *Remedial and Special Education*, 35(3), 153-166. https://doi.org/10.1177/0741932513518980

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review,* 57, 1–22.

A Human Algorithm: How Artificial Intelligence Is Redefining Who We Are

(Flynn Coleman, Counterpoint LLC, Berkeley, California, 2020
pp. 336, ISBN-13 : |978-1640094284)

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As Artificial Intelligence (AI) is gaining traction, its impact can be seen in sectors all around the world. One such is also in the field of education and academia. The launch of OpenAI and the resultant ChatGPT has made the task of a student and researcher easier while that of the teacher and reviewer more complex. While still, others argue that ChatGPT has democratised plagiarism, for at least now, people are coming forward and admitting to having used it for their academic purposes.

In the field of Education, AI has the potential to personalise learning according to the pupil's needs. At the same time, it may also be extended towards tutoring, grading and gaining a real-time feedback mechanism on course quality and its delivery mechanism.

This is just one field of AI use and its possible abuse. The task of gathering data, processing it and using it to connote choices and express results has now been levied upon a bunch of codes (algorithms). We witness it around us in a number of ways through the use of automated voice commands using Siri, Alexa or Google, which are all based on intelligent machine learning.

Stemming from this, the book under review is about directing AI towards our highest values rather than creating cold algorithms that might harm us without meaning to or even reinforce the worst of our values. Author Flynn Coleman is a Human rights activist and an environmental advocate. This combination serves well for penning a book that incorporates aspects of the safe and sustainable use of technology, one that fulfils the needs of the current generation without hampering those of the future ones.

The author mentions in the beginning of the book that it is a work to comprehend the "relationships with technologies we create" (p.13) in a pursuit to uncover the "definition of humanity" (p. 13). Coleman argues that humans are now at the receiving end of technological development and that AI would be able to take over the processes of advancement in ways and methods that humans could not have accomplished on their own. The book investigates the use of AI towards the highest moral values, instead of churning out algorithms which only justify the means and does nothing to support the ends.

The book begins with an introductory chapter subtitled 'A Brave New World', acknowledging through the text the resilience and ingenuity that human and technology interactions brought about. The author goes on to argue that machines are now able to reason and, in the process, become a better and improved version of themselves as the last stage of human-led invention and innovation. From here on, the machines would be capable of improving upon their systems to the point that they may not be comprehensible to humans. The independence these machines can achieve would put them on the route of automated course correction.

The dilemma, for Coleman, lies here. Whether to impose a set of moral principles upon the machines or allow the machines to learn, unlearn and re-learn in order to set themselves on a path of course correction, thereby educating humans? It is in a quest to answer this basic question, the book then is divided into ten chapters.

Chapter 1 begins from the beginning. It gives a brief history of technology right from the Greek times to the present. Thus setting up a background to the human achievements through history. Chapter 2 tries to understand in-depth the meaning of intelligence both at the level of humans and machines and the implications thereof. Chapter 3 discusses the disconnect of human to human interaction in the setting up of technological innovations. That a certain class, race, and educational level of people comes to wield the power to government intervention in science and technology becomes problematic.

Chapter 4 discusses an interesting proposition of the 'trolley problem', which is a series of thought experiments designed to raise ethical and moral questions. Coleman juxtaposes this problem with ascertaining whether AI will be able to overcome this ethical dilemma by either responding in the same manner as a human brain would or coming up with a whole new set of solutions. The author bases her argument on the pretext that AI is meant to be smarter, more efficient and consistent than humans. So, for the sake of the argument, technology holds the potential to either celebrate human nature or extinguish planetary life itself.

Chapter 5 and 7 discuss the potential effects of machines on the human workforce. There has been a debate on whether technology will be able to replace human labour from time immemorial. While it has been observed that technology only creates a new workforce, one which is capable of moving ahead of the analogue times, the author tries to assess the situation through the use of statistics.

Chapter 6 explores the design aspect of AI. Whether the AI in question attempts to protect our rights and freedoms or act in complete discordance with them.

Chapter 8 explores the meanings of what it means to be 'conscious'. Something that we use in the contexts of humans, can that be replicated in the case of machines? Chapter 9 focuses on the way we communicate with machines. The transfer of knowledge not just from a single individual but a group of individuals poses its own challenges since human values may vary from person to person. How then is the machine learning capable of accommodating such differing viewpoints.

Chapter 10 goes on to clarify that this book is an attempt to caution the readers of the flaws and vulnerabilities of humans while at the same time holding the zeal to improve the lives of humans around the world. The book brings to the fore the journey that is yet to be taken forward.

On the positive side, the book gives a meaningful and hopeful end to a discussion spanning various uses and abuses of technology. The author described at least one group that is attempting to address each issue she raised. This includes controlling how AI will evolve and incorporating human understanding into it. A human algorithm for the author gives a more nuanced definition to "us" which includes AI itself. It describes the values and relationships in place of the codes that form the basic constituents of an algorithm.

In this book, Coleman presents both arguments in favour of and against AI extremely well. While she carefully outlines the ways in which it could be a complete disaster, she acknowledges that it has the potential to be a force for good. She examines a wide range of topics related to AI, including its history, the economy, and even what consciousness is and whether AI can develop it. A complex issue is written about in an understandable manner. There can be no moral machine without a moral person, and empathy—the capacity that humans have to feel what other people are feeling—is the key to developing usable technology that works for everyone, not just a technologically privileged elite.

It's challenging, but not impossible, and this book offers the next progressive government a comprehensive road map for thinking about how to leverage the revolutionary potential of AI to make the world a better place. The book also encourages us to think about ways to widen our own perspectives on the interconnection of our world and the significance of approaching it from the standpoint of empathy.

Do we want AI to serve us or turn into an existential threat? That is the central question this book poses. If we do this correctly, we get a wonderful new partner; if we do this incorrectly, a new dark era may begin, and we will all perish. How will AI and robotics affect the world's population as a whole? AI is like a glass onion, to use a metaphor, where each layer presents itself with new information, new sets of challenges and predicaments. While the centre of the onion, in this case, the concept of AI, is very much visible, its effects can only be experienced by going through the onion, layer by layer.

eJaadui Pitara: Empowering Early Childhood Education

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eJaadui Pitara is an educational treasure trove developed by the National Council of Educational Research and Training (NCERT) in India. Designed specifically for parents and teachers, it empowers them to create engaging, enjoyable, and interactive learning experiences for children aged 3-8 years. This initiative aims to realise the National Curriculum Framework for Foundational Stage (NCF-FS) 2022 goals at the grassroots level, providing valuable support for both adults and children. Through eJaadui Pitara, parents and teachers can learn engaging methods and access a wealth of resources to help children learn and thrive.

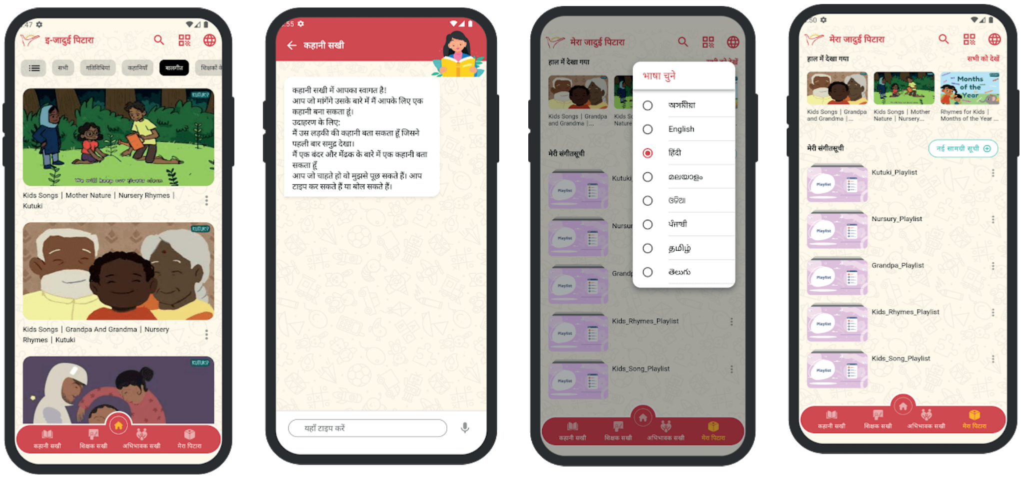
Features and Processes:

- **Playful Learning:** Emphasises "Learning through Play," allowing children to learn through interactive activities, games, stories, and songs.
- **Multiple Access Points:**
  - ➢ **Mobile App:** Download the free app for a wide variety of educational content, including stories, rhymes, puzzles, and activities. Download link
  - ➢ **Dial-Up Service (IVRS):** For those without internet access, listen to daily stories, songs, riddles, and questions by dialling a toll-free number.
- **AI-powered Assistance:** Get help from AI-powered bots on WhatsApp and Telegram, providing age-appropriate activity suggestions and answering questions on early childhood development.
  - ➢ **Story Bot (Katha Sakhi):** Suggests stories in different languages.
  - ➢ **Parent Bot (Parent Tara) & Teacher Bot (Teacher Tara):** Offers expert knowledge on NEP 2020, NCFs, kids' activities, psychology, pedagogy, etc.
- **Focus on Foundational Skills:** Resources build essential skills such as language development, maths concepts, critical thinking, and social-emotional skills.
- **Multilingual Support:** Offers content in 10 Indian languages (Assamese, Bengali, Gujarati, Hindi, Odiya, Punjabi, Tamil, Telugu, Kannada, Malayalam) and English.

Impact:

- **Strong Audience Reach:** eJaadui Pitara has over 45,641 downloads, indicating a growing interest in early childhood education.
- **Active Engagement:** With over 205,563 total plays, users are actively engaging with the content, suggesting it provides valuable learning experiences.
- **Diverse Access Points:** Utilisation of IVRS calls (1,385) and AI-powered chatbots (Story bot messages - 4,488, Teacher bot messages - 6,097, Parent bot messages - 4,402) showcases the app's accessibility.

By offering a variety of engaging and accessible resources, eJaadui Pitara empowers parents and educators to create a fun and enriching learning environment for young children. However, to better serve India's diverse conditions—including resources, languages, skilled human resources, technology, and internet connectivity—the app needs to support more Indian languages, be available offline and on other platforms like iOS and Windows, and regularly digitise and upload more resources to ensure wider access and better impact on users.



Review of PRASHAST App

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The National Council of Educational Research and Training (NCERT) under the aegis of Ministry of Education, Department of School Education and Literacy, Government of India has taken a groundbreaking step towards ensuring accessibility and inclusion in Indian classrooms with the launch of the PRASHAST (Pre-Assessment Holistic Screening Tool) android based multilingual mobile app. This mobile application empowers schools to identify students with potential disabilities at an early stage, paving the way for a more equitable and supportive learning environment.

The PRASHAST app by NCERT utilizes a two-part process to effectively screen students for potential disabilities. This structured approach ensures a thorough assessment while maintaining ease of use within the school environment in India.

Part 1: Classroom Observation by Regular Teachers

- **Target Users:** Regular classroom teachers are responsible for completing Part 1 of the PRASHAST app.
- **Focus:** This initial screening focuses on observing students in their regular classroom setting. Teachers use a checklist within the app to assess a student's performance across various developmental domains.
- **Domains Covered:** The checklist considers aspects like communication skills, cognitive abilities, motor skills (both gross and fine), sensory skills, social and emotional development, and activities of daily living.
- **Benefits:**
  - ➢ Early Detection: By observing students in their familiar environment, Part 1 allows for early identification of potential developmental delays or disabilities.
  - ➢ Teacher Expertise: Regular classroom teachers are well-positioned to observe students' daily interactions and learning styles, providing valuable insights.
  - ➢ Streamlined Process: The app-based checklist simplifies data collection and record-keeping for teachers.

Part 2: Validation by Special Educators

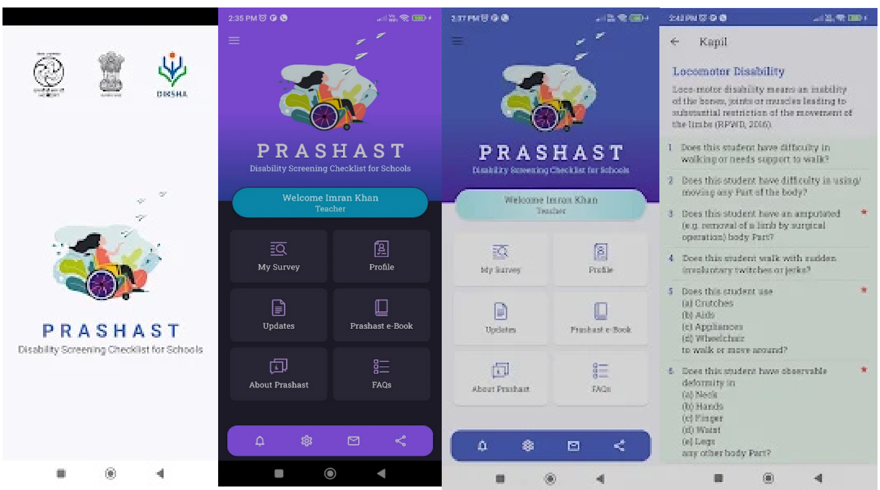
- **Target Users:** Once teachers complete Part 1, special educators within the school or designated support system take over.
- **Focus:** Part 2 involves in-depth evaluation based on the observations documented in Part 1. Special educators may interact directly with the student, conduct additional assessments, and consult with parents or guardians.
- **Validation and Next Steps:** Based on the combined findings from both the parts tools, special educators can:
  - ➢ Validate the initial observations made in Part 1.

- ➢ Recommend further diagnostic assessments for specific disabilities.
- ➢ Develop individualized education plans (IEPs) to cater to the student's specific needs.

- **Benefits:**
  - ➢ Expert Analysis: Special educators bring specialized knowledge and expertise to refine the screening process.
  - ➢ Comprehensive Evaluation: Part 2 provides a more in-depth analysis, ensuring accurate identification of needs.
  - ➢ Individualized Support: Combining data from both parts allows for creating tailored learning plans to support each student effectively.

Working Together for Inclusive Education

The two-part structure of the PRASHAST app leverages the expertise of both regular and special educators. This collaborative approach ensures a comprehensive screening process while remaining mindful of teachers' time constraints within the classroom setting. By effectively identifying students with potential disabilities, PRASHAST paves the way for timely intervention and personalized support, ultimately contributing to a more inclusive learning environment for all. It is strongly felt that the app should not be used in isolation; rather, it should play a supplementary and complementary role to other existing apps under the Ministry of Women and Child Development, Government of India and Ministry of Health and Family Welfare, Government of India. This may provide both a vertical and horizontal service to the stakeholders. The app further needs to use AI/ML for automatic data analysis and visualisation of data and seamlessly integrate with professionals like doctors, counsellors, teachers, etc., for its holistic use.



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