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G20

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वसुधैव कुटुम्बकम्

ONE EARTH • ONE FAMILY • ONE FUTURE

The Group of Twenty (G20) is the premier forum for international economic cooperation. It plays an important role in shaping and strengthening global architecture and governance on all major international economic issues.

India holds the Presidency of the G20 from 1 December 2022 to 30 November 2023. The theme of India's G20 Presidency - "Vasudhaiva Kutumbakam" or "One Earth · One Family · One Future" - is drawn from the ancient Sanskrit text of the Maha Upanishad. Essentially, the theme affirms the value of all life – human, animal, plant, and microorganisms – and their interconnectedness on the planet Earth and in the wider universe.

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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, List-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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Editorial

As we publish the July issue of the Journal in 2023, the fourth and final meeting of Education Working Group (EdWG) of G20 under India's presidency got over in Pune on 20-21 June, 2023. The outcomes of this meeting and three previous meetings of EdWG, which were held in Chennai (from 31st January to 2nd February, 2023), Amritsar (from 15th March to 17th March, 2023) and Bhubaneswar (from 26th April to 29th April, 2023) were presented, discussed and finalized in the Meeting of the Education Ministers of the member countries on 22 June, 2023 in Pune. The EdWG has shared the best practices of the member countries in the realm of technology enabled learning, research, collaboration, future of work and Foundational Literary and Numeracy (FLN). The final report of this EdWG and those of other working & engagement groups of various tracks on various themes will be released in form of declaration later in the month of September in Leaders' Summit in New Delhi.

The report recommends making tech-enabled learning more “inclusive, equitable, relevant, effective, qualitative and collaborative at all levels”. The focus on inclusive, qualitative and collaborative tech-enabled learning underscores the stance of G20 countries on technological integration in education in light of human rights and sustainable development goals. The G20 education ministerial meeting reaffirmed the need to develop a technology ecosystem, leveraging the potential of digital technologies in enabling inclusive, equitable, contextualized accessible quality education; encouraged the development of standardized frameworks for educational technology; capacity building of teachers and trainers to ensure availability of quality, effective and safe tech-enabled learning and assessment. The criticality of measures required towards overcoming the digital divide for all learners also emerged as one of the important themes and the key role of open educational resources, interoperability of digital resources and leveraging data analytics in hastening educational progress were reiterated.

Group of Twenty Presidency, the Government of India has prioritized four key areas under the G20 Education Working Group (EdWG) which are a) FLN and lifelong learning, b) leveraging digital resources and technologies for accelerating educational progress, c) the impact of future of work on education systems, and d) greater synchronicity and collaboration between higher education, research and development and societies within and across boundaries. In case of digital technology, EdWG has highlighted the contextuality of the digital transformation of education across the member countries as each G20 member is at a different stage in its journey of the development of sustainable, inclusive and equitable access to tech-enabled learning. The tech-enabled learning in different countries has taken a different route but there have been some commonalities in the initiatives by the G20 actors. The member countries fair differently as the Republic of China has reached 100% internet access for all types of schools at all levels, while Argentina is focusing on equitable distribution of technological materials under its Conectar Igualdad policy and Italy is working on National Plan for Digital Schools to help digitalize their learning process and methodologies.

The three major areas of intervention across the countries have been the development of digital platforms, ensuring infrastructure and equitable access to it, and eContent creation. At the level of infrastructure some countries are focusing on the level of material infrastructure like equipment and others are focusing on providing better connectivity. Digital platforms are being used not only for school education but also for higher education and VET and hence serving a plethora of educational and learning needs. Quality eContent creation is the natural next step with the focus being on the digitization of learning material. Therefore, G20 countries are concentrating on creating econtent, for instance, UAE created bilingual content, and Turkey and India created content for CWSN.

The year 2023 has been a momentous year for India's diplomacy. India is presiding over the G20 forum, a forum where countries meet, debate and discuss the common concerns of sustainable development. When the Asian Financial Crisis of 1997-99 struck, the finance ministers of the Group of Seven (G7) and the leaders of Group of 8 created a new body-G20 (Kirton, 2013, p.ix). Initially, it was a forum for Finance Ministers and Central Bank Governors of the 19 countries and the European Union to focus on global economics and financial issues and in 2008, it was elevated to the level of leaders' summit. G20 represents 85% of the global GDP and about two-thirds of the world population. It discusses issues ranging from economics to those of socio-politics including education. This year's presidency lies with India with the logo of "Vasudhaiva Kutumbakam" (One Earth - One Family - One Future). The three-member management group consists of the past, present and future chair/precedency together referred to as Troika. The preparations for the G20 Summit are conducted through the established Sherpa Track and Financial Track which are responsible to prepare and follow up on issues and resolutions adopted at the Summits. Financial Track, led by Finance Ministers and Central Bank Governors, focuses on the economic and financial issues of the member countries while Sherpa track focuses on socio-political issues like education, agriculture etc. Sherpa represents the leader of the country. Apart from the two tracks, Engagement Groups also form part of the structure of the G20, which consists of participants from non-government entities like businesses, labour, youth, women and researchers of the member countries who can make policy recommendations to G20 leaders. Over the years, different Presidencies have led to the constitution of different Engagement Groups like Supreme Audit Institutions 20 (SAI20) was introduced under the Indonesian Presidency and India under its Presidency has created the Startup20 engagement group. A lot needs to be done in incorporating extended technologies (AR, VR and MR) and AI in creating digital learning resources. Multilateral cooperation is the key to the success of these initiatives.

The July 2023 issue has twenty two manuscripts in total. There are nineteen research articles, one review article, one communication article, and one book review. These articles deal with mobile augmented reality, inclusive enrollment policy, ICT and disintegrating teaching-learning process, massive open online courses, open educational resources, web-enabled student support services (WESSS) in open and distance learning (ODL) system, and artificial intelligence. I would like to thank all the authors and reviewers for contributing to taking out the 2nd issue of the 5th volume of the Indian Journal of Educational Technology.

(ABHAY KUMAR)
Editor

Research Article

Web-Enabled Student Support Services (WESSS) in Open and Distance Learning (ODL) system: a case study

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Abstract

The concept of the ODL system focuses on open access to education and training to make the learners free from the constraints of time and place, and offering flexible learning, curriculum or other elements of structure opportunities to individuals and groups of learners. IGNOU is serving its best in developing the attitude and aptitude among the learners for education for those who cannot afford to go far. Effective Student Support Services are a vital means of enabling students to cope with the academic and personal pressures of distance education. This research explored the implementation of Web Enabled student support services by IGNOU Regional Centre Karnal, in order to obtain feedback from the learners amidst COVID 19 pandemic. Keeping in view of the probability of responding to the questionnaire, a random sample was drawn from the 3400 learners of PG, UG, Diploma and Certificates Programmes, admitted for July 2019 (Fresh) under Regional Centre Karnal. An online questionnaire was used for the collection of the primary data that contained 12 Items based on the Likert Scale in addition to 16 open-ended questions. The Likert Scale items ranged (5 Point scale) from (1) strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) strongly agree. The other 16 items pertaining to the learner profile and using resources were also included in the questionnaire. The findings indicate a positive attitude among the IGNOU ODL learners towards learning through Web-enabled mode/online mode.

Keywords: ODL, IGNOU, Online Support Services

Introduction

Indira Gandhi National Open University (IGNOU), one of the world's largest Universities, has continuously endeavoured to build a knowledge society through the Open and Distance Learning (ODL) system. ODL is a tool for those who have no access to conventional education but want to continue their education to compete in the changing world. Open learning serves as an easy source of education for the marginalized and disadvantaged and inaccessible territories sections of society. Support services are very significant elements for all educational institutions in general; however, for distance learners, these services are more essential than traditional (F2F) counterparts. One of the most important reasons for this is that learners and instructors do not share the same physical environment and that distance learning settings generally require intrapersonal interactions rather than interpersonal ones. Some learners in distance learning programs feel isolated because of this geographical and transactional distance (Moore, 1993). Furthermore, some fail to feel a sense of belonging to the institution because of a lack of self-management skills, lack of motivation levels, and the need of being socialized. This is likely to lead to high drop-out and failure rates and noncompletion of studies as suggestions in the literature indicate (Simpson, 2003; Belawati and Zuhairi, 2007; Fraser and Killen 2006; Nsamba and Makoe, 2017). In order to overcome all these problems, support services have emerged as a critical element for an effective and sustainable distance education system. Student support services are developed by distance education institutions to help students with their learning. These services cater for students' cognitive, emotional and social needs. They serve as the interface between the institution and the student (Krishnan, 2012) because they compensate for the isolated "individual" by making the necessary basic facilities available, in the absence of "live support" from the teacher (Pulist, 2001).

The emergence of the Internet and related networks such as the World Wide Web has had and will increasingly have a radical effect on the transformation of education and training in all sectors. The impact is already significant in all developed countries, and the great majority of developing countries are despite difficulties and fears seeking to take part in the emerging global educational community. Within the context of distance education support services, it is natural to include technology-based and web-based services and also related materials. Moreover, institutions in the education sector are expected to use ICT (Information and Communication Technologies) effectively in order to be successful in educational activities and programs. In terms of the sustainability of the system, an institution should provide distance education services through ICT-enabled processes to support all stakeholders in the system, particularly distance learners. IGNOU today is making a valuable contribution towards the Digital Revolution in the field of education. It is leading the way for promotion of ICT applications across all its operations, from teaching–learning to provide technology-based support services. The aim of this study is to explore the effective use of technology, digital initiatives in providing for learner's support, and challenges faced by the learners.

Research Methodology

A single case study research design was used in the study. Keeping in view of the probability of responding to the questionnaire, a purposive random sample was drawn from the 3400 Learners of PG, UG, Diploma and Certificates Programmes, those are admitted for July 2019 (Fresh session) at various learner support centres under Regional Centre Karnal. The questionnaire was then administered to all 3400 learners and a later response of 300 learners was received.

Tools and Data Analysis

An Online Questionnaire through Google Forms was developed and used for the collection of the primary data containing 12 Items based on the Likert Scale in addition to 16 open-ended items. The Likert Scale items ranged (5 Point scale) from (1) strongly disagree (2) Disagree (3) Neither agree nor disagree (4) Agree (5) strongly agree. Part 1 consists of questions on personnel information of the students, Part 2 consists of questions on resources and availability of ICT infrastructure and view of the learners on online support services. Part 3 consists of statements about Student Satisfaction with Online Student Support Services. While Part 4 consists of questions i.e. positive aspects of online services and faced problems or challenges during availing the online support services. The raw scores are obtained after scoring the questionnaire. The following Statistical Techniques were adopted to realize the given objectives and to test the hypotheses i.e. (a) Descriptive

Analysis (Mean and S.D) and (b) Test of Significance (t-test). The mean and the standard deviation of the attitude scores of the entire sample were calculated. The mean and standard deviation of the attitude scores of all the sub-samples were also calculated. The test of significance (t-test) was used in order to find out the significance of the difference between any two means of the attitude scores of the sub-samples involved in this study.

Result and Discussion

In the present study, it is observed that 63.67 per cent of male learners showed interest towards education through ODL mode in comparison to females 36.33 per cent. Among these learners, the majority of the respondents were from Master's (PG) and Bachelor's (UG) Degrees (43 per cent and 44 per cent). And very few numbers were recorded from Diploma (9 per cent) and Certificate (4 per cent) programmes (Figure 1). Data reveal that more than half of the learners pursuing the study through the ODL System are unemployed (70 per cent) and belong to rural (60 per cent) backgrounds followed by employed (30 per cent) and urban backgrounds (40 per cent). In the present scenario, the use of ICT gadgets is also perceived and recorded that 85.33 per cent of learners are using the smartphone for their study as well as fewer are using the laptop (10.67 per cent) and Desktop (4 per cent) (Figure 2). Some financial glitches may be among these learners due to the majority of the rural background learners. Data reveal that the majority of the learners are using the IGNOU Regional centre website (57.33 per cent) and approaching the learner support centres (28.33 per cent) to collect the updated information for their study and a less number of the learners are using other Social media of Regional Centre i.e. Facebook page 4.00 per cent, while negligible numbers are noticed on the way to twitter account (Figure 3).

Figure-1: Programme wise number of respondents

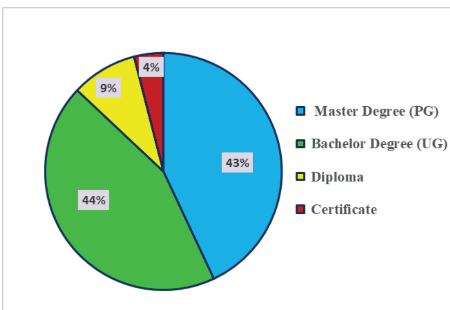


Figure-2: Acquired Source of IGNOU Online Services

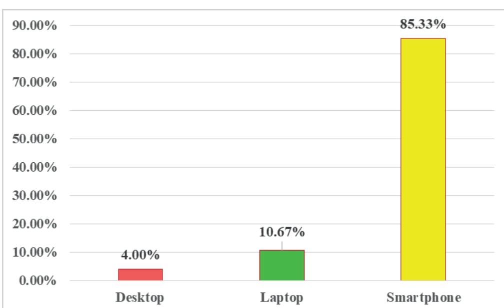
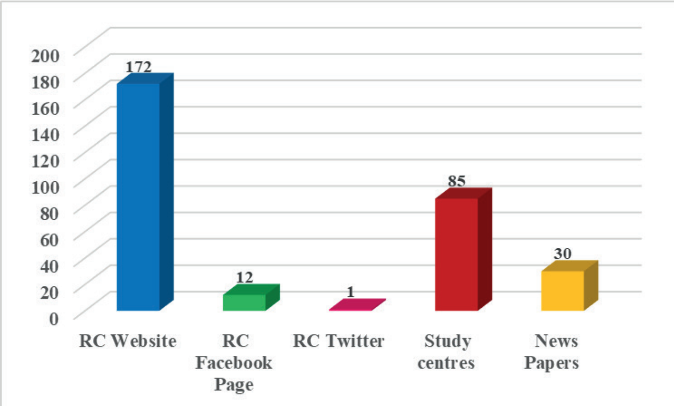


Figure-3: Source of information about IGNOU Web Enabled Support Services



As evident from the result (Figure 4), 48.33 per cent of learners are interested to study in offline mode with the ODL system, some of the learners (36.67 per cent) showed their interest in Web Counselling Video sessions, while very less number showed interest to study through Web Counselling Audio (4.33 per cent) and Facebook live session (10.67 per cent). The response of the learners was obtained to evaluate their satisfaction level with IGNOU towards Web Enabled Student Support Services amidst COVID-19. From the data, it is evident that 7 per cent learners strongly appreciated GV/GD/IRC Session of IGNOU, 10 per cent Facebook live sessions, 18.67 per cent Twitter, 14.67 per cent e-Gyankosh and e-Content, 17.33 per cent online submission of assignments, and 11.33 per cent for Online counselling session. On the other hand, more than half recommended these online support services i.e. GV/GD/IRC session (63.33 per cent), Fb live sessions (55.33 per cent), Twitter (63.33 per cent), e-Gyankosh (65.33 per cent) and e-Content (65.33 per cent) online submission of assignments (50 per cent) and online counselling session (70 per cent). While less than 2 per cent showed unwillingness 7.67 per cent online submission of assignments and less than 20 per cent neither agree nor disagree and less than 10 per cent disagree except for Fb Live sessions (12.33 per cent) and online submission of assignments (13.33 per cent) (Figure 5).

Figure-4: Preferred Mode of Study

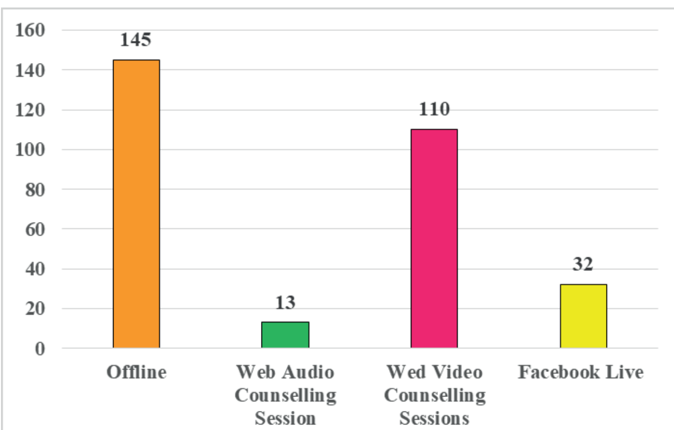
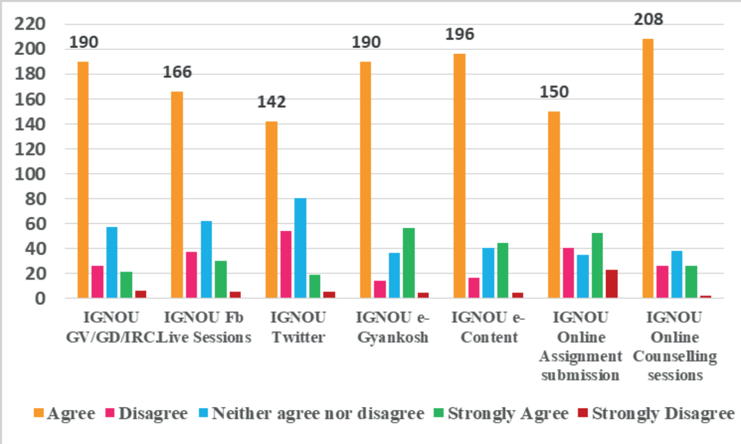


Figure-5: IGNOU Online Support Service including Online Counselling Sessions



Similarly, more than half learners (51.67 per cent) agreed to study online mode. Results on the basis of respondents show that the open education system is providing qualitative education (69.33 per cent) and they are getting related valuable information through web-linked support services (61.67 per cent). The majority of the learners (73.33 per cent) relied on online support services for smooth study. Though, use of the online support services is a financial challenge recorded (agreed) by 74.67 per cent of learners, while less than 10 per cent strongly agreed and strongly disagreed (Figure 6). However, it is observed from the respondent that overall more than half (63.61) of learners agreed with online support services, less than fifteen per cent neither agree nor disagree (14.39), strongly agree (10.95 per cent), disagree (9.17), and negligible were strongly disagreed (1.89 per cent) with web linked services (Figure 7). Thus, a positive attitude was seen among the learners towards ODL learning through various aspects of online mode amidst COVID-19.

Figure-6: Various sides of Online Student Support Services (OSSs)

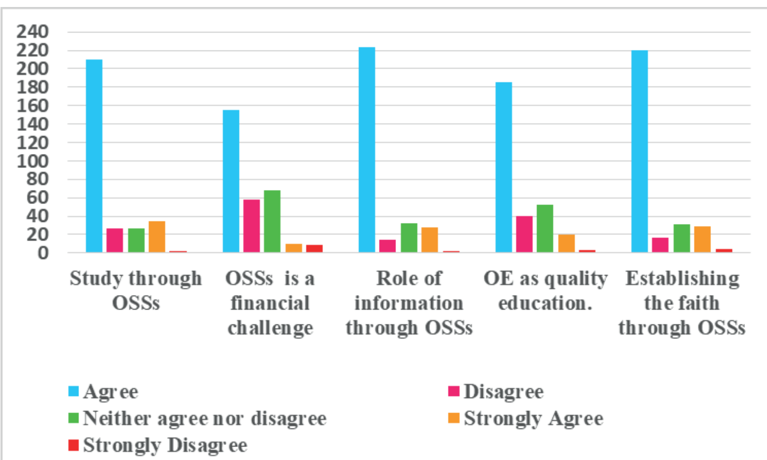
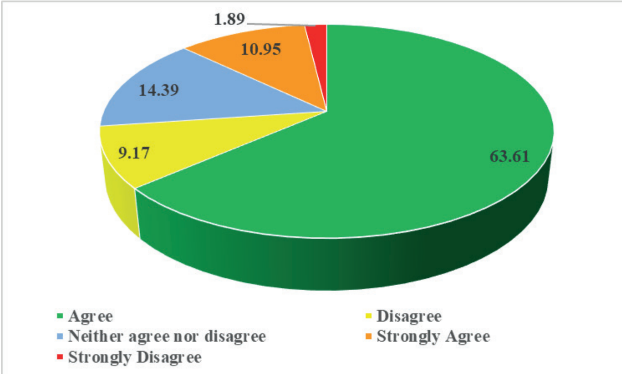


Figure-7: Overall views of learners for Online Support Services



Conclusion

With the advancement in ICTs, heterogeneous and diverse learners' groups who are geographically scattered and have increasing expectations from all concerned, necessitate effective support services to ensure proper guidance and learning conditions in open and distance learning systems. Learner support services include not only the availability of high-quality academic programmes but also ensuring that the students receive their study material on time, assignments are assessed and evaluated within the stipulated time frame and provided academic guidance. Web-linked devices are becoming ubiquitous while technological fluency is becoming a common expectation. It has been found that learners are increasingly using various ICT tools during their studies. ODL emerged as an effective tool to educate learners, particularly residing in far-flung areas and who are not able to have access to education due to tough geographical conditions, social and financial issues. The ODL system and its associated learner support services need to be extended to reach the unreached and improve the quality of these services.

There is a need to develop ways and means to improve upon the internal and external environment of the distance education system to avoid stagnation. Periodical surveys and feedback from learners and other associates are needed to review and fill the gaps in the present system as well as a centralized system may be developed for providing the web-enabled student support services by the open universities at all levels including learner support centres.

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Research Article

Effect of Online Learning Augmented Reality Programme on Academic Achievement in Science

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Abstract

This research explores the effect of NCERT-based Augmented Reality (AR) applications and conventional teaching on academic achievement in Science subjects in online classes. The sample consisted of 28 students from class IX of a government girl's senior secondary school in Sonepat, Haryana, India, during the academic session 2021-2022. The sample was selected based on academic scores attained by students in the previous VIII class in the science subject. Due to the experimental nature of the study, the students were equally and randomly segregated into the control and experimental group. A Self-constructed Science achievement test was implemented before and after the experiment. The control group was taught with traditional teaching, and the experimental group was taught by NCERT-based AR application on the theme "The Fundamental unit of life" in Science subject, and the application was shown to the students through Zoom online learning programme. The intervention programme was administered for four weeks. The data obtained were analyzed by applying the 't'-test. The research findings revealed that students' achievement in Science courses increased significantly with the use of NCERT-based AR applications. Moreover, the students keenly observed and showed interest in the 3-dimensional images. So, it is supportive and considerate in enhancing students' academic success. The research study has applications for in-service or pre-service teachers, policymakers of the curriculum framework, and secondary school students.

Keywords: NCERT-based Augmented Reality application, Student's Achievement, Online Learning Programme

Introduction

With the advancement in technology, there is a rapid expansion in various ways of learning and economic sustainability. Various mediums like virtual learning environments, augmented reality (AR), virtual reality (VR), and mixed reality (MR) are creating vulnerable and incredible prospects for enhancing motivation, achievement, and learning in different subject areas and educational settings. With the practical and affordable development in augmented reality, virtual simulated reality, and mixed hybrid reality, the learner got the chance to be acquainted with an immersive learning environment in and outside of the classroom (Liu et al., 2017). A vast majority of enterprises in education technology are using simulated virtual reality to provide real-life experiences in the classroom to motivate and grasp the student's attention.

Science education is a way of acquiring problem-solving skills, asking questions, applying learned skills, and developing critical thinking, communication, and organisation skills. Because of the above benefits of teaching science subjects in the future and present life, subjects must be prudently and pragmatically designed and applied with innovative methodologies and techniques to enhance motivation and success among students (Nurita et al., 2017). There are various innovative methodologies and applications like role-playing (Wulandari, 2018), experimentation (Shana and Abulibdeh, 2020), and Gamification (Kalogiannakis et al., 2021; Hursen and Bas, 2019) in science subject that enhances academic success and motivation to learn new concepts of science. In contrast, it was observed that the traditional instructional method used by the teacher in a science course is poor in remembering skills among students (Aina and Langenhoven, 2015). Though in the traditional learning method, learners immediately recall only forty-two percent of the information; a week later, this rate diminishes to twenty percent (Bok, 2006). Therefore, the above findings indicate that student-centred and up-to-date activities should nurture students' curiosity, interest, academic success, and motivation. An effective learning environment including modern technologies like visual effects, simulation, and three-dimensional visualisation tools in the teaching-learning process enhances the student's interest, motivation, collaboration, the skills to remember and understand the concepts clearly and enjoyable (Price and Lee, 2013; Raja and Nagasubramani, 2018). According to societal demands, the perspective on science education has evolved with time (DeBoer, 2000). Therefore, the inclusion of the prevalent application of current technology in science education is augmented reality (AR) which solves current problems of science learning (Tsai and Wen, 2005; Chen and Tsai, 2012; Lin et al., 2019). Augmented reality is a technology that supports the interaction and collaboration between virtuality and reality, which supplements each other (Azuma, 1997). It is the amalgamation of digitalization with concrete objects, which allows a real-world user to interconnect with the digital apparatus impeccably. Therefore, augmented reality is one of the innovative technology used in the teaching-learning process (Timur and Ozdemir, 2018), which contribute to the current learning environment (Ozdemir, 2017) and brings new possibilities for transforming education (Wu et al., 2013, Huang et al., 2016).

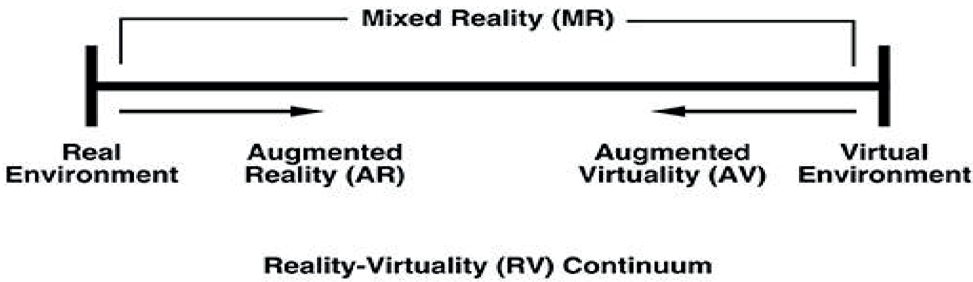
Augmented Reality

Augmented reality (AR) is a technology that overlays a computer-simulated image of the existing domain, thus providing a multifaceted observation. It is a simultaneous association where simulated and factual phenomenon exists collectively (Azuma et al., 2001; Carmigniani and Furht, 2011). It is a three-dimensional technology that helps to comprehend and recognize the existing domain enclosed by items produced in computer-generated settings (Leung and Blauw, 2020). Additionally, augmented reality (AR) is a technology-based representation that connects real and virtual spaces (Diegmann et al., 2015). In AR, an innovative learning environment and new opportunities are available to facilitate learning (Huang et al., 2016). The functioning of augmented reality is possible with the help of mobile technology that connects the real-world environment by visually overlaying and linking a current view with virtual objects.

On the other hand, virtual reality is the replication of computer-generated insightful information (Panciroli et al., 2018). It is experienced in a simulated learning environment by computer technology in which one's actions moderately govern the surrounding learning environment

(Merriam-Webster.com Dictionary). Therefore, augmented reality helps in understanding facts or information about concepts in an actual environment that seems to be challenging to imagine and explain (Del Cerro Velazquez and Morales Mendez, 2018). The structure and organisation of mixed reality are shown in Figure 1.

Figure-1: Structure and Organisation of Augmented Reality and Virtuality (Milgram et al., 1995)

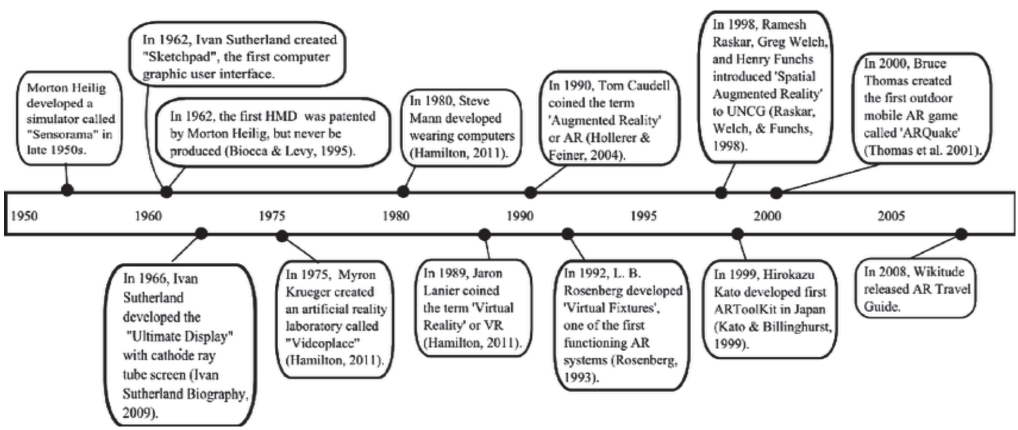


Source: frvir-02-647997-g001.jpg (510×184) (frontiersin.org)

Genesis of Augmented Reality

Caudell and Mizell (1992) used the augmented reality model for demonstration in companies, and with the progression in technology and innovation, the use of computers and phones has become simpler and more accessible in a diverse environment (Johnson et al., 2010). As a result, the various technical tools are applicable in many areas, including scientific research and art activities (Kapur, 2019). Augmented reality applications substitute the technological tools and applications used in diverse areas. Therefore, the topic of how the augmented reality application started and emerged. Additionally, how did advancements and inventions begin after being created? Figure 2 shows this information as a timeline.

Figure-2: Genesis of augmented reality (cited by Yuen et al., 2011)



Source: History-of-AR-a-brief-timeline.png (850×396) (researchgate.net)

Review of related literature

Learning is perceived as influenced by learners' experience, interest, and approach toward the technological environment (Norman, 2004; Preece et al., 2007). Augmented reality provides a realistic environment in a particular situation, like teaching imperceptible happenings, representing hazardous conditions, personifying intangible thoughts, and explaining complex evidence (Walczak et al., 2006). Augmented reality applications can enhance the teaching-learning opportunities that assist learning (Wu et al., 2013; Huang et al., 2016) by influencing the current learning environment (Johnson et al., 2014; Ozdemir, 2017). It is an innovative and advanced technology applied in educational settings (Timur and Ozdemir, 2018). The augmented reality application can focus the student's attention by bringing vivid reality to a course (Winkler et al., 2002). Together, the virtual and physical element demonstrations allow viewers to see how three-dimensional things relate to abstract ideas (Arvanitis et al., 2009). Augmented reality application is capable of enhancing interest among learners (Sotiriou and Bogner, 2011), symbolizes learning and wisdom (Kaufmann Schmalstieg, & Wagner, 2000), and increases the three-dimensional capabilities of the learners (Kaufmann et al., 2005; Martin-Gutierrez et al., 2010), increases motivation and students engagement in the lesson (Klopfer and Squire, 2008; Sotiriou and Bogner, 2011; Di Serio et al., 2013). AR application can attain higher-level cognitive skills (Dunleavy et al., 2009). Therefore, AR application used in educational settings produces positive and constructive outcomes. Tsai and Wen (2005), Chen and Tsai (2012), and Lin et al. (2019) research findings supported the importance of technology and competence in science learning. Palmer (1999) suggested in his study that if AR is used in Science subjects, learners clearly understand abstract and complex concepts. For instance, in some Science topics where the learner finds difficulty in understanding and learning, AR technology assists in visualising the three-dimensional object's image (Wu et al., 2013). AR applications developed for educational purposes are less adapted or modified according to the learning environment (Cuendet et al., 2013). Furthermore, the research on the effects and implementation of AR is in the zygotic stage, and to understand the benefits of augmented reality, the frequency of research in this area must be enhanced.

The literature review shows the vacuum of learning science among secondary students, and the present research addresses the existing gap in the Indian context.

Envisioned e-Pathshala AR Application-An Initiative of NCERT

The fundamental aim of contemporary education is to increase quality aspects at all stages of learning. The digital resources facilitate the learner to move beyond the classroom and textbooks, offer a vivid, experiential learning environment, and develop problem-solving approaches among learners. In the digitalization context, the e-Pathshala AR Application is an initiative of NCERT under the guidance of the Ministry of Education-Government of India, directed to invigorate the textbooks, augment or intensify learner-to-learner, teacher-to-teacher, and learner to teacher. Through augmented interaction, the learner will be able to understand the concept by experimentation rather than through reading and memorization. Augmented reality's purpose is to change inactive listeners to active listeners. Therefore, the e-Pathshala AR application is an effort toward Prime Minister "Digital

India" by exploring different technology areas.

Rationale

The rationale of the study was to discover an augmented reality-based teaching strategy that helps students in attaining academic achievement. In augmented reality, students can gain a three-dimensional experience of content or subject in a virtual environment. A positive environment is created, which thereby enhances their academic achievement. The performance of the student must be compared with their past experiences. The study's rationale was to employ an augmented reality application launched by NCERT, New Delhi, India, and identify the effect on students' academic achievement.

Objectives

The research study is intended to recognize and understand the following objectives:

I. To employ an augmented reality application launched by the NCERT, New Delhi.

II. To find out the effect of AR application on the academic achievement of secondary school students in science.

Hypothesis

The following hypothesis was developed based on the literature review:

> Augmented reality application has a significant positive effect on academic achievement in science.

Methodology

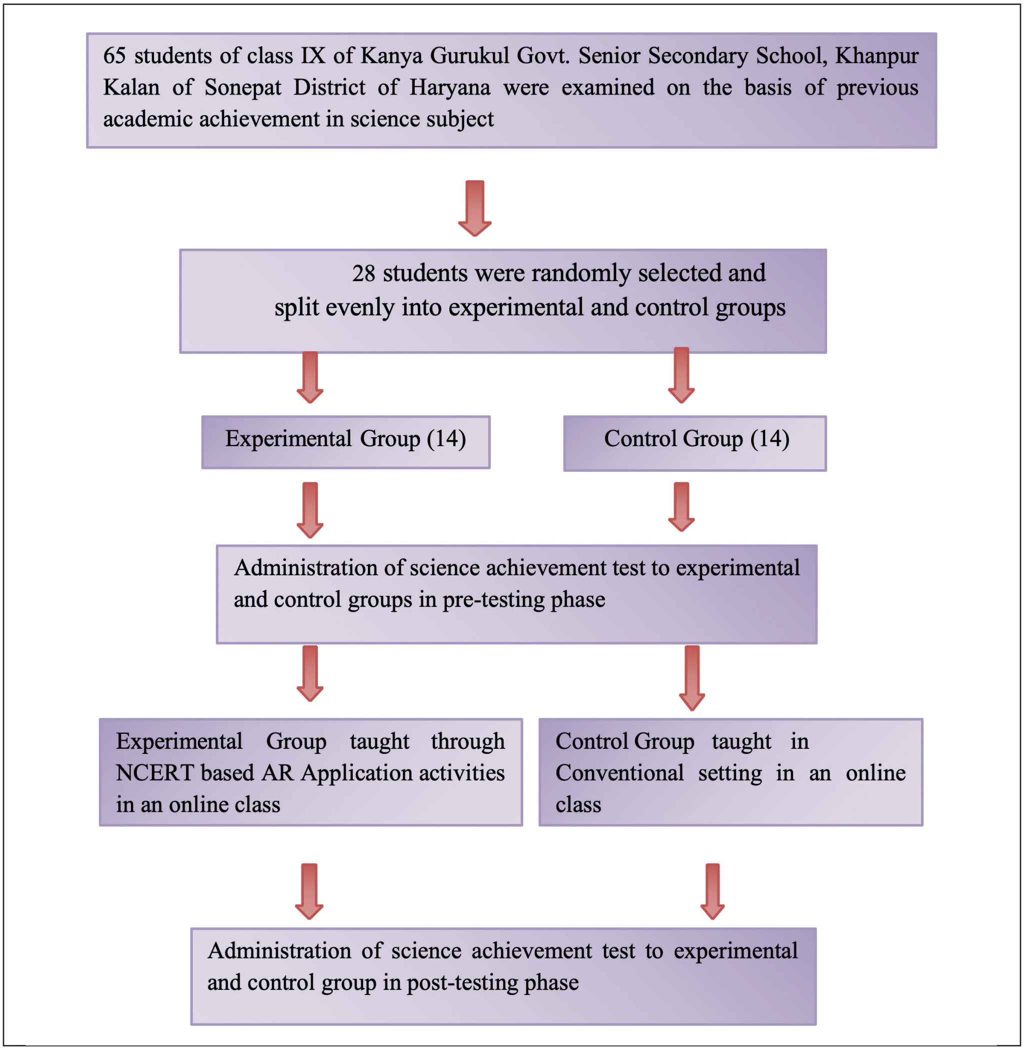
This section includes research design, sample, tools, experimental procedure, and data analysis and interpretation. In the present research, the NCERT e-pathshala AR application (intervention) was an independent variable, and the score attained by subjects in the science achievement test was a dependent variable.

Research Design and Procedure

The "pre-test, post-test true experimental design" was used to determine how the NCERT-based e-Pathshala augmented reality application affects students' academic achievement. In a true experimental design, students were randomly selected and split evenly into experimental and control groups. Considering the research design, the academic achievement test was applied as a pre-test to determine the level of attainment in Science subjects among ninth-class students. After the pre-test, the students were exposed to the NCERT-based e-Pathshala augmented reality application as an intervention programme in the experimental group, and the control group was taught through the traditional method. Then, post-testing was done to find out the success of the applied programme. The above procedure determines to what extent the applied programme affects students' academic attainment. Finally, the AR application was shown to the students through Zoom online learning platform.

Considering the specific design, an academic achievement test of sixteen items was applied as a pre-test to determine the level of attainment in science among ninth-class students. After pre-testing, the students were exposed to the NCERT-based e-Pathshala augmented reality application as an intervention programme, and after that, post-testing was done to determine the program's effectiveness. The steps of the intervention programme are shown in Figure 3.

Figure-3: Flow chart of Experimental Design



Sample

The study sample comprised 48 secondary school students studying in Kanya Gurukul Government Senior Secondary School, Khanpur Kalan, Sonepat, Haryana, in the academic session 2021-2022. The school was selected through a convenient sampling technique. This was because of school closures during lockdown due to the COVID-19 pandemic, and finding an appropriate number of students in the online learning programme was challenging.

Tools

A self-made science achievement test was developed to assess student achievement in science by considering the content and objective of science teaching. The chapter for achievement test construction was "The fundamental unit of life" (syllabus of ninth class followed by Haryana Board of School Education), prescribed by NCERT. Initially, 20 items were included in the planning phase related to four domains of instructional objectives, i.e., knowledge, understanding, application, and skill. The test items of selected content were multiple choice questions of one mark each. Students had to give their responses on the same question-cum-answer sheet, and the time for attempting the test was 35 minutes. The scoring key was also prepared for the above said questions.

The try-out of the achievement test was governed by a sample of 100 students of class X, and scoring was done accordingly. Subsequently, item analysis is done to determine the item quality and was exhibited in two ways, i.e., item difficulty value and discriminating power. The scoring sheet for each student for item analysis was arranged from highest to lowest score in descending order. The item analysis is done on the top twenty-seven per cent and bottom twenty-seven per cent test scores (Kelley's method 1939).

a. The given formula calculated the difficulty value of each item of the achievement test:

$$\text{Difficulty Value (D.V.)} = \frac{\text{Number of students who answered the items correctly in upper group and in lower group}}{\text{Total number of students}}$$

Based on difficulty value, too difficult and too easy items were deleted. The calculated difficulty value ranges from +0.20 to +0.80, and items below +0.20 and above +0.80 were rejected.

b. Similarly, discriminating power value is employed to discriminate between above average and below average learners and calculated by formula;

Discriminating Power=N_U-N_L / N

N_U and N_L =Number of students who answered the items correctly in the upper and lower group

N=Number of students who answered the items correctly in each group

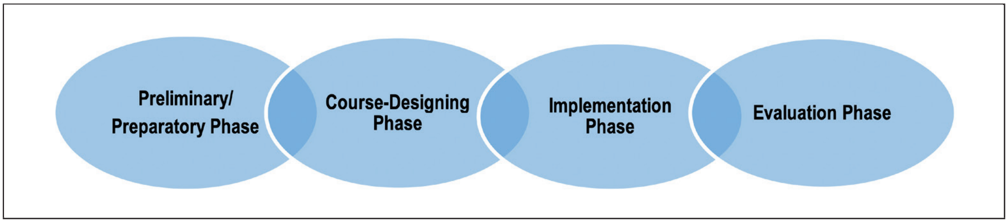
The calculated discriminative power value ranges between +0.20 (lowest value) to +0.50 (highest value). Items below +0.20 and above +0.50 were rejected. Therefore, the final science achievement test includes questions with acceptable discriminative power indexes (+0.20 to +0.50) and item difficulty value indexes (+0.20 to +0.80). Eventually, 16 items were selected and retained for the final science achievement test.

The split-half and Cronbach's alpha methods were used to calculate the science achievement test's reliability and validity, and the results showed that they were, respectively, 0.69 and 0.82 and were found reliable. The validity of the achievement test was determined by establishing content and face validity. Subject experts reassessed items selected for achievement test construction, the specialized teacher in science teaching was involved in assessment and evaluation, and the language expert edited test items. The ambiguous items were adapted, modified, and reworded in simple sentences and lucid language.

Experimental Process of the Research

The experimental research process comprises four phases: preliminary/ preparatory phase, course designing phase, implementation phase (application of NCERT-based e-pathshala AR application), and evaluation phase, as shown in Figure 4.

Figure-4: Experimental Process of Research



I. Preliminary/ Preparatory Phase:

In this phase, prior consent was taken from the students who were willing to participate. A need-based analysis survey was conducted to know the interest and aptitude of learners toward the online learning environment to avoid boredom in learning and a pre-test was applied.

II. Course–Designing Phase:

After considering the needs and requirements of the learner, the technical supported Science course design based on the NCERT e-pathshala AR application was applied. The design of the course was a four-week augmented reality-based activity prepared on the theme "The Fundamental Unit of Life." In the course-designing phase, persistent help was taken from science teachers and curriculum developer professionals who understand the use of augmented reality applications.

III. Implementation Phase:

Before the execution of a four-week experimental programme, an orientation programme was conducted, where students were informed about NCERT-based e-pathshala augmented reality applications, and a pre-test was conducted. After the orientation, the execution of the course with the topic "The Fundamental Unit of Life" was initiated.

IV. Evaluation Phase

In this phase, students' views were taken about the augmented reality teaching method, whether the content taught through this application accomplished the objective or not was noted, and a post-test was applied. Detailed information about the four-week experimental process is shown in Table 1.

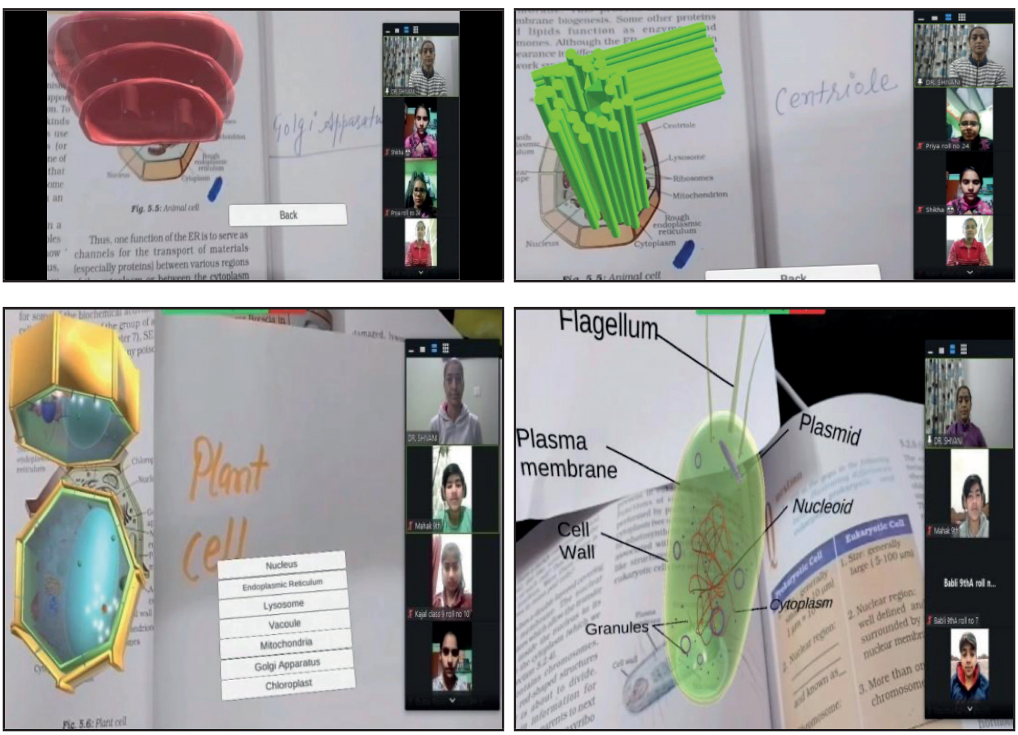
Table-1: Information about four week's course design

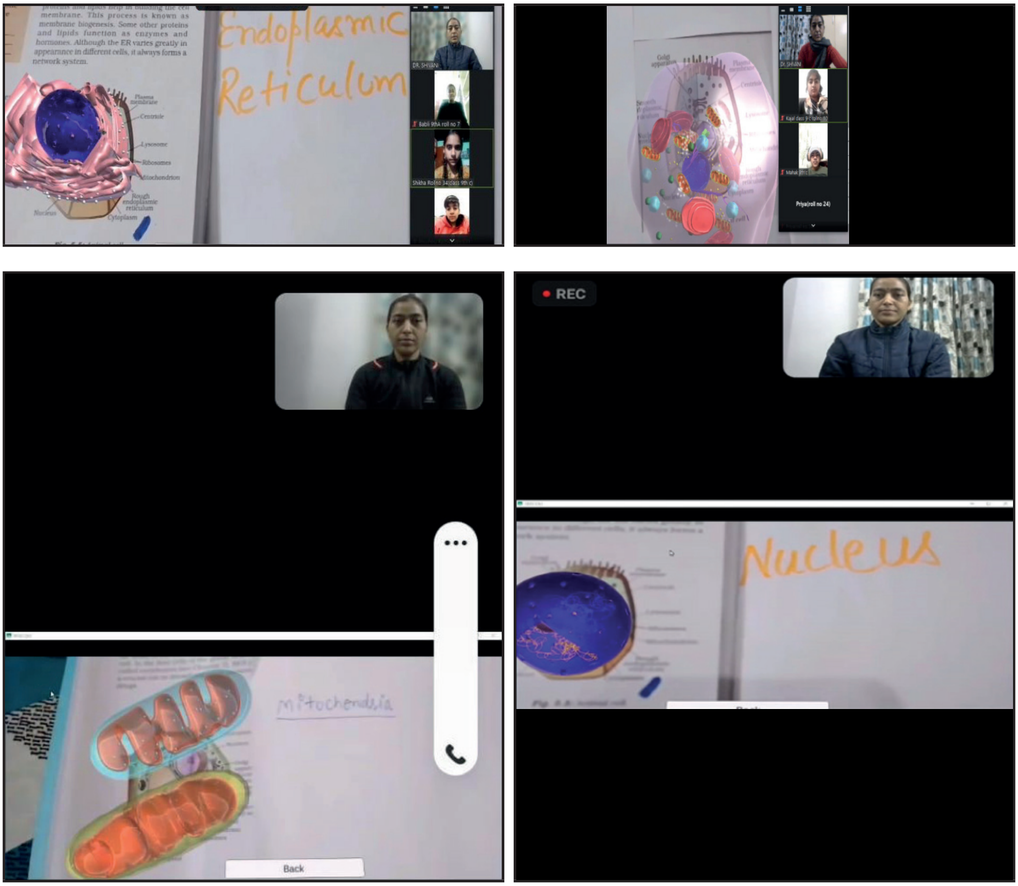
Week	Topic	Learning objectives	Learning activities	Learning outcome
First week	The Fundamental Unit of Life	To understand that all living organisms are made up of cells. To know the basic cell composition in an AR environment	Displaying the formation and structure of a cell in an AR environment and by adding video	To give examples of cell composition in leaf peels, root tips, onion peels, etc.

Week	Topic	Learning objectives	Learning activities	Learning outcome
Second week	The Fundamental Unit of Life	To understand the structural and functional system of organelles present in an animal cell in an AR environment	Demonstrating and displaying the structural and functional system of organelles present in an animal cell in an AR environment	Realizing the importance of different cell organelles present in animal cell
Third week	The Fundamental Unit of Life	To understand the structural and functional system of organelles present in a plant cell in an AR environment	Demonstrating and displaying the structural and functional system of organelles present in a plant cell in an AR environment	Realizing the importance of different cell organelles present in plant cell
Fourth week	The Fundamental Unit of Life	To differentiate between animal and plant cells in an augmented reality setting	Elucidating the differences between animal and plant cells in an augmented reality setting	Necessary information about the significant differences between plant cell and animal cells

Some glimpses of the use of NCERT-based applications are shown below in Figure 5.

Figure-5: Glimpses of the use of NCERT-based applications





Results

The mean, standard deviation, and degree of freedom of pre-testing and post-testing scores of the students in both groups were computed and tested for significance of difference by using paired sample “t” test. Before this Shapiro-Wilk Test was applied to determine the normality of the data, it was observed that data is normally distributed. Therefore, the results obtained are shown in Table 2.

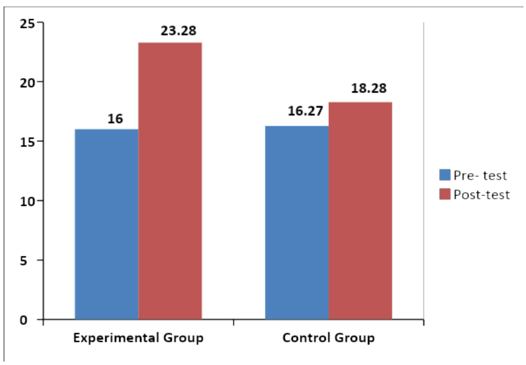
Table-2: Academic Achievement Mean Scores of the Experimental Group and Control Group

Variable	Phase	Group	N	Mean	SD	df	‘t’ Value	Significance Level
Science Academic Achievement	Pre-testing	Experimental Group	14	16.00	6.65	13	0.69	Not-significant at 0.05 level
		Control Group	14	16.27	5.96			
	Post-testing	Experimental Group	14	23.28	6.25	13	2.16	Significant at 0.05
		Control Group	14	18.28	5.96			

Table 2 indicates that at the pre-testing phase, the mean and standard deviation scores of the experimental group were 16.00 and 6.65, whereas the mean and standard deviation for the control group were 16.27 and 5.96, and the 't value of both groups were 0.69 at 13 degrees of freedom which is not-significant at 0.05 level. It means students in both experimental and control groups have the same level of academic achievement before the onset of the intervention programme.

Further, it is also evident from Table 2 that the post-test mean and standard deviation value for the experimental group were 23.28 and 6.25, respectively, whereas, for the control group, it was found to be 18.28 and 5.96. For a one-tailed test, at a 5% significance level, the critical table value of 't' with the degree of freedom 13 is 1.71, and our computed 't' value is 2.16. Hence, it is greater than the critical table 't' value of 1.71. Therefore, it is to be taken as significant at a 5% significance level but does not reach 2.50 and is not significant at 0.01 levels. It reveals that the experimental group students attained higher academic success than the control group after the intervention of augmented reality in online classes. The graphical representation of the above results is given in Figure 6.

Figure-6: Graphical presentation of Academic Achievement results



It is depicted in figure 6 that there is an enhancement in post-test scores in both groups to pre-test scores. Further, it also revealed that the improvement is highly visible in the experimental group in comparison to the control group.

Comparison of Academic Achievement Gain Scores

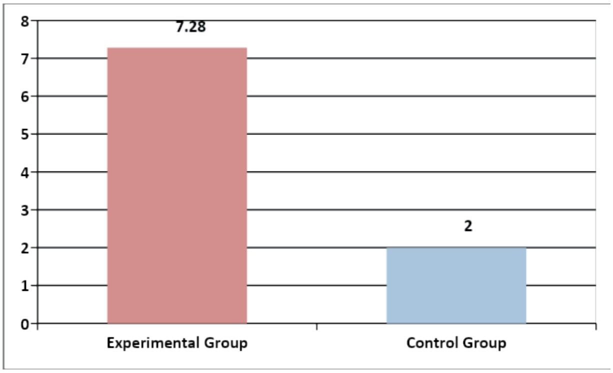
The mean and standard deviation of the gained academic achievement scores of both experimental and control groups were 7.28± 2.16, whereas, for control groups, it was 2.00±2.48. The "t" value for both groups was 2.16 and was found significant at 0.05 levels. The gain score difference of the experimental group is three times greater than the control group and is shown in Table 3.

Table-3: Gain score difference between the experimental group and control group

Variable	Group	N	Mean	SD	"t" value	Significance levels
Academic Achievement	Experimental Group	14	7.28	2.16	2.16	Significant at 0.05 levels
	Control Group	14	2.00	2.48		

Further, the experimental group has shown higher academic attainment after their exposure to augmented reality-based intervention than the control group. Therefore, it is concluded that teaching with augmented reality applications significantly positively affects academic success. This can be graphically represented in Fig. 7.

Figure-7: Mean Gain Scores of Academic Achievement



Therefore, it is concluded that students of the experimental and control groups differ significantly from each other. So it is concluded that augmented reality teaching has a positive advantage over the traditional method.

Discussion

It is clear from the results that using AR applications in Science learning is effective. Petrov and Atanasova (2020) supported the results, and Lin et al. (2019), confirmed that the use of augmented reality in STEM education helps in acquiring the skill to discover, train, and correlate with STEM education, and also the augmented application has a positive effect on spatial ability on medium achievers mathematics students. Research studies (Dede, 2009; Chang et al., 2016; Hwang et al., 2016; Cetin and Turkan, 2021) confirm that augmented reality complements student-teacher interaction and enhances academic achievement. The findings are incongruent with Kumaran, Santhi, and Anand (2007), reflecting that developing augmented reality applications helps in learning the various application domains of civil engineering.

Conclusion

The present study justified that augmented reality application in science helps increase learners' academic achievement. Besides research findings, it was also observed by the researchers that augmented reality is effective in creating a world that does not exist physically, and students were showing keen interest and curiosity towards 3-dimensional images and were more focused on Science learning. Furthermore, the finance issue was also resolved because no such costly gadgets are required in augmented reality applications in the teaching-learning process. Therefore, it is suggested that augmented reality helps to bring reality to the classroom and develop divergent thinking among learners.

Educational Implications/ Recommendations

The outcomes of this research may be helpful for researchers, students and teachers, and policy planners. AR application is an exciting and innovative way of teaching which helps significantly in raising the students' achievement, updating knowledge, solving queries, motivation, comprehensive understanding and application of the concept, and positive attitude towards science subject. This form of learning eases the learning cost and is accessible training simulations to different-stage learners. For implementing the AR application, the positive attitude of teachers, facilities like proper space, seating arrangement, different improved digital learning materials, internet connectivity, etc., need to be at every learning end to make the academic atmosphere more lively and exciting. The effect of AR application can be further extended to other variables like scientific creativity, scientific attitude, science self-efficacy, science process skills, and laboratory skills by conducting experiments in the virtual and simulated learning environment. NCERT's e-Pathshala AR application is presently applicable for class IX and X science subjects only. Therefore, a similar application can be extended to the achievement of learners of different age groups, grade levels, and different subject areas. Hence provisions should be made in teacher education programmes to explore the possibilities of practising innovative e- Pathshala AR applications like models.

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E- Resources:

frvir-02-647997-g001.jpg (510×184) (frontiersin.org)

History-of-AR-a-brief-timeline.png (850×396) (researchgate.net)

Research Article

A systematic literature review on significant and sustainable impact on teaching and learning in the 21st Century classroom

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Abstract

This study presents a comprehensive examination of the teaching and learning benefits of digital storytelling in the 21st-century classroom, as well as the prevailing theoretical and methodological trends in digital storytelling research in school education. A systematic literature review encompassed 59 articles published between 2000 and 2021, sourced from databases such as Google Scholar, ERIC, EBSCO, Web of Science, and Social Science Index. Digital storytelling has a significant positive impact on the 21st-century classroom. The literature highlights that digital storytelling is an invaluable instructional tool for teachers to develop the essential 21st-century skills and competencies required to meet the demands of the global economy. The active involvement of learners in the creation and presentation of their own digital stories has been found to foster the development of these skills. The review also identifies the prevailing theoretical and methodological perspectives observed in digital storytelling research over the past two decades, which predominantly revolve around the theoretical framework of social constructivism and the use of interviews as a data collection method. Furthermore, more than 50 per cent of the studies focused on the second-grade level, indicating a concentration of research in this educational context. The findings of the literature review highlight essential areas for future research in digital storytelling. This study contributes to the existing literature by providing a comprehensive overview of the teaching and learning benefits of digital storytelling in the 21st-century classroom. It also identifies research gaps and areas for further exploration, facilitating the advancement of knowledge in this field and informing future research endeavors.

Keywords: digital storytelling, teaching-learning benefits, benefit to disabled children, 21st Century classroom

Introduction

In the 21st century, with the rapid advancements in technology and the changing landscape of education, there is a growing need to explore innovative approaches that can significantly impact teaching and learning in classrooms. One such approach that has gained considerable attention is digital storytelling. Digital storytelling in education harnesses the power of technology to engage learners in a creative and collaborative process, enabling them to construct meaningful narratives using various media elements. This approach has been widely recognized for its potential to enhance students' cognitive and literacy skills, promote critical thinking, and foster effective communication and collaboration. While digital storytelling holds promise as a valuable educational tool, there is a need for a comprehensive and systematic review of the literature to understand better its significant and sustainable impact on teaching and learning in the 21st-century classroom. Existing studies have provided insights into the positive effects of digital storytelling on various educational outcomes, such as language competence, identity exploration, and presentation skills. However, there is a lack of meta-synthesis literature reviews that synthesize and analyze the existing research in this field.

Therefore, this systematic literature review aims to bridge this gap in the research by conducting a comprehensive analysis of the available evidence on the significant and sustainable impact of digital storytelling on teaching and learning in the 21st-century classroom. By employing a rigorous meta-synthesis approach, this study will synthesize the findings from multiple studies, providing an overall picture of the effectiveness of digital storytelling as an educational tool. This systematic literature review will draw upon the citations and findings discussed in the previous sections to advance our understanding of educational digital storytelling and its impact on teaching and learning. By synthesizing and analyzing the existing research, this study aims to provide valuable insights into the potential of digital storytelling as an effective educational tool in the 21st-century classroom, thereby informing educators, researchers, and policymakers about its significance and sustainable impact.

Theoretical Background

Educational digital storytelling is grounded in the theoretical framework of constructionism, developed by Seymour Papert of the MIT Media Lab, building upon Jean Piaget's constructivism theory of learning. Constructionism emphasizes the active creation of tangible outcomes in the real world as a means of meaningful learning. According to Papert, successful learning occurs when learners engage in the process of constructing physical or meaningful objects within educational activities. However, constructionism extends beyond mere construction and highlights the importance of the creative process and the sharing of the final product with others to harness the learning experience fully. Papert's focus was on how learners interact with their own creations or artifacts, as these interactions promote self-directed learning and the construction of new knowledge. He emphasized the role of technologies, media, and context in human development. Constructionism theory posits that learning is most effective when learners create a product to share with others. This theory aligns with constructivism in promoting individualized, child-centered, and discovery learning, where children actively explore new knowledge and construct meaning by connecting it to their prior knowledge and experiences.

While constructivism centers on mental constructions, constructionism emphasizes materializing learners' ideas in tangible objects in the real world, referred to by Papert as "public entities". Constructionism sheds light on how ideas are developed and transformed through diverse media, shaped by learners' minds, and actualized within specific contexts. In other words, the focus shifts from universal learners to individual learners' interactions with their own artifacts, representations, and objects to think. Educational digital storytelling embodies Papert's philosophical approach and learning theory of constructionism by emphasizing collaboration, the creation of meaningful artifacts, sharing those artifacts, and utilizing tools, media, and context. A crucial element of educational digital storytelling is the expression of ideas, thoughts, and emotions by learners to their peer groups through communication and collaboration. Drawing upon the theoretical framework of constructionism, educational digital storytelling underscores the importance of learners actively creating tangible outcomes and sharing them, facilitating meaningful learning experiences. Through its incorporation of collaboration, diverse media, and artifact development, educational digital storytelling aligns with the principles of constructionism and offers a powerful approach to learning in the 21st-century classroom.

Digital story

Digital storytelling is a multimedia form of presentation that combines photos, animations, music, and narration within a narrative structure. It emerged from artistic experimentation in the 1970s and 1980s, allowing for the sharing of personal narratives with a broader audience. The Center for Digital Storytelling defines it as using computer-based storytelling tools, incorporating various multimedia elements like graphics, audio, video, and web publishing. Digital storytelling provides a creative platform for individuals to express their experiences and perspectives using technology, engaging audiences through visual and interactive elements. It transcends traditional limitations, allowing stories to be shared globally through digital platforms, fostering connectivity, and amplifying diverse voices. In summary, digital storytelling combines technology and artistry to create impactful narratives that connect with audiences worldwide.

Digital Storytelling in Classroom

Storytelling, as a pedagogical approach, has been recognized for its effectiveness in enhancing learning outcomes across various domains of education (Sharda, 2007; Smeda, Dakich, & Sharda, 2014). With the rapid advancements in technology, storytelling has taken on a digital form, utilizing various hardware and software systems (Van Gils, 2005; Smeda, Dakich, & Sharda, 2014). This digital transformation has given rise to the concept of digital storytelling, which has emerged as a powerful tool in educational settings for enhancing teaching and learning (Xu, Park, & Baek, 2011). Digital storytelling offers unique opportunities for children to nurture their creativity and problem-solving skills in innovative ways (Ohler, 2008). In the twenty-first century, the evolution of technology and global competition has significantly influenced the conceptualization of literacy practices. Educators are now challenged to incorporate effective teaching strategies that blend traditional and innovative forms of literacy (Kress, 2003; Lankshear & Knobel, 2003; Mills, 2010). Digital storytelling is a technological application that harnesses learner-contributed content, empowering instructors to overcome the challenges associated with productive technology integration in classrooms.

By leveraging digital storytelling, educators can tap into the potential of student-generated content, enabling learners to participate in the creation and sharing of their narratives actively. This approach fosters engagement, creativity, critical thinking, and digital literacy skills among students. Furthermore, digital storytelling provides a platform for students to communicate their ideas, knowledge, and perspectives effectively, fostering a collaborative and interactive learning environment. Digital storytelling offers a promising avenue for educators to incorporate technology in meaningful ways that enhance teaching and learning. By embracing this pedagogical approach, educators can harness the power of technology to engage students, foster creativity, and develop essential literacy skills for the twenty-first century.

21st Century Classroom Skills

21st-century learners need to develop various skills to succeed in today's society. Communication, collaboration, creativity, critical thinking, and problem-solving are essential skills that enable students to thrive in the 21st century. These skills, often referred to as 21st-century skills, are vital for both everyday life and the workplace. Therefore, it is crucial to incorporate these skills into the education of students alongside subject-specific content. Digital storytelling plays a significant role in fostering 21st-century skills among students. When students create their own digital stories, they acquire key skills and literacies identified by the Consortium for 21st Century Skills (Robin, 2008). These literacies, often called "Twentieth-Century Literacy," have evolved with technological advancements (Robin, 2006; Brown, Bryan, & Brown, 2005). These 21st-century literacies encompass digital literacy, which involves effective communication, social issue discussions, information gathering, and seeking support. Global literacy focuses on reading, analyzing, interpreting, and responding to messages from a global perspective. Technology literacy uses devices and technological advancements to enhance learning, performance, and productivity. Visual literacy involves the ability to communicate, understand, and produce visual images. Information literacy encompasses finding, analyzing, evaluating, and synthesizing information (Robin, 2006).

In addition to the aforementioned literacies, developing digital stories also cultivates a broader set of skills. These include research skills, writing skills, organization skills, technology skills, presentation skills, interview skills, interpersonal skills, problem-solving skills, and assessment skills (Robin, 2006). Garcia and Rossiter (2010) propose adding three additional skills to these literacies: empathy and perspectives, self-understanding, and community-building. These skills involve sharing experiences, expanding perspectives, self-reflection, and fostering communication and collaboration with others. Digital storytelling not only enhances students' technological proficiency but also nurtures a wide range of 21st-century skills and literacies. By engaging in the process of creating digital stories, students develop valuable abilities such as communication, critical thinking, problem-solving, and collaboration, preparing them to be active and informed citizens in an ever-evolving digital world.

Research Questions

This study aims to address the existing gap in comprehensive and reliable research on digital storytelling in the 21st-century classroom. The research questions aim to address the existing gap in comprehensive and reliable studies on digital storytelling in the 21st-century classroom environment. By conducting a systematic review, this study aims to analyze the results of previous research holistically, examine the theoretical and methodological trends in digital storytelling in K-12 classrooms, and identify the areas that require further investigation and research in the field. The research questions are as follows

RQ1: Why is digital storytelling considered to have a significant and sustainable impact on teaching and learning in the 21st-century classroom?

RQ2: What are the prevailing theoretical and methodological trends observed in using digital storytelling in K-12 classrooms?

RQ3: What are the future research needs and areas of exploration in the field of digital storytelling in school settings?

Methodology

Systematic literature review

In this research, the researcher followed the PRISMA 2021 guidelines for data collection. A systematic literature review was conducted to identify, select, and critically evaluate published research works to address a specific research question. The review followed a well-defined protocol, with clearly determined inclusion criteria, and encompassed a systematic, comprehensive, and transparent search of published literature across multiple databases. This approach allows for the replication and innovative reproduction of the study by new researchers.

Literature Search and Author's Contribution

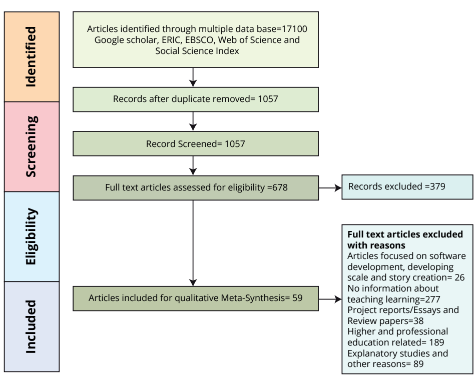
During the literature collection process, relevant search keywords such as "benefits of digital storytelling in teaching and learning," "educational implications of digital storytelling," and "digital storytelling and 21st-century competencies and skills" were used to obtain educational digital storytelling studies. Multiple databases, including Google Scholar, ERIC, EBSCO, Web of Science, and Social Science Index, were searched to gather the articles. The inclusion criteria for the meta-synthesis of research studies were as follows:

- Studies conducted between the years 2000 and 2021
- Studies available as open-access or publicly accessible
- Studies published in peer-reviewed journals and written in English
- Studies conducted with school children from pre-kindergarten to higher secondary level (K-12 grade)
- Studies addressing the teaching and learning benefits of using educational digital storytelling
- Studies addressing 21st-century competencies and skills

The first author systematically searched articles based on predetermined research questions, and the second author identified, selected, systematically analyzed, and critically examined 59 included articles. Both authors then classified the research work in a structured manner to answer the formulated questions, replicating and reproducing the findings. A comprehensive and systematic approach was taken to collect, analyze, and synthesize the literature, ensuring the inclusion of relevant studies that meet the predetermined criteria.

PRISMA chart

Figure-1: Search flow chart



Systematic Analysis of Selected Studies

The systematic analysis of selected literature focused on the three main research questions. The analysis involved examining the purpose of each study, understanding the theoretical foundations guiding the research, evaluating the rigor of the research methods, considering the grade level of participants, reviewing data analysis and interpretation techniques, assessing the validity of data collection strategies, exploring future research needs and methodological improvements, and analyzing the positive impacts and advantages of digital storytelling for various student populations. This systematic analysis provided a comprehensive understanding of the research landscape, encompassing objectives, theoretical foundations, methodologies, participant characteristics, data analysis approaches, data collection strategies, future research needs, and the benefits of digital storytelling in education.

Objectives of Digital storytelling research Studies

The objective of the systematic analysis was to examine and code the objectives of the research articles systematically to provide a comprehensive understanding of the objectives of digital storytelling in the 21st century. This analysis also aimed to provide literature references that can serve as a valuable resource for further research and understanding of the topic. By systematically examining and coding the objectives of the research articles, this analysis contributes to a deeper understanding of the purpose and focus of digital storytelling in the context of the 21st century.

Table-1: Objectives of Digital storytelling research studies

Theme	Reference
Academic and social skills	[4][7][8][14][19][22][23][24][30][31][37][40][41][44][47][51][57]
Integration of technology	[3][12 [15][18][22]][27][35][37][46][47][49][51][53]
Personality factors	[19][23][28][30][31][34][44] [47][52][54][57]
Academic achievement	[15][21][26][32][34][38][45][46][52][54]
21st Century competencies	[1][4][8][12][17][20][35] [56]
Learning	[9][12][27][35][47][49][56]
Classroom management	[2][4][15][23][27][35]
Perception and opinion	[23][32][38][42][59]
Knowledge construction	[40][49][53]

Theoretical and conceptual framework

The theoretical and conceptual frameworks employed in digital storytelling studies were systematically analyzed and synthesized. Using theories aims to contribute to developing research problems, designing appropriate research questions, guiding the selection of relevant information, interpreting the data, and providing explanations for observed phenomena. Most of the studies reviewed in this analysis adopted a social constructivist theoretical framework. Theoretical and conceptual frameworks used in the studies are presented in the table below. This analysis provides a comprehensive overview of the theoretical foundations of digital storytelling research, offering insights into the frameworks guiding the investigations.

Table-2: Theoretical and conceptual framework

Theme	References
Social Constructivism	[4][5][20][23][44][49][50][58]
Multiliteracies Pedagogy	[4][6][7][15]
New Literacy Theory	[49][55]
Child-centered learning	[28][53]
Situation learning and cognition learning	[32][47]
Dialogical approach	[49][55]
Critical literacy theory	[4][51]
Critical engaged pedagogy and global sharing pedagogy	[3][35]
Cognitive apprenticeship	[29]
Community learning and practice	[16]
Constructionism	[41]
Inquiry based learning	[30]
Active learning	[44]
Reflective learning	[51]
Cognitive developmental theory	[23]
Symbolic interactionism	[33]
critical race theory	[43]
Ecological system theory	[20]
Double diamond theory	[3]

Methodology

Research methodologies are essential in addressing specific issues and provide scholars with the necessary knowledge to apply them to real-world problems. By examining the research methods employed in digital storytelling studies, this synthesis aimed to understand which methods are most suitable and effective for investigating digital storytelling-related issues in school education. The detailed examination revealed that most researchers opted for quasi-experimental research methods as their approach to conducting research in digital storytelling.

Table-3: Methodology

Theme	Reference
Quasi-Experimental	[7][19][23][27][28][38][47][51][52][53][54][57]
Case study	[3][15][18][25][40][41][48][49][50][59]
Action research	[17][22][55][58][50]
Mixed method	[9][16][44][46]
Experimental	[1][35][42]
Participatory research	[11][33]
Ethnography	[4]
Narrative study	[51]

Grade of participants

In the selected digital storytelling articles, the participants were primary school students ranging from grades K-12. The systematic analysis revealed that researchers predominantly focused on secondary-level students (grades 6-8) in their studies. However, there was a limited amount of research conducted on digital storytelling in pre-primary level students. This finding highlights the need for further exploration and understanding of the application of digital storytelling in early childhood education.

Table-4: Grade of participants

Theme	Reference
Grades 6-8	[2][3][4][6][7][9][10][11][4][15][16][18[]21][22][23][33][41] [43][45][51][53][[55]
Pre-school to 5	[1][5][12][13][17][20][27][32][35][40][42][47][54][56][59]
Grades 9- 12	[8][11][18][19][28][34][45][47][49][51[[57][58]

Data collection

The data collection strategies employed in digital storytelling studies played a crucial role in determining the quality and reliability of the data analysis and interpretation. The systematic analysis revealed various data collection techniques, including surveys, interviews, observations, and document analysis. These strategies allowed researchers to gather diverse perspectives and rich insights on the benefits and impacts of digital storytelling in education. The careful selection and application of data collection methods ensured the validity and comprehensiveness of the findings.

Table-5: Data collection

Theme	Reference
Interview and focus group discussion	[1] [3][4][9][11][16][17][22][25][28][31][33][35][40][41][42][44][45][46] [48][49][50][52][55][58] [59]
Questionnaire and survey	[7][9][16][19][23][27][28][38][44][46][47] [51][52][53][54][57]
Artifacts	[3][15][18][25][40][41] [11][33][35][42] [9][44][46] [17][22][55][58][50]
Field notes	[1][3][9][11][16][22][25][33][35][45][48][50][52][55][58][59]
Observations	[1][3][4][9][22][25][28][33][35][42][44][48][52][55][58]
Video and audio records	[1][3][4][9][16][17][22][25][28][31][33][40][44][48][55][58][59]
Achievement test	[4][9][16][19][20][24][27][29][34][37][44][46][47]
Scales	[6][10][13][15][9][21][23][28][33][37][44][51][55][58]
Reflective journals	[8][15][16][19][20][49]
Documentary and blogs	[9][13][48][53]

Data analysis and interpretation

The data analysis and interpretation in the digital storytelling studies encompassed a range of approaches and techniques. Thematic coding/analysis was commonly employed, allowing researchers to identify and categorize recurring themes and patterns within the data. The descriptive analysis provided a comprehensive overview and summary of the collected data, while artifacts and content analysis examined the digital stories themselves for deeper insights. Ethnography and protocol analysis delved into the social and cultural contexts of digital storytelling practices, while interaction and dialogical discourse analysis focused on communication and dialogue within the storytelling process. Textual narrative and analytic memo techniques were used to explore the narrative elements and reflective insights present in the data. These diverse approaches enabled researchers to analyze and interpret the data from multiple perspectives, enriching the understanding of the impact and benefits of digital storytelling in education.

Table-6: Data Analysis and Interpretation

Theme	Reference
Inferential analysis	[1][7][16][19][23][27][28][35][38][44][46][47][50][52][53][54][57]
Thematic coding/ analysis	[4][5][9][11][13][17][21][24][43][45][51]
Descriptive analysis	9][16][23][27][44][46][50][52][54][59]
Artifacts and content analysis	[3][11][15][18][25][40][41] [42][55][58][50]
Ethnography and protocol analysis	[4][51]
Interaction and dialogical discourse analysis	[11][33]
Textual narrative and analytic memo	[51]

Future research needs, methodological changes, and context

The literature examination revealed several areas of future research needs and scope in educational digital storytelling. These can be classified into three main themes: the problems that need to be investigated, the methodological changes that are required, and the priority contexts for digital storytelling research in school education. Identifying and addressing these research needs will contribute to the advancement and understanding of digital storytelling as an effective educational tool.

Table-7: Future research needs, methodological changes, and context

Themes	Sub-themes
Problem to be investigated in educational digital storytelling	Integration of digital storytelling and augmented reality
	The social context of digital storytelling
	Gifted education curriculum and digital storytelling
	Individual education plan and personalized education
	Digital Storytelling in early childhood education
	Story writing in a digital context
	Efficiency and effectiveness of digital storytelling in STEM Subjects.
	Digital storytelling for remedial students learning
	Cooperative and collaborative learning
	Art of digital storytelling
	Curriculum design and digital storytelling
	Culture of thinking and digital storytelling

Themes	Sub-themes
Research methodology to be changed	Phenomenological studies
	Comparative studies (subject, grade, and country)
	Experimental studies
	Follow-up studies
Context need to be conducted	Inter-culture
	Multilingual and multicultural context
	Slumps, migrants and wide digital gap

Benefits of digital storytelling in the teaching-learning process

Numerous research studies have demonstrated the various benefits of educational digital storytelling in the teaching and learning process. Personalized education and instruction are among the attractive advantages observed in digital storytelling. Van Gil (2005) highlights that students can actively participate by presenting their understanding, reflections, and experiences while creating their own digital stories. This active engagement transforms them from passive information consumers to active knowledge constructors (Ohler, 2008). The UNESCO program for the United Nations Decade of Education for Sustainable Development acknowledges the significance of digital storytelling as a critical teaching strategy for achieving the objectives of education for a sustainable future (UNESCO, 2010). Teachers also recognize digital storytelling as a valuable tool for enhancing students' research skills and promoting other essential competencies. For instance, Smeda, & et.al. (2014) note that digital storytelling can improve spelling, writing, communication, and collaboration skills. Furthermore, it facilitates the learning of cross-curricular competencies such as teamwork, independent learning, and project work, empowering students to choose the competencies they want to develop (Smeda, Dakich, & Sharda, 2014). In addition to these pedagogical benefits, digital storytelling simplifies the comprehension of complex ideas through the use of multimedia (Oppermann, 2008). It provides an effective medium for learners to express their voices with creativity and intellectual depth. This fosters a sense of agency and empowerment among students. Moreover, educational digital storytelling is considered an asset-based pedagogy, as it incorporates multiple aspects of the core curriculum, allowing for the integration of various content areas (Benmayor, 2008). Educational digital storytelling offers personalized education, encourages active participation, enhances research and other key skills, facilitates the learning of cross-curricular competencies, promotes the comprehension of complex ideas, and empowers students to express their voices. It is recognized as a valuable pedagogical approach that aligns with the objectives of education for a sustainable future.

Table-8: Benefits of using digital storytelling in the 21st Century classroom

Characteristics of learners	Suggested instructional strategies	How to use digital storytelling	Benefits/outcome
Tech intelligence and creativity	Meaning full integration of technology into instructional methods, classroom activities and assignment.	Learners' creation of digital stories as classroom activities/ assignment and as group work	Deeper understanding
Multimedia lovers	Gives an active activity/ task/ assignment to complete	Synthesis content from a range of resources and create an entirely new story based on the content.	Higher order thinking
Interest in internet content creation	Encourage students to contribute helpful content blogs, and websites and create YouTube videos	Created stories upload to the blog, youtube, and other mediums.	World exploration Vast variety of resources, information and content Communication and collaboration Shared reflections Global pedagogical sharing Social interaction (William &et. al.,2018)
Inductive discovery	Just-in-time teaching, inquiry-based instruction and hypothetical case studies.	Organize their own ideas-ask questions-express opinions-construct narratives.	Motivation Experimental data interpretation
Hit or miss/ trial and error	Allow learners to use their techniques and strategies to solve problems and allow them to analyze their own failure and take complete control of their learning	to create their own stories through the learning of what worked and why? Or what didn't work and why?	Complex real-world problem-solving Critical thinking ability Research and experiment Alternative learning

Visual communication	Support endless possibilities for designing assignment innovative and creatively with the use of images, videos and augmented realities	Creative and innovative story making	Creativity and interest Inquiry based learning Research aptitude Long lasting memory Engagement and concentration Technology literacy (Robin, 2008)
Short attention span	Encourage digital multitasking	Making narrations their own pace	Improved attention Multiple intelligence Continuous engagement Concentration
Pressure to succeed	Activation and utilization of learners multiple intelligence	Narration from deep understanding and critical reflection	Critical thinking Deep learning Innovation Independent thinking
Self learners	Allow students to learn their own way	Making own content for learning	Interest and self motivation Research aptitude Content writer and creator
Gifted	More challenging and complicated problems	Freedom of expression and creation	Problem solving Critical thinking Discovery learning
Influencers	Allow learners take content from real life experiences or socially relevant content for assignment, classroom activities.	Own voice, sound modulation and emotions	Leadership Engagement Evoke emotions
feedback/ suggestion seeker	At the End of each storytelling section provide positive and critical feedback	Include peer feedback section in the digital storytelling process	Better planning Accepting positive and negative criticism

Benefits to gifted and learning disabled students

Digital storytelling in the classroom offers specific benefits to both gifted and disabled students. Gifted students can benefit from personalized education and instruction through digital storytelling, allowing them to explore their understanding, reflect on their experiences, and evaluate their potential (Van Gil, 2005). This active participation helps gifted students utilize their intellectual abilities to create meaningful digital stories, fostering their creativity and intellectual depth. Additionally, digital storytelling is a powerful tool for inclusive education, benefiting students with disabilities. Ohler (2008) emphasizes that digital storytelling transforms students from passive consumers to active knowledge constructors, enabling disabled students to engage actively with the learning process. It allows them to express their understanding and experiences in a multimodal format, accommodating diverse learning styles and abilities.

In addition, digital storytelling can support the development of various skills and competencies for both gifted and disabled students. Teachers have reported improvements in research skills, spelling, writing, communication, collaboration, and other essential skills through the use of digital storytelling (Smeda, Dakich, & Sharda, 2014). This inclusive approach allows gifted and disabled students to enhance their academic abilities while fostering a sense of belonging and empowerment in the classroom. Digital storytelling in the classroom offers personalized education, active participation, and skill development for both gifted and disabled students. It provides a platform for inclusive learning, allowing students to express their understanding and experiences in a multimodal format. By leveraging the benefits of digital storytelling, educators can create an inclusive and engaging learning environment that supports the unique needs and abilities of gifted and disabled students.

Discussions

The literature provides evidence supporting the significant and sustainable impact of digital storytelling on teaching and learning in the 21st-century classroom. Numerous studies have highlighted the positive effects of digital storytelling in enhancing various skills and competencies demanded by the modern global economy. Researchers have found that digital storytelling promotes personalized education and instruction, enabling students to participate actively in their learning process rather than being passive consumers of information. By creating their own digital stories, students can express their understanding, reflections, and experiences, while also evaluating their own potential. This active engagement fosters critical thinking, problem-solving, communication, and collaboration skills, among others. UNESCO recognizes digital storytelling as a key teaching strategy for achieving education objectives for a sustainable future. Furthermore, teachers have reported that digital storytelling is a valuable tool for improving students' research skills and facilitating cross-curricular competencies such as teamwork, independent learning, and project work. In addition, digital storytelling allows for the compression and communication of complex ideas through the use of multimedia, enabling learners to express their creativity and intellectual depth. Digital storytelling is considered an asset-based pedagogy that incorporates multiple aspects of the core curriculum.

Digital storytelling is considered to have a significant and sustainable impact on teaching and learning in the 21st-century classroom. It promotes personalized education and active student participation, fostering critical thinking, problem-solving, communication, and collaboration skills (Van Gil, 2005; Ohler, 2008). UNESCO recognizes digital storytelling as a key strategy for achieving education objectives (UNESCO, 2010). Additionally, it enhances research skills and facilitates cross-curricular competencies (Smeda, Dakich & Sharda, 2014). Digital storytelling allows for compressing complex ideas through multimedia, fostering creativity and intellectual depth (Oppermann, 2008; Benmayor, 2008). The prevailing theoretical framework in digital storytelling research is social constructivism, emphasizing the active construction of knowledge through social interactions (Van Gil, 2005). In terms of methodology, in-depth interviews have been commonly used to gain insights into students' experiences and learning outcomes (Ohler, 2008). Qualitative approaches such as thematic and narrative analyses have been employed to interpret and analyze the data (Van Gil, 2005). Future research in digital storytelling should focus on developing 21st-century skills, integrating digital storytelling into STEM education, exploring outcome-based and self-directed learning, and investigating augmented reality applications (UNESCO, 2010; Oppermann, 2008). Additionally, there is a need to explore digital storytelling in early childhood education, gifted education programs, and as an instructional aid for differently abled students (Smeda, Dakich & Sharda, 2014). Conducting in-depth qualitative studies is recommended to gain a comprehensive understanding of digital storytelling's educational benefits (Van Gil, 2005).

Findings and Conclusion

The research findings on digital storytelling in the 21st-century classroom reveal compelling evidence of its profound impact on teaching and learning. Numerous studies have consistently demonstrated the positive outcomes and benefits associated with this innovative pedagogical approach. Firstly, digital storytelling has been found to significantly enhance language skills, including writing and speaking abilities (Van Gil, 2005). By creating and sharing their own digital stories, students engage in active expression and reflection, which fosters language development and communication proficiency. Furthermore, digital storytelling cultivates critical thinking and problem-solving skills (Ohler, 2008). Through the process of crafting narratives and incorporating multimedia elements, students are challenged to analyze, synthesize, and present information coherently and engagingly. Collaboration and teamwork are also nurtured through digital storytelling (Smeda, Dakich & Sharda, 2014). Students work together, sharing ideas, perspectives, and creative inputs, thus fostering a sense of community and enhancing their ability to collaborate effectively.

Digital storytelling stimulates creativity and innovation (Oppermann, 2008). By blending textual, visual, and auditory elements, students are encouraged to think outside the box, experiment with various media tools, and express their ideas in unique and imaginative ways. Moreover, digital storytelling aligns with the development of 21st-century skills, which are essential for success in the modern global economy. These skills include critical thinking, problem-solving, communication, collaboration, creativity, and digital literacy (UNESCO, 2010). The literature also suggests potential applications of digital storytelling in specific educational contexts. For instance, it can be used to support early childhood education by fostering imagination, language development, and social-emotional skills (Benmayor, 2008). Additionally, digital storytelling shows promise in gifted education programs, catering to the unique needs and abilities of gifted students (Smeda, Dakich & Sharda, 2014). The findings underscore the immense potential of digital storytelling as a powerful teaching and learning tool. Its ability to enhance language skills, critical thinking, collaboration, creativity, and 21st-century competencies positions it as a valuable approach to preparing students for success in the rapidly evolving digital age.

Limitations and suggestions

While this study provides valuable insights into the teaching and learning benefits of digital storytelling in the 21st-century classroom and the prevailing theoretical and methodological trends in educational digital storytelling, it is important to acknowledge certain limitations. The inclusion criteria for the literature review may have inadvertently excluded relevant studies that were not captured by the selected databases. This could introduce a potential bias in the findings. To mitigate this limitation, future research could expand the search strategy to include additional databases or sources to ensure a more comprehensive coverage of the literature. Most of the included studies focused on secondary grade levels, which may limit the generalizability of the findings to other educational settings. While the identified theoretical and methodological trends are based on the selected studies, there may be emerging theoretical frameworks and research methods in educational digital storytelling that have not yet been widely explored. Future research could investigate alternative theoretical perspectives and innovative methodologies further to enrich the theoretical and methodological landscape in this field.

Researchers could delve deeper into the cognitive, affective, and social processes involved in digital storytelling to identify the key factors contributing to its positive impact on student learning outcomes. There is a need to explore the integration of digital storytelling in STEM education. Future research could examine how digital storytelling can be effectively incorporated into STEM curricula to foster engagement, critical thinking, problem-solving, and creativity among students in these fields. This would provide valuable insights into the potential of digital storytelling as a tool for interdisciplinary learning. Additionally, future studies could focus on outcome-based learning and self-directed learning in the context of digital storytelling. Researchers can investigate how digital storytelling aligns with outcome-based approaches and supports students' ability to take ownership of their learning process, set goals, and reflect on their progress. This would contribute to a deeper understanding of the role of digital storytelling in promoting student agency and meta-cognitive skills.

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Research Article

Awareness of Plagiarism among Student Teachers of Indian Teacher Educational Institutions

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Abstract

Today, the Internet is a rich source of study materials, and Google Scholar offers free access to a large number of scientific articles. There are excellent research publications available in many more databases. Students have the option of easily copying the material. Reusing, paraphrasing, patchwriting, and ghostwriting without citing the original documents are plagiarism. Plagiarism is increasing in academics, particularly in research. This study aims to study the awareness of plagiarism and to analyze the reasons for plagiarism. The study samples are the student teachers in India. For this study, we used a survey method, and the author prepared a questionnaire to collect data from the student teachers. Study respondents are the student teachers of the Regional Institute of Education Mysore; Purposive sampling was used to select samples. The total number of study respondents is 207. The findings of the study revealed that over 70 per cent of respondents mentioned reasons for plagiarism as lack of relevant literature studying, lack of preparation and time, difficulty checking every piece of work, do not know the manual citation style, lack of knowledge about bibliographic management software and also they stated that getting easily available materials on the internet is also a reason for plagiarism. The study recommends that teachers teach or conduct awareness programs on plagiarism, avoiding plagiarism, citation style, and software.

Keywords: Academic research, Plagiarism, Academic integrity, Academic writing, Academic ethics

Introduction

For many decades, copying others' ideas has been happening worldwide. To avoid the imitation of others' works, most institutions introduced plagiarism rules and regulations (Dey & Sobhan, 2011). Even though some situations are unavoidable, the educational institute provides examples of students copying friends' assignments, exam papers, and unpublished works (Martin & Sloan, 2009). Anti-plagiarism software, such as Turnitin, was developed in the 20th century to manage plagiarism and content similarly. This plagiarism software's features are finding text similarities, paraphrase detection, improper quotation highlighting, multilingual detection findings, automatic recognition of missing and inaccurate citations, and sentence and grammar corrections. Students who are interested in publishing their articles should correct the plagiarism. It is the responsibility of the higher education institution to alert the students. Teachers must encourage the students to present quality materials (Levin & Pazdernik, 2018).

Nevertheless, most colleges and

institutes have not fully adopted and enforced plagiarism concepts at the graduate and postgraduate levels. Teacher education programs are prevalent in Indian universities. Student teachers are the future teachers. Educational ideas and philosophical, sociological, and psychological underpinnings are taught in teacher education schools (Kutieleh & Adiningrum, 2011). India is a place of multiculturalism and various regional languages. Education in contemporary Indian society is also one of the courses in teacher education. Student teachers should be trained to reflect on their ideas, share their teaching experiences, and suggest incorporating ideas into the curriculum. So it is essential to encourage the students to publish articles. While publishing their articles, they must be careful about plagiarism (Sapatnekar, 2004).

Plagiarism means copying or stealing someone's ideas, inventions, thoughts, and expressions and making them their own. Most plagiarism happens because of not giving the proper citations and acknowledgment to the authors or referred resources. Plagiarism-related words are scientific misconduct, cheating, fabrication and falsification, data manipulation, academic integrity, text recycling, and verbatim (Clarke, 2006).

Causes and Consequences of Plagiarism in the Indian Context

In India, only academics have had a firm understanding of plagiarism during the previous few decades. Students enrolled in Ph.D. programs are required to submit plagiarism reports alongside their theses. Before submitting journal articles, it is required to perform a plagiarism check. (Vij et al., 2020). Due to these pressing needs, researchers are using plagiarism software. However, the need to avoid plagiarism is now realized at all levels (Awasthi, 2019). Teachers must know the importance of avoiding plagiarism and its adverse effects. Before turning in work, teachers should advise their students to examine them for plagiarism. Teachers must ensure the originality of pupils' work. Students could worry about failing. Teachers should so support students and assist them in avoiding plagiarism (Krishan et al., 2020). Teachers can also be careful in avoiding plagiarism in their teaching notes and other literature. Plagiarism destroys students' reputations and the professional reputation of teachers. The teacher will give some punishment to the student for plagiarism. Teachers should correct students when plagiarizing (Pathak & Malakar, 2016). As it affects the academic reputation of teachers and students, awareness of plagiarism is required for the student teachers as they are the present students and future teachers. Many software tools are now available to detect plagiarism. The use and utilization of this software are needed during their teacher education programs (Rai et al., 2010). Student teachers will be encouraged to use the available materials to detect plagiarism. In bringing these things into practice, we can avoid the consequences of plagiarism which is now considered the biggest flaw in Indian writing.

Review of Literature

Javaid et al. (2020) conducted research with Pakistani University's first-year and final-year electrical engineering students about plagiarism. Their study result shows no significant differences between first-year and final-year undergraduate students. Because of the lack of awareness of university policies, plagiarism rules, and regulations, students continuously commit the same errors. The study findings show that many easily available materials tempt students to plagiarise. The study additionally shows a lack of students' knowledge about plagiarism, and it was suggested that students need awareness programs, workshops, research method papers at the undergraduate level, and punishment.

Merkel (2021) did qualitative survey research on students' understanding of plagiarism. The study sample is a Norwegian University of Science and Technology undergraduate teacher educator students. The result of the study shows that students have the perception of plagiarism as stealing one or more than one intellectual idea and concept. It is called copying, stealing, and without giving proper citations, using others' work as their own. However, there is poor referencing style, citation management knowledge, and limited awareness of plagiarism rules and regulations. Furthermore, some students think it is the shortest way to success, lack knowledge in managing time, and intentionally commit plagiarism. The study suggests a few points for avoiding plagiarism, such as citations have to be taught and adopted as much as earlier in college days.

Farahian et al. (2021) examined the understanding of plagiarism among English language students. They collected the data from five countries: Canada, China, India, Iran, and Turkey. The result of the study shows that Canadian students have more awareness of plagiarism than Chinese students. The cultural influences show the different understandings between the countries. Furthermore, Asian students mentioned that a lack of awareness of citation manual rules and styles and academic writing skills are prime reasons for plagiarism.

According to Pagaddu (2021), procrastination is another reason men and women commit plagiarism differently. Contrarily, women like to meet deadlines, and as a result, they are less prone to plagiarize than men. Contrarily, men tend to procrastinate more and submit assignments at the last minute.

Khathayut et al. (2022) investigated 137 Thai undergraduate students about plagiarism and planned behavior. The survey result investigation shows that students lack an understanding of plagiarism; usually, they do patchwriting and ghostwriting. Students' actions contributing to plagiarism include indifference, lack of self-assurance in their writing abilities, ignorance of how to cite sources correctly and why, and a lack of time to turn in a report to the teachers. Furthermore, the result of the study reveals that students did not get support from the university because the university does not organize workshops and awareness programs on plagiarism.

University teachers' roles in managing academic integrity were studied by Gottardello and Karabag (2022) using purposive sampling. The ideal function of a teacher in higher education was highlighted as going beyond simply conveying knowledge in the classroom. The research revealed that academic integrity was covered in the course module and updated last year. Discussion on self-plagiarism, giving out a manual, citations, and other topics were disclosed by professors.

A survey on plagiarism and pre-service teachers' competence in referencing and citation was done by Bautista and Pentang (2022). Descriptive and correlational research methods were used in the study. The findings indicated that while most pre-service teachers have a reasonable understanding of citing and citation, their awareness of plagiarism is only moderate. Additionally, the findings indicated a significant correlation between academic success, understanding of references and citations, and awareness of plagiarism. It is advised that organizations give librarians and educators the tools they need to instruct PSTs in citation and referencing techniques.

The instructor knowledge on plagiarism Issues study was conducted by Hasanah and Dewantara (2022). According to the study's findings, 92.7 per cent of faculty members spend their time teaching students about plagiarism, including its various forms and terminology. However, 63 per cent of faculty members discover plagiarism among the students their instructor oversees in academic writing. Students are first made aware of the risks of plagiarism. Faculty then educates students on how to deal with plagiarism by offering tips and tricks to avoid it. Faculty also forewarns students by threatening sanctions against those who plagiarize. Finally, faculty uses plagiarism detection tools/software to identify plagiarism in students' assignments.

Objectives of study

1. To examine student teachers' awareness of plagiarism
2. To know the attitude towards research writings among Indian student teachers
3. To identify the most critical factor responsible for plagiarism

Research Questions

The following inquiries served as the study's compass:

i. What causes plagiarism among teacher educator students?

ii. What expectations and perceptions do student teachers have regarding plagiarism?

Methodology

The research methodology used in this study was a descriptive survey. Primary data were collected from the students of BA B.Ed, BSc B.Ed, MSc.Ed, B.Ed, M.Ed programmes. A questionnaire was prepared and shared in the student's mail for data collection. Purposive sampling was used, and the authors adopted the survey method because it is cost-effective and convenient to collect and analyze the data. The sample comprises a large number of female student teachers. The research was conducted with the permission of the Regional Institute of Education Mysore authorities, and the students were invited to participate in an online survey. Questionnaires were distributed to 500 students, and 207 students responded. The authors surveyed from February to March 2022. The authors analyzed quantitative and qualitative data; the Researcher used descriptive and inferential statistics with quantitative data. The authors use the following democratic variables for statistical data analysis: gender, course, and year of study. For data collection, the author used Google Forms and for data analysis, along with the Excel Worksheet. The responders gave their agreement after being fully informed. The study's objectives and implications were explained to the respondents. The respondents received guarantees about privacy, security, and anonymity. Out of 100 responses, 41.4 per cent were responsive. None of the responders received a prize or cash.

Data analysis and findings

Table-1 Socio-Demographic details of Respondent

Socio-Demographic details of the respondent's			
Variables Frequency		**Responses**	
		Percentage	
Gender	Female	156	75.4
	Male	51	24.6
Mother Tongue	Hindi	15	7.2
	Kannada	42	20.3
	Malayalam	50	24.2
	Tamil	29	14
	Telugu	54	26.1
	Others	17	8.2
Medium of instruction in higher secondary level	English	195	94.2
	Hindi	0	0
	Kannada	5	2.4
	Malayalam	2	1
	Tamil	1	0.5
	Telugu	3	1.4
	Odia	1	0.5
Residence	Rural	89	43
	Urban	118	57
Age	17-23	143	69.1
	23-27	50	24.1
	27-35	8	3.9
	35-50	6	2.9
Course	BA B.Ed	47	22.7
	BSc B.Ed	68	32.9
	MSc.Ed	46	22.2
	B.Ed	29	14
	M.Ed	17	8.2
Total		207	100

Table 1 shows the socio-demographic details of the respondents. The total number of respondents in this study is 207. Participant gender distribution showed more female respondents, 156 (75.4 per cent), and males, only 51 (24.6 per cent). Further, the table shows the respondents' first language or native language. The results revealed that the majority of the respondents have the native language, Telugu 54 (26.1 per cent), followed by Malayalam 50 (24.2 per cent), Kannada 42 (20.3 per cent), Tamil 29 (14 per cent), Hindi 15 (7.2 per cent), and other languages 17 (8.2 per cent) including Oriya 6, Tulu 4, Konkani 2, Kodava 2, Jasari1, Bengali 1 and Marathi 1. In addition, mediums of instruction at higher secondary levels are studied. English 195 (94.2 per cent), Kannada 5 (2.4 per cent), Telugu 3 (1.4 per cent), Malayalam 2 (1 per cent), Tamil, and Odia each 1. 118 (57 per cent) respondents hail from urban and 89 (43 per cent) from rural backgrounds. The ages of the respondents are in the range of 17 - 23 years 143 (69.1 per cent), 23 - 27 years 50 (20.7 per cent), 27 - 35 years 8 (3.9 per cent), and 35 - 50 years (2.9 per cent). Course-wise, more respondents are BSc B.Ed 68 (32.9 per cent), MSc.Ed 46 (22.2 per cent), B.Ed 29 (14 per cent), and M.Ed 17 (8.2 per cent).

Knowledge and beliefs about plagiarism

The authors attempted to study the knowledge and beliefs of student teachers about plagiarism and the plagiarism checker. The authors also wanted to check student teachers' awareness of avoiding plagiarism. The details are given below.

Table-2: Knowledge and beliefs about plagiarism

Knowledge and beliefs about plagiarism	Yes	No
Do you know what plagiarism means?	186 (89.9%)	21 (10.1%)
Do you have an awareness of avoiding plagiarism	123 (59.4%)	84 (40.6%)
Do you need training on awareness of plagiarism?	133 (64.3%)	74 (35.7%)
Have you used a plagiarism checker?	50 (24.2%)	157 (75.8%)
Do you know bibliographic management software?	18 (8.7%)	189 (91.3%)

Respondents were asked about plagiarism. Table 2 shows that 186 (89.9 per cent) student teachers know about the meaning of plagiarism, 123 (59.4 per cent) know about avoiding plagiarism, 133 (64.3 per cent) respondents expected training on plagiarism, and 157 (75.8 per cent) respondents did not use plagiarism checker.

Reasons for plagiarism or motivator of plagiarism

The authors wanted to study the reason behind the occurrence of plagiarism and wanted to check the motivator of plagiarism. The details are given below.

Table-3: Reasons for plagiarism or motivator of plagiarism

Reasons for plagiarism or motivator of plagiarism	Yes	No
I do not know citation manual styles (e.g. APA, MLA, Chicago, etc.,)	132 (63.8%)	75 (36.2%)
I do know how to cite the document in text citation	94 (45.4%)	113 (54.6%)
I do not know how to use reference management software (E.g. Mendeley, Zotero, etc.,)	148 (71.5%)	59 (28.5%)
Lack of knowledge of academic writing	140 (67.6%)	67 (32.4%)
Lack of preparation and time	152 (73.4%)	55 (26.6%)
Lack of relevant literature reading	161 (77.8%)	46 (22.2%)
Do you think the internet is a reason for plagiarism?	147 (71%)	60 (29%)
Do you think vast resources are reasons for plagiarism?	105 (50.7%)	102 (49.3%)
Do you have the experience of copying entire text from online without modifying anything?	85 (41.1%)	122 (58.9%)
If one cannot write well in a foreign language (e.g., English), it is justified to copy parts of a similar paper already published in the language.	95 (45.9%)	112 (54.1%)
I could not write a scientific paper without plagiarism	76 (36.7%)	131 (63.3%)
Lack of interest and enthusiasm for publishing quality research works	135 (65.2%)	72 (34.8%)
Difficult to check every piece of work	152 (73.4%)	55 (26.6%)

Table 3 identifies reasons for plagiarism: 63.8 per cent lack knowledge of citation manual styles (e.g., APA, MLA, Chicago, etc.,). Likewise, 71.5 per cent lack familiarity with using reference management software (E.g., Mendeley, Zotero, etc.,); 67.6 per cent lack knowledge of academic writing, 73.4 per cent lack preparation and time, 77.8 per cent lack relevant literature reading, 71 per cent of respondents thinks the internet is a reason for plagiarism, 50.7 per cent thinks vast resources are reasons for plagiarism, 65.2 per cent lack of interest and enthusiasm for publishing quality research works and 73.4 per cent challenging to check every piece of work.

Who can control plagiarism?

Next, the authors studied how to control the occurrence of plagiarism. They wanted to study who is responsible for controlling plagiarism.

Table-4: Who can control plagiarism?

Limiting plagiarism	Respondents	Percentage
Author	74	35.8
Editor	22	10.6
Reviewer	25	12.1
Plagiarism software	83	40.1
Do not know	3	1.4

From Table 4, which explains who can control plagiarism, 40.1 per cent of respondents tell plagiarism software, and 35.8 per cent tell self-control.

Table-5: How can we control plagiarism?

How can we control plagiarism?	Respondents	Percentage
Collecting fine	63	30.5
Degree withdrawal	48	23.2
Do not know	3	1.4
Other	53	25.6

It is evident from the table-5 that most respondents mentioned collecting fines 63 (30.5 per cent), is a way of punishing plagiarism followed by other reasons such as withdrawal of their work 48 (23.2 per cent) and the others do not know about it.

Effects of plagiarism

The authors wanted to get student teachers' ideas about plagiarism and raised some questions to answer this.

Table-6: Plagiarism concept makes you stressed or relaxed

plagiarism concept is	Respondents	Percentage
Stress	116	56
Stress-free	72	34.8
Do not know	19	9.2

Table 6 reveals that most student teachers feel stress due to plagiarism. 116 (56 per cent) feel stress, but 72 (34.8 per cent) are stress-free, and 19 (9.2 per cent) do not know.

Table-7: Are you expecting a plagiarism-free tool?

Are you expecting a plagiarism-free tool?	Respondents	Percentage
Yes	161	77.8
No	46	22.2

Table 7 shows the expectation of plagiarism detection tools. 161 (77.8 per cent) expected it free, and the rest of 46 (22.2 per cent) did not expect it free of cost.

Table-8: If yes, means from where?

If yes, means from where?	Respondents	Percentage (n=207)
OSS online platform	54	26.1
Government	71	34.3
Institute or University	91	44
Library	68	32.9
Do not know	42	20.3

Table 8 shows that the students expect the plagiarism tool available in universities 91 (44 per cent) followed by the Government agencies71 (34.3 per cent), library 68 (3.9 per cent), Open source software online platforms 54 (26.1 per cent), and do not now 42 (20.3 per cent)

Discussion

From the present study, it is evident that plagiarism must be avoided as it affects the reputation of academic writings and research works. Most of the participants in this survey are female, and their medium of instruction at the school level is English. They are well-versed in English. The medium of instruction of their present teacher education program is also English. As a foreign language, it has its limitations. Most of them hail from urban areas, and most belong to the 18-23 age group. They have studied various teacher education programs such as B.Ed., B.Sc., B.Ed., B.Sc.,Ed., M.Ed, and M.Sc.,Ed. Out of 207 participants, the majority (181) know about plagiarism, but only a few (50) have used plagiarism checkers. Understanding citation manual style and reference management software is necessary for student teachers. 63 per cent to 71 per cent of student teachers are aware of it. Many of them pointed out that the lack of preparation time and related literature is the primary reason for plagiarism. The respondents viewed that only authors can hold the responsibility and collecting fines from the authors will control plagiarism. Many of them expect plagiarism-free tools from the government that may be available in libraries.

Conclusion

Plagiarism will give stress to both authors as well as publishers. It affects the reputation of any academic work. Many plagiarism detection tools are now available. The Department of Higher Education at the state and central levels should take the initiative to detect plagiarism in the works of academic writers, researchers, teachers, and students. People preparing their assignments and research works are visiting libraries for reference, literature review, and collection of materials for the conceptual framework. So high-quality plagiarism checkers should be made available in libraries. Awareness of plagiarism is essential for student teachers as they will guide future generations.

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Research Article

Deciphering the Reaction of M.Ed. Students towards a MOOC developed at the Institutional Level

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Abstract

MOOCs have emerged as an important form of online learning, which continues to be a useful way to reach large numbers of learners without the constraints of geography and time. These are largely self-paced, do not require official enrolment on campus, and are accessible from any device with a reliable internet connection. National Education Policy 2020 also highlights the importance of leveraging the benefits of technology. The policy recommends pilot studies for online education, online teaching platforms, and tools, content creation and dissemination, addressing the digital divide, virtual labs, teacher training, and incentives, online assessment, blended learning models, and so on. The present study is an attempt in this direction to study the effectiveness of a MOOC developed for M.Ed. students in terms of reactions of the students on various components like overall effectiveness, course structure, video lessons, assessments, discussion forums, additional resources, instructors' support, and challenges faced. The study's findings suggested that M.Ed. students found the MOOC interesting, self-paced, and flexible.

Keywords: MOOC, Research Methodology, M.Ed. students, Reaction Scale

Introduction

MOOCs have emerged as an important form of Open Distance Learning. MOOCs stands for a massive open online course. These courses are massive because there is no limit on the enrolment of students in these courses. It is considered open because anyone from anywhere with the internet can access it and it is online because all course components like instruction, testing, and discussions are done online. MOOC can be defined as a course that has no limits on its enrolment may have a set start and end duration, is open for all irrespective of the background, all components are shared online, and has features of video lectures, discussion forums, online assignments and assessments leading to certifications. According to Goel & Goel (2012), "Open Distance Learning through MOOCs has great potential to be infused in teacher education in both pre-service and in-service modes which seems to be a neglected area. Teacher education in India has a slow pace in getting access to modernization and has not yet integrated the technological innovations for transacting education." The researchers in the present study developed a MOOC for student-teacher educators and studied its effectiveness with the help of a reaction scale developed and validated by the researcher. The developed MOOC enabled students to get acquainted with a new learning method, compelling them to use various authentic open educational resources available online, enabling self-paced and flexible learning among them.

Review of Related Literature

MOOCs is the new revolution sweeping the higher education sector. As per a study conducted by Kaur (2019), the major advantages of MOOCs in higher education are scalability, free education, removal of other constraints of boundaries, job, etc. force professors to improve lectures in the future, and designed to ensure students keep up, bringing people together from different parts of the world and provide many business opportunities of making platforms and collaborating with universities like Coursera and Edx. Ahmed et al. (2017) examined the evolution of MOOCs, their characteristics, and their potential and problems in Pakistan from the perspectives of teachers and students. They concluded that MOOCs inspire students and are very useful for students after graduation who cannot return to universities when being in jobs. Kilgore (2018) did an empirical study on Adult College Student's Perceptions about Learning Mathematics through developmental mathematical xMOOCs and emphasized that MOOC offers an alternative platform for learning for students who are intrinsically motivated and like to work independently. It also offers confidence to students and motivates them to refresh their skills. Latha (2019) included 500 Indian Learners who have completed at least one MOOC course through Coursera, Edx, or Udacity MOOC platforms and found that students in post-graduation have a higher inclination toward studying through MOOCs, where the behaviour is driven by the internal rewards. Sukhbaatar et al. (2018) also explored undergraduates' and high school students' perceptions of MOOCs. They found considered that students consider MOOCs as a learning resource and as a worthy source of knowledge. Salas et al. (2022) studied 122 teachers from the National Autonomous University of Mexico's perception of MOOCs during the pandemic and found that MOOC is a viable solution to transform education. Soffer & Cohen (2015) integrated MOOC at the undergraduate level and listed various benefits like a flexible environment and development of 21st-century skills. Hence, MOOCs are a welcome step that brings immense benefits to various stakeholders of the Indian education system.

Rationale

With 20-26 million children born annually in India, an estimated 700 million to 1.3 billion young people would demand higher education in the next 35-50 years (Kumar, 2018). India's defining challenge and opportunity for the twenty-first century is to provide great higher education and prepare students for their future livelihoods and jobs. Unconventional educational approaches, such as distance and open learning, on-demand education, and other flexible learning models, should be tried and tested, according to a position paper published by NCERT in 2006. For today's youth, flexible systems, futuristic curricula, and a twenty-first-century vocational orientation are necessary. It is critical to persuade the educational system, which has a key role to play in engineering the teaching-learning scenario and making it a more meaningful experience for both teachers and students. MOOC is the answer to all these problems and can provide access to education to any massive population. MOOCs can offer students better and more diversified instruction than individual instructors can offer (Daniel 2012).

Research Questions

The study was comprised of the following research question:

To what extent can MOOCs be effective for professional courses like Teacher Education?

Objectives of Study

1. To develop a MOOC in research methodology for M.Ed. students.
2. To implement the developed MOOC in research methodology on M.Ed. students.
3. To study the effectiveness of the developed MOOC in terms of the reaction of M.Ed. students on the components i.e.:
   - Overall effectiveness
   - Course structure and planning
   - Video lessons
   - Discussion forums
   - Assessment
   - Additional resources
   - Challenges faced
   - Instructor support

Methodology

Research Design

The present study was experimental research. The design adopted was a single group post-test only design. Here, the researcher implemented the designed MOOC on the M.Ed. students' and then immediately after the MOOC ended, the researcher measured students' reactions toward it. As the development and designing of a MOOC is an exorbitant and time-consuming process, trying it out on a small sample is a highly beneficial way of testing its effectiveness before opening it for global use. Hence the researcher adopted this design.

Variables

The independent variable used was MOOC and the dependent variable was students' reaction towards the developed MOOC.

Population and Sample of the Study

The study population was all the students enrolled in two years M.Ed. program in India. A convenient sampling technique was used to select the sample. All the 40 M.Ed. students studying in the Department of Education, Faculty of Education and Psychology, The Maharaja Sayajirao University of Baroda, Vadodara in the first year of batch 2021-2023 were selected.

Research Tool

To study the effectiveness of the massive open online course in terms of the reaction of M.Ed. students a reaction scale was implemented consisting of 35 statements. The reaction scale was a 5-point Likert type of scale.

Developed and Implementation of the MOOC

The researchers developed a MOOC using the WordPress platform. The developed MOOC was divided into three specializations courses on the selected topic of research methodology i.e. introduction to research methodology, type of research methods, and sampling techniques. The students were provided a manual and also given orientation on how the MOOC works. Students then registered in MOOC and started learning on the MOOC with fixed start and end dates. After the implementation, a reaction scale was implemented on the M.Ed. students.

Analysis of Data

As the study was quantitative the statistical techniques were used to analyze the data. The reaction scale was analyzed using frequency, percentage, and intensity index(II). In a Likert scale, the II specifies the exact point of intensity chosen by the sample for each item. It is simple to make a judgment regarding the participants' response to the given statement by converting the data into a single number (Chaudhari, 2016; Khirwadkar. A & Chaudhari. P, 2019; Kothari. C. R, 2004; Lakhera 2017; Kumar, 2016 cited in Lakshmi, 2020).

i. Overall effectiveness

Eleven statements focused on the reaction of M.Ed. Students towards the overall effectiveness of MOOC. The intensity of each statement along with percentage and frequency is given below:

Table-1: Frequency wise (F), Percentages (%), and Intensity Index wise (II) reaction (Strongly Agree-SA, Agree-A, Undecided-UD, Disagree-D, and Strongly Disagree- SD) of M.Ed. students towards Overall Effectiveness of the MOOC.

Sr. No	Statements	SA (F,%)	A (F,%)	UD (F,%)	D (F,%)	SD (F,%)	II
1	Learning Research Methodology through a Massive open online course (MOOC) was interesting.	32 80.0	08 20.0	0	0	0	4.80
2	The MOOC was well structured and planned.	31 77.5	08 20.0	0	01 2.5	0	4.72
3	The instructions provided in every lesson were elaborate.	27 67.5	10 25.0	1 2.5	2 5.0	0	4.55
4	The MOOC helped me to achieve the given course objectives.	25 62.5	15 37.5	0	0	0	4.62
5	Time duration of the course was appropriate.	23 57.5	12 30.0	03 7.5	02 5.0	0	4.40
6	MOOC promotes self-paced learning	30 75.0	9 22.5	01 2.5	0	0	4.72
7	I would like to learn other topics of research methodology through MOOCs	24 60.0	13 32.5	01 2.5	01 2.5	01 2.5	4.45
8	The MOOCs were flexible to learn at my own preferred time.	26 65.0	14 35.0	0	0	0	4.65
9	The MOOCs were user-friendly.	25 62.5	14 35.0	0	0	01	4.55
10	This course has increased my interest in online learning.	29 72.5	9 22.5	01 2.5	01 2.5	0	4.65
11	I would highly recommend this course to other students	30 75.0	08 20.0	02 5.0	0	0	4.70
Average I							4.62

For statement 1, 80 per cent and 20 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.80 for the statement showed that most of the students found it interesting to learn Research Methodology through MOOC. 77.5 per cent, 20 per cent, and 2.5 per cent of students reacted strongly agree, agree, and disagree respectively to the statement 2. The intensity index of 4.72 for the statement showed that most of the students found the MOOC well-structured and well-planned.

For statement 3, 67.5 per cent and 25 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.55 for the statement showed that all the instructions provided in the lesson were elaborate. 62.5 per cent, 37.5 per cent, and 2.5 per cent reacted strongly agree and agree respectively to the statement 4. The intensity index of 4.62 for the statement showed that most of the students found MOOC course objectives achievable.

For statement 5, 57.5 per cent and 30 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.40 for the statement showed that the time duration was appropriate. 75.0 per cent and 22.5 per cent reacted strongly agree and agree respectively to the statement 6. The intensity index of 4.72 for the statement showed that most of the students found the course self-paced

For statement 7, 60.0 per cent and 32.5 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.45 for the statement showed that students preferred learning other topics also through MOOC. 65.0 per cent and 35.0 per cent reacted strongly agree and agree respectively to the statement 8. The intensity index of 4.65 for the statement showed that most of the students found the course flexible.

For statement 9, 62.5 per cent and 35.0 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.55 for the statement showed that students found the MOOC user-friendly. 72.5 per cent and 22.5 per cent reacted strongly agree and agree respectively to the statement 10. The intensity index of 4.65 for the statement showed that MOOCs increased student interest in online learning.

For statement 11, 75.0 per cent and 20.0 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.70 for the statement showed that students will recommend such a course in the future to others.

ii. Course structure

Five statements focused on the reaction of M.Ed. Students towards the course structure and planning of MOOC. The intensity of each statement along with percentage and frequency is given below:

Table-1.1: Frequency wise (F), Percentages (%), and Intensity Index wise (II) reaction (Strongly Agree-SA, Agree-A, Undecided-UD, Disagree-D, and Strongly Disagree- SD) of M.Ed. students towards course structure and planning of the MOOC

Sr no	Items	SA (F,%)	A (F,%)	UD (F,%)	D (F,%)	SD (F,%)	II
1	The course was delivered as outlined in the syllabus.	25 62.5	14 35.0	0	0	1 2.5	4.55

2	The introduction (learning objectives, instructor information, target group, etc.) given at the beginning of this MOOC was clear to me.	30 75.0	8 20.0	2 5.0	0	0	4.70
3	The manual provided to use the MOOC was easy to understand.	27 67.5	10 25.0	1 2.5	2 5.0	0	4.55
4	Badges at the end of each module motivated me to learn more content through MOOC.	27 67.5	9 22.5	4 10.0	0	0	4.57
5	The new platform developed to host MOOCs was well-designed.	27 67.5	12 30.0	1 2.5	0	0	4.65
Average II							4.60

For statement 1, 62.5 per cent and 35.0 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.55 for the statement showed that most of the students found the course was delivered as per the outline. 75.0 per cent, 20 per cent, and 5.0 per cent of students reacted strongly agree, agree, and undecided respectively to the statement 2. The intensity index of 4.70 for the statement showed that most of the students found instruction clear and lucid.

For statement 3, 67.5 per cent and 25.0 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.55 for the statement showed that most of the students found the manual easy to understand. 67.5 per cent and 22.5 per cent of students reacted strongly agree and agree respectively to the statement 4. The intensity index of 4.57 for the statement showed that most of the students found badges motivating. For statement 5, 67.5 per cent and 30.0 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.65 for the statement showed that most of the students found the platform well-designed.

iii. Video Lesson

3 statements focused on the reaction of M.Ed. Students towards the video lessons in MOOC. The intensity of each statement along with percentage and frequency is given below:

Table-1.2: Frequency wise (F), Percentage wise (%), and Intensity Index wise (II) reaction (Strongly Agree-SA, Agree-A, Undecided-UD, Disagree-D, and Strongly Disagree- SD) of M.Ed. students towards video lessons in MOOC

Sr no	Items	SA (F,%)	A (F,%)	UD (F,%)	D (F,%)	SD (F,%)	II
1	Examples used in the videos were relevant to the topics.	34 85.0	5 12.5	1 2.5	0	0	4.82
2	The length of the videos used in this MOOC was appropriate.	20 50.0	18 45.0	1 2.5	1 2.5	0	4.42
3	Interactive videos used in all courses were fun and made the content engaging.	20 50.0	18 45.0	2 5.0	0	0	4.45

4	The language used in the video was simple and easy to understand.	30 75.0	10 25.0	0	0	0	4.75
Average III							4.61

For statement 1, 85 per cent and 12.5 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.82 for the statement showed that most of the students found examples in videos relevant. 50 per cent, 45 per cent, and students reacted strongly agree and agree respectively to the statement 2. The intensity index of 4.42 for the statement showed that most students found the length of videos appropriate.

For statement 3, 50 per cent and 45 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.45 for the statement showed that most of the students found interactive videos engaging. 75 per cent, 25 per cent, and students reacted strongly agree and agree respectively to the statement 4. The intensity index of 4.75 for the statement showed that most of the students found the language used in videos easy.

iv. Additional resources

Two statements focused on the reaction of M.Ed. Students towards the additional resources in MOOC. The intensity of each statement along with percentage and frequency is given below:

Table-1.3: Frequency wise (F), Percentage wise (%), and Intensity Index wise (II) reaction (Strongly Agree-SA, Agree-A, Undecided-UD, Disagree-D, and Strongly Disagree- SD) of M.Ed. students towards additional resources in MOOC

Sr no	Items	SA (F,%)	A (F,%)	UD (F,%)	D (F,%)	SD (F,%)	II
1	The course was supported by adequate additional E-resources in form of YouTube, PDF documents, and articles.	22 55.0	16 40.0	1 2.5	1 2.5	0	4.47
2	All additional resources provided in the course were relevant to the topic.	26 65.0	14 35.0	0	0	0	4.65
Average IV							4.56

For statement 1, 55 per cent and 40 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.47 for the statement showed that most of the students found adequate additional resources in the course. 65 per cent, and 35 per cent of students reacted strongly agree and agree respectively to the statement 2. The intensity index of 4.65 for the statement showed that resources were relevant to the course topic.

v. Discussion forums

There was 1 statement that focussed on the reaction of M.Ed. Students towards the discussion forums in MOOC. The intensity of each statement along with percentage and frequency is given below:

Table-1.4: Frequency wise (F), Percentage wise (%), and Intensity Index wise (II) reaction (Strongly Agree-SA, Agree-A, Undecided-UD, Disagree-D, and Strongly Disagree- SD) of M.Ed. students towards discussion forums in MOOC

Sr no	Items	SA (F,%)	A (F,%)	UD (F,%)	D (F,%)	SD (F,%)	II
1	The discussion forum used in MOOC helped me in collaborating with my peers.	14 35.0	18 45.0	6 15.0	1 2.5	1 2.5	4.07
Average V							**4.07**

For statement 1, 35 per cent and 45 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.40 for the statement showed that most of the students found discussion forums collaborative.

vi. Assessment

There were 3 statements that focused on the reaction of M.Ed. Students towards the assessment in MOOC. The intensity of each statement along with percentage and frequency is given below:

Table-1.5: Frequency wise (F), Percentage wise (%), and Intensity Index wise (II) reaction (Strongly Agree-SA, Agree-A, Undecided-UD, Disagree-D, and Strongly Disagree- SD) of M.Ed. students towards assessments in MOOC

Sr no	Items	SA (F,%)	A (F,%)	UD (F,%)	D (F,%)	SD (F,%)	II
1	Practice multiple-choice questions in each of the courses helped me in revising the content.	24 60.0	15 37.5	1 2.5	0	0	4.57
2	There were adequate quizzes in each course.	24 60.0	12 30.0	2 5.0	2 5.0	0	4.45
3	Lessons in the form of activities made the course engaging	29 72.5	11 27.5	0	0	0	4.72
Average VI							4.58

For statement 1, 60 per cent and 37 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.57 for the statement showed that most of the students found MCQ beneficial to revising the content. 60 per cent and 30 per cent of students reacted strongly agree and agree respectively to the statement 2. The intensity index of 4.45 for the statement showed that most of the students found quizzes adequate in the course. For statement 3, 72.5 per cent and 27.5 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.72 for the statement showed that most of the students found that activities made the course.

vii. Instructors' Support

There were 5 statements that focused on the reaction of M.Ed. Students towards the instructor's support in the implementation of MOOC. The intensity of each statement along with percentage and frequency is given below:

Table-1.6: Frequency wise (F), Percentage wise (%), and Intensity Index wise (II) reaction (Strongly Agree-SA, Agree-A, Undecided-UD, Disagree-D, and Strongly Disagree- SD) of M.Ed. students towards instructor's support in MOOC

Sr no	Items	SA (F,%)	A (F,%)	UD (F,%)	D (F,%)	SD (F,%)	II
1	As the instructor was always available to help students, I never felt lost in the course	35 87.5	5 12.5	0	0	0	4.87
2	The daily progress report shared by the instructor on WhatsApp made me complete the course on time.	39 97.5	1 2.5	0	0	0	4.97
3	Enrolment deadlines and course deadlines (start and end date) were informed in advance.	34 85.0	5 12.5	1 2.5	0	0	4.82
4	Feedback was given by the instructor on the final graded assignments.	18 45.0	17 42.5	5 12.5	0	0	4.32
5	All my queries were answered through WhatsApp by the instructor.	27 67.5	12 30.0	1 2.5	0	0	4.65
Average VII							4.72

For statement 1, 67.5 per cent and 12.5 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.87 for the statement showed that most of the students found the instructor always available to help students. 97.2 per cent, 2.5 per cent of students reacted strongly agree and agree respectively to the statement 2. The intensity index of 4.97 for the statement showed that most of the students found daily progress reports help to them complete the course. For statement 3, 85 per cent and 12.5 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.78 for the statement showed that most of the students viewed that deadlines were conveyed in advance. For statement 4, 45 per cent and 42.5 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.32 for the statement showed that most of the students got feedback on final graded assignments. For statement 5, 67.5 per cent and 30 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.65 for the statement shows that all of the queries of students were answered through WhatsApp.

viii. Challenges encountered

Four statements focused on the reaction of M.Ed. Students towards the challenges encountered during the implementation of MOOC. The intensity of each statement along with percentage and frequency is given below:

Table-1.7: Frequency wise (F), Percentage wise (%), and Intensity Index wise (II) reaction (Strongly Agree-SA, Agree-A, Undecided-UD, Disagree-D, and Strongly Disagree- SD) of M.Ed. students towards challenges encountered in MOOC

Sr no	Items	SA (F,%)	A (F,%)	UD (F,%)	D (F,%)	SD (F,%)	II
1	The final graded assignments were long and took a lot of my study time.	2 5.0	2 5.0	2 5.0	21 52.5	13 32.5	4.02
2	There were lots of disturbances in the audio used in the content video of the MOOC.	0	0	2 5.0	22 55.0	16 40.0	4.35
3	Too much workload was given during each week.	2 5.0	2 5.0	5 12.5	5 12.5	26 65.0	4.27
4	I did not face any major technical difficulties while navigating through MOOCs.	20 50.0	18 45.0	0	1 2.5	1 2.5	4.37
Average VIII							4.25

For statement 1, 52.5 per cent and 32.5 per cent of students reacted strongly disagree and strongly disagree respectively. The intensity index of 4.02 for the statement showed that most of the students did not find assignments too long. 40 per cent and 55 per cent of students reacted disagreed and strongly agree respectively with the statement 2. The intensity index of 4.35 for the statement showed that most of the students did not find any disturbances. For statement 3, 65 per cent and 12.5 per cent of students reacted as disagreeing and strongly disagree respectively. The intensity index of 4.27 for the statement showed that most of the students did not find too much workload in the course. For statement 4, 50 per cent and 45 per cent of students reacted strongly agree and agree respectively. The intensity index of 4.37 for the statement showed the majority of students faced no technical difficulties.

Findings

The developed MOOC was found to be effective regarding the reaction of M.Ed. students towards it. M.Ed. students not only found the course interesting but it increased their bend towards online learning.

Discussion and Conclusion

Majority of the M.Ed. students in the present study had favorable reactions toward the use of MOOCs. Even Lathe (2019) concluded in an empirical study that post-graduation students are more inclined toward MOOCs. The study has proved that students are interested in learning through MOOCs which promotes self-paced and flexible learning among them. Kilgore, (2018), Israel, (2015), Andone & Mihaescu (2018) also emphasised that MOOC is a novel method that promotes self-paced learning. The majority of students found relevant examples in the content video which is in line with the finding of Oakley et al. (2016) listing the factors that create a highly liked MOOC which included easy materials, convenient time, and practical examples in the course, and many more. Aljaraideh (2019) concluded that teachers perceive MOOCs to provide better learning opportunities to students and recommended higher education institutes introduce MOOCs in their day-to-day learning. Students in the present study also want to recommend others to adopt MOOCs. MOOCs can be a powerful approach to online learning in the future. They provide students and teachers with a lot of opportunities to learn and grow in their profession.

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Research Article

Mobile Augmented Reality in Teaching Upper Primary School Science: Perspectives of Subject Handling Teachers

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Abstract

The incorporation of technology into education is necessary and inevitable in our technological society of today. The application of Mobile Augmented Reality (MAR) in education is becoming gradually more significant in the global dissemination of knowledge. The majority of school teachers in Tamil Nadu use MAR, and they have sufficient experience using it in the classroom. This research investigates how upper primary school science instructors view the usefulness of MAR in the classroom. To gather the necessary data, 135 science teachers were randomly selected from the Coimbatore district of Tamil Nadu and given the Teacher Perception Scale on Mobile Augmented Reality. The study's key findings show that the majority of teachers believed that MAR helped them reasonably when teaching science at the upper primary level, and there was a significant difference between perception teachers in terms of gender, but not in terms of locality or teaching experience of teachers.

Keywords: Augmented reality, Content teaching, Perception of teachers, Student learning, Upper primary schools

Introduction

In today's technologically advanced culture, it is more challenging than ever to keep students' attention and active participation in the classroom due to the various stimuli in their learning environment that make them more demanding during the learning process. While teaching science content in schools, most of the teachers use traditional way teaching and learning, and many times they use two-dimensional media according to their convenience. The science content is related to three-dimensional things, and a teacher handling this subject may not make the students immerse in the subject at the expected level. As a result, there is a need to integrate technology into teaching and learning to increase student motivation and commitment to academic activities (Shapley et al. 2011). The purpose of integrating technology into classroom activities is to improve the teaching and learning processes, especially in science-related subjects. Nowadays, the application of augmented reality (AR) in teaching and learning is becoming more and more important, gaining a foothold in the educational system from elementary school to higher education (Huang, Li, & Fong, 2016; Carlson & Gagnon, 2016). Augmented reality can be expressed as the synchronized blending of digital and physical information using different technological devices.

According to Di Serio, et al. (2013), AR system has the characteristics, such as the combined nature of real and virtual images within virtual surroundings; reciprocated association between real and virtual images; and interaction implemented in accurate time. Further, it involves computer-generated files, including visuals, sounds, films, or digital information, encrusting various environments. Perfect interaction between the actual and virtual environments is supported by AR as well (Singhal et al., 2012), and virtual objects and real-time visuals are provided simultaneously (Azuma et al., 2001). This helps the students to have access for gaining more knowledge than they usually would have through their sense organs. Early on, this technology was employed with equipment like head-mounted displays, but it is now simple to use with any computer or mobile device (Sirakaya, and Sirakaya, 2018).

The majority of science topics in Tamil Nadu school textbooks have two-dimensional square-shaped QR codes that allow for the storage of a wide range of numeric characters and may then be seen using a QR reader application. In Tamil Nadu, the State Council of Educational Research and Training (SCERT) and the Department of School Education (DSE) provided adequate in-service training programmes for school teachers on how to use mobile augmented reality (MAR) technology during their subject teaching through mobile and computer devices. The purpose of using MAR technology in the school system is to promote a better understanding of an abstract concept among students through proper motivation, participation, and engagement in classroom practices. In this context, a study investigated upper primary school science teachers' perspectives on the utility of MAR technology in classroom practices.

Literature Review

According to Khairuldin et al. (2019), augmented reality (AR) is technology-driven learning that incorporates virtual items into authentic learning scenarios to fill in information gaps. Students who attend school can retain a high level of motivation and engagement by using augmented reality (AR) technology (Rasalingam et al. 2014). Further, as per AlNajdi et al. (2020), AR gives students the chance to see how theories are put into practise while also giving them the chance to observe and learn from real-world situations. Additionally, AR reduces students' anxiety levels when learning science (Beyoglu et al., 2020).

According to Bistaman et al. (2018), Augmented Reality (AR) gave primary school pupils effective learning opportunities and helped teachers include their students more actively in classroom activities. As per Tashko and Elena's (2015) research, augmented reality dramatically increased students' interest in, comprehension of, and interiorization of the learning materials. Arici et al. (2019) found that smartphone applications and marker-based content are the most popular types of Augmented Reality (AR) utilised in science education since they can be generated more quickly.

According to Lu et al. (2021), students' perceptions of the AR app improved their awareness, learning, knowledge, and engagement. This finding allayed worries about how to keep students interested while teaching and learning about real-world chemistry. The study's findings, according to Yilmaz (2021), showed that AR is the best method for teaching abstract concepts in science classes that don't involve direct observation and assessment. The usage of AR in other science education courses is similarly well-received by students. Also Abdullah et al. (2022) found that AR significantly improved students' achievement, interest, and science-process skills.

AlNajdi (2022) discovered that

integrating augmented reality and quick response (QR) codes in teaching enhances and improves student performance. The research findings of Saputra et al. (2022) demonstrate that augmented reality in scientific education materials might enhance students' comprehension and learning motivation. Because the learning skills are so enjoyable, augmented reality has a beneficial impact on students' passion for learning science. This prevents students from becoming disinterested in their studies.

Objectives of the Study

- To examine the perceptions of science subject handling teachers at the upper primary school level on the usefulness of mobile augmented reality in teaching science and
- To analyse the impact of gender, locality, and teaching experience on their perception of the usefulness of mobile augmented reality in teaching science.

Research Questions

- What are the different perspective levels of upper primary school science teachers on the usefulness of MAR in classroom practices?
- In which components of instruction through MAR, the science teachers are strong or weak?
- Whether the upper primary school science teachers differ in their perception of the usefulness of MAR in classroom practices?

Methodology of Research

The study's survey technique of inquiry was adopted to find out how certain teacher participants viewed the value of mobile augmented reality (MAR) in teaching upper primary students in science. The researchers contacted upper primary school teachers before the survey and talked with them about the convenience of MAR in their classroom instruction. They addressed their experiences using MAR from a motivational, instructional, educational, and technical perspective. After interacting with the teachers, the researchers gave them a research tool- the teacher Perception Scale on Mobile Augmented Reality (TPS-MAR) along with appropriate instruction.

Sample

A total of 135 school science teachers who teach classes from sixth to eighth were selected randomly from the Coimbatore district of Tamil Nadu as a study sample. Self-developed research tool: The distribution of the sample selected is furnished in the following table.

Table-1: Sample distribution

Sample		Frequency	Percentage
Gender	Male	57	42.22
	Female	78	57.78
Locality	Rural	78	57.78
	Urban	57	42.22
Experience	Less than 10 years	53	39.26
	10 years and above	82	60.74
In General		**135**	**100.00**

Research Tool Used

A self-developed research tool- The teacher Perception Scale on Mobile Augmented Reality was used in this study with four components, such as, motivational aspects; content teaching; student learning; and technical aspects. Each component of the scale contains five statements and all statement items are set against a five-point rating from 1 (strongly disagree) to 5 (strongly agree). Each subscale has a maximum score of 25, and therefore, the composite scale has a maximum score of 100. When developing the tool, the content validity was confirmed by soliciting feedback from the jury, and the test-and-retest methodology was used to determine the reliability of the composite tool (0.78).

The utility of mobile augmented reality in teaching science was divided into three categories, namely, low useful, reasonably useful, and more useful based on the teachers' perception scores. The teachers' perception of the utility of mobile augmented reality in teaching science is considered to be more useful if the perception scores were above one standard deviation from the mean score (Mean + SD).

Likewise, the teachers' perceptions of the usefulness of mobile augmented reality in science teaching are considered to be low useful if the perception scores were less than one standard deviation from the mean score (Mean - SD). According to the ratings between Mean + SD and Mean - SD, teachers believe mobile augmented reality in teaching science in upper primary classes is reasonably useful.

Research Findings and Discussion

Teachers' perspective level on Mobile Augmented Reality (MAR)

The perspectives of teachers regarding the usefulness of mobile augmented reality in teaching science at upper primary classes concerning their mean and standard deviation scores in the teacher perception scale for mobile augmented reality are summarised in the following table.

Table-2: Teachers' perception level on the usefulness of MAR

Usefulness of MAR in Teaching Science	Low useful	Reasonably useful	More useful
N (=135)	24	93	18
%	17.78	68.89	13.33
Mean (M)= 63.68 & Standard Deviation (SD) = 5.12			

According to the data in table 2, the sample's mean and standard deviation on the teacher perception scale are 68.68 and 5.12, respectively. Further, it is found that 13.33 per cent of the science teachers believed that MAR was more useful to them for their classroom instructional purposes, 68.89 per cent felt that it was used reasonably, and 17.78 per cent felt that it was low useful for teaching science subjects.

Utility of MAR: Strength and weakness

The following table examines the strengths and weaknesses components of MAR in teaching and learning science contents at upper primary level classes.

Table-3: Profile on MAR Utility

Teacher Perception	Mean (M)	Remark	
Motivational aspects	15.93	Strong	M > GM
Content Teaching	16.37	Strong	M > GM
Student Learning	15.87	Weak	M < GM
Technical Aspects	*15.52*	*Weak*	*M< GM*
Grand Mean Score (GM)	***15.92***		

By comparing the sample's mean scores for each component to the overall mean of the component mean scores for the research instrument, the usability of mobile augmented reality in teaching science was assessed. The assumption is that the MAR is strongly supporting the teacher to teach the subject in classroom practices if the mean of any component is more than the grand mean of mean scores of components; otherwise, it is regarded to be a weak one. According to the information in Table 3 above, teachers who teach science in upper primary schools said that MAR was very helpful for motivating students and teaching science content, but not so much helped them for boosting student learning and in terms of technical aspects.

Various research studies reported that the accomplishment of any technology-based instruction depends on factors, such as ability, interest, and involvement of students in learning (Huang, Chen, & Chou, 2016). The study results of Erbas & Demirer (2019) found that using the augmented reality technique had no impact on the science achievement of ninth-grade students, contrary to the research report of Lindgren, et al. (2016) which found that students at the middle school level displayed high levels of interest in learning science. Furthermore, Billinghurst (2021) noted in his research study that many teachers encountered technical difficulties when utilising AR.

Analysis of teacher perception scores on MAR: Variable wise

The following table provides a comparison of the mean scores of teachers on the teacher perception scale concerning various teacher variables.

Table-4: Variable wise comparison of mean scores of sample

Variable wise Teacher Perception Score		Male			Female			Total		
Locality	**Experience in Years**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**	**Mean**	**N**	**SD**
Rural	**10 years and above**	77.11	19	4.70	79.97	30	4.25	78.86	49	4.60
	Less than 10 years	78.92	13	4.59	80.44	16	5.07	79.76	29	4.84
	Total	77.84	32	4.67	80.13	46	4.50	79.19	78	4.68

Urban	**10 years and above**	75.73	15	7.94	80.83	18	5.40	78.52	33	7.05
	Less than 10 years	78.90	10	6.62	82.14	14	6.99	80.79	24	6.89
	Total	77.00	25	7.47	81.41	32	6.08	79.47	57	7.02
Total	**10 years and above**	76.50	34	6.27	80.29	48	4.68	78.72	82	5.68
	Less than 10 years	78.91	23	5.43	81.23	30	6.00	80.23	53	5.82
	Total	77.47	57	6.01	80.65	78	5.21	79.31	135	5.76

In accordance with the results of a study by Dirin et al. (2019), stated that, female participants' perception of using AR technology was better than male participants, the mean scores of the teachers given in the above table show that the mean score of female teachers is better than that of male teachers. Additionally, teachers in urban areas score well than those in rural areas. This finding may be attributable to the technical resources offered in schools, and it is corroborated by the findings of a study by Putiorn et al. (2018), who noted that teachers in rural schools found it challenging, in terms of technical aspects, to implement augmented reality (AR) technology. Additionally, teachers with less than ten years of teaching experience scored well than those with ten or more years of experience. The experienced teachers, due to their age and health conditions, may found hard and less comfortable to use of the latest technologies in the classroom practices than the young teachers.

In addition to the aforementioned, an ANOVA test was carried out to determine whether there was a difference in significance between the mean scores of teachers according to the variables of gender, locality, and teaching experience of the teacher sample. The results are provided in the following table.

Table-5: Three-way ANOVA test teacher perception scores

Source	Sum of Squares	df	Mean Square	F-value	p-value
Gender (A)	311.66	1	311.66	9.97	0.00
Locality (B)	2.67	1	2.67	0.09	0.77
Experience (C)	88.17	1	88.17	2.82	0.10
A x B	30.32	1	30.32	0.97	0.33
A x C	19.78	1	19.78	0.63	0.43
B x C	9.22	1	9.22	0.30	0.59
A x B x C	0.50	1	0.50	0.02	0.90
Within	3969.66	127	31.26		
Total	4444.93	134			

The results from the table above indicate that gender affected teachers' perceptions on the usefulness of MAR in teaching science at the upper primary level (F = 9.97; p = 0.00); however, locality and teaching experience had no effect on the teachers' perceptions because their corresponding p-values were greater than 0.05. Additionally, there was no interaction effect of gender, locality, and teaching experience on teachers' perceptions of the usefulness of MAR in teaching science.

Conclusion

According to the main findings of the present study, the upper primary school teachers have viewed that MAR as reasonably useful to them in teaching science subjects in upper primary classes. The use of augmented reality in education is growing in acceptance at all levels of the worldwide educational system. It is more participatory than other traditional classes because both students and teachers in this setting are constantly involved in virtual modes of academic activities. When used in a school setting, AR helps the students and teachers to get pleasure in teaching-learning processes and hold unforgettable learning experiences. Students will remember the knowledge they have learned in the classroom better as a result. Through the use of the AR technology, the students will get improvement in their learning skills and maximise their content understanding. Therefore, the school administrators may set up the necessary classroom infrastructure and support their teachers by providing them with the right technology tools to boost students' academic performance.

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Research Article

Higher Education during and after COVID-19: Is Online Education the New Normal?

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Abstract

The Covid-19 pandemic has transformed Indian education into a new phase with technology coming upfront. All educational institutions from primary to universities have adopted technology-mediated education. It has opened up new directions in the education arena and online education becomes the 'new normal. Many EdTech Startups have also boomed in this period to capitalize on the market for online education. It is in this context that this study analyses the impact of online education on Indian higher education during this pandemic through a case study of the learning experience of a Central University in India. The study was limited to the discipline of social science. Out of the 182 students of the School of Social Sciences and Policy of the Central University of South, Bihar contacted through Google Form, 100 forms have been rated in proper order. So these 100 students constituted the sample for this study. Being a new platform for education, the students have faced some difficulties in coping with it. However, it was found that despite the challenges and limitations, the students experienced online education as an alternative to conventional education.

Keywords: Online education, digital divide, EdTech startups, SWAYAM

Introduction

Covid-19 has brought about an unprecedented crisis across the world economy. It has affected all sectors of the economy. The production and services sectors have been affected badly during this pandemic. Governments all over the world are in a dilemma on how to combat the hither-to-unknown crisis. Among the various sectors seriously impinge on during the Covid -19 crisis is education in general and higher education in particular. The day when education was restricted to clearly delineated rooms, frequently called classrooms, is passed, right? A person may study everything they want now with the aid of technology, at their own pace, at a time that works for them, and all with the press of a button. Similarly, various institutions, autonomous bodies, and even private players have come forward with solutions to mitigate the problem of education during these difficult times.

Online education is the most sought-after mechanism adopted by and large by most countries. As an illustration, after the World Health Organization declared the new coronavirus a pandemic on March 11, universities all over America closed their doors in an effort to stop the virus' spread. The University of Washington took the initiative on March 6, 2020, by canceling all in-person classes Chiodini, J. (2020). A wave of colleges and universities around the nation soon followed suit, including Duke, Stanford, Harvard, Columbia, Barnard, N.Y.U., Princeton, and Stanford. Both wealthy and emerging nations share a similar situation UNESCO Report. (2020). All these universities have shifted to virtual class classrooms Sun, L., Tang, Y., & Zuo, W. (2020).

To capitalize on the increasing demand for online education, many EdTech startups have been emerging across the world Naylor, R. (2020). The EdTech industry is expected to grow and generate close to $2 billion by 2021, according to reports by KPMG and Google. Famous EdTech startups include Byju's, Adda247, Alolearning, AptusLearn, Asmakam, Board Infinity, ClassPlus, CyberVie, Egnify, Embibe, ExtraaEdge, iStar, Jungroo Learning, GlobalGyan, Lido Learning, Pesto, Vedantu, Edubrisk, ZOOM Classroom, ZOOM Business, Toppr, Unacademy, Coursera Zheng, B., Hsi Lin B, C., & Kwon, J. B. (2020). Some of the Digital e-Learning Platforms in India like SHAGUN Online Junction, National Repository of Open Educational Resources (NROER), DIKSHA, e-Pathshala, SWAYAM, Swayam Prabha, Other Online Platforms for Education Approximately 55 school boards, 359 state universities, 123 deemed universities, 47 central universities, and 260 private universities are affiliated with the National Academic Depository (NAD), which is controlled by the UGC. To give content to students pursuing higher education and doctoral degrees, the National Digital Library of India is administered by the Ministry of Human Resource Development (MHRD) as part of the National Mission on Education through Information and Communication Technology (NMEICT). Another important project of the MHRD and GoI is called Virtual Labs, and it is administered by NMEICT. It is a partnership between 12 IITs that aims to offer online courses and study materials via virtual laboratories, where 700+ virtual experiments are created and promoted for candidates to study and comprehend.

Review of Literature

Before and after the outbreak of the pandemic, a few attempts were done by scholars to understand the effect and problems of online education on different levels of education across the world. As a preface to this paper, it is meaningful as well as helpful to go through such studies. It will also provide a proper guideline to frame the present study on sound footings. The learning and teaching environment have undergone a noticeable transformation thanks to web technologies. Supporters of online learning have observed that it can be efficient in possibly removing barriers while providing more convenience, flexibility, current content, personalized learning, and feedback compared to a typical classroom teaching environment. (Harasim, 1990; Matthews, 1999; Swan et al., 2000) Brown, G., & Wack, M. (1999) Matthews, D. (1996). Rivals, however, are worried that students in an online setting may feel alone (Brown, 1996), confused, and disappointed (Hara & Kling, 2000), and that student's interest in the subject and learning effectiveness may be diminished (R. Maki, W. Maki, Patterson, & Whittaker, 2000).

(Bhushan, 2020) carried out a survey to learn more about the realities of the online alternative and other approaches to opening higher education institutions. The survey's findings support the absence of internet access. It was challenging to conduct online classes. The ability of the teachers to use IT resources needs to be developed. There is a problem with students access to online classes that have to be resolved. Many private unaided institutions believe that there will be a significant drop in enrollment, a hike in fees that will shift the incidents to students, and a decrease in the employment of contract teachers and temporary teachers. The government may offer a financial stimulus package in the situations mentioned above. The University Grants Commission may provide the university more freedom to make judgments that are appropriate for the situation.

200 university administrators from 53 different countries participated in a survey by Times Higher Education (2020). One hundred per cent of university instruction has been or will be relocated online, according to 53 per cent of respondents. According to 33 per cent of respondents, COVID-19 has caused or will cause the relocation of more than 75 per cent of university instruction online. The main reason people do not intend to migrate online is not a lack of resources, technical expertise, or availability; rather, it was because specific disciplines or modules cannot be taught online. More than 80 per cent said the move was successful. Only 9 per cent firmly concur that online instruction is of a higher caliber than instruction provided before the Covid amendment. For classes that had to be moved online, 79 per cent of respondents said they would ask students for course evaluations. Sixty per cent of respondents felt that in at least some subjects, a continuous evaluation is a valid substitute for online final exams. They also mentioned how difficult it is to transfer all applied disciplines and professional courses to online teaching and learning.

A study was done (Vaccani, 2016) to determine whether webcast lectures are equally effective as live lectures as a teaching tool in medical school. Third-year medical students were given three lectures on otolaryngology-head and neck surgery (OTO-HNS) as part of their usual academic program; one group attended live lectures, and the other group watched webcasts of the lectures. The same instructor delivered the same content in all lectures, whether broadcast live or online. A student satisfaction survey, performance on the OTO-HNS portion of their written exam, and performance on an OTO-HNS OSCE station during the general end-of-year OSCE assessment session were employed as the three outcome measures. Study results showed that both sets of students performed equally well on the written test. Performance in the OSCE station's webcast group was superior to that of the live lecture group. In the opinion of most students in the webcast group, it was a useful educational tool. The majority of participants reported that they found it helpful to watch the lectures more than once.

(Litao Sun et al., 2020) discuss their experience with statewide distance learning in Chinese institutions during the COVID-19 pandemic. We examine the findings of a statistical survey done among 39,854 students at Southeast University in China to have a better understanding of the efficacy of such extensive online education. About 50 per cent of students thought the intended learning objectives had been fully accomplished, and 46 per cent thought they had been mostly attained. Intriguingly, most students concurred that, in addition to ensuring continuity in the classroom, teachers contributed a pleasant vibe to help pupils deal with the stress of being in quarantine. However, when asked about "focus and restraint," students were less enthusiastic and gave it a relatively low score. This indicates that there is a greater need to improve self-discipline and concentration in the face of distractions like sluggish network speed, a noisy environment, and a lack of professional equipment. To lessen the effects of unreliable networks and boost student engagement, students suggested mixing recorded films and live classes with greater online interactivity. One of the most popular recommendations was to offer a unified teaching platform with playback features and an adequate quantity of homework.

According to the (KPMG, 2017) survey study, online education will continue to grow in popularity among prospective students, professionals, and others driven by features like simple and on-demand access to content, self-paced learning opportunities, and interactive and modular learning modes. Due to the lack of connection with peers and instructors, roughly one-third of online students also hold the view that online learning cannot replace traditional learning.

(Saxena et al., 2016) believed that the educational system is transforming. There is a growing understanding that education must be regarded from the perspective of lifelong learning. People are starting to take control of their education. As a result, "e-Learning," a new educational phase, has emerged. The term "eLearning" describes creative ways to use technology to share information and provide more people access. Through the development, application, and management of suitable technology processes and resources, online education's primary goal is to facilitate learning and enhance performance. By removing the barriers between students and the rest of the world, these eLearning techniques are converting the static learning environment into a dynamic one. The main barrier to the widespread adoption of this technology-driven learning, despite encouraging trends in India as a whole, is the lack of internet connectivity in smaller towns and semi-urban areas. Only once these problems are resolved can the enormous promise of learning tools like gamification, video-based learning, competency training, etc. be realized. It is anticipated that India would see a profound transition in the upcoming ten years, driven by companies that are bringing technology-driven education to a pan-Indian scale through digital learning.

(McGrath, 2020) a study by Britain's Open University found that compared to traditional face-to-face courses, preparing and delivering e-Learning courses uses an average of 90 per cent less energy and generates 85 per cent less CO_2 emissions per student. According to data on the state of eLearning in corporate education published by CertifyMe.net, 72 per cent of the firms surveyed felt that eLearning gives them the ability to maintain their competitive edge by keeping up with developments in their particular industry Dash, S. K., & Sidharth, R. (2022, July 19). The same IBM study from 2014 found that investing in online training boosts productivity by $30 for every dollar spent, mostly because workers can quickly resume their jobs and put their newfound knowledge to action. After introducing an eLearning programme, IBM discovered that participants retained roughly five times as much information without having to spend additional time in training. Companies can cut expenses by reducing the time employees spend in training by teaching more material in a shorter time and allowing them to return to work sooner.

The Research Institute of America discovered that eLearning enhances retention rates by 25 per cent to 60 per cent, whereas face-to-face training has far lower retention rates (8–10 per cent). This is because eLearning gives students more control over the learning process and allows them to review the material as much as necessary. Compared to learning the same subject in a traditional classroom setting, e-learning often consumes between 40 per cent and 60 per cent less employee time, according to a Brandon-Hall Study. This is because it may be completed whenever the student needs it and asynchronously, preventing interruptions to workflow.

Some students find it difficult to engage in digital learning when they lack reliable internet access and/or technology. According to OECD data, only 34 per cent of students in Indonesia have access to a computer for schooling, compared to 95 per cent of students in Switzerland, Norway, and Austria (http://www.oecd.org/pisa/). In the US, there is a noticeable difference between those from rich and poor families: although almost all 15-year-olds from a privileged family reported having a computer to work on, only around 25 per cent of those from underprivileged backgrounds did.

Only 23.8 per cent of Indian families, as reported in the Key Indicators of Household Social Consumption on Education in India report based on the 2017–18 National Sample Survey, have access to the internet (NSSO, 2018). Furthermore, only 4.4 per cent of rural homes have computers, compared to 23.4 per cent of urban households. Only 33 per cent of women have internet connectivity, according to IAMAI's (Internet and Mobile Association of India) 2019 India Internet report Bolliger, D. U., & Halupa, C. (2018). This ratio is even more alarming when one realises that 67 per cent of men in the same nation have internet access. in rural areas, only 28 per cent of women and 72 per cent of men have access to the internet, respectively.

(Joshi, 2017) provides evidence that student performance as measured by grade is independent of the mode of instruction by comparing student performance measures and assessments of learning experience from online and traditional sections of a required Quantitative methods & techniques course taught by the same instructor. In quantitative techniques classes more so than in other subject areas, persistence in an online environment could be difficult. Online classes may also see a decrease in participation aggression and a change in the type and volume of engagement.

In this light, it is relevant to look at how beneficiaries in the Indian setting view online education. Reviews of the experience with online education shed information on the system's strengths and weaknesses. However, further study is necessary for this innovative field of teaching. This study describes the models and issues of online education provided by a Central University in India in the context of its student body.

Research Questions

1. What is the role of online education in the aftermath of Covid-19?
2. What are Socio-economic features of online learners?
3. What is the online education endeavor in India?
4. What are Learners' Perceptions of Problems of Online Classes?
5. What is the experience of learners about online education?

Objectives of the Study

The general objective of the study is to examine the trend and experience of online education in the country. The specific objectives of the paper are:

1. To understand the role of online education in the aftermath of Covid-19.

2. To review the online education endeavor in India, and

3. To analyse the experience of learners with online education

Methodology

The study has used both primary and secondary data. Primary data were collected from a randomly selected 100 Post Graduates currently undergoing education through online mode. The students belonged to the School of Social Science and Policy of the Central University of South Bihar[1]. The survey was conducted in April-May 2021 using a structured questionnaire. Secondary data were collected from various published and unpublished sources.

Empirical Experience

We have conducted a quick survey among the postgraduate students who were undergoing online learning during the COVID-19 period at the Central University of South Bihar. The following paragraphs portray the information collected from them.

Socio-economic features of the online learners

In any social science study, the demographic and other social features are to be understood to carry out any serious research. So, we have endeavored to do that exercise first. The socio-economic features of the sample students are given in Table 1.

Table-1: Socio-Economic Characteristics of the Sample Population

Sl.No.	Characteristics		Number	Percentage
1	Gender	Male	16	16.0
		Female	84	84.0
2	Residential Status	Rural	54	54.0
		Semi-urban	24	24.0
		Urban	22	22.0
3	Caste	Forward	59	59.0
		Backward	35	35.0
		SC/ST	6	6.0
4	Marital Status	Married	4	4.0
		Unmarried	96	96.0
5	Monthly Income (Rs.)	Below 10000	48	48.00
		10000-20000	26	26.00
		20000-3000	19	19.00
		Above 30000	7	7.00

Source: Sample Survey

The gender-based distribution of the sample reveals that 84 per cent are females. On the basis of residential status, 78 per cent of the sample beneficiaries are from rural and semi-urban areas. Caste-wise, 59 per cent are from the forward community, 35 per cent are from backward castes and only 6 per cent of the sample is from SC/ST. According to marital status, 96 per cent are unmarried. The financial status of the sample students reveals that 48 per cent of them have a monthly income of less than Rs.10,000. Similarly, about 26 per cent of students have a monthly income between Rs.10,000 and 20,000. A general conclusion of the discussion is that on average the students who undergo online education belong to all income classes, caste, and gender groups.

Technology and Platforms Used for online learning

Online education requires technological support. So, equipment is a prerequisite for successfully completing the program. An inquiry in this regard has been conducted among the sample learners. The results are provided in Table 2. The main equipment for online learning is desktop computers, laptops, smartphones, tablets, etc. It is seen that 80 per cent of learners use their smartphones for online learning. Around 15 per cent use desktop computers and only 5 per cent have laptop availability. The second important requirement is internet connectivity for accessing classes. The learners can go for broadband connection or major other companies. In the case of Bihar students, it is seen that the majority are using the Jio network followed by Airtel. As 80 per cent of the learners learn through smartphones, a question was asked about the trademark of the phone. It is seen that Realme, Samsung Galaxy, and Oppo are the major brands used by learners. To the question on the data pack used by the learners, it is seen that 60 per cent purchase 1.5. GB daily package and 20 per cent 2 GB daily data package.

Table-2: Platforms Used for online learning

TYPES OF EQUIPMENT USED FOR ONLINE LEARNING			
Desktop Computers	Laptops	Smartphone	Tablets
15.0	5.0	80.0	0.0
INTERNET NETWORKS USED FOR ACCESSING CLASSES			
Airtel	Jio	Vodafone	BSNL
20.0	78.0	1.0	1.0
BRAND NAMES OF SMARTPHONES USED			
Realm	Samsung Galaxy	Oppo	Others
67.0	17.0	14.0	2.0
DAILY DATA PACK USED			
1 GB	1.5 GB	2 GB	3 GB and above
10.0	60.0	20.0	10.0

Source: Sample Survey

Expenditure for Data packs

To stand the monthly expenditure for using the internet for online education before and after online education, it is revealed that before online education was mandatory, 78 per cent were using a below Rs.149 pack. But its share decreased to 23 per cent after online education started. While the monthly expenditure was between Rs.150-249 pack, earlier only 16 per cent were the users, but after the online education, the share of this group has increased to 56 per cent. In conclusion, the monthly expenditure for using the internet after online education has increased considerably.

Table-3: Monthly expenditure for the Internet before and after online education

(Figures are Percentage users)

Sl.No.	Range of Expenditure (Rs.)	Before	After
1	<149	78.00	23.00
2	150-249	16.00	56.00
3	249-399	6.00	15.00
4	>399	0.00	6.00
	Total	100.00	100.00

Source: Sample Survey

Location of online classes

An inquiry was carried out to understand the accessibility of online education location-wise. It is really interesting to see that 81 per cent of them access online education from their own home. Only 6 per cent uses neighbors' home and 9 per cent relatives' home and 4 per cent use public institutions like the public library, Anganwadi, etc.

Table-4: Location of accessing online classes

Location	Male	Female	Total
At own home	9.00	72.00	81.00
Neighbours' home	3.00	3.00	6.0
Relatives home	4.00	5.00	9.00
Public institutions	0.00	4.00	4.00
Total	16.00	84.00	100.00

Source: Sample Survey

Opinions about online classes

Information has been sought from the learners about the different dimensions of online support. The information in this regard is presented in Table 5. The learners' perception of online classes revealed that 40 per cent perceive it as 'good', while 28 per cent feel it as 'average' and 11 per cent consider it as 'excellent'. But it is serious to see that about 21 per cent perceive that online classes have only 'poor' standards. Regarding the quality of study materials, 35 per cent grade it as 'very good and 29 per cent 'good'. But at the same time, 28 per cent find the study materials as 'average', and 8 per cent see it as 'poor' only. Regarding satisfaction with online classes, 16 per cent are 'highly satisfied, and 42 per cent have stated 'satisfied'. At the same time, it is seen that 31 per cent are 'dissatisfied' and 11 per cent are 'highly dissatisfied' about online classes. Video classes are the most preferred medium for online classes.

Table-5: Opinion about online- study support (Figures are in percentages)

PERCEPTIONS ABOUT ONLINE CLASSES			
Excellent	Good	Average	Poor
11.00	40.00	28.00	21.00
QUALITY OF STUDY MATERIALS			
Very Good	Good	Average	Poor
35.00	29.00	28.00	8.00
SATISFACTION LEVEL OF ONLINE CLASSES			
Highly Satisfied	Satisfied	Dissatisfied	Highly Dissatisfied
16.00	42.00	31.00	11.00
PREFERRED MODE OF ONLINE CLASSES			
Video classes	WhatsApp	Audio Clips	Email
84.00	16.00	6.00	4.00

Source: Sample Survey

Learners' Perceptions of Problems of Online Classes

In accessing online classes, the learners are confronted with various constraints. An inquiry in this regard was conducted among the sample learners and their opinion is presented in Table 6. In the rural areas, the learners were assigned irregular power supply as the first rank followed by low internet bandwidth. The third and fourth ranks assigned by them are low voltage and technical errors. As far as urban learners are concerned technical errors were assigned the first rank followed by long hours of online classes. The third problem they feel is the absence of peer groups.

Table-6: Major problems in proper access to online education (Rank)

Sl.No.	Problem	Rural	Semi-urban	Urban
1	Low Internet bandwidth	III	VIII	VI
2	Irregular power supply	IV	VII	V
3	Voltage instability	V	V	VII
4	Technical errors	VI	IV	I
5	Long hours of online classes	VIII	VI	II
6	Lack of interaction with faculty	I	II	IV
7	Absence of peer group	VII	I	III
8	Data shortage	II	III	VIII

Source: Sample Survey

Discussion

The aforesaid discussion on the impact of online education during the period of Covid-19 Pandemic has brought out some revealing facts. Countries all over the world have come forward to promote education through online platforms. Though it is new to India, Indian universities have picked up fast. Even the governments have come forward with exclusive education channels like the KITE-VICTORS Channel of Kerala. Similar to that many universities have started various types of Learning Management Systems (LMS). The most popular Learning Management System adopted by educational institutions in India is INFLIBNET LMS (ILMS). Similarly, various teachers have used Google Meet, Zoom, WebEx, Jitsi Meet, etc., for delivering online classes.

As our study reveals online education has both positive and negative features. On the positive side, in times of a pandemic like Covid-19, online education is a blessing. As students and teachers cannot move from their homes, but to continue their education, online is the only medium. It will prevent the spread of disease. Secondly, online education provides learners with the classes of the best teachers. Also, they can use different courses offered by SWAYAM and other online learning structures. On the negative side, online education has innumerable issues. First, in developing countries like India with a high digital divide, online education is not at all accessible to large numbers. Secondly, online education requires some basic infrastructure at the disposal of learners like computer/ smartphone, internet connectivity, regular power supply, high bandwidth of internet, etc. These requirements demand that the learners should have enough income to make these facilities available. Moreover, the major problem as revealed by our study is that in rural areas most online learners face low bandwidth connectivity and irregular power supply. Thirdly, in a family with more learners who venture into online learning, some of them have to forgo online classes someday as the family may not have adequate gadgets. Fourthly, the majority of people still adhere to the traditional model of learning and think that employing technology in the classroom is confined to PowerPoint presentations, even though a small number have adapted to the new ways of learning. So, these flipsides of online learning are also seriously looked into. Most of the findings of the present study conform to the findings of the recent studies on online education referred to in the literature review.

Conclusion and suggestions

The present scenario of the pandemic due to Covid-19 has forced society and administration to abruptly close academic institutions, basically non-operating the face-to-face mode of teaching, for more than five months now. The prevailing situations also clearly indicate the non-opening of the face-to-face mode of teaching for at least one more semester i.e., the odd semester of 2020-21. Therefore, in this critical situation, there is a need to transform our teaching, learning, and assessment approaches by using quality online resources, strategies, and digital platforms.

The global footprint of the digital world and e-learning is growing. With the advancement of technology, online education in India has advanced significantly. India is one of the countries where technological development is accelerating exponentially. India boasts the most technologically savvy people with a population of more than 1.3 billion with access to high-speed internet and smartphones. India's way of life has changed as a result of the internet's growth. Many people in India prefer to learn online due to the abundance of online courses and the ever-growing knowledge available. The advantages of online education are the same: classes can be attended anywhere, not having to commute allows for more time for studying or other responsibilities, and the structure is more accommodating to students with physical disabilities or illnesses.

The survey conducted by the author found that Online classes are no better than regular classes because of the absence of peer groups, lack of interaction with teachers, and inexperience with the online experience. Similarly, the teachers are not well trained in online teaching which results in the supply of long notes which are difficult to read on mobile phones. Some students are unable to access classes due to the sparing of the same phone as other members of the family. The slow speed of networks, irregular power supply, and lack of adequate study infrastructure at home make the continuity of online classes very difficult to use effectively. In a poor country like India, these problems are very serious in the case of marginalized communities and Dalits. So, adequate Information and Communication Technologies (ICTs) should be ensured to make the online classes functional. Similarly, broadband connectivity, subsidized data packs for students, and other measures should be implemented to ensure the participation of weaker sections in the online platform. Otherwise, our inclusion agenda will be questioned and polarization in society will happen.

A few suggestions are here for the practitioners. Before going for any pre-scheduled online class in real-time synchronous mode, faculty members are required to provide e-material to the students through LMS and/or using other asynchronous modes like email, WhatsApp, Google Meet, etc. The e-materials should preferably be in the form of self-instructional handouts/ concept notes/key points/short videos/ small excerpts/preloaded material LMS. The faculty members will avoid giving long readings/full PDF books as e-material. Once the students have gone through the shared e-materials, an online synchronous video interaction session of a maximum of one hour in one go will be advisable by the concerned teacher on a particular topic/or group of topics. - Instead of delivering a lecture like a face-to-face class using video meeting technology, the session should focus to discuss critical highlights of the topic and taking the questions/doubts of the students. If required, video lectures may be recorded and uploaded on the Learning Management System (LMS) beforehand so learners can view them before and after the class. If these types of measures are introduced, there is no doubt that online education will be the new normal in the Indian educational sphere.

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Research Article

Inclusive Enrollment Policy, ICT and Disintegrating Teaching-Learning Process: Where do Universities Stand in this Paradox?

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Abstract

Recognizing the significance of education in the development of valuable Human Capital, investing in appropriate infrastructure for providing quality education to all is presently high on the policy agenda of India. However, looking at the diversity of the population in terms of caste, class, and region, every attempt to ensure quality education has an inherent challenge to be addressed. The present paper aims to understand the efficacy and reliability of having an inclusive admission policy and a simultaneous ICT-enabled teaching-learning methodology in vogue. The article argues that an inclusive admission policy demands a teaching-learning methodology that equally minimizes otherwise prevailing disparities. Having IT enabled facilities requires an efficient mechanism to train the stakeholders and create mass awareness about the facilities that would enable everyone to have equal access to the facilities.

Keywords: Education; Reservation; Inclusion; ICT; Teaching-learning, Alienation

Introduction

Institutions of higher learning have played an essential role in educating the elite and achieving significant accomplishments in science and the humanities throughout human history. (Chankseliani, Qoraboyev & Gimranova, 2021). Studies reveal that a robust higher education system is crucial to the nation’s ability to compete in the global economy while contributing to its economic growth, quality of life, and positioning as a global leader. (Teague, 2015). Through their institutional policies and practices, institutions of higher learning play a crucial role in initiating and promoting sustainable development measures which are essential to the welfare of any society (Blessinger, Sengupta, and Makhanya, 2018). In this backdrop, Article 26 of the Universal Declaration of Human Rights advocates that based on merit higher education should be affordable and accessible to everyone. However, the challenges to implementing it are hidden in the basic composition of the population of any society and the nature of social inequality and exclusion the society reflects.

Given the diversity of Indian society, wherein people from all walks of life are found to be living, social inequality and exclusion are the facts of life. The occurrence of social inequality and exclusion is so multifaceted and multi-dimensional that hardly any segment of the population in India is devoid of its presence and hardly any institution has escaped its influence. While in India, we come across Scheduled Castes, Scheduled Tribes, Other Backward Classes, specially-abled, poor, religious, and regional minorities thereby reflecting the nature of exclusion. Rural-urban differences, gender and educational level of people further add to the existing scene of exclusion of the

Indian society. Given this complexity, it is challenging for India to realize the objectives set by the 'Universal Declaration of Human Rights'.

Given this backdrop, Indian higher education institutions have been pro-people as they attract students from diverse socio-economic backgrounds by reserving quotas for the downtrodden sections to lift them in society. The Central Educational Institutions (Reservation in Admission) Act 2006 and as amended in 2012 provides for 'the reservation in the admission of the students belonging to the Scheduled Castes, the Scheduled Tribes and the Other Backward Classes of citizens, to certain Central Educational Institutions, established, maintained or aided by the Central Government, and for matters connected therewith or incidental thereto' (HBNI, 2020).

The inclusion of the downtrodden, however, is not the only objective of educational institutions. An effective institutional facility has to correspond to the changing programs of educational delivery and must provide a comfortable, safe, protected, affordable, well ventilated, and aesthetically pleasing physical environment. Furnishings, materials and supplies, equipment and information technology, as well as amenities that facilitate co-curricular activities, are all included in the facility. (Osuji, 2016). The last few decades have seen remarkable progress and innovation in technology and those leveraging these advances have seen paradigm shifts.

ICT has quickly become an essential part of the classroom and school infrastructure. From preschool through higher education, computers, laptops, smartphones, smart boards, and tablets is a powerful medium through which we get information and then interact. Several research and analyses have recently highlighted the opportunities and potential benefits of ICT for improving the quality of life and educational quality. ICT is regarded as a "key tool for establishing knowledge societies." and, particularly, as a mechanism at the school education level that could provide a way to rethink and redesign the educational systems and processes, thus leading to quality education for all (Sangra & Gonzalez-Sanmamed, 2010).

At the national level, India has significantly contributed to raising the infrastructure of education based on ICT and during this process; both public and private institutions have made landmark contributions. While some of these learning applications focus on wide-ranging topics or are used as learning aids, others are formulated with specialized fields of study in mind. If, on the one hand, private players like BYJU, Unacademy, Vedantu, Toppr, and Doubtnut facilitate students to learn on e-platforms, government platforms like Study Webs of Active Learning for Young Aspiring Minds (SWAYAM) Swayam Prabha, National Digital Library of India, Diksha, National Programme on Technology Enhanced Learning, e-ShodhSindhu, etc. have also made a significant contribution in this field.

Such initiatives, however, are productive only if they reach uniformly to its respective stakeholders. Disproportionate access to such initiatives may result in new kinds of inequalities and subsequent concerns among the learning communities. This is evident from the fact that institutes of excellence in terms of ICT facilities witness varied issues among the students. Pertinently, '27 students across 10 Indian Institutes of Technology (IITs) in India have committed suicide between 2014 and 2019 with IIT Madras topping the list with suicides by seven students during this period (Business Standard, 2019).

Prior literature

On the one hand, academics believe that technology plays an important role in the teaching-learning process. (González-Zamar et al, 2020, Agarwal and Mittal, 2018, Montrieux, 2015, Bhaumik 2012, Tamin, Bernard, Borokhovski, Abrami, and Schmid, 2011), on the other hand, some raise questions about whether ICT is appropriate for all types of pupils or for all kinds of teaching-learning processes and caution that educators need to be aware and careful in their handling of technology vis-à-vis students (Lembani et al, 2020;). Many scholars have also warned against the addiction, underuse, and mishandling of Technology while emphasizing that it has offered us a massive opportunity that must be taken advantage of. Given the circumstances, some researchers have departed from conventional presumptions and studied them from different focal points.

Before the use of ICT, the primary basis for understanding the significance and reliability of ICT-enabled teaching-learning lies in the accessibility to the technology and associated gadgets. This disparity cuts across age, income, gender, and educational attainment. The flow of technology would not work unless it ensures deep-rooted and universal access to its stakeholders. Tewathia et al (2020) argue that the less educated, lower-income, and lower-caste strata are more marginalized since they lack ICT assets and skills. Fraillon Et al. (2014) while studying Grade 8 students of selected European countries discovered that for social communication, females made slightly more frequent use of the internet than males. While there are some differences in how men and women use information and communication technologies, these disparities are minor. However, Jha and Shenoy (2016) suggest that in the modern ICT-enabled educational system in India, the people are diverse not only in terms of culture and ethnicity but also in terms of purchasing power and cost. The National Statistical Organization, in its 75th round survey on 'Social Consumption of Education (2017-18)' studied the 'computers and access to the internet' possession of households. 'The analysis only included households that had students aged between 5 to 29 years and were at that time enrolled and attending school. The survey revealed that only 8.3 per cent of households had computers and 21.6 per cent had access to the Internet. (Ministry of Statistics and Programme Implementation, 2020) The study reflected the ineffectual accessibility of learners to the devices that link them to ICT. Extreme poverty and highly patriarchal societal systems, in which a strong cultural preference for boys relegates mothers and female children to a lower status, combine and perpetuate the impediments that stand in the way. (Singh, et. al., 2018). Without access to ICT, learners are at greater risk of being left behind in a rapidly changing global society. Studies (Bala and Singhal, 2018; Cummings & O'Neil, 2015) argue that it is essential to promote ICT prospects for women as it can supplement the prospects in education and employment for women.

The review of the prior literature, as such, reveals a complex relationship of ICT with various stakeholders in the arena of education. Its impact is determined by the awareness, access of people to ICT, and availability of the facilities about the Internet.

Objective of the study

Usually, an institution of learning has pupils of almost homogenous backgrounds and in such a condition one does not face different problems while teaching/learning. However, in a condition of reservation, institutions attract students of diverse socio-economic backgrounds, and addressing such a diverse class is not so easy. It is challenging to bring the whole class to a homogenous level of teaching-learning. In this context, the study sought to understand the efficacy and reliability of ICT-enabled teaching-learning methodology in a diverse classroom wherein students of diverse socio-economic backgrounds are enrolled. The study also aimed to study the challenges faced by the students of different weak and underprivileged settings in ICT-enabled settings.

Methods

The study is qualitative, and the empirical data was gathered from primary and secondary sources. The information related to the students' intake capacity, reservations policy, facilities, and infrastructure were sought from different secondary sources, viz. various university published documents, university websites, relevant books, journals, and various newspapers reflecting the data about the study.

To gather the primary data from varied stakeholders of the institution, a purposive sampling technique was used to derive the desired sample. When using purposive sampling, there is no way of knowing how many people will take part; as such, the research presented here was not determined by finding a set number of participants but rather by engaging those who desired to share their experiences concerning the influence of the teaching-learning process. Three types of people were approached for participating in the study, i.e. students, professors, and IT professionals. Student participants were recruited using the following inclusion criterion: (a) belonging to a weak or underprivileged section of society; (b) seeking admission in the course against a reserved category and (c) presently enrolled as a regular student in the university. For professors and IT professionals, no specific criterion was adopted because they were not the ones getting influenced and their participation could only complement the data collected from the students.

At the outset, 36 potential individuals were contacted of whom only 11 disagreed to participate. Hence, the study shares the experiences of 25 participants who consisted of 20 students (representing various categories), 3 professors, and 2 IT professionals. The relevant information of the participants is given in Table 1.

Table-1: Demographic Profile of Participants

S. No.	Sex	Residence	Category of the student	Level of enrolment	Family Income/month (in Rupees)
1.		Rural	Scheduled Tribe	Postgraduate	> 5,000
2.		Urban	Weak & Under Privileged Class	Postgraduate	5,001 – 15,000
3.		Rural	Residents of Backward Areas	Undergraduate	5,001 – 15,000
4.		Rural	Residents of Backward Areas	Undergraduate	< 15,000
5.		Urban	Weak & Under Privileged Class	Postgraduate	> 5,000

6.		Urban	Differently-abled	Postgraduate	5,001 – 15,000
7.		Rural	Scheduled Tribe	Postgraduate	< 15,000
8.		Rural	Residents of Backward Areas	Postgraduate	5,001 – 15,000
9.		Rural	Differently	Undergraduate	5,001 – 15,000
10.		Urban	Differently	Postgraduate	< 15,000
11.		Urban	Weak & Under Privileged Class	Undergraduate	5,001 – 15,000
12.		Rural	Living along Line of Actual Control	Postgraduate	> 5,000
13.		Rural	Residents of Backward Areas	Postgraduate	5,001 – 15,000
14.		Rural	Residents of Backward Areas	Postgraduate	< 15,000
15.		Rural	Scheduled Tribe	Postgraduate	< 15,000
16.		Rural	Residents of Backward Areas	Postgraduate	> 5,000
17.		Rural	Children of Gujjar and Bak-erwal	Postgraduate	5,001 – 15,000
18.		Rural	Residents of Backward Area	Postgraduate	5,001 – 15,000
19.		Urban	Differently-abled	Postgraduate	< 15,000
20.		Urban	Weak & Under Privileged Class	Postgraduate	> 5,000
21.		-	-	Professor	-
22.		-	-	Professor	-
23.		-	-	Professor	-
24.		-	-	IT professional	-
25.		-	-	IT professional	-
26.		-	-	IT professional	-

The study includes in-depth qualitative interviews with all 20 student participants and semi-structured interviews with the rest of the participants. The interviews were conducted from September 15, 2020, to November 15, 2020, a period, predominantly influenced by the Covid-19 pandemic, and teaching-learning was mainly based on ICT. However, it was ensured that the participants were part of the university teaching-learning process before the Covid-19 pandemic as well. Permission was sought from all participants and interviews were conducted at their convenience in the local, Urdu, Hindi, or English language. Each interview ranged from 30 to 50 minutes in length. The sequence of the questions, which was kept simple and clear of technical terminology, was frequently changed as the conversation progressed. All the interviews were taped with the participants' agreement, and later responses were transcribed before being translated into English for analysis.

Names of participants highlighted in the research are pseudonyms and some significant details have been changed to ensure that their identities are protected.

Findings

Two main themes evolved after the data was analyzed. The first theme highlights the facilities the institution offers to the students. The second theme brings out the experiences of the students coming from the reserved categories with the ICT enabled teaching-learning process.

University of Kashmir

The main campus of the University of Kashmir is situated in the Hazratbal area of Srinagar city (in Jammu and Kashmir Union Territory of India). Over a while, it has expanded its infrastructure significantly and has come up with Satellite Campuses at Anantnag (South Campus), Baramulla (North Campus), and Kupwara to make education more accessible to the people living in far-off places of Kashmir. The University has also set up an office in the Jammu division to facilitate the students living outside Kashmir enrolled with the University. The official website of the university reads as follows:

> 'The University is committed to providing an intellectually stimulating environment for productive learning to enhance the educational, economic, scientific, business, and cultural environment of the region. It has constantly been introducing innovative/new programmes to cater to the needs and demands of the students and society.
>
> Over the years, the University has marked excellence in its programmes and activities. It has been re-accredited as Grade-A+ University by the National Assessment & Accreditation Council (NAAC) of India. This is recognition and reflection of the high quality standard in teaching and research at the University of Kashmir.'

It further adds,

> 'The University promotes a diverse and inclusive campus environment that fosters creativity and innovation. The University fundamentally affirms and embraces the multiple identities, values, belief systems, and cultural practices of its stakeholders. Thus, the philosophy of diversity and inclusiveness is integrated into the work and lives of every member of the University community.'

The University of Kashmir attracts students and scholars from the multi-ethnic, multi-religious, and multi-lingual areas of Jammu, Kashmir, and Ladakh (Jahangir, 2015). Every year the university accommodates more than four thousand students in varied courses both at undergraduate and postgraduate levels. However, the students admitted to the university do not belong to a specific homogenous background. The students admitted to the university are, in fact, of diverse socioeconomic, religious, cultural, and ethnic backgrounds. The diversity of the students is reflected in examining the admission policy of the university which is inclusive and ensures that students from all walks of life get an opportunity to study there.

The admission policy of the University of Kashmir

The selection of a candidate to study at the University of Kashmir is purely based on her/his performance in the entrance test conducted every year for admission to various courses. However, to make the selection process more inclusive, the University of Kashmir has adopted a reservation policy whereby students of almost all kinds of backgrounds seek admission in the various courses. Primarily, 67 per cent of the seats are filled by the candidates belonging to open merit. The remaining 33 per cent of seats available in a Programme/ Course are filled up from amongst the reserved categories in order of merit. The breakup of seats for various reserved categories is given in Table 2:

Table-2: Reservation of Seats

S. No	Category	Quota (in Percentage)
1	Open Merit	67
2	Schedule Caste (SC)	5
3	Scheduled Tribe (ST)	3
4	Children of Gujjar and Bakerwal (CGB)	2
5	Residents of Backward Areas (RBA)	10
6	Line of Actual Control (LAC)	1
7	Scouts/Guides/Rovers and Rangers	1
8	Weak & Under Privileged Classes (Social Caste) (WUP)	2
9	Children of Permanent Resident of Defence Personnel	2
10	Candidates possessing outstanding proficiency in Sports	2
11	Candidates possessing outstanding proficiency in NCC	2
12	Differently-abled (PH)	3

Source: Admission Policy of Kashmir University, 2020

As the information in Table 2 divulges, reservation has been made for almost every marginalized section of society viz. SCs, STs, Social castes, residents of backward areas, differently-abled, people living along borders, etc. Reservation has also been made for the candidates who have made an outstanding performance in sports, NCC, or have been associated as scouts, rovers, rangers, and children of the defense personnel. Besides, a supernumerary quota (in addition to the intake capacity) has also been kept for persons outside the Kashmir division (two per cent), people living outside India (five per cent), and one seat for children of employees of the University of Kashmir.

Consequent to the reservation policy, students from all categories join the different courses and add to the diversity and heterogeneity of the classrooms. The diversity of the classroom is multiplied by other variables, as well, which are not otherwise reserved viz. gender, religion, economic background, etc.

Once somebody enters a classroom after the admissions, she/he finds females, males, rich, poor, SCs, STs, RBAs, WUPs, sportsmen, NCC cadets, rural, urbanites, etc studying together in a common classroom. The diversity of the classroom, on the one hand, depicts the nature of oneness, unity, and tolerance, however, on the other hand, it challenges the teaching-learning process in terms of inclusivity, understanding, and deliverance.

Facilities offered by the University for the students

The University of Kashmir provides its students, scholars, and teachers with an ample number of facilities within and outside classrooms. The classrooms of the students who were taken as participants were equipped with LCD projectors and wifi-enabled. Within the campus, we find a centralized Library housing lakhs of text and reference books, besides thousands of hardbound and full-text online journals, online databases, microfilms/microfocus, and rare manuscripts. It is also connected to a chain of departmental libraries with many books and other reference material. Access to the library is provided round the clock (24×7) for the benefit of users. Most library services are available through network-enabled computers. The library also houses the International Resource Cell, established with the financial support of the British High Commission in India to facilitate the dissemination and sharing of knowledge and experiences through electronic resources. The use of ICT in the teaching-learning process, research, and extension activities has been the hallmark of the University. The measures that the University has undertaken to strengthen the popularization and use of ICT in the curriculum include the making of virtual educational programmes, the production of educational multimedia, and the development of e-contents and learning objects by the Educational Multimedia Research Centre (EMMRC). It is assumed that such facilities provide students and teachers with more prospects for communication and collaboration.

Even though the university offers such a large spectrum of online facilities for its students and teachers but it does not directly address the issue of ignorance of the students concerning these facilities and their lack of knowledge to use ICT.

Experiences of students

Against the available ICT facilities within and outside the classroom, the response of the students concerning the teaching-learning process was studied and the following interpretations were made while analyzing the data collected from the participants:

After seeking admission at the university, it is generally presumed that the teaching-learning process would be inclusive and address the academic aspirations of the whole class. The use of ICT is expected to enhance its efficiency further. However, during the study, some startling revelations were made by the participants about the application of ICT. During the fieldwork, it was revealed that the students enrolled in the University have to deal with ICT in three different spaces viz. within the classroom, outside the classroom (library, admission department, scholarship department, etc), and at home and/or hostels.

Classroom: While delivering lectures, teachers frequently use PowerPoint presentations (PPTs) to enhance the efficiency of the teaching-learning process. Even though its use is fruitful for the majority of the class but it does not prove to be encouraging. "As and when the teacher opts for a PowerPoint presentation, it is spontaneous that our attention shifts towards LCD projector, and most students like it. However, owing to my weak eyesight, I am unable to reveal to my teachers that looking towards an LCD projector is meaningless for me. Sometimes he asks us to look towards an image on the projector and then explains the same but how can I understand it"? (P6) Usually such problems are frequent among poor-sighted students and albinos.

The use of an LCD projector is not limited to the delivery of lectures only but is frequently used by students to deliver presentations as a part of the evaluation process. There are some students (and teachers) who are not aware of its usage and putting them to such a thing that they are not aware of proves to be more challenging and discouraging. “I was not initially aware of what PPTs mean. I came to know about it only after teachers used it at the University. However, I was cornered when given the assignment to deliver as a PPT with a specific period to prepare. Till the period other students prepared presentations, I underwent a process of learning how to make PPT while focusing less on the content. Eventually, I scored less. It then seemed that I was assessed for making PPT and not for the presentation’s content.” (P13) The use of LCD projectors by the students for delivering PPTs becomes selective and consequently escalates the disparity within the class rather than integrating the stakeholders within the teaching-learning process. Such students who are not aware of such things face discouragement and develop issues of anxiety. “I have decided to opt for elective courses wherein the teacher does not ask for PPTs. Although I am very hard working and good at paper reading or even extempore, I face anxiety issues when asked to deliver a PPT. (P1)”

Besides PPTs, the use of laptops, tabs, and/or smartphones by the students and teachers within a classroom is, quite often, encouraged to make a classroom more interactive and productive. Primarily, it depends upon a teacher’s will whether to allow the use of such gadgets in a classroom or not. If allowed, such kind of encouragement poses new types of challenges in a classroom accommodating students of different reserved categories. “I believe that using a laptop or a smartphone inside a classroom is very helpful. It can provide us with efficient access to study material while the teacher discusses things. We can even record the lectures to understand them while at home. However, I come from a very humble background and access to such gadgets is difficult and someone else getting them inside the classroom proves to be discouraging for me. I wonder how far I shall go in my career as compared to those who use them inside the classroom. It seems access to ICT wins over hard work and intelligence. (P5) During the teaching-learning process, a teacher expects students to have access to various online journals and e-books, prepare assignments and watch some video lectures; however, accessibility prevails over hard work. “I was once asked to prepare a review of five articles of the same theme published in some reputed journals. Even though reviewing those articles was not a difficult task for me but having access to the article was a herculean task because of my technological ignorance.” (P20)

A sense of discouragement also prevails in a segment of the teaching fraternity towards the use of ICT. Many teachers still exclusively encourage offline book reading and offline libraries. I once appeared in a viva voce. After responding to the query of my teacher, he reacted by asking about the source of my response and I quoted one of the prestigious online journals for which he annoyed me. He then suggested specifying the books available in the library exclusively and discouraged other online means. (P18)

Outside Classroom: In contemporary times, the usage of ICT tools is equally important outside classrooms as well. Students, teachers, and researchers are found to be seeking the assistance of ICT in multiple ways and at multiple places. The University of Kashmir offers a multi-faceted facility to the students and teachers outside the classroom too. However, the students show a varied response in availing the facilities.

Everyone does not avail of the facilities and whosoever avails does so to a very limited extent. On inquiring about the facilities, out of 20 students, only two were aware of all facilities, 6 had some knowledge and 12 had no information at all. There is an enormous number of students in the university who deposit the library fee after the final semester to get a 'No Objection Certificate' from the library which enables them to get the degree-related certificates. (P26) Students, on the other hand, depicted a sense of helplessness owing to their ignorance towards ICT. My knowledge of ICT is limited to a few social networking sites while using a phone. I don't have any knowledge of computers or laptops and hence going to the library to access ICT is not helpful. Moreover, I find myself in an awkward situation while sitting in front of a computer while my classmates are around. (P14)

Allama Iqbal Library (The centralized library of the campus) provides free online access to e-books, e-journals, online databases, online libraries, newspapers, digital talking books, etc. However, poor response from the participants was found concerning its use. I am aware of a few of such online resources but never happened to know about their availability on campus and even did not even feel a need to use them. I rely on the books available at my home and those in the department library. Besides, I already waste a lot of time coming to university and going back home owing to traffic jams, and as such, I do not find time to go to the Allama Iqbal Library. (P2) A specially-abled student further revealed, 'Online access to the sources is a blessing for me but, owing to lack of gadgets, I have to visit the library to use a computer. However, the library's design is such that I cannot easily enter its premises frequently. It has a long path and is far from my hostel' (P9).

Home and/or Hostel: The last two decades have seen a swift escalation in the availability and application of ICT in Kashmir. Its use has thus become popular in a comparatively lesser period and now, ICT has permeated diverse professions and places. Growth in student use of ICT at home has been accompanied by a growing interest in how these technologies are used across communities and groups. However, the student community is not empowered to have universal access to gadgets and knowledge of ICT. When it comes to why a student will utilize ICT, there may be a variety of variables affecting them at multiple levels. Gender, age, mental outlook, motivation, ability, and other personal characteristics of students, as well as family factors such as socioeconomic background, family structure, ICT equipment at home, and parents' attitudes toward ICT, influence the use of ICT at home. (Agasisti et.al., 2017). On inquiring about the use of ICT at home, participants revealed varied responses concerning studies. Although, the majority of the students (17 out of 20) possessed an internet-enabled smartphone only 12 were using it for studies but were limited to accessing search engines (preferably Google), YouTube and surprisingly only two were found to be accessing MOOCs, e-contents, online courses, etc. available on different portals. A student who lived in the university hostel said, 'I live in the hostel of the university which is wifi enabled but am not rich enough to have a smartphone, laptop, or a computer. One of the participants revealed, 'Although I possess an internet-enabled smartphone but am not aware of any such portals which offer any kind of help to study'. (P2) The participants were aware of online private tutoring firms such as Byju's, and Unacademy (because of frequent advertisements on television) but were not aware of e-PG Pathshala, e-Pathshala, Diksha, Sakshat, etc offered by the government of India free of cost. Although many participants were aware of the Swayam portal they did not use it for studies. A participant revealed, 'I am aware of Swayam but don't have so strong vision to access the phone continuously' (P6) another one narrated, 'I am aware of Unacademy but cannot access it for financial reasons. One of the female participants narrated, 'I know about e-contents available on Swayam and CEC (Consortium for Educational Communication). Even YouTube has uploaded many informative lectures which could be very helpful for my studies but my problem is being a female at home. I access anything on my phone, and my parents complain about watching and/or chatting with friends. Convincing them is difficult owing to their ignorance, illiteracy, and conservative thinking.' (P13) Other participants expressed issues concerning their socio-economic background and lack of awareness as the reasons prohibiting them to access the benefits of ICT-enabled facilities.

Conclusion

The article presents novel findings of the limited use of ICT by students belonging to different reserved categories against a pool of ICT-enabled facilities provided to them in and outside the classroom by the university and government. By systematically analyzing all the interviews conducted with different participants, we identify the following two different issues about the teaching-learning process enabled by ICT:

a. The University of Kashmir has a marginalized-friendly admission policy that ensures admission to people from all walks of life. It also offers a pool of updated and contemporary facilities (both infrastructural and online) about ICT for its students and teachers. However, such facilities are offered with a general presumption that the enrolled students are aware of such facilities and know the use and applications.

b. All the enrolled students are not, however,

    - Either fully equipped with such technologies;
    - Or/and aware of facilities available online on various portals;
    - Or/and owing to their socio-economic incompetence possess gadgets that enable such learning;
    - Or/and lack the physical capabilities to cope with such technologies.

Given this background, it becomes challenging to bring students of diverse socio-economic settings on a single podium of the teaching-learning process featured by ICT. Likely, ICT may further alienate such students who are not capable of engaging themselves in this process of learning unless an inclusive approach is adopted which may not be for 'many' while ignoring 'some'. The first and foremost job of any academic institution, including the University of Kashmir, is to ensure that proper infrastructure is in place before adopting any innovation in the teaching-learning process. The Government of India has been appointing a number of commissions and committees to look at various aspects of education and suggest measures to make the educational system of India inclusive and accessible to one and all. A centrally sponsored scheme 'Rashtriya Uchchatar Shiksha Abhiyan' (RUSA) opines that inclusiveness is the bedrock on which universities can build truly diverse classrooms. Likewise, the 'National Educational Policy' (2020) envisions a complete overhaul and re-energizing of the higher education system to overcome the challenges and thereby deliver high-quality higher education, with equity and inclusion. All such institutions must organize regular awareness workshops for their stakeholders (especially for students with humble socio-economic profiles) to enable them to have holistic knowledge and competence of ICT, at least, of those items which are deemed for them to be learned as students. This would enable an inclusive teaching-learning process and provide the subjugated an opportunity to avail a timely benefit of ICT-enabled services and facilities.

Limitations and Further Research

Despite the fact that qualitative research is a better way to gather detailed information about the perceptions of people, some restrictions are inherent. Data were obtained from a few individual cases in this study, and it was based on first-person observation. However, we are confident that these results will bring value to the research in various ways and can be applied to other novel contexts. While the results of this study only look at the participants' opinions, they challenge teaching practices and the production of learning resources. In future work, it would be fascinating to look at the effects of ICT engagement in the teaching and learning process. To acquire a better understanding of the effects of modern technology on teaching and learning, more empirical research in educational establishments from different locales is required.

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Research Article

Massive Open Online Courses: Awareness, Readiness and Preferences of Pre-service Teachers

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Abstract

A MOOC (Massive Open Online Course) is an online course that can be accessed by an unlimited number of participants dispersed geographically. Although MOOCs are in trend for the past few years, a lot of concerns are being raised because of the high enrolment rate, but low completion rate. One of the major reasons for this difference in enrolment and completion rates can be the lack of readiness of participants in using MOOCs. This study attempts to explore the pre-service teachers' readiness in using MOOCs. An online questionnaire was used to collect data from 159 pre-service teachers of Delhi/NCR universities. The collected data was analysed through MS Excel. Descriptive statistics were used to analyse the data for final interpretation. The results revealed that although many pre-service teachers are aware of MOOCs, only a few of them have used them yet. Most of the pre-service teachers are found to have the technological accessibility required for using MOOCs but some of them still lack computer peripherals like headphones or microphones, which may be required during the course. The findings also reveal that pre-service teachers' competence level was higher than their motivation level. In addition, it was also found that those who are ready for MOOCs still prefer face-to-face more over online or remote involvement.

Keywords: MOOCs, awareness, readiness, preferences, pre-service teachers

Introduction

With the advancement of technology, the way of teaching and learning has changed. MOOC is a platform through which learning materials can be accessed free of cost and if anyone wants to go for certification, a minimal amount is charged to them for the same. These courses can be accessed from anywhere, at any time, but the only prerequisite for using such courses is to have an internet connection.

MOOCs are a relatively new trend in the educational scenario. MOOCs were first introduced in 2008 and emerged as a popular mode of online, distance learning in 2012 (Carey, 2012). MOOCs are considered one of the major thrust areas under the Digital India Campaign launched by the Government of India. SWAYAM (Indian MOOC) was first announced in August 2014 and since its beta launch in July 2017, it has enrolled over 10 million learners (Shah, 2020). The European Association of Distance Teaching Universities (EADTU, 2015) defined MOOCs as "online courses designed for a large number of participants, can be accessed by anyone anywhere as long as they have an Internet connection, are open to everyone without entry qualifications and offer a full/complete course experience online for free".

According to Chan et al. (2019), these courses are massive because a large number of students can join the course; they are open because students can access the course materials at no cost; they are online because through the internet these courses are delivered. MOOCs are available to students to supplement their learning and personalized learning environments, and the use of learning analytics is set to transform education (Fadzil et al., 2016). MOOCs also help individuals to gain education from top universities, and the best faculty even when they have not been able to physically present there (Morris, 2014).

Kpolovie and Iderima (2016) state that, learners come into the MOOCs platform having different characteristics which may impact their learning and their level of readiness is one of those characteristics. They further claim that learners' lack of readiness can negatively impact the teaching and learning process and hence to take maximum benefits from such online courses, the readiness of the learners is important as they have to be ready to learn for effective learning to take place.

MOOCs readiness is defined as the minimum requirement of what learners should know and do to maximize the benefits of using MOOCs (Subramaniam et al., 2020). Readiness for learning is a holistic way of assessing learners' learning preparedness. Readiness embraces the interrelationships between skills and behaviours across domains of development and learning (UNICEF, 2012). These can be seen as minimum standards of what the learner should know and be able to do to be successful in his learning. Measuring MOOC readiness can be likened to identifying the prerequisites to the MOOC's enrolment, which is based on required competencies that would enable a student to pursue a course and complete the associated learning tasks. (Loizzo et al., 2017)

Previously conducted studies on MOOCs claim that there are certain challenges that MOOC participants face. According to Zulkifli et al. (2020), there are eight types of challenges they identified in their study namely, internet/Wi-Fi coverage sources, understanding of MOOC usage, MOOC usage equipment, student commitment, student motivation, MOOC materials, allocation of grades and course offerings in MOOC. MOOCs have also been criticized for their low completion rates (Thakur, 2018). People find out about MOOCs through social media, blog posts, or internet surfing and enroll in just a few minutes but they soon fall behind or forget to log in to the course from the beginning (Subramaniam et al., 2020). A study conducted by Loizzo et al. (2017) revealed that while the respondents valued MOOCs for professional development and lifelong learning, they had full lives with other priorities such as family, career, school, and volunteerism, so when their lives become hectic, MOOC participation was assigned a lower priority.

In the past few years, many researches have been conducted on the use of MOOCs in different disciplines but in teacher education, there are very limited studies available, in India and abroad. Therefore, this study focuses on exploring pre-service teachers' perceptions regarding MOOCs. The following are the research objectives of this study:

1. To identify the extent of awareness about MOOCs among B.Ed. students of Delhi/NCR universities

2. To understand the perception of pre-service teachers towards their readiness in using MOOCs concerning Technology Access, Competence, and Motivation

3. To identify the preferences of pre-service teachers regarding the implementation of MOOCs in their university

4. To identify the barriers and challenges faced by pre-service teachers in using MOOCs

Methods and Materials

Population and Sample

The population of the study consists of all the pre-service teachers enrolled in Delhi/NCR universities. A random sampling technique was used to collect data from pre-service teachers. Therefore, the sample of this study involved 159 pre-service teachers of Delhi/NCR.

Tools and Techniques

A "MOOC Readiness Questionnaire" developed by Prof. Dr. Mohammad Amin Embi in 2014, for National Higher Education Strategic Plan (Malaysia), was adapted and used by the researcher to collect data from pre-service teachers. The questionnaire included closed ended-questions as well as open-ended questions. The questionnaire consisted of 3 sections: Demographic information; MOOCs awareness and readiness in using MOOCs concerning Technology Access, Competence, and Motivation; Barriers/Challenges in using MOOCs. Five experts from the field validated the questionnaire.

Procedure of Data Collection

The questionnaire was sent to around 600 pre-service teachers enrolled in Delhi/NCR universities. The questionnaire was returned by 183 pre-service teachers, of which 159 responses were usable. The remaining responses were either repeated ones or do not belong to the population of the study, hence their responses were not considered. Descriptive statistics were calculated using MS Excel for final interpretation.

Results and Discussion

In the first section of the questionnaire, the pre-service teachers were asked about their demographic information. It was found that 76.1 per cent (n=121) of them were females whereas, only 23.9 per cent (n=38) were males.

Table-1: Gender of the Pre-service

Gender	Frequency (n)	Percentage (%)
1. Female	121	76.1%
2. Male	38	23.9%

Majority of the pre-service teachers, i.e., 68.5 per cent (n=109) were below the age of 25 years. The pre-service teachers between 25-30 years old account for 28.3 per cent (n=45) whereas, only 5 per cent of them were above 30 years.

Table-2: Age of the Pre-service Teachers (in years)

Age (in years)	Frequency (n)	Percentage (%)
1. Below 25	121	76.1%
2. 25-30	38	23.9%
3. Above 30	5	3.1%

The sample of the study (as shown in Table 3), included pre-service teachers from different universities of Delhi/NCR. It was found that around 42 per cent of the pre-service teachers were from Central Universities, 30 per cent were from State Universities, and around 28 per cent were enrolled in Private Universities of Delhi/NCR.

Table-3: Type of Universities where the Pre-Service Teachers are Enrolled

Type of Universities	Number of Pre-service Teachers (n)	Percentage (%)
1. Central Universities	67	42.1%
2. State Universities	48	30.1%
3. Private Universities	44	27.6%

Table 4 indicates that 70.4 per cent (n=112) of the pre-service teachers' medium of instruction was English, those having Hindi as their medium of instruction constituted 18.2 per cent (n=29) of the sample whereas, 11.3 per cent (n=18) pre-service teachers were from Urdu medium.

Table-4: Medium of Instruction of Pre-service Teachers

Medium of Instruction	Frequency (n)	Percentage (%)
1. English	112	70.4%
2. Hindi	29	18.2%
3. Urdu	18	11.3%

In the next section of the questionnaire, the pre-service teachers were asked about their MOOCs awareness and their readiness in using MOOCs with respect to Technology Access, Competence and Motivation.

MOOCs Awareness

Findings shown in Table 5 indicate that almost half of the pre-service teachers (49 per cent) were aware of MOOCs but they have not used them yet. Around 20 per cent of the pre-service teachers reported that they do not know about MOOCs but they have heard people talking about them and those who are not aware of MOOCs at all also constituted about 20 per cent of the sample. The findings also reveal that only a few of them (11.3 per cent) were not only aware of MOOCs but they have used them as well i.e., participated in one or more MOOCs.

Although MOOCs are in trend for the past few years, it was found that it is still unknown to some students. However, being a future-teacher they need to be aware of such platforms, and therefore, knowledge about MOOCs needs to be provided at both levels i.e., Pre-service Teacher Education as well as In-service Teacher Education.

Table-5: MOOC Awareness

Q. Are you aware of MOOCs?	Frequency (n)	Percentage (%)
1. Aware and have used	18	11.3%
2. Aware but haven't used	78	49%
3. Don't know but have heard people talking about it	32	20.1%
4. Not aware of MOOCs at all	31	19.5%

In the next question, the pre-service teachers were asked to indicate their understanding of MOOCs. They were given the authority to choose more than one option if they want. The responses are depicted in Table 6.

Table-6: Pre-service teachers' understanding of MOOCs

Q. What do you understand by MOOCs? (You may choose more than one option)	Frequency (n)	Percentage (%)
1. An online course aimed at unlimited participation and open access via the web	68	42.7%
2. Massive Open Online Courses	88	55.3%
3. Web-based distance learning program	35	22%
4. MOOCs comprise video lessons, readings, assessments, and discussion forums	53	33.3%
5. MOOCs are in trend due to Covid-19	4	2.5%
6. These are freely accessible courses and the syllabus can be seen even without signing up	1	0.6%
7. Don't know about MOOCs	42	26.4%

It was found that the majority of the pre-service teachers (around 70 per cent) have a basic understanding of the concept of MOOCs. A few of them (2.5 per cent) indicated that MOOCs are in trend because of Covid-19. However, around 26 per cent of the pre-service teachers reported that they don't know about MOOCs. Due to the Covid-19 pandemic when all educational institutions were closed, universities rapidly switched to online mode for conducting classes and assessments so that the lockdown could not become a hurdle in students' learning and their academic session should not be delayed. Since the students were more engaged in digital platforms ever than before, this could have led to an increase in MOOCs awareness and use by them. Yet, from the findings, it was evident that there are several pre-service teachers who are still not aware of MOOCs.

Technology Access

The findings related to the accessibility of a laptop/computer with an internet connection are given in Table 7. The majority of the pre-service teachers (73 per cent) indicated that they have access to a laptop or a computer with an internet connection. However, some of the pre-service teachers (6.9 per cent) reported that they do not have access to a laptop or a computer and some of them (6.9 per cent) also reported that they do not have an internet connection. Furthermore, around 11 per cent of the pre-service teachers agreed that they have access to a laptop/computer with the internet but they face slow internet issues and intermittent disconnections. A few of them (1.8 per cent) also indicated that they do not have a laptop/computer but they have an internet connection in their mobile phone.

Table-7: Accessibility of laptop/computer with internet

Q. Do you have access to a laptop/computer with an internet connection?	Frequency (n)	Percentage (%)
1. Yes, I have a laptop/computer with an internet connection	116	73%
2. No, I don't have a laptop/computer	11	6.9%
3. No, I don't have an internet connection	11	6.9%

4. Yes, but I face slow internet issues/intermittent disconnections	18	11.3%
5. I do not have a laptop but I have an internet connection in my mobile phone	3	1.8%

Concerning the accessibility of laptops/computers with enough RAM to run adequate software like MS Office or Adobe Reader etc (as shown in Table 8), more than half of the pre-service teachers (59.7 per cent) agreed that they have a laptop with enough RAM to run adequate software, some of them (10.7 per cent) indicated that they have access to a laptop/computer with enough RAM but they do not own adequate software like MS Office whereas, 29.6 per cent of them denied having a laptop or a computer with sufficient RAM to run adequate software.

Table-8: Accessibility of laptop/computer with enough RAM to run software like Microsoft Office, Adobe Reader etc.

Q. Do you have access to a laptop/computer with enough RAM to run software like Microsoft Office, Adobe Reader, etc	Frequency (n)	Percentage (%)
1. Yes, I have a laptop/computer with enough RAM to run adequate software	95	59.7%
2. No, I do not have any laptop/computer with sufficient RAM to run adequate software	47	29.6%
3. Yes, I have access to a laptop/computer with enough RAM but I do not own software like Microsoft Office	17	10.7%

To access MOOCs, having a laptop/computer with enough RAM to run adequate software is necessary to access the course materials and for doing the assignment work. In the previous question, some of the respondents (1.8 per cent) reported that they do not have a laptop, but they have an internet connection in their mobile phone. Most mobile phones have this software pre-installed or the students may also install these apps. through Google Playstore or Apple store as well and through this, they can access the course materials available on the MOOCs platform.

When asked about the accessibility of headphones/speakers for the courses, the majority of the respondents (74.2 per cent) reported that they have access to headphones/speakers, and some of them (19.5 per cent) reported that they do not have headphones/speakers while 6.3 per cent pre-service teachers reported that if required, they can arrange a headphone/speakers. Findings are indicated in Table 9 given below.

Table-9: Headphone/Speaker Accessibility

Q. Do you have access to headphones or speakers for courses that may have video conferences or require student-recorded presentations?	Frequency (n)	Percentage (%)
1. Yes, I have a headphone/speaker	118	74.2%
2. No, I do not have a headphone/speakers	31	19.5%
3. If required, I can arrange a headphone/speaker	10	6.3%

If the MOOC provider plans to conduct a live session for the students for clearing their doubts, students may need a microphone for this purpose. From the findings given in Table 10, it was found that the number of pre-service teachers who have access to a microphone (43.4 per cent) was less than those who do not have access to a microphone (46.5 per cent) for the courses that may have video conferences or require student recorded presentations. Whereas, around 10 per cent of pre-service teachers indicated that they can arrange a microphone/recorder if there is such a requirement. Inaccessibility of headphones/speakers could be very challenging for the students as it is required for listening to the audio and video lectures.

Table-10: Microphone Accessibility

Q. Do you have access to a microphone for courses that may have video conferences or require student-recorded presentations?	Frequency (n)	Percentage (%)
1. Yes, I have a microphone/recorder	69	43.4%
2. No, I do not microphone/recorder	74	46.5%
3. If required, I can arrange a microphone/ recorder	16	10.1%

Competence

The pre-service teachers were asked to indicate their level of competence on a 5-point Likert scale, i.e., Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly Disagree (SD). The frequency counts, percentage, and mean for each item were calculated for the same, as shown in Table 11.

Table-11: Level of Competence of the Pre-service Teachers

S. No.	Statement	SA	A	UD	D	SD	Mean
1	I have the basic skills to operate a computer (e.g. saving files, creating folders, etc)	82 (51.6%)	61 (38.4%)	10 (6.3)	5 (3.1%)	1 (0.6)	4.37
2	I have the basic skills for finding my way around the internet (e.g. using search engines like Firefox, Safari, Internet Explorer, etc)	67 (42.1%)	67 (42.1%)	13 (8.2%)	12 (7.5%)	0	4.18
3	I think that I would be comfortable using a computer several hours per week to participate in course	39 (24.5%)	66 (41.5%)	38 (23.9%)	14 (8.8%)	2 (1.3%)	3.79

4	I am proficient at sending or receiving emails	80 (50.3%)	63 (39.6%)	15 (9.4%)	0	1 (0.6%)	4.38
5	I am proficient at sending or receiving emails with attachments	74 (46.5%)	63 (39.6%)	17 (10.7%)	4 (2.5%)	1 (0.6%)	4.28
6	I am proficient at typing on a keyboard	48 (30.2)	83 (52.2%)	21 (13.2%)	6 (3.8%)	1 (0.6%)	4.07
7	I think that I would be able to communicate effectively with others using online technologies (e.g. chat)	64 (40.3%)	69 (43.4%)	21 (13.2%)	4 (2.5%)	1 (0.6%)	4.20
8	I think that I would be able to use online tools to work on my assignments	53 (33.3%)	78 (49.1%)	22 (13.8%)	5 (3.1%)	1 (0.6%)	4.11
9	I think that I would be able to ask questions and make comments in clear writing	44 (27.7%)	86 (54.1%)	22 (13.8%)	7 (4.4%)	0	4.05
10	I can work independently	59 (37.1%)	76 (47.8%)	20 (12.6%)	4 (2.5%)	0	4.19
11	I can work in groups	44 (27.7%)	87 (54.7%)	23 (14.5%)	5 (3.1%)	0	4.06
12	I am good at managing/planning my time well	40 (25.2%)	80 (50.3%)	33 (20.8%)	6 (3.8%)	0	3.96
13	I can meet deadlines on regularly	41 (25.8%)	76 (47.8%)	34 (21.4%)	7 (4.4%)	1 (0.6%)	3.93
14	I am comfortable asking for assistance when needed	39 (24.5%)	88 (55.3%)	25 (15.7%)	7 (4.4%)	0	4.0
15	I am good at following directions	48 (30.2)	90 (56.6%)	20 (12.6%)	1 (0.6%)	0	4.16
16	I can learn from various instructional formats (e.g. text, video, podcast, online discussions, video conferencing)	56 (35.2%)	76 (47.8%)	21 (13.2%)	6 (3.8%)	0	4.14

A high mean value (M=4.37) on the statement " I have the basic skills to operate a computer e.g. saving files, creating folders, etc." indicates that many pre-service teachers are competent enough to operate a computer. They also reported that they have the basic skills for finding their way around the internet e.g. using search engines like Firefox, Safari, Internet Explorer, etc. (M=4.18).

To participate in a MOOC, one must spend several hours a week attending the lectures and doing the assigned work. On enquiring, if they would be comfortable using a computer several hours per week to participate in a course, many pre-service teachers indicated positive responses (M=3.79).

With respect to their proficiency, the pre-service teachers reported that they are quite proficient at sending or receiving emails (M=4.38), sending or receiving emails with attachments (M=4.28) and most of them indicated that they are proficient at typing on a keyboard (4.07).

To clear their doubts or, convey messages to the instructors or peers, one needs to be able to use online technologies for effective communication with others. On this, the pre-service teachers reported that they can communicate effectively with others using online technologies, e.g. chat (M=4.20).

The participants of MOOCs must submit their assignments if they want to attain a completion certificate for the course in which they have got themselves enrolled. For this purpose, they need to have basic knowledge of using online tools that would be required for doing the assigned work. A large number of pre-service teachers reported that they would be able to use online tools to work on their assignments (M=4.11).

One of the important features of MOOCs includes a discussion forum for clearing the doubts of the participants. SWAYAM, an Indian MOOC, also has an "online discussion forum for clearing the doubts" as its one of the four Quadrants. Therefore, to ask questions one needs to be competent in writing comments clearly and ask for assistance confidently whenever such a need arises. The pre-service teachers indicated that they would be able to ask questions and make comments in clear writing (M=4.05). Also, they reported that they would be comfortable asking for assistance when needed (M=4.0).

Pre-service teachers who reported that they would be able to work independently (M=4.19) were found to be a little higher in number than those who would be able to work in groups (M=4.06) which means that people tend to be more comfortable working individually than working with peers or in groups.

Many pre-service teachers reported that they are good at managing or planning their time well (M=3.96) and they can meet deadlines on regularly (M=3.93). The learners opt for MOOCs for their professional development and for enhancing their knowledge and skills so, apart from their college work/ school work/ office work, they need to take out several hours from their schedule to attend lectures and for doing the work that has been assigned to them and hence time management plays an important role here.

The findings also revealed that the majority of the pre-service teachers were good at following directions (M=4.16), as reported by them. Many of them also reported that they would be able to learn from various instructional formats, e.g. text, video, podcast, online discussions, and video conferencing (M=4.14).

Motivation

The pre-service teachers were enquired about their level of motivation, on a 5-point Likert scale, i.e., Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D), and Strongly Disagree (SD). The frequency counts, percentage, and mean for each item were calculated for the same, as shown in Table

Table-12: Level of Motivation of the Pre-service Teachers

S. No.	Statement	SA	A	UD	D	SD	Mean
1	In case my query is not answered I think I would remain motivated	24 (15.1%)	78 (49.1%)	40 (25.2%)	15 (9.4%)	2 (1.3%)	3.67
2	I think that I would be able to complete my work even when there are online distractions (e.g. friends sending messages on social media, game notifications, etc)	39 (24.5%)	81 (50.9%)	23 (14.5%)	15 (9.4%)	1 (0.6%)	3.89
3	I think that I would be able to complete my work even when there are distractions in my home (e.g. television, children, etc)	30 (18.9%)	68 (42.8%)	34 (21.4%)	27 (17%)	0	3.63
4	I would describe myself as self-motivated	46 (28.9%)	87 (54.7%)	24 (15.1%)	2 (1.3%)	0	4.11

Many pre-service teachers reported that they would remain motivated, in case their query is not answered (M=3.67) but a relatively low mean on this statement indicates that if participants' queries are not resolved on the priority they may lose their motivation to participate actively and continue with the course till its completion.

Since the participants are not in a formal set-up (brick and mortar setting), the chances of getting distracted while learning online could become a hindrance and they may find themselves a little less motivated to continue working at the same pace. The majority of the pre-service teachers agreed that they would be able to complete their work even when there are online distractions like, friends sending messages on social media, game notifications, etc. (Strongly agree: 24.5 per cent; Agree: 50.9 per cent) whereas, the number of pre-service teachers who disagree with this statement is quite less (Disagree: 9.4 per cent; Strongly Disagree: 0.6 per cent). Some of the pre-service teachers reported that they are not sure about this (Undecided: 14.5 per cent).

Many pre-service teachers agreed that they would be able to complete their work even when there are distractions in their home like television, children, etc. (Strongly agree: 18.9 per cent, Agree: 42.8 per cent). Those pre-service teachers who either disagree (Disagree:

17 per cent; Strongly Disagree: 0 per cent) or, were not sure about this statement (Undecided: 21.4 per cent) were fewer in number than those who agreed. The findings also revealed that a large number of pre-service teachers believed that they are self-motivated (M=4.11).

The overall mean for all the questionnaire items related to competence and motivation of the pre-service teachers were found to be M=4.11 and M=3.82 respectively. This finding indicates that pre-service teachers' competence level is higher than their motivation level. Although most of them were found to be ready in terms of competence, the motivation level among them was relatively low.

In the next section of the questionnaire, the pre-service teachers were asked about their preferences regarding implementing MOOCs in their university. The findings are shown in Table 13 given below.

Table-13: MOOCs Preferences of the Pre-service

Q. If your university plans to implement MOOCs, how much face-to-face (f2f) vs. online would you prefer?	Frequency (n)	Percentage (%)
1. f2f 10% : online 90%	4	2.5%
2. f2f 20% : online 80%	5	3.1%
3. f2f 30% : online 70%	8	5%
4. f2f 40% : online 60%	7	4.4%
5. f2f 50% : online 50%	39	24.5%
6. f2f 60% : online 40%	19	11.9%
7. f2f 70% : online 30%	28	17.6%
8. f2f 80% : online 20%	14	8.8%
9. f2f 90% : online 10%	14	8.8%
10. f2f 100%	11	6.9%
11. online 100%	8	5%
12. Can't say	2	1.3%

Findings revealed that more than half of the pre-service teachers (54 per cent) indicated that if their university plans to implement MOOCs, they would prefer more than 50 per cent of their courses to be conducted in face-to-face mode. However, only 20 per cent of them indicated that they would prefer more than 50 per cent of their course to be conducted online. Some of the pre-service teachers (around 12 per cent) also reported that they would prefer 50 per cent of their course to be conducted in face-to-face mode and 50 per cent through online mode.

The pre-service teachers were asked to indicate their preferences for the teaching content format to be made available online if their university plans to implement MOOCs. The findings are shown in Table 14 given below.

Table-14: Pre-service teachers' preferences of teaching content to be made

Q. If your university plans to implement MOOCs, what format would you prefer the teaching content to be made available online? (You may choose more than one option)	Frequency (n)	Percentage (%)
1. Reading text only (e.g. PDF)	51	32%
2. PowerPoint Presentation only	40	25.1%
3. Audio only (audio recording of teaching content)	18	11.3%
4. Video only (video recording of teaching content)	25	15.7%
5. PowerPoint with Audio (PowerPoint with an audio explanation)	67	42.1%
6. PowerPoint with Video (PowerPoint with video explanation)	66	41.5%
7. Interactive Videos	69	43.3%
8. Animated Videos	38	23.8%
9. Live sessions	68	42.7%

Live Session allows participants to interact with the course instructor and clear their doubts then and there only. Findings revealed that live sessions are one of the most preferred teaching content formats to be made available online for the participants because of their synchronous nature. Therefore, many pre-service teachers (42.7 per cent) reported that they would prefer Live Sessions. Among other most preferred teaching content formats included, "Interactive Videos" (43.3 per cent), "PowerPoint with an audio explanation" (42.1 per cent), "PowerPoint with video explanation" (41.5 per cent) and "Reading text only (e.g. PDF)" (32 per cent). With respect to their preference of meeting the course instructor face-to-face, the pre-service teachers' answers are indicated in Table 15.

Table-15: Pre-service teachers' preferences of meeting the course instructor face-to-face

Q. If your university plans to implement MOOCs, how often would you prefer to meet face-to-face with the course instructor/lecturer?	Frequency (n)	Percentage (%)
1. Daily	32	20.1%
2. Six days a week	1	0.6%
3. Four days a week	1	0.6%
4. Thrice a week	2	1.3%
5. Once a week	97	61%
6. Once every two weeks	9	5.7%
7. Once every three weeks	10	6.3%
8. Once a month	5	3.1%
9. Once a semester	1	0.6%
10. Don't know about MOOCs	1	0.6%

Many of the pre-service teachers (61 per cent) indicated that they would prefer face-to-face interaction with the course instructor at least "once a week", while some of them (around 20 per cent) reported that they would prefer to meet face-to-face with the course instructor on a "Daily" basis. Some of the other responses included a preference for meeting face-to-face with the course instructor "once every 3 weeks" (6.3 per cent), "once every 2 weeks" (5.7 per cent), "once a month" (3.1 per cent), and "thrice a week" (1.3 per cent).

In the last section of the questionnaire, the pre-service teachers were asked about the challenges they faced while using MOOCs or the barriers that restrict them to take up MOOCs and how they would overcome those barriers/ challenges. The findings are depicted in Table 16.

Table-16: Barriers/challenges in using MOOCs

Q. What are the challenges you face while using MOOCs or what are the barriers that restrict you to take up MOOCs? (You may choose more than one option)	Frequency (n)	Percentage (%)
1. Lack of infrastructure	35	22%
2. Lack of technological skills	34	21.3%
3. Short attention span	29	18.2%
4. Problems with website	52	32.7%
5. Lack of interaction	31	19.4%
6. Lack of instant feedback	36	22.6%
7. Lack of instructor presence	20	12.5%
8. Lack of support	11	6.9%
9. Lack of motivation	21	13.2%
10. Time constraints	33	20.7
11. Technological problems	69	43.3%
12. Medium of instruction	13	8.1%
13. Too much strain on eyes	1	0.6%
14. Instructor's lack of certain skills and incompetency	1	0.6%
15. Sometimes the cost of the certificate is too high and to remain motivated one would need a certificate that would help in future also	1	0.6%

The findings revealed that most of the pre-service teachers (43.3 per cent) face "technological problems". Some of the major issues they face, as reported by them, are: "problems with the website" (32.7 per cent), "lack of instant feedback" (22.6 per cent), "lack of infrastructure" (22 per cent), "lack of technological skills" (21.3 per cent), "time constraints" (20.7 per cent), "lack of interaction" (19.4 per cent), "short attention span" (18.2 per cent), "lack of motivation" (13.2 per cent), "lack of instructor presence" (12.5 per cent), "medium of instruction" (8.1 per cent) and "lack of support" (6.9 per cent). Other issues that the pre-service teachers reported include “Too much strain on eyes” (0.6 per cent), “Instructor’s lack of certain skills and incompetency” (0.6 per cent) and the problem of high charge of certification (0.6 per cent). Even if the students are ready for MOOCs, these challenges could restrict them from using MOOCs extensively and this may lead them to drop out from the course in which they have been enrolled.

The present study was undertaken to investigate the level of MOOC readiness among pre-service teachers of Delhi/NCR. For this purpose, the data about their demography, MOOC awareness and preferences, readiness in using MOOCs (with respect to Technology Access, Competence & Motivation), and challenges in using MOOCs, were gathered and analysed.

Most of the pre-service teachers involved in this study were below the age of 25 years. In terms of gender, females outnumbered males in the study. Also, the majority of the pre-service teachers had English as their medium of instruction. The findings of this study suggest that many pre-service teachers were quite aware of MOOCs but not many have not enrolled themselves in any such courses yet. Although a lot of pre-service teachers are well equipped with internet connectivity and software, some still lack the computer peripherals required to utilize the full extent offered by MOOCs.

It was found that although most of the pre-service teachers were ready in terms of technology access and competence, motivation level among them was found to be relatively low which means that even if a lot of students have technology access and skills required for taking up MOOCs, some of them are still not motivated enough to participate in such courses or to work actively in all the activities till completion of the course.

Findings shown in Table 15 appears that pre-service teachers still trust traditional methods over digitalization. They still prefer face-to-face interactions more than online involvement.

Some of the issues that arise while using MOOCs may restrict the participants from successful completion of the course. Challenges like technological issues, problems with the website, lack of instant feedback, time constraints, etc., are found to be quite commonly faced by the participants. The findings are consistent with Zulkifli et al. (2020). These problems and issues should be known to the MOOC providers so that some measures for improvisation can be taken up by them. The deadlines for submission of the assignments should also be appropriate so that the learner does not feel overburdened due to time constraints. Instant feedback and support would help the students in keeping them motivated to ensure their continuous participation in the course till its completion.

Conclusion

MOOCs have been around in educational scenario for a while due to rapid advancements in technology and the Covid-19 situation have brought it more attention than ever. According to Nath (2019), it is expected that MOOCs will cater towards providing low-cost or almost free education to students of schools and colleges. Based on the literature review it was found that not much research has been performed in India on how ready students are to adopt MOOCs. It was necessary to understand and analyse the awareness and readiness of MOOCs among the current pre-service teachers (future teachers). Therefore, this study was an attempt to find out the extent of readiness of pre-service teachers and it was found that most of them are ready for MOOCs but they still prefer face-to-face over online or remote involvements. Some of the major challenges that they usually face includes technological problems, the problem with the website, lack of instant feedback, lack of infrastructure, time constraints, etc. These barriers could restrict them from using MOOCs extensively. Therefore, these challenges have to be taken into consideration to increase MOOCs' usability and successful completion rates.

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Research Article

Pre-Service Teachers' Perceptions about Augmented Reality (AR) Applications in Science Learning

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Abstract

The pre-service teachers' perception of augmented reality applications is studied as they are one of the best technologies for making science learning interesting. The main objective is to study the level of pre-service teachers' perception of augmented reality applications in science learning using a normative survey and the sample of pre-service teachers in the Kasaragod and Alappuzha districts were collected through simple random sampling. The tool used for this study is the perception scale, and its reliability is tested through Cronbach's Alpha (0.977) and split-half method (0.948). The content validity is established by consulting the experts and construct validity through factor analysis. The study found that half of the pre-service teacher (58.6 per cent) has a moderate level of perception, 34.3 per cent have a low level, and 7.2 per cent have a high perception of augmented reality applications in science learning. The main conclusions from the study are that pre-service teachers were found to have an insufficient perception of augmented reality applications in science learning. The teacher educators and pre-service teachers should be provided with proper training regarding the appropriate usage of augmented reality applications.

Keywords: Perception, Augmented reality applications, Pre-service teachers, Science learning, etc.

Introduction

In today's digital world, every aspect of our life is influenced by technology, and it plays an enormous role in education. New technologies have emerged, which make the teaching-learning process meaningful and exciting. Augmented reality applications are gaining popularity as it makes learning a joyful experience by providing a multi-sensory experience. Augmented Reality combines virtual objects with real ones or scenes to maximize natural and intuitive user experience in real-time. It is an interactive environment where virtual things enhance real-life experiences. According to Azuma (1997), Augmented Reality must have three characteristics: combining the real and virtual worlds, having real-time user interaction, and being registered in a 3D space. Augmented Reality allows the user to see the natural world and aims to supplement reality without completely immersing the user inside an artificial environment (Kesim & Ozarslan 2012). Digital information, which can be text, audio, images, video, 3D objects, etc., is cloaked in the real world so that it emerges as part of the actual domain. The significant reason for the popularity of AR applications is that it does not segregate the user from the physical environment (Tzima et al., 2019) (Kounavis et al., 2012). Augmented reality applications are very effective in learning science as it helps to understand abstract concepts easier and gives an in-depth understanding of the concepts (Yilmaz, 2021). They also increase students' achievement, contribute to the meaningful learning of abstract subjects, and increase the student's interest and motivation toward science learning (Yildirim, 2020).

To effectively integrate augmented reality applications in science learning, the teacher should possess adequate techno-pedagogical knowledge, that is, what type of AR apps should be used to teach a particular topic for a certain level of learners. Hence it is essential to give appropriate training to pre-service and in-service teachers regarding the effective integration of augmented reality applications in science learning (Thiyagu, 2021). Most studies focused on students' and teachers' views on the practical usage of augmented reality applications, but the studies on pre-service teachers' views are negligible. Therefore, the investigator attempts to study the perception of pre-service teachers toward augmented reality applications in science learning.

Review of Research Literature

Augmented reality technology has its roots in computer science interface research. (Sutherland et al., 1977) Many science fiction movies like 'The Terminator (1984) and 'RoboCop' (1987) have used the fundamentals of AR. The term" augmented reality" was first used by Tom Caudell, at Boeing in 1990. he was asked to improve the expensive diagrams and to mark devices used to guide workers on the factory floor (Thomas& David 1992). He proposed replacing the large plywood boards that contained each plane's wiring instructions that were individually designed with a head-mounted apparatus that displays a plane's specific schematics through high-tech eye ware and projects them onto multipurpose, reusable boards (Chauhan et al., 2017).

Augmented Reality is technology in which virtual objects are blended with the natural world and they interact with each other. Augmented reality applications are used in several areas, and the most important of these areas is the field of education. AR technology allows combining natural objects and virtual information to increase students' interaction with physical environments and ease their learning. Developing AR applications enables students to learn complex topics in a fun and easy way through virtual reality devices (Lin et al., 2013). Students interact with objects in the virtual environment, which helps them learn more about them (Yildiz, 2021). AR is an apt tool for teaching abstract concepts that do not feature direct observation and examination in science education. Students show positive opinions about using AR applications in science education (Yilmaz, 2021). Sahin& Yilmaz (2020) studied the impact of learning materials developed with augmented Reality (AR) technology on middle school student's achievement and attitudes towards the course and to determine their attitudes towards AR applications. Students in the experimental group had higher levels of achievement and more positive attitudes toward the study than those in the control group. Additionally, the results also revealed that the students preferred to continue the use of AR applications in the future and showed no signs of anxiety when using AR applications. In addition, the academic achievements and attitudes of the students in the experimental group showed a positive, significant, and intermediate correlation.

The research literature review showed innumerable integration of augmented reality applications in education. Some significant projects in integrating AR in education are The Aumentaty project, developed by the Labhuman laboratory (http://www.labhuman.com) at the Polytechnic University of Valencia in Spain. The Build AR project by the HITLabNZ laboratory (http://www.hitlabnz.org) at the University of Canterbury in New Zeeland. Both projects mentioned above were developed to implement AR in the classrooms by furnishing tools to design educational AR apps. Some of the research projects funded by the European Union, like CONNECT (2005-2007), CREATE (2004), and ARiSE (2006-2008) were focused on integrating informal learning in a learning environment. Researchers have used Aurasma (http://www.aurasma.com) extensively used as a tool in different learning strategies (Parton & Hancock, 2012; Connolly & Hoskins, 2014). Science Center to Go project (http://www.sctg.eu) is one more example of integrating AR into lessons to improve the quality of science education. Magicbook (Billinghurst, Kato, & Poupyrev, 2001) is among the first few integrations of AR in textbooks. This type of AR book can be used as a regular textbook. Still, it has additional features like visualizing virtual content like 3D objects, animations, or videos (Martín-Gutiérrez et al., 2017).

Objectives of the Study

The following are the main objectives of the study.

1. To find out the pre-service teachers' level of perception towards augmented reality applications in science learning.

2. To assess the familiarity of augmented reality applications in science learning among pre-service teachers.

Purpose and Research Questions

This study intends to determine the pre-service teachers' level of perception towards augmented reality applications in science learning. The following research questions were developed based on fulfilling the needs of the objective of the study.

1. What is the level of pre-service teachers' computer skills?

2. How long do the pre-service teachers have experience in using the internet?

3. What is the familiarity of augmented reality applications in science learning among pre-service teachers?

4. What is pre-service teachers' exposure level towards augmented reality applications in the classroom through their teachers' usage?

5. What is the experience level of using augmented reality applications in science learning during internship among the pre-service teachers?

6. What is the level of the pre-service teachers in terms of their familiarity with AR textbooks?

7. What is the level of familiarity with AR tools among the pre-service teachers?

8. What is the pre-service teachers' familiarity with different augmented reality applications?

9. What is the pre-service teachers' opinion of the purpose of using augmented reality applications in science learning?

10. What are the pre-service teachers' opinions on the effective use of augmented reality applications in science learning?

11. What are the pre-service teachers' perceptions of augmented reality applications in science learning?

12. What is the pre-service teachers' level of perception towards augmented reality applications in science learning?

Methods of Research

The study intended to determine the pre-service teachers' level of perception of augmented reality applications in science learning. Therefore, the present study was conducted using the normative survey method.

Population of the Study

In this study, the target population will be the pre-service teachers who are studying the science stream irrespective of the nature of management and universities but located in the Alappuzha and Kasaragod districts, Kerala. For this study, 181 samples were collected using a random sampling technique.

Tool for the Study

The investigator developed a rating scale for finding the pre-service teachers' perception of augmented reality applications in science learning. The tool was prepared after referring to so many reviews of related studies. The researcher discussed fixing her final tool with the supervisor, senior students, and Ph.D. scholars. Format and language, the wording of items used by the researcher were simple, and the respondent could easily follow these items. The investigator used a self-made tool entitled "Perception of Augmented Reality Applications in Science Learning Rating Scale (PARA-SLRS)". The researcher standardized the tool with the help of the supervisor.

Reliability of the Tool

In the present study, the investigator employed Cronbach's Alpha and split-half method to establish the reliability of the tools. The Cronbach's alpha value obtained is 0.977, which indicates a high level of internal consistency of the tool. Therefore, the tool is reliable. The investigator employed a split-half method to establish the 'γ' value of the tools. Then the reliability of the tools was estimated by the Spearman-Brown formula. The Spearman-Brown Coefficient value of the tool is 0.948. Thus, the reliability of the tools was established.

Validity of the Tool

The content validity is established by consulting the experts and construct validity through factor analysis.

Statistical Techniques Used

The investigator used frequency and percentage analysis to describe the data. SPSS Statistics Version 25 was used for analyzing the collected data.

Analysis of Data

Reporting of the findings is organized according to the research questions.

Research Question 1

What is the level of pre-service teachers' computer skills?

Table-1: Analysis of the sample in terms of rating the level of skills with computer

Skills in computer	No. of Pre-service Teachers	Percentage (%)
Beginner	34	23.1
Intermediate	92	62.6
Advanced	21	14.3

The above table (Table 1) presents the sample distribution in terms of their level of skills in using the computer. As seen from the table, 23.1 per cent of the sample is beginners, 62.6 per cent are intermediate, and the remaining 14.3 per cent are advanced computer users. It is seen that more than half [62.6 per cent] of the sample have intermediate skills with the computer. It might be the consequence of integrating ICT in teacher training programs, thus increasing computer skills among pre-service teachers.

Research Question 2

How long do the pre-service teachers have experience in using the internet?

Table-2: Analysis of the sample *regardin*g their experience in using internet

Years of Experience	No. of Pre-service Teachers	Percentage (%)
<3 years	1	0.6
3-5 years	27	14.9
Above 5 years	153	84.5

The above table (Table 2) presents the sample distribution in terms of their experience in using the internet. As seen from the table, 84.5 per cent of the sample has over five years of experience in using the internet, 14.9 per cent have been using the internet for 3-5 years, and the remaining 0.6 per cent has less than three years of experience. It is clear from the findings of the table that the majority of the sample [84.5 per cent] have above five years of experience using the internet. As a result of the revolution in telecommunications in India, internet services have become cheaper, and internet exposure significantly increased during the pandemic period. Thus, the majority of pre-service teachers have experience in using the Internet.

Research Question 3

What is the familiarity of augmented reality applications in science learning among pre-service teachers?

Table-3: Analysis of the sample regarding their familiarity of AR applications in science learning

Familiarity of AR apps	No. of Pre-service Teachers	Percentage (%)
Yes	89	49.2
No	92	50.8

The above table (Table 3) presents the sample distribution regarding their familiarity with augmented reality applications in science learning. As seen from the table, 49.2 per cent of the samples are familiar with augmented reality applications in science learning, and 50.8 per cent responded that they are not familiar with augmented reality applications in science learning. It is clear from the table that half of the study samples are not familiar with augmented reality applications in science learning. It may result from a lack of proper training for the pre-service teachers in augmented reality applications in science learning.

Research Question 4

What is pre-service teachers' exposure level towards augmented reality applications in the classroom through their teachers' usage?

Table-4: Analysis of the sample *regarding* their teacher's usage of the AR applications

Teacher's Use of AR	No. of Pre-service Teachers	Percentage (%)
Yes	45	24.9
No	136	75.1

The above table (Table 4.) presents the sample distribution regarding the teacher's use of AR applications in the classroom. As seen from the table, 24.9 per cent of the sample responded that their teachers use augmented reality applications in their class, and 75.1 per cent responded that their teachers do not use augmented reality applications in their class. The majority [75.1 per cent] of the pre-service teachers are not made familiar with augmented reality applications by their teachers. It may be due to teacher educators' lack of awareness about augmented reality applications.

Research Question 5

What is the experience level of using augmented reality applications in science learning during internship among the pre-service teachers?

Table-5: Analysis of the sample regarding their experience of using AR apps during internship

Usage in Internship	No. of Pre-service Teachers	Percentage (%)
Yes	34	18.8
No	147	81.2

The above table (Table 5.) presents a distribution sample regarding their experience using augmented reality applications in science learning during their internship. As seen from the table, 18.8 per cent of the sample used augmented reality applications in science learning during their internship, and the majority of the samples, 81.2 per cent, have not used augmented reality applications in their internship. Even though 49.2 per cent [Table 3] of pre-service teachers are familiar with augmented reality applications, only 18.8 per cent use AR in their internship, indicating they are not confident in using it. It may result from not properly training pre-service teachers about the effective integration of AR applications in science lesson plans.

Research Question 6

What is the level of the pre-service teachers in terms of their familiarity with AR textbooks?

Table-6: Analysis of the sample regarding rating the level of their familiarity of AR textbooks

AR textbooks familiarity	No. of Pre-service Teachers	Percentage (%)
Yes	22	12.2
No	159	87.8

The above table (Table 6) presents the sample distribution regarding their familiarity with AR textbooks. As seen from the table, 12.2 per cent of the samples are familiar with AR textbooks, and the majority of the samples, 87.8 per cent, are unfamiliar with AR textbooks. It indicates that although 49.2 per cent [Table 3] of pre-service teachers are familiar with augmented reality applications, they are unaware of various other aspects of AR applications in science learning. It may be due to a lack of training in pre-service teachers about augmented reality applications.

Research Question 7

What is the level of familiarity with AR tools among the pre-service teachers?

Table-7: Analysis of the sample regarding rating the level of their familiarity of AR tools

Familiarity of AR tools	No. of Pre-service Teachers	Percentage (%)
Head – mounted Displays	28	15.5
Handheld Displays	23	12.7
Spatial Displays	21	11.6
Pinch Gloves	5	2.8
Others	26	14.4
None of these	107	59.1

The above table (Table 7) presents the sample distribution in terms of their familiarity with AR tools. As seen from the table, 15.5 per cent are familiar with head-mounted displays, 12.7 per cent are familiar with handheld displays, 11.6 per cent are familiar with spatial displays, 2.8 per cent is familiar with pinch gloves, 14.4 per cent are familiar with other AR tools, and remaining 59.1 per cent are not familiar with any of these AR tools. It specifies that although 49.2 per cent [Table 3] of pre-service teachers are familiar with augmented reality applications, they are unaware of various other aspects of AR applications in science learning due to a lack of proper training given to pre-service teachers about augmented reality applications.

Research Question 8

What is the pre-service teachers' familiarity with different augmented reality applications?

Table-8: Analysis of the sample regarding the level of their familiarity of different AR Apps

AR Applications	Not Used		Intermediate		Advanced	
	F	%	F	%	F	%
ARLOOPA	161	89	16	8.8	4	2.2
Assembler EDU	163	90.1	17	9.4	1	.6
Google expeditions	128	70.7	47	26	6	3.3
Autumn visualizer	159	87.8	20	11	2	1.1
AR VR Molecules	156	86.2	23	12.7	2	1.1

Anatomy 4D	147	81.2	25	13.8	9	5
Science AR	142	78.5	29	16	10	5.5
Elements 4D	149	82.3	27	14.89	5	2.8

The above table (Table 8) presents the sample distribution regarding their familiarity with different augmented reality applications. As seen from the table, 89 per cent have not used ARLOOPA, 8.8 per cent have intermediate familiarity, and only 2.2 per cent have advanced knowledge. In the case of Assemblr EDU, 90.1 have not used it, 9.4 per cent have intermediate familiarity, and only 0.6 per cent have advanced knowledge. 70.7 per cent have not used google expeditions, 26.0 per cent have intermediate familiarity, and only 3.3 per cent have advanced knowledge. In the Autumn visualizer, 87.8 per cent have not been used, 11.0 per cent had intermediate familiarity, and only 1.1 per cent have advanced knowledge. 86.2 per cent have not used AR VR molecules, 12.7 per cent have intermediate familiarity, and only 1.1 per cent has advanced knowledge. 81.2 per cent have not used Anatomy 4D, 13.8 per cent have intermediate familiarity, and only 5.0 per cent have advanced knowledge. In the case of Science AR, 78.5 per cent have not used it, 16 per cent have intermediate familiarity, and only 5.5 per cent have advanced knowledge. In the case of Elements 4D, 82.3 per cent have not used it, 14.9 per cent have intermediate familiarity, and only 2.8 per cent have advanced knowledge. It is seen from the table that the majority of the pre-service teachers are not familiar with specific augmented reality apps in science learning. It indicates that pre-service teachers' knowledge about augmented reality applications in science learning is limited.

Research Question 9

What is the pre-service teachers' opinion of the purpose of using augmented reality applications in science learning?

The sample was asked to rate their opinion about the purpose of using augmented reality applications in science learning. They were given the following four statements and asked to rate them; multiple responses were allowed.

1. Helps in understanding abstract concepts
2. In depth understanding of scientific concepts
3. Provides multi-sensory learning experience
4. Promotes active learning

Table-9: Analysis of the sample regarding their opinion of purpose of using AR Apps

Purpose of using AR apps	F	%
Helps in understanding abstract concepts	76	42
In depth understanding of scientific concepts	85	47
Provides multi-sensory learning experience	107	59.1
Promotes active learning	117	64.6

The above table (Table 9) presents the sample distribution in terms of rating their opinion of the purpose of using augmented reality applications in science learning. Forty-two per cent of pre-service teachers believe that the purpose of using augmented reality applications in science learning is because it helps in understanding abstract concepts. Forty-seven per cent believe that it helps in-depth understanding of scientific concepts and 59.1 per cent thinks that it provides a multi-sensory learning experience. The majority of 64.6 per cent pre-service teachers think that it promotes active learning. It shows that even though the pre-service teachers' familiarity with various AR tools or AR apps is limited. They do have a favourable opinion about the purpose of using AR applications in science learning.

Research Question 10

What are the pre-service teachers' opinions on the effective use of augmented reality applications in science learning?

The sample was asked to rate their opinion about the effective use of augmented reality applications in science learning. They were given the following three statements and asked to rate them; multiple responses were allowed.

1. Selecting the appropriate AR applications
2. Effective integration of AR applications in the lesson
3. Using Interactive AR applications ensuring active student participation

Table-10: Analysis of the sample regarding their effective use of AR Apps in Science Learning

Effective use of AR apps in science learning	F	%
Selecting the appropriate AR applications	87	48.1
Effective integration of AR applications in the lesson	113	62.4
Using Interactive AR apps ensuring active student participation	121	66.9

The above table (Table 10) presents the sample distribution in terms of rating the level of their opinion about the effective use of augmented reality applications in science learning. 48.1 per cent of pre-service teachers believe that the effective use of augmented reality applications in science learning is because of selecting the appropriate AR applications. 62.4 per cent thinks that the effective use of augmented reality applications in science learning is because of the successful integration of AR applications in the lesson. The majority, 66.9 per cent, think that using augmented reality applications in science learning is effective because interactive AR applications ensure active student participation. It indicates that the pre-service teachers have strong opinions about using augmented applications effectively in science learning.

Research Question 11

What are the pre-service teachers' perceptions of augmented reality applications in science learning?

Table-11: Analysis of sample regarding of the perception towards AR apps in science learning

Statements	SD	DA	N	A	SA
	F (%)	F (%)	F (%)	F (%)	F (%)
I feel augmented reality applications make the science class more interesting.	09(5.5)	13(7.2)	25(13.8)	49(27.1)	85(47.0)
I feel AR applications help learners to understand abstract science concepts better.	04(2.2)	23(12.7)	15(8.3)	85(47)	54(29.8)
AR applications help in-depth understanding of scientific concepts.	6(3.3)	11(6.1)	35(19.3)	73(40.3)	56(30.9)
I believe that the practical use of AR applications can significantly change the science learning process.	10(5.5)	16(8.8)	19(10.5)	78(43.1)	58(32)
AR applications create a joyful learning experience for learners.	9(5)	12(6.6)	23(12.7)	73(40.3)	64(35.4)
I think AR applications bring significant change to science learning.	2(1.1)	23(12.7)	25(13.8)	79(43.6)	52(28.7)
I feel AR applications promote learner-centred learning	3(1.7)	10(5.5)	49(27.1)	78(43.1)	41(22.7)
AR applications inculcate various science process skills.	7(3.9)	22(12.2)	29(16)	88(48.6)	35(19.3)
I will use AR applications in the future of my science teaching and learning	11(6.1)	12(6.6)	29(16)	84(46.4)	45(24.9)
I believe AR application usage results in a high level of achievement in science learners.	9(5)	23(12.7)	41(22.7)	73(40.3)	35(19.3)
I feel AR application usage creates a positive attitude toward science learning.	11(6.1)	12(6.6)	32(17.7)	84(46.4)	42(23.2)
I think AR applications reduce the scientific anxiety of learners.	17(9.4)	29(16)	42(23.2)	63(34.8)	30(16.6)
I believe AR applications can replace paper-based textbooks, physical models, posters, and printed manuals in future.	13(7.2)	23(12.7)	58(32)	59(32.6)	28(15.5)

I feel we should get more opportunities to use AR applications in our internship.	4(2.2)	16(8.8)	44(24.3)	73(40.3)	44(24.3)
I feel we need special training to use AR applications in our classroom teaching.	12(6.6)	16(8.8)	23(12.7)	71(39.2)	59(32.6)
I believe AR applications are an optimal tool for teaching abstract topics.	10(5.5)	18(9.9)	30(16.6)	88(48.6)	35(19.3)
AR applications help the students to self-evaluate.	10(5.5)	25(13.8)	49(27.1)	74(40.9)	23(12.7)
I believe AR technology may help teach students with different learning styles.	7(3.9)	11(6.1)	40(22.1)	91(50.3)	32(17.7)
I feel AR applications facilitate the integration of theory and practice.	7(3.9)	16(8.8)	33(18.2)	96(53)	29(16)
AR applications help evaluate the various aspects of the students, like creativity, critical thinking, etc.	7(3.9)	20(11)	50(27.6)	76(42)	28(15.5)
AR applications help to identify the effectiveness of class in the context of students' perception, engagement, interactivity, and comfort with the activity.	8(4.4)	16(8.8)	39(21.5)	94(51.9)	24(13.3)
AR applications provide a multi-sensory learning experience.	10(5.5)	13(7.2)	32(17.7)	76(42)	50(27.6)
I feel AR applications increase students' attention span compared to traditional methods.	7(3.9)	21(11.6)	32(17.7)	84(46.4)	37(20.4)
AR applications increase student engagement in the classroom.	8(4.4)	17(9.4)	43(23.8)	65(35.9)	48(26.5)
I believe AR applications increase long-term memory retention of scientific concepts.	8(4.4)	15(8.3)	35(19.3)	73(40.3)	50(27.6)
I feel AR applications increase students' motivation for science learning.	5(2.8)	16(8.8)	28(15.5)	88(48.6)	44(24.3)
Using AR applications for evaluation reduces exam stress among students.	5(2.8)	30(16.6)	36(19.9)	81(44.8)	29(16)

I feel AR application is effective in teaching 3D spatial and kinesthetic content.	7(3.9)	15(8.3)	35(19.3)	81(44.8)	43(23.8)
I feel AR applications increase student participation in science learning activities.	8(4.4)	13(7.2)	42(23.2)	86(47.5)	32(23.8)

The above table (Table 11) presents the sample analysis regarding perception towards augmented reality applications in science learning.

AR 1: I feel augmented reality applications make the science class more interesting.

Among 181 pre-service teachers, 27.1 per cent agreed, and 47 per cent strongly agreed that they feel augmented reality applications make the science class more interesting. 7.2 per cent disagree, and 5 per cent strongly disagree with this statement.13.8 per cent gave neutral responses.

AR 2: I feel AR applications help learners to understand abstract science concepts better.

Among 181 pre-service teachers, 47 per cent agreed, and 29.8 per cent strongly agreed that they feel AR applications help learners to understand abstract science concepts better. 12.7 per cent disagree, and 2.2 per cent strongly disagree with this statement.8.3 per cent gave neutral responses.

AR 3: AR applications help an in-depth understanding of scientific concepts*.*

Among 181 pre-service teachers, 40.3 per cent agreed, and 30.9 per cent strongly agreed that they feel AR applications help an in-depth understanding of scientific concepts. 6.1 per cent disagree, and 3.3 per cent strongly disagree with this statement.19.3 per cent gave neutral responses.

AR 4: I believe that the effective usage of AR applications can make significant changes in the science learning process

Among 181 pre-service teachers, 43.1 per cent agreed, and 32 per cent strongly agreed that they believe that the effective usage of AR applications can make significant changes in the science learning process. 8.8 per cent disagree, and 5.5 per cent strongly disagree with this statement.10.5 per cent gave neutral responses.

AR 5: AR applications create a joyful learning experience for learners*.*

Among 181 pre-service teachers, 40.3 per cent agreed, and 35.4 per cent strongly agreed that they feel that AR applications create a joyful learning experience for the learners. 6.6 per cent disagree, and 5.0 per cent strongly disagree with this statement.12.7 per cent gave neutral responses.

AR 6: I think AR applications bring significant change to science learning.

Among 181 pre-service teachers, 43.6 per cent agreed, and 28.7 per cent strongly agreed that they feel that AR applications bring significant change to science learning. 12.7 per cent disagree, and 1.1 per cent strongly disagree with this statement.13.8 per cent gave neutral responses.

AR 7*:* I feel AR applications promote learner-centred learning

Among 181 pre-service teachers, 43.1 per cent agreed, and 22.7 per cent strongly agreed that they think that AR applications promote learner-centred learning. 5.5 per cent disagree and 1.1 per cent strongly disagree with this statement.27.1 per cent gave neutral responses.

AR 8: AR applications inculcate various science process skills.

Among 181 pre-service teachers, 48.6 per cent agreed, and 19.3 per cent strongly agreed that they feel that AR applications inculcate various science process skills.12.2 per cent disagree and 3.9 per cent strongly disagree with this statement.16 per cent gave neutral responses.

AR 9: I will use AR applications in the future of my science teaching and learning

Among 181 pre-service teachers, 45.4 per cent agreed, and 24.9 per cent strongly agreed that they would use AR applications in the future of their science teaching and learning.6.6 per cent disagree, and 6.1 per cent strongly disagree with this statement.16 per cent gave neutral responses.

AR 10: I believe AR application usage results in a high level of achievement in science learners.

Among 181 pre-service teachers, 40.3 per cent agreed, and 19.3 per cent strongly agreed that AR application usage results in a high level of achievement in science learners.12.7 per cent disagree, and 5 per cent strongly disagree with this statement.22.7 per cent gave neutral responses.

AR 11: I feel AR application usage creates a positive attitude to the learners toward science learning.

Among 181 pre-service teachers, 46.4 per cent agreed, and 23.2 per cent strongly agreed that AR application usage creates a positive attitude toward science learning. 6.6 per cent disagree, and 6.1 per cent strongly disagree with this statement.17.7 per cent gave neutral responses.

AR 12: I think AR applications reduce the scientific anxiety of learners.

Among 181 pre-service teachers, 34.8 per cent agreed, and 16.6 per cent strongly agreed that AR applications reduce the scientific anxiety of the learners. 16 per cent disagree, and 9.4 per cent strongly disagree with this statement.23.2 per cent gave neutral responses

AR 13: I believe AR applications can replace paper-based textbooks, physical models, posters, and printed manuals in future.

Among 181 pre-service teachers, 32.6 per cent agreed, and 15.5 per cent strongly agreed that AR applications have the potential to replace paper-based textbooks, physical models, posters, and printed manuals. 12.7 per cent disagree, and 7.2 per cent strongly disagree with this statement.32 per cent gave neutral responses.

AR 14: We should get more opportunities to use AR applications in our internship.

Among 181 pre-service teachers, 40.3 per cent agreed, 24.3 per cent strongly agreed that they should get more opportunities to use AR applications in the internship, 8.8 per cent disagreed, and 2.2 per cent strongly disagreed. 24.3 per cent gave neutral responses.

AR 15: We need special training to use AR applications in classroom teaching.

Among 181 pre-service teachers, 39.2 per cent agreed, and 32.6 per cent strongly agreed that they need special training to use AR applications in the classroom teaching 8.8 per cent disagreed, and 6.6 per cent strongly disagreed with this statement.12.7 per cent gave neutral responses.

AR 16: I believe AR applications are optimal for teaching abstract topics.

Among 181 pre-service teachers, 48.6 per cent agreed, and 19.3 per cent strongly agreed that they believe AR applications are an optimal tool for teaching abstract topics. 9.9 per cent disagree, and 5.5 per cent strongly disagree with this statement.16.6 per cent gave neutral responses.

AR 17: AR applications help the students to self-evaluate.

Among 181 pre-service teachers, 40.9 per cent agreed, 12.7 per cent strongly agreed that AR applications help the students to self-evaluate, 13.8 percent disagreed, and 5.5 per cent strongly disagreed with this statement. 27.1 per cent gave neutral responses.

AR 18: AR technology may help teach students with different learning styles.

Among 181 pre-service teachers, 50.3 per cent agreed, and 17.7 per cent strongly agreed that AR technology might help to teach students with different learning styles. 6.1 per cent disagree, and 3.9 per cent strongly disagree with this statement. 22.1 per cent gave neutral responses.

AR 19: I feel AR applications facilitate the integration of theory and practice.

Among 181 pre-service teachers, 53 per cent agreed and 16 per cent strongly agree that AR applications facilitate the integration of theory and practice. 8.8 per cent disagree, and 3.9 per cent strongly disagree with this statement. 18.2 per cent gave neutral responses

AR 20: AR applications help evaluate the various aspects of the students, like creativity, critical thinking, etc.

Among 181 pre-service teachers, 42 per cent agreed, and 15.5 per cent strongly agreed that AR applications help evaluate the various aspects of the students, like creativity, critical thinking, etc. 11 per cent disagree and 3.9 per cent strongly disagree with this statement. 27.6 per cent gave neutral responses.

AR 21: AR applications help to identify the effectiveness of class in the context of students' perception, engagement, interactivity, and comfort with the activity.

Among 181 pre-service teachers, 51.9 per cent agreed, and 13.3 per cent strongly agreed that AR applications help identify the class's effectiveness in the context of students' perception, engagement, interactivity, and comfort with the activity. 8.8 per cent disagree, and 4.4 per cent strongly disagree with this statement. 21.5 per cent gave neutral responses.

AR 22: AR applications provide a multi-sensory learning experience.

Among 181 pre-service teachers, 42 per cent agreed, and 27.6 per cent strongly agreed that they feel AR applications provide a multi-sensory learning experience.7.2 per cent disagree, and 5.5 per cent strongly disagree with this statement. 17.7 per cent gave neutral responses.

AR 23: I feel AR applications increase students' attention span compared to traditional methods.

Among 181 pre-service teachers, 46.4 per cent agreed, and 20.4 per cent strongly agreed that they feel AR applications increase students' attention span compared to traditional methods .11.6 per cent disagree, and 3.9 per cent strongly disagree with this statement. 17.7 per cent gave neutral responses.

AR 24: AR applications increase student engagement in the classroom.

Among 181 pre-service teachers, 35.9 per cent agreed, and 26.5 per cent strongly agreed that they feel AR applications increase student engagement in the classroom. 9.4 per cent disagree, and 4.4 per cent strongly disagree with this statement. 23.8 per cent gave neutral responses.

AR 25: I believe AR applications increase long-term memory retention of scientific concepts.

Among 181 pre-service teachers, 40.3 per cent agreed, and 27.6 per cent strongly agreed that they believe AR applications increase long-term memory retention of scientific concepts. 8.3 per cent disagree, and 4.4 per cent strongly disagree with this statement.16 per cent gave neutral responses.

AR 26: AR applications increase students' motivation for science learning.

Among 181 pre-service teachers, 48.6 per cent agreed, and 24.3 per cent strongly agreed that they feel AR applications increase motivation for science learning. 8.8 per cent disagree, and 2.8 per cent strongly disagree with this statement.15.5 per cent gave neutral responses.

AR 27: Using AR applications for evaluation reduce exam stress among the students.

Among 181 pre-service teachers, 44.8 per cent agreed, and 16 per cent strongly agreed that using AR applications for evaluation reduces exam stress among students. 16.6 per cent disagree, and 2.8 per cent strongly disagree with this statement.19.9 per cent gave neutral responses.

AR 28: AR application effectively teaches 3D spatial and kinesthetic content.

Among 181 pre-service teachers, 44.8 per cent agreed, and 23.8 per cent strongly agreed that AR application effectively teaches 3D spatial and kinesthetic content. 8.3 per cent disagree, and 3.9 per cent strongly disagree with this statement.19.3 per cent gave neutral responses.

AR 29: I feel AR applications increase student participation in science learning activities.

Among 181 pre-service teachers, 47.5 per cent agreed, and 17.7 per cent strongly agreed that AR applications increase student participation in science learning activities. 7.2 per cent disagree, and 4.4 per cent strongly disagree with this statement.23.2 per cent gave neutral responses. When analyzing the individual response regarding augmented reality applications in science learning, some pre-service teachers responded neutrally, and some disagreed with certain aspects of augmented reality applications. Some expressed their strong agreement with some features of augmented reality applications, and a few students responded as strongly disagreed with some particular statements. After analyzing the complete response, the output showed that most pre-service teachers moderately perceive augmented reality applications in science learning. The remaining students have a low-level perception, and a few have a high perception of augmented reality applications in science learning.

Research Question 12

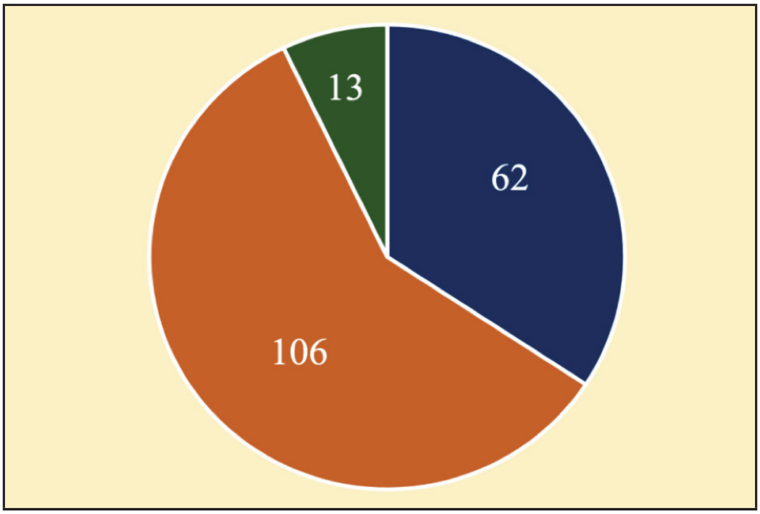
What is the pre-service teachers' level of perception towards augmented reality applications in science learning?

Table-12: Analysis of sample regarding the level of perception towards AR apps in science learning

Perception level on AR Apps	Frequency	Percentage (%)
Low	62	34.3
Moderate	106	58.6
High	13	7.2

The above table (Table 12) presents the sample analysis regarding the level of perception towards augmented reality applications in science learning. As seen from the above table, 62 (34.3 per cent) of the sample have a low level, 106 (58.6 per cent) of the sample have a moderate level, and 13 (7.2 per cent) of the sample have a high level of perception toward augmented reality applications in science learning.

Graph-1: Graph shows the level of perception of pre-service teachers towards AR apps



This study gained more insights into pre-service teachers' perceptions of augmented reality applications in science learning. More than half of the sample (58.6 per cent) has moderate level perception, but there are, however, still 34.3 per cent of Pre-service teachers who have a low level of perception. This can be due to several factors; even though AR applications have been popular worldwide for the last couple of years, it has not been popular in India. It may also be because students do not have access to smartphones and reliable internet services.

In the beginning, operating AR applications required additional equipment like various AR tools. In India, even though smart classrooms are gaining popularity, the availability of AR tools is negligible. Furthermore, the lack of awareness among teacher educators also adds to the low perception among the pre-service teachers. 7.2 per cent of pre-service teachers have a high level of perception towards augmented reality applications in science learning due to the availability of smartphones and reliable internet service.

Recommendations for Future Research

- Future research must focus on pre-service and in-service teachers in special education, as augmented reality applications would enormously help in the teaching-learning process of special children. The teachers should know how to integrate various augmented reality applications successfully according to the needs of the children.
- In the future, the perception of teacher educators to augmented reality applications in science learning can be studied.

- Future research should investigate whether using augmented reality applications in science learning would increase students' interest in science subjects.
- Further studies should be conducted to identify the technical barriers the pre-service teachers might have in integrating augmented reality applications in their classes.
- In the future, a detailed study can be made by using a large sample covering other districts and states, and more variables can also be included.
- Further research will be conducted to determine the influence of augmented reality applications on students' academic performance and behaviour.
- The challenges teachers face while integrating augmented reality applications can be studied in the future.

Conclusions

In the current scenario, ICT-integrated learning is gaining popularity, and many schools are equipped with smart classrooms; the teachers should be proficient in integrating ICT into their lesson plans. In this scenario, the pre-service teachers' perception of augmented reality applications in science learning is studied as augmented reality applications are one of the best technologies for making science learning interesting. The following are the conclusions derived from the study:

- Pre-service teachers were found to have an insufficient perception of augmented reality applications in science learning.
- The pre-service teachers should be allowed to use various augmented reality applications in their internship as it would help them gain confidence to use them in the future.
- The inadequacy of pre-service teachers in identifying various AR apps and AR tools may be because they don't know how to use them.

Following are the educational implications of the study:

- The pre-service teachers should be trained to integrate augmented reality applications in the lesson plan effectively, identify the appropriate science AR apps for a particular concept and student level, and develop AR apps to make them suitable for their lessons.
- Teacher educators should be given special training in integrating various AR apps in their classrooms. They should also teach the pre-service teachers about effectively integrating AR apps into their lesson plans.
- Teacher educators should encourage students to use AR apps in their studies and implement them effectively in their future classes.
- Pre-service teachers should be allowed to use AR apps in their internships. It would give them the confidence to use it in the future.
- This study helps determine the level of perceptions of augmented reality applications in science learning among pre-service teachers.
- This study is significant from a global perspective.

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Research Article

Digital Competence among School Teachers in Nagaland State: Differences with reference to Type of Management, Work Experience, and Subject Taught

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Abstract

The purpose of this study is to examine the Digital Competence among the school teachers in Nagaland State with reference to the type of management, work experience, and subject taught. A total of 400 teachers participated in the study. The sampling method of study is Multi-Stage Random Sampling Method. The Digital Competence Scale for Teachers (DCST) was used as a data collection tool in the study. The study revealed that private school teachers have higher digital competence. The study also revealed a significant difference among the school teachers about work experience, the school teachers having less than 2 years were found to have higher Digital Competence than those teachers having more years of work experience. With regard to the results of the subject taught, it is evident that there seems to be no significant difference among the school teachers teaching different subjects.

Keywords: Digital Competence, School Teachers, Management, Work Experience, Subject Taught

Introduction

With the progression of digital technology in education, there has been a paradigm shift in the education system throughout the world. It is proceeding from the traditional methods of teacher-centered learning to modern learner-centered teaching methods. Today, students learn facts, skills, knowledge, and attitudes from computers, the internet, and social media. Technology has created a significant difference in various processes related to education. Digitalization of education includes using digital tools and technologies for educational administration, the teaching and learning process, evaluation, research, and extension activities. Teaching and learning through digital technology is playing an increasingly vital role in assisting teachers meet many of the expectations of today's technological world by providing innovative teaching tools, access to information, global collaboration opportunities, and alternative ways to professional development that have consistently resulted in the enhancement of the educational development of many nations. Technology has heralded the development and implementation of new and innovative teaching strategies in higher education. Globally, there is an increasing demand for skilled teachers to prepare students to lead successful lives in a technology-infused, knowledge-based society. Technology offers teachers the keys to unlock a huge world of opportunities available to meet the demands of the education system across the world. One of the most acceptable ways of learning being practised nowadays is learning through digital technology. Shipra (2020)

The University Grants Commission (UGC) is encouraging the development of e-contents for all subjects. Teachers can also use online courses like Modular Object-Oriented Dynamic Learning Environment (MOODLE) and Massive Open Online Courses (MOOCs) such as SWAYAM, Coursera, edix, Udacity, Future Learn, NovoEd, Canvas, etc ., to develop their ICT based lessons. Software like M.S.Word , Excel spreadsheets, SPSS, Publisher, VLC media player, Youtube, Clip-grab, etc. can be used by the teachers for their techno-pedagogical needs. The Internet has a vast variety of e-resources such as E-mail, group mail, podcasting, e-portfolios, e-learning platforms, audiovisual resources and multimedia, Blogs and library websites like ERIC (Education Resources Information Center) books, online Databases, Gateways and portals, e-journals, e-reports, Websites and home pages like Central Institute of Educational Technology (CIET) is a unit of the National Council of Educational Research and Training (NCERT), yahoo, google, bing, Aol, altavista, excite, lycos, etc., can also be used by the teachers as ICT resources for their techno-pedagogic teaching. Teachers and students can use Open Educational Resources (OER) these are public domain resources or resources that can be used under an intellectual property license that allows re-use or adaptation - e.g., Creative Commons for their teaching/ learning process. OER can be used as educational resources by all, especially those in resource-poor environments to achieve quality education.

Digital Competence consists of various skills and competencies and its scope covers media and communication, technology and computing, literacy, and information science. Digital competence consists of technical skills and abilities to use digital technologies in a meaningful way for working, studying, and for daily life in various general activities, abilities to critically evaluate digital technologies, and motivation to participate in the digital era.

Literature Review

Anjali Shokeen et al.,(2022) found that attitude & self-efficacy, required skills & knowledge, practical experiences of using technology, and access to technology are the factors that majorly influence pre-service teachers' digital competence. Himangshu et al., (2022) found no significant difference between male and female teachers in access and use of ICT in the teaching-learning process. Nandhakumar & Govindarajan (2022) found that significant effects like digital pedagogy in the teaching-learning process led to the effective teaching competency of the B.Ed. students in physical science. Mohalik (2020) study intended to find out the level of digital literacy and its uses among teacher trainees at the secondary level. This study indicates that teacher training institutes are equipped with digital devices and the majority of trainees have a smartphone with a data plan. The study also indicates that trainees are using digital devices during the internship in the teaching programme for planning lessons, preparing teaching-learning materials, and presenting the lesson. Yazon et al., (2019) showed that there is a strong and significant relationship between faculty members' digital literacy and research productivity. Lagarto et al., (2018) found that there was a significant improvement in the number of teachers who have undergone information and communication technologies training Vázquez-Cano et al., (2017) found that males had greater perceived competence in digital cartography and online presentations, whereas females preferred to request personal tutorials to resolve doubts about technology and had greater perceived competence in corporate emailing. Dangwal and Srivastava (2016) discussed the role of digital pedagogy in the Indian teacher education system. They concluded that every teacher must ensure technological integration, pedagogy, and subject area content effectively in their classroom teaching. Grünwald et al., (2016) found that university teachers had the optimal level of competence in media and equipment, media literacy, and teaching staff motivation but showed a low-level competence that requires specific professional knowledge in courses, didactics, and instructional design, Learning Management Systems and e-moderation. Kimmons (2015) conducted a study on Technology integration coursework and finding meaning in pre-service teachers' reflective practice and suggested that they need to have good command over accessing, creating, and effectively utilizing such digital resources to get their learners acquainted with a better understanding of its meaningful exploitation. Srivastava and Bisht (2015) revealed that the majority of the pre-service teachers have a positive attitude towards the use of ICT and they are competent in the use of a few basic ICT tools. The study also indicated no significant difference between male and female pre-service teachers' competence and attitudes toward ICT. Shabana Tabusum et al., (2014) findings of the study revealed that the students were digitally literate and the majority of them were average in computer literacy level. Kumbar and Pattanshetti (2013) examined the essential competencies of Indian school librarians in the digital age and found that competence and collaboration are the key factors that may determine the professional growth and contribution the school librarians and with proper training, they may become the main link between digital resources and users. Magdaş and Bontea (2011) developed educational software for developing digital skills among students of XII grade of a technical profile. They found that the use of educational software and computer-assisted instruction in teaching and learning contributes to a significant increase of the efficiency of education.

Objectives of the study

1. To study the difference in digital competence scores among school teachers with respect to management.
2. To study the difference in digital competence scores among school teachers with respect to work experience.
3. To study the difference in digital competence scores among school teachers with respect to the subject taught.

Hypotheses of the Study

1. There is no significant difference between government and private school teachers towards digital competence scores.
2. There is no significant difference in digital competence among school teachers with reference to work experience.
3. There is no significant difference in Digital Competence scores among school teachers with reference to the subject taught.

Methodology

Research Design: A research design program guides the investigator in collecting, analyzing, and interpreting observations. It thus provides a systematic plan of procedure for the researcher to follow. (Krishnaswami & Ranganatham, 2016)

Research Method: For the present study Descriptive method was used. Descriptive studies are primarily concerned with finding out "what is". To obtain quantitative data, the Digital Competence Scale for Teachers (DCST) developed by Ramkrishna (2017) and the personal data sheet prepared by the researchers to obtain the qualitative data, were applied to the school teachers.

Population and Sample: The population of the present study comprised all teachers working in high schools and higher secondary schools of bo1th government and private schools in Nagaland. The sample used in the present study is 400 school teachers which comprise 128 male and 272 female school teachers who were the sample subjects. For the present study, Multi-Stage Random Sampling Technique was adopted to select the school teachers of both government and private schools.

Data Collection Tools:

1) Personal Data Sheet: Personal Data Sheet prepared by the researchers consist of questions such as the name of the teacher, name of the school, management of the school, years of work experience, and subject taught. To gather information about the teachers who are the subjects in the study.

2) Digital Competence Scale for Teachers (DCST): The tool which was used by the investigator in the present study was Digital Competence Scale for Teachers (DCST) developed and standardized by Ramkrishna (2017) was adopted and used by the researchers to determine the difference in digital competence about gender, age and educational qualifications. The scale consisted of 50 items and the major factors included in this scale are: A. Knowledge of Digital Practices, B. Expertise in Using Digital technology for teaching learning, C. Evaluating and Authorizing Online information, D. Managing and Communicating Digital Data, E. Collaborating and Sharing Digital Data for Teaching Learning.

Application and Data Collection: The investigators personally met the school teachers and asked them to volunteer to participate in the study conducted. Each of them was given sufficient time to reflect on the question while answering them so that they could understand each and every question properly before they answer them. After collecting the data, tabulation of the information according to the objectives and subsequent evaluation of the data was done.

Data Analysis: In this context, in the analysis of the data; independent t-Test, ANOVA were used.

Data Analysis and Interpretation

Digital Competence and Management:

To find out the significant difference, the data has been analysed and interpreted using descriptive statistics such as mean, and standard deviation. The hypothesis is tested by employing the "t" test. The value of "t" was set at 1.96 for the significance level with df = 398. It is presented in the table below.

Table-1: Mean Score, SD and t- value of Digital Competence Scores between Government and Private School Teachers

Variable and its Dimensions	Management	N	Mean	S.D	t-Value
Knowledge of Digital Practices	Government	185	44.88	7.859	4.252*
	Private	215	48.25	7.920	
Expertise in Using Digital Technology for Teaching Learning	Government	185	45.57	6.537	7.262*
	Private	215	50.43	6.789	
Evaluating and Authorizing Online Information	Government	185	36.19	5.746	5.947*
	Private	215	39.79	6.250	
Managing and Communicating Digital Data	Government	185	29.92	4.650	5.305*
	Private	215	32.31	4.325	
Collaborating and Sharing Digital Data for Teaching Learning	Government	185	31.42	4.332	5.325*
	Private	215	34.15	5.722	
Digital Competence score	**Government**	**185**	**187.98**	**26.263**	**6.256***
	Private	**215**	**204.92**	**27.617**	

Note: Table value for 398 df at 0.05 level= 1.96
@ indicates not significant at 0.05 level and * indicates significant at 0.05 level

From Table-1 overall data shows the mean score of digital competence of government teachers is 187.98 and the mean score of private teachers is 204.92. This indicates the difference of mean score of 16.94 which is in favour of private school teachers and shows that private school teachers have higher digital competence than private school teachers.

Again a result from the above table shows the observed t-value is 6.256 is higher than the table value (1.96) with 398 df at 0.05 level of significance. It indicates that there is a significant difference in digital competence with respect to government and private school teachers. The stated null hypothesis, "there is no significant difference between government and private school teachers towards digital competence scores" is not accepted. Thus the result revealed that the private school teachers have higher digital competence than the school teachers working in government schools. The probable reason may be that in private schools the teachers performance is being monitored as a result private school teachers are updated with modern teaching methods which is lacking in government schools.

Digital Competence and Work Experience:

The Secondary School teachers were classified as having Work Experience, Less than 2 Years, 2 Years to 5 Years, 6 Years to 10 Years, 11 Years and above, and the results are given in table- 2.

Table-2: Summary of Analysis of Variance digital competence scores on school teachers Based on the Work Experience

Variable and its Dimensions	Sum of squares	Mean of squares	F Value
Knowledge of Digital Practices	Between Groups	270.927	4.310*
	Within Groups	62.865	
Expertise in Using Digital Technology for Teaching Learning	Between Groups	244.536	5.058*
	Within Groups	48.347	
Evaluating and Authorizing Online Information	Between Groups	38.193	0.969@
	Within Groups	39.405	
Managing and Communicating Digital Data	Between Groups	52.757	2.500*
	Within Groups	21.104	
Collaborating and Sharing Digital Data for Teaching Learning	Between Groups	27.058	0.963@
	Within Groups	28.090	
Digital Competence Score	**Between Groups**	**2119.843**	**2.700***
	Within Groups	**785.237**	

Note: Table value for (4,395) df at 0.05 level= 2.39
@ indicates not significant at 0.05 level and * indicates significant at 0.05 level

The above Table-2 shows that the calculated value of F is 2.700 which is greater than the table value of 2.39 at 0.05 level of significance with (4,395) df. Hence, we do not accept the null hypothesis, "There is no significant difference in digital competence among school teachers with reference to work experience.". We may, therefore, conclude that there is a significant difference in digital competence with years of work experience among school teachers in Nagaland. The observed result shows that the teachers having less than 2 years have more Digital Competence than teachers having more years of teaching experience. This may be because the newly added teacher was more proficient in using digital devices and was able to prepare the lesson and get more information about the content. Overall data shows the mean scores of digital competence with respect to categories of years of work experience, i.e., less than 2 Years and 2 years to 5 years is 205.43 and 202.12 respectively, 6 years to 10 years and 11 years and above mean scores is 195.95 and 192.15 each. Lastly, the mean scores of other categories are 200.33. This indicates that school teachers with less than 2 years of working experience have higher digital competence.

Digital Competence and Subject Taught:

Table-3: Summary of Analysis of Variance digital competence scores on school teachers Based on the subject taught

Variable and its Dimensions	Sum of squares	Mean of squares	F Value
Knowledge of Digital Practices	Between Groups	176.786	2.770*
	Within Groups	63.819	
Expertise in Using Digital Technology for Teaching Learning	Between Groups	17.157	0.339@
	Within Groups	50.649	
Evaluating and Authorizing Online Information	Between Groups	26.808	0.678@
	Within Groups	39.520	
Managing and Communicating Digital Data	Between Groups	36.370	1.710@
	Within Groups	21.270	
Collaborating and Sharing Digital Data for Teaching Learning	Between Groups	15.178	0.538@
	Within Groups	28.211	
Digital Competence Score	**Between Groups**	**669.246**	**0.837@**
	Within Groups	**799.926**	

Note: Table value for (4,395) df at 0.05 level= 2.39
@ indicates not significant at 0.05 level and * indicates significant at 0.05 level

The above Table-3 shows that the calculated value of F is .837 which is lower than the table value of 2.39 at 0.05 level of significance with (4,395) df. Hence, we accept the null hypothesis, "there is no significant difference in Digital Competence scores among school teachers with reference to the subject taught". We may, therefore, conclude that there is no significant difference in digital competence among school teachers about subjects taught in Dimapur District. The results also depicts that teachers teaching mathematics subject have slightly higher Digital Competence than teachers teaching other subject the probable reason may be that mathematics subject is mostly considered a dull and difficult subject to many students therefore the teacher may be using digital tools to arouse the interest of the students in this subject which have resulted in higher digital competence among the school teachers. overall data shows the mean scores of digital competence concerning the subject taught i.e., the mean scores of Mathematics and Science are 200.98 and 200.58 respectively, and Social studies and Languages mean scores are 196.03 and 193.80 each. Lastly, the mean scores of other categories are 196.95. Thus it can be concluded that school teachers teaching Mathematics subject has slightly higher digital competence than school teachers teaching other subjects.

Discussion, Educational implications and Conclusion

Discussion

According to the results of Digital Competence among school teachers with reference to Management, there is a significant difference in digital competence between government school teachers and private school teachers. Thus, private school teachers have higher digital competence when compared to teachers working in government schools. This may be due to better awareness and better infrastructure along with regular supervision in private schools as compared to government schools.

Another finding of the present study observed that there is a significant difference among school teachers regarding work experience. Among the categories such as Less than 2 years, 2 years to 5 years, 6 years to 10 years, 11 years and above, and Others, the school teachers having less than 2 years were found to have higher Digital Competence than those with more work experience. This may be because those school teachers comprise young and fresh graduates who are experts in ICT. Contradictory results have, however, also been reported by Benali et al. (2018) where the findings reveal that teachers with higher levels of digital teaching confidence are those with more years of experience.

Through this study, the researcher also identified that there were no significant differences among school teachers with reference to their subject taught. However, mathematics subject school teachers are found to have slightly higher Digital Competence than other subject teachers namely Science, Social Science, English and Other subject teachers. The probable reason may be because mathematics subject is mostly considered as a dull and challenging subject to many students therefore the teacher may be using digital tools in order to arouse the interest of the students in this subject which may have resulted in higher Digital Competence among the school teachers. These findings contradict the findings of Kozuh et al. (2021) which show that science and technology teachers apply digital tools while teaching more frequently than other subject teachers.

Educational Implications of the Study

Any research is useful and meaningful as long as it is fruitful in adapting to current educational changes and providing insights to guide the field in question to a higher level of achievement. An attempt was made to explore teachers' digital literacy regarding administration, work experience, and subjects taught. This study makes several valuable contributions to the educational system and the learning process of education as far as teacher quality is concerned.

Following are the main implications of this study:

1. The results indicate that those teachers with higher digital competence which comprise of young and fresh graduates tend to perform better and more effectively than those with lower levels of digital competence. Schools, school education departments, and governments at large should therefore take appropriate steps to provide regular digital literacy training to school teachers working in both public and private schools.

2. The importance of digital empowerment and ICT training of school teachers for quality education should be recognized by all concerned stakeholders to adapt to the urgency of the digitalization of education systems.

3. This research is of great importance because the digital skills of school teachers are a new trend in the education system to increase professional efficiency in teaching and to provide quality education to students.

4. Special efforts should be made to raise awareness of digital literacy among school teachers.

5. School education departments should take the lead in providing in-service training courses for secondary school teachers to improve their digital literacy skills.

Conclusion

The study investigated the level of Digital Competence among School Teachers. The sample of 400 teachers was drawn from the school teachers working in Government and Private Schools in Dimapur District. A glance at the findings of the result reveals that private school teachers have higher digital competence. It was also revealed that there is a significant difference among the school teachers with reference to work experience. The school teachers having less than 2 years of experience were found to have higher Digital Competence than those having more work experience. This study makes several valuable contributions to the education system regarding teacher quality. This research has significant educational implications related to teacher digital literacy and some of its key determinants. In today's world of increasing economic globalization and the digitization of education, there is an urgency to improve the digital competencies of teachers so that they can inspire new generations through well-informed guidance and decisions in educational practice.

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Research Article

Gender, Technology and Representation: Analysis of Ban's *U Syiem* (2013)

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Abstract

The film is a medium that has the ability to bring change to society. Films, especially regional films, influence the audience since they connect more with the local content. The advancement in film production technology has not only improved the film-viewing experience but also provided an opportunity to filmmakers to offer a variety of content. This puts the filmmakers in a privileged position as they decide what the viewers will consume although films may or may not represent reality. This study analyses the first animation film of Meghalaya, U Syiem (2013) with representation theory as a framework to understand the portrayal of male and female characters in the film. The study also includes an interview with the film's director to understand the process of developing and creating characters in the film. The study aims to provide new perspectives to viewers and learners in understanding various aspects of men's and women's roles in a matrilineal society through the nuances of animation technology.

Keywords: gender; representation; Khasi film; technology; animation; U Syiem

Introduction

Technology has the ability to promote gender equality and empower women. It provides women with increased "access to education, employment, and entrepreneurship", while "challenging traditional gender roles and stereotypes that often restrict their potential" (Mint, 2023). The use of technology to promote gender equality has made significant progress, especially in the wake of the COVID-19 pandemic. "Remote work, flexible schedules, online education, and mentorship programs" have offered vital support and platforms for women to develop their "social and intellectual capabilities" (Mint, 2023). Despite these promising advancements, the tech industry remains predominantly male-dominated, with women underrepresented in various roles, including engineering, leadership, and decision-making positions (Goldstaub, 2021). Women in technology face gender pay gaps and encounter biases and stereotypes that hinder their career advancement and recognition (Slotboom, 2022). To ensure an inclusive and thriving environment where gender is not a barrier, there is still work to be done. Technological advancements have revolutionized various sectors including healthcare and education. This article examines the film industry, focusing on an animation film, which heavily relies on the nuances of technology.

Technology plays an important role in today's film production process. It has changed how films are made, distributed, screened, and consumed. The inclusion of technology in cinema is "to trigger the audience's empathy and bring them closer to the story" (Li, 2021). On-screen it has helped provide an enhanced film experience to the viewers, off-screen it engages the audience with sharp images and visuals (Sharma, 2022). The history of cinema started with silent black and white films, then colour and sound were introduced, followed by VFX, and animation. Animation films are a popular form of visual storytelling that use drawings, computer-generated imagery (CGI), or other forms of visual art to bring characters and stories to life. These films have been entertaining audiences of all ages for decades, and their popularity has grown over the years. Animation films come in many styles and genres, from light-hearted comedies to heart-wrenching dramas. Some of the most popular animation film genres include family films, action and adventure films, fantasy films, science fiction films, mythological epics, etc. One of the main benefits of animated films is that they allow filmmakers to tell stories that might be difficult or impossible to tell in live-action films. Because animation films are not bound by the laws of physics or the limitations of the real world, they can explore fantastical concepts and create characters and settings that are truly unique (Lascala, 2022). Animators can create any character or setting they can imagine, and they can use visual effects and computer-generated imagery (CGI) to create stunning and intricate visuals that would be difficult or impossible to achieve in live-action videos. Additionally, animation films can use "exaggeration and caricature to create characters that are larger-than-life" and more expressive than their live-action counterparts (Hilder, 2023). Another advantage of animated films is that they can appeal to a wide range of audiences. While some may think of animated films as primarily for children, many animated movies are designed to appeal to adults as well.

Animation films have been gaining popularity in India recently, both among children and adults. Indian animation films have come a long way since their inception in the early 1900s with the first animated film Agkadyanchi Mouj (Matchstick's Fun) directed by Dada Saheb Phalke (Chakraborty, 2023). The Pea Brothers, directed by Gunamoy Banerjee became the first film released in theatres in 1934 (Ghose & Gupta, 2018). Today, Indian animation films cover various genres, styles, and themes. One of the most popular Indian animation films of all time is the Ramayana: The Legend of Prince Rama released in 1992. This animated retelling of the epic of Ramayana became a cult classic for its beautiful animation and engaging storytelling.

Other notable Indian animation films include the Hanuman series, Chhota Bheem, and Mighty Raju. These movies have gained popularity among children for their colourful characters and lively storylines.

In addition to films, Indian animators are also producing animated series for television and streaming platforms. Netflix's Mighty Little Bheem is a popular animated series featuring the adventures of the popular character, Chhota Bheem, and has been well-received by audiences worldwide.

Indian animators are also increasingly venturing into the realm of adult-oriented animation. The web series The Legend of Hanuman has been praised for its stunning animation and engaging storytelling. Indian animation films also incorporate traditional Indian art and culture, helping to promote and preserve India's rich heritage. One example of a successful Indian animated film is Hanuman, a 2005 movie based on the Hindu epic Ramayana.

In recent years, the Indian animation industry has grown significantly, with studios producing high-quality animated films that are viewed by audiences worldwide.

Representation of characters in animation films

A number of studies have been conducted to understand the representation of characters in animation films. Jimenez's (2022, p. 2) analysis of Disney animated films found that women characters were given more "pervasive roles". It was also found that while 63.3 per cent of the characters were male, only 36.6 per cent were females (Jimenez, 2022). A similar study by Sims (n.d) on the analysis of Disney films found that there has been no change in the portrayal of characters. The characters are portrayed stereotypically with male characters possessing masculine traits.

Many early animated films perpetuated traditional gender stereotypes, portraying women as passive and men as dominant and aggressive. In more recent years, there has been an attempt toward more inclusive and diverse depictions of gender in animation films. Shehattah (n.d.) examined the depiction of male main characters in three animated films and found that characters exhibited various typical traits associated with masculinity. Despite this, the protagonists reveal a modest advancement in the representation of males within the chosen animated films.

Fischer's (2010) evaluation of how female and male characters are depicted in five animated films found that they do not fall into gender stereotypes. Female characters were portrayed in various roles and were depicted with less stereotypical imagery. Similarly, male characters were shown in diverse roles with characteristics that did not conform to typical stereotypes.

In 2008, Gillam and Wooden conducted an analysis of how masculinity is portrayed in Pixar's films. The study discovered a transformation in how male characters were represented. Previously, they were portrayed as dominant and powerful. However, in recent years, male characters have been depicted with masculine and feminine traits.

Palupi's (2019) analysis of three animation films found that Disney portrays its princesses as strong and self-reliant. However, the princesses are not portrayed as capable of completing their goals without assistance from men. They tend to believe they are less proficient than men in achieving their goals. The results suggest that gender stereotypes persist in animated films. Nevertheless, a positive change is noticeable as female and male characters are often depicted in non-conventional ways.

The present study

The literature review indicates that the characters have been portrayed stereotypically in animation films. There are very few studies conducted on Indian animation films. Hence, this study will analyse the first animation film of Meghalaya, *U Syiem* to answer the following question: How the male and female characters have been represented in the film? What was the process of developing and creating characters in the film?

This study is significant because most films emerge from patriarchal societies that follow patrilineal social structures. Although Meghalaya has a matrilineal social structure unlike the other states in India, it is still a patriarchal society. However, it is one of the few regions where "women enjoy social mobility and there are no bars to achieve economic mobility." (Rathanayak, 2021).

Theoretical framework

This study draws on Stuart Hall's (1997) concept of representation to understand the representation of characters and character design in film. Representation theory seeks to explain how meaning is created and conveyed through cultural representations, such as "language, images, and symbols" (Hall, 1997, p. 15). According to Hall, these representations are not simply reflections of "reality", but are constructed through social processes that are shaped by power relations and historical contexts. At the heart of Hall's representation theory is the idea that cultural representations are always encoded with meanings that reflect the dominant ideologies of the society in which they are produced. These ideologies are not necessarily consciously held by individuals but are rather the product of the social and historical conditions that shape the cultural context. Hall argued that representations are never neutral or objective, but are always produced within specific historical, social, and cultural contexts. He also emphasized the importance of understanding the power relations that shape the production and reception of representations, and how they can reinforce or challenge dominant ideologies and social norms.

Representation theory as a theoretical framework has been used by many scholars to understand how different forms of media portray individuals, groups, and communities. Parvez (2022) employed representation theory to investigate how gender is depicted in films featuring female superheroes. According to the study's findings, two out of three films portrayed the female lead characters as deviating from traditional gender roles. Sharma and Pathak (2022) employed the representation theory to analyze the social issues that the director of *Parasite* portrayed in different "scenes, shots, and sequences" of the film, which won an Oscar. Similarly, a study conducted by Fatimah et. al. (2022) applies representation theory to investigate the portrayal of Japanese individuals and their interactions with Koreans in the film, *Pacchigi* (2005). Stuart Hall's representation theory helps us understand how different media and popular culture portray individuals, groups, and communities.

Method

A scene-by-scene textual analysis was done to understand the representation of the male and female characters in the film. Textual analysis is a "methodology that involves understanding language, symbols, and/or pictures present in texts to gain information regarding how people make sense of and communicate life and life experiences" (Hawkins, 2017). The study also includes an interview with the film director to understand the process of developing and creating characters in the film. As animation is not restricted by reality, it does not require real-life characters which gives the makers the freedom to decide on the appearance and traits of the characters. Hence, the interview with the filmmaker is important to understand the idea behind the character design.

Analysis of U Syiem (2013)

The film is based on the life of the freedom fighter, U Tirot Sing Syiem. At a very young age, Tirot Singh loses his father in a battle. Upon his mother's request, he leaves the Nongkhlaw region to receive training. This is also a custom in the Khasi tradition, where the chief should receive good training for the coming years to be a rightful king. He spends his childhood with his uncle receiving training in warfare, craftsmanship, and other arts. After a decade, Tirot Singh returns to the Nongkhlaw region and is bestowed with the responsibility of a king who is well-versed in the art of military warfare and combat and well-educated in administrative studies. He takes up the responsibility and life is very peaceful in the village until the East India Company comes to him with a proposal to build a road for uninterrupted trade. The king signs the treaty in consultation with his *durbar* (local council) for the welfare of his people but little does he know about the intention of the East India Company. As soon as the treaty is signed, a battalion of soldiers arrives in the region creating havoc. Women and villagers are harassed, and the childhood friend of Tirot Singh is killed. Looking at the sufferings of his people the king feels betrayed by the East India Company and decides to fight against the British. The king fights the British army in the Khasi hills for four years and signs a peace treaty following his surrender to the British. He eventually dies in Bangladesh.

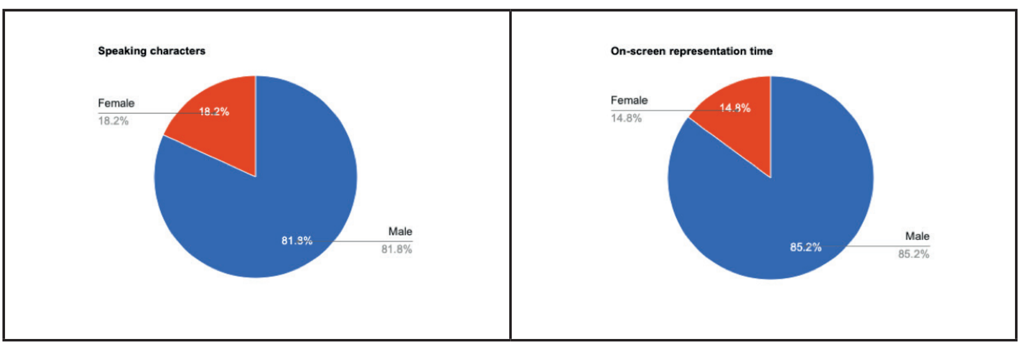
A scene-by-scene analysis was carried out to understand the representation of characters. The analysis has been categorised on the following themes: speaking characters and representation time; character roles and traits; appearance and costume.

Speaking characters and Representation time

The first thing that is noticeable while analysing the film is the number of male and female-speaking characters in the films. The male characters outnumber the female characters in the film. There are nine male-speaking characters in comparison to only two female characters. There are multiple scenes in the film when the king, Tirot Singh addresses the "people" of the village. In these scenes, there are only male characters in the village, not even a single woman is found in the frame. In the cremation scene of Tirot Singh's childhood friend, village people are seen standing alongside Tirot Singh. In this scene, except for Tirot's mother all the characters are male. This creates the impression that the village consists of only male residents.

Similarly, when it comes to on-screen representation time, male characters get more on-screen space than females. Male characters get an on-screen time of 46 minutes and 30 seconds, whereas female characters get only 8 minutes and 59 seconds. Figure 1 shows the representation of time and speaking characters in percentage.

Figure-1: Speaking characters and on-screen representation time



Character roles and traits

The two female characters not only get less on-screen representation time but also their roles are not central to the story. The two female characters in the film play the roles of a mother and Tirot Singh's childhood friend. The mother is portrayed stereotypically as caring, self-sacrificing and dependent. When Tirot Singh is young, his mother sends him away from her to learn, get trained, and acquire skills to become a king so he can protect the people of the village. Though the mother is very close to Tirot Singh, it is his uncle who makes decisions along with Tirot Singh. After the return of Tirot Singh, there are very few scenes with the mother and when she is present in the scene she is seen just as a spectator and not as a speaking character. She has no role in the film to drive the plot or the story forward. The other female character, Tirot's friend is also portrayed as dependent and submissive. The film has two major scenes with her and in both scenes, she is portrayed as dependent and submissive. In both scenes, she can be seen running away from danger in fear and getting help from the male character to rescue herself from the situation. The female characters are portrayed as dependent, submissive, caring, and self-sacrificing. On the other hand, the male characters are portrayed as strong, independent, responsible, and brave. For instance, when Tirot Singh leaves the village for training, the mother tells him, "You have to promise me to be strong, responsibility is in your hands now". And when Tirot Singh returns, the voice-over says "After a decade-long wait, he returned to his people, a man, his stature strong, muscular, and bold ready to bear the burden bestowed upon him. A brave leader to watch over the welfare of his kingdom and his people. Such stereotyped images of male and female characters can be seen throughout the film.

Appearance and Costume

The characters in the film can be seen wearing traditional and non-traditional dresses. The Khasi traditional dress for women is Jainsem and for men is a dhoti with a turban and a jacket. Keeping in mind it is a period drama, the decision to go with the traditional dress is suitable for the film. However, the difference is in their representation. The male lead character, his mother, and his uncle can be seen wearing the traditional dress which reflects the Khasi culture and tradition. The traditional dress worn by U Syiem signifies him as the leader of the village and a king who represents the Khasi tribe and stands for his people. But, the childhood friend of U Syiem, wears Jainkyrshah throughout the film. Jainkyrshah is also a traditional attire of the Khasi tribe. It is one side shoulder drape cloth, more like an apron, worn by Khasi women while doing chores at home or in public. Jainkyrshah symbolizes modesty and respect and Khasi women wear it to protect themselves from the stains of cooking or other chores. In the film, the childhood friend of U Syiem wears Jainkyrshah which signifies two things. First, it means she is involved only in domestic work at home which can be seen in the first scene where she is carrying a basket of fruits and heading to her home. Second, as Jainkyrshah is worn by women to protect themselves from stains, in the film it acts as a symbolic tool that she wears to protect herself from the people around her. In both scenes, she wears Jainkyrshah and runs away from danger to protect herself.

Character design

The main character in the film is U Syiem, his mother, uncle, childhood friend, and a British officer. As mentioned earlier in this paper, an interview was conducted with the film's director to understand the character design. The character design of the films was all imaginative and no real-life references were taken. The looks and appearance of Tirot Singh have been described in many books as tall and having a well-composed body. However, the director decided to exaggerate and stylize the characters to appeal to a wider audience. The character design was influenced by Indian and foreign films. The director has taken the character's reference from Ramayana (1992) and The Prince of Egypt (1998). Hence, the characters were designed with stereotypical traits, which are a "tried and tested formula" and can be seen in commercial films. The makers went for the exaggerated and stylized characters since it was a fictional feature film, not a documentary or experimental film, and they wanted the characters to be accepted and liked by the audience. The makers followed the concept of shape language to communicate the personality of the characters. The male lead characters were developed on an inverted triangle shape to make the characters look strong, muscular, and dominant. The director wanted the mother to be a neutral character and hence decided to follow a rectangle shape to design the character. The childhood friend of U Syiem was designed on an hourglass shape so the shoulders and hips are of proportional width, and have a defined waist. All other characters were developed on either square or rectangular shapes.

Discussion

This study looks at the portrayal of male and female characters in the first animation film of Meghalaya. This study found that the male characters dominate the on-screen space, and the characters were portrayed stereotypically. The characters designed were also stylized and exaggerated to appeal to a larger audience. Hall (1997) states that cultural representations are never neutral or objective, but are always constructed through social and historical processes that are shaped by power relations. The film begins with a disclaimer "While the story is inspired by actual events, certain characters, and characterization were fictionalized for the purpose of dramatization". It means that this film is not an accurate representation of reality and such representation can reinforce harmful stereotypes, which can lead to discrimination and prejudice. Meghalaya is a matrilineal society where women can be seen occupying spaces from offices to the marketplace. However, in the film, very less representation time is given to women characters and the roles given to them are not central to the story. This shows that women are less important in a society where only male members lead and make decisions. How can inaccurate representations in the film be harmful to society?

It cannot be denied that gender disparity is on the rise in Meghalaya but this region is known for its unique matrilineal social structure and this is not reflected in the film. The film follows the representation trend of other major film industries in stereotypically portraying the characters. In the film, women were portrayed as dependent and submissive whereas the male characters were portrayed as independent and strong. Such representation can form negative perceptions and reinforce stereotypes in society.

The stereotypes can also be seen in the film regarding physical appearance. The character design for the film is exaggerated. The male lead characters are given a well-composed muscular body, and the female characters are portrayed as thin and simple looking. This type of portrayal can reinforce harmful stereotypes by shaping the viewer's perception of beauty and perfection, based on the images they consume.

The director in his interview said that the film is not an accurate representation of reality and that the references for the film have been taken from Hollywood and Hindi films. As Hall (1997) stated that representations are always encoded with meanings that reflect the dominant ideologies of the society in which they are produced. The film, U Syiem has been dramatized and stylized to appeal to the audience. For instance, the director has taken the character's reference from Ramayana (1992) and The Prince of Egypt (1998). Further, the director talks about the representation of male characters and how a v-shaped body can make the character look dominant and powerful and be seen in films like Hercules, 300, etc. The director went for a tried and tested formula for character design which can be accepted by the audience. Even an animated cartoon character like Jerry in Tom and Jerry will turn into a v-shape if it needs to be portrayed as powerful.

The male and female characters in the film, U Syiem are portrayed stereotypically and the character designs were also exaggerated. One of the reasons for the stereotypical portrayal can be related to Laura Mulvey's theory of the male gaze. The film's creators such as the director, screenplay writer, animators, and VFX artists were predominantly male, as seen in other tech industries, which may have influenced their perspective regarding the portrayal of the characters. Similarly, Simone de Beauvoir also wrote on the perspective of representation by a male, which states "representation of the world, like the world itself, is the work of men; they describe it from their own point of view, which they confuse with absolute truth" (Beauvoir, 1952, p. 143).

As stated earlier in this article, animation films provide animators with the freedom to create diverse characters and settings limited only by their imagination. With the advancements in technology, the visual aspects of animation are becoming increasingly realistic. Consequently, it is crucial for animators to take on the responsibility of accurately representing society, particularly when it comes to the portrayal of issues related to gender. In the state of Meghalaya, animation is still in its early stages, and it should not simply follow the trends set by commercial live-action films. Instead, it should prioritize depicting society in a manner that benefits everyone.

Conclusion

This study looks at the representation of male and female characters in the first animation film of Meghalaya. U Syiem. The study found that the male and female characters are portrayed stereotypically and the character design is stylized. This type of portrayal can generate negative perceptions about gender and gender roles which get fixed in people's minds especially "children from a very young age and accordingly are forced to fit in with society's expectations of them" (Childrens Society, 2020). For a more comprehensive understanding of gender depictions in animation films from Meghalaya, it is recommended that further research be conducted when more films are produced in the future. This article specifically analysed one animation film, which currently stands as the first and only animation film from Meghalaya. Regional cinema, unlike Hindi cinema, influences the local audience as it is rooted in their culture and should portray the reality which can challenge gender roles and stereotypes, and help in building a more inclusive and dynamic society.

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Research Article

Open Educational Resources and Intellectual Property Rights: A Study on the awareness of OER and IPR among Elementary Teacher Educators

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Abstract

Digitalization is a major factor in education that brings advancements and mitigates educational boundaries. The accessibility of education has undoubtedly improved because of technological innovations. Computers and smartphones are such technological equipment that is most accessible to everyone, and both offer a broad selection of programs that make educational content available online in different formats. In this age of technological advancements, it is crucial to protect both the author's intellectual property rights and the credibility of the available content. For such circumstances in education, open educational resources (OER) are the workable alternative. This paper aims to measure the awareness of OER and intellectual property rights (IPR) among the DIET teachers of Himachal Pradesh. Future primary teachers who will shape the young brains of our country are being prepared by teachers in DIETs. Teachers use both open educational resources and online educational content, thus, they must be acquainted with these resources and how to use them effectively. Online content and OER are made available under several licenses and IPRs. Providing acknowledgment and monetary gains to the creator or innovator can encourage the educational community, whereas a lack of understanding of IPR could obstruct societal and economic growth. Therefore, any country must spread awareness about OER and licensing and apply it effectively.

Keywords: DIET, OER, IPR, Creative Commons

Introduction

Universal elementary education depends primarily on the role of the teacher. A teacher can take the lead in raising the standard of primary education by incorporating value orientation, environmental and health education, and other topics. District Institutes of Education and Training (DIET) were established in each state and district as the first and only significant institutional investment in elementary teacher education (Sarangapani, 2016). The teacher educators of DIET institutes have significant importance in elementary education as they are responsible for creating competent elementary teachers. As a result of the District Primary Education Program (DPEP) implementation, more organizations and institutions are now involved in delivering public education at various levels (Azam, & Saing, 2017). To achieve the success of the educational objectives of these institutions open access (OA) resources play a vital role. As the world is exposed to an explosion of knowledge, and education is no longer restricted to instructor and student inside the confines of four walls (Saxena, & Hans, 2018) teacher also needs to upgrade themselves to cater to the need of young curious minds.

A teacher educator must be trained in

pedagogy, science, and technology, as well as using open sources available in education. They need to know how to use the numerous open-access and open educational resources that are available in abundance on various digital platforms. Open access contents are freely accessible online teaching, learning, or research resources that may or may not be edited, remixed, or disseminated in any other way but the educational materials that are openly licensed, freely distributable, in the public domain or made available under a license to utilize intellectual property are known as open educational resources, or OERs (University of Mary Washington, 2022). The integration and adoption of technology and online educational materials is a challenging process that requires comprehensive strategic planning on the part of the policy and decision-makers (Hashim, 2007, as cited in Ghavifekr, & Hussin, 2011). In this digital age, teachers are significantly less likely able to use digital teaching aids in classrooms (Szyszka et al., 2022). The Open Educational Resources provide access to a wide range of international educational materials, which creates several opportunities for digital learning. Open licenses under intellectual property rights are closely related to the concept of open educational resources. It is necessary to understand the permissions given under the copyright license before using any educational content. Copyrights are a type of intellectual property right, along with patents, trademarks, and industrial property rights.

Intellectual property rights help to protect the rights of an original author. Intellectual property is tied to human creativity and ingenuity (Teixeira & Ferreira, 2019). It takes work, time, energy, talent, money, and other resources to develop or create anything new. The proper application of intellectual property rights in any country or organization may hinder the overall development of the entire country (Sreeragi. 2021). To receive IPR's benefits, one must register with the work under appropriate legal authorities. IPR has mainly two categories- copyrights and industrial property rights. The copyrights include literary and artistic work, while the industrial property rights cover the patent, trademark, industrial design, and geographical indication (Gaikwad, 2020). IPR gives people the legal right to prevent others from doing certain actions, such as pirating, forging, copying, and in some situations, using others' independently developed ideas without the original author's knowledge. Policymakers must include intellectual property rights (IPR) in the basic education framework of the education system and promote IPR registration by facilitating inventors and creators (Chudasama, & Patel, 2021). The OER supports and facilitates the creators' rights. The OER are generally released with creative commons (CC) license, which gives the freedom of copying, distributing, modifying, or using the resource for commercial purposes depending upon the type of CC license. OER websites established by numerous national institutions to make their educational materials accessible to all individuals have helped open educational resources (OERs) gain popularity over time in India (Deivam, & Devaki, 2022). OER is available in different forms and types. Since OER will positively impact teaching and learning, the OER policy framework must distinguish between various OER types and give a precise definition of each (Ebner et al., 2022).

Review of Related Literature

In light of the possibility that Epigone could be a future creator, Marjit, & Yang (2015) investigated the connection between IPR and R&D incentives. According to their research, giving rise to such a possibility can lead to the development of fresh insights that defy accepted thinking. They look at the fundamental connection between intellectual property rights (IPR) and rewards for R&D in the context of copycats who may be future innovators of both simple and complicated technologies. Most of the higher educational institutes (HEIs) lack IPR policies due to several obstacles, such as a lack of qualified staff, a holdup in research funding, and a lack of creative facilities and lack of qualified IPR specialists who can assist instructors, researchers, and students at HEIs is one of the challenges that have a detrimental impact on IP generation (Sattiraju et al., 2021). Teachers cannot do their jobs as effectively without a grasp of the complexity of global evolution as well as without the necessary skills and competence (Sharifi & Imani, 2013). Chidi & Babalola (2016), examine how open access and creative commons may be used as instruments to balance intellectual property rights while also ensuring that information is easily created and accessible. The study supports that creative commons and open access are served as balancing ways for the public interest and intellectual property rights. Open educational resources which released with creative commons are used as a model to help a unified approach in IPR (McAndrew & Cropper, 2011, pp. 2-3). OER are all publicly available materials used for learning, education, and training, and the quantity of OER, as well as its accessibility and dissemination through learning object repositories, has grown significantly in recent years (Clements & Pawlowski, 2012). All OER is distributed under an open license that gives the necessary permissions from the owner of the intellectual property to use the material, and the most well-known of these licenses is Creative Commons (Kumar & Prabu, 2021). The academic community is actively debating using open educational resources (OER) in teaching, which are divided between outright resistance, partial adoption, and full acceptance (Menzli et al., 2022). OER was utilized by teachers to enhance their instructional techniques, acquire fresh perspectives, and deepen their understanding of certain subjects (Admiraal, 2022). The advantages of OER can not be neglected by the educational community. To fairly use of such resources, it is important for the elementary teachers to distinguish such resources from other copyright materials. In the research gap, it was found that

This research aims to find out the awareness level of OER and IPR among elementary teacher educators of Himachal Pradesh.

The objective of the study

The goal of this study was to determine whether the DIET teachers of Himachal Pradesh are familiar with the concept of IPR and OER. The level of awareness will indicate how the DIET Teacher educators are aware of these resources. Utilizing educational materials healthily and legally has several advantages, including lessening financial burdens and increasing recognition of original work. The objectives of this study are -

- To evaluate DIET teacher educators' familiarity with OER.
- To study the IPR knowledge level of DIET teacher educators.
- To study the relationship between DIET teacher educators' level of OER and IPR awareness.

Hypotheses of the study

- DIET teacher educators' awareness of OER does not differ significantly in relation to gender and teaching experience.

- DIET teacher educators' awareness of IPR does not differ significantly in relation to their gender and teaching experience.
- The awareness of OER and IPR among DIET teacher educators is not significantly correlated.

Delimitations of the Study

The study is delimited to 54 teacher educators of 9 DIETs of Himachal Pradesh.

Methodology

The present study followed the descriptive survey method. The sample of 54 teacher educators from DIET institutes of Himachal Pradesh is selected with a random sampling method. The 9 DIET institutes are selected out of 12 government DIET institutes of Himachal Pradesh. The data is collected with the help of a self-developed questionnaire and prepare a Google form link to send to the 90 teachers who were selected for the study with the help of a random sampling technique. Out of 90 teacher educators, 61 responses were received. The researcher has selected 54 responses for the study, which were completed in all aspects.

Survey Instrument

A structured questionnaire was used in the survey. The relevant literature on IPR and OER served as a basis for the development of the research tools. The survey questionnaire has 3 parts.

i. Demographic information

ii. Awareness of IPR

iii. Awareness of OER

The instrument was evaluated by six subject experts in the field of education and open educational resources who determined its face and content validity. The required revisions were then made in accordance with their recommendations. The reliability of the test is evaluated with the test-retest method. The Cronbach's alpha score of reliability was found 0.73, which is under the acceptability threshold. Respondents were asked to rate their degree of agreement with each statement on a scale of 1 to 5, where 5 meant "strongly agree," 4 meant "agree," 3 meant "undecided," 2 meant "disagree," and 1 meant "strongly disagree.".

Data interpretation and findings: The data of the study were analyzed with the help of SPSS in the light of the objectives. The data was analyzed with quantitative analysis, and the outcomes were tabulated.

Table-1: Analysis of Items

Sl. No.	Items	Mean	SD
1	Copyright License use for Intellectual Property Right.	4.10	0.67
2	IPR license protects the rights of Author.	4.31	0.74
3	Copying the online content without the author permission is an illegal activity.	4.22	0.88
4	Plagiarism is not illegal if the author is cited in the work.	2.30	0.89
5	It is necessary to cite, quote and acknowledge the author when you use his/her work.	4.33	0.64

6	Any educational content available online can be use freely and without any restriction.	2.22	0.86
7	IPR License helps to prevent Infringement.	4.13	0.80
8	All literary work published with copyright	3.63	0.76
9	OER stands for Open Educational Resources	4.24	0.75
10	All OER are released with IPR License.	3.67	0.97
11	Every educational Content available online are OER.	2.70	0.87
12	OER are free to use by anyone.	4.07	0.72
13	OER can be remix to make new educational Content.	3.76	0.91
14	Photos and videos can be OER	2.78	0.64
15	Free courses are available on OER repositories.	3.83	0.73
16	OER are released under Creative Commons License.	4.02	0.62

The survey consists of 16 items. Item no1-8 measures the awareness of intellectual property rights, and item number 9-16 measures the awareness of open educational resources. The item no-4, 6, and 11 are negatively worded and are scored in a reverse manner. The highest means for items 1 and 9 in Table 1 demonstrate that instructors are highly knowledgeable about the concepts "Copyright License Use for Intellectual Property Right" and "OER stands for Open Educational Resources," with mean values of 4.10 and 4.24, respectively.

The demographic details are given in Table 2.

Table-2: Demographic Details of the Sample

Demographic status	Item	N	Percentage
Gender	Male	26	48.1
	Female	28	51.9
Experience	Less than 10 years	47	87
	11-20 years	4	7.4
	21 and above	5	5.6

The total respondents are 54 and 26 are male, and 28 are female teachers of different DIET from Himachal Pradesh. The maximum per cent (87 per cent) of teachers have less than 10 years of teaching experience, and only 7.4 per cent and 5.6 per cent of teachers are under the category of 11-20 and above 21 years of experience, respectively.

Table-3: Awareness Level of OER

Level	Frequency	Percentage
Low	35	64.8
Average	4	7.4
High	15	27.8
Total	**54**	**100**

The awareness level of OER from the survey is shown in Table 3. From the table, it shows that 64.8 per cent of teachers have low awareness of OER, while the average level has only 7.4 per cent and only 27.8 per cent of teachers have a high level of OER awareness. Thus, it can be concluded that the awareness level of OER of the DIET teachers is at a low level.

Table-4: Awareness Level of IPR

Level	Frequency	Percentage
Low	20	37
Average	16	29.6
High	18	33.3
Total	**54**	**100**

From the table 4 above, It is evident that 37 per cent of instructors had low awareness of IPR, compared to 29.6 per cent who have moderate awareness and 33.3 who have high awareness. The knowledge level of IPR among DIET instructors is, therefore, poor, despite the fact that there is no significant variation in the percentage.

Null hypothesis-1 "DIET teacher educators' awareness of OER does not differ significantly in relation to gender and teaching experience."

Table-5: OER awareness among DIET teacher educators in relation to their gender and teaching experience

Tests of Between-Subjects Effects					
Dependent Variable: OER awareness					
Source	**Type III Sum of Squares**	**DF**	**Mean Square**	**F**	**Sig.**
Corrected Model	4.514a	4	1.129	.112	.978
Intercept	11173.029	1	11173.029	1104.231	<.001
Gender	.000	1	.000	.000	.997
Experience	1.297	2	.649	.064	.938
Gender* Experience	.613	1	.613	.061	.807
Error	495.801	49	10.118		
Total	40899.000	54			
Corrected Total	500.315	53			

R Squared = .009 (Adjusted R Squared = -.072)

The above table:5 explored the 'F' Value and significant level related to OER awareness among teacher Educators in relation to their Gender and teaching experience. The above analysis shows the value of significance between OER awareness among the Gender and teaching experience as follows:

The Gender of respondents with respect to OER awareness among teacher educators related 'F' value is 0.00 with a significant probability is .997. "The null hypothesis is accepted since it indicates that the ‘F’ value is not significant at the 0.05 level of significance”. So it can also be deduced that there is no significant gender difference in OER awareness among teacher educators at DIET institutions.

The teaching experience of respondents with respect to OER awareness among teacher educators related F value is 0.064 with a significant probability is .938. “The null hypothesis is accepted since it indicates that the F value is not significant at the 0.05 level of significance,” and it can also be deduced that there is no significant difference among DIET teacher educators’ awareness of OER based on their teaching experience.

The gender*experience with respect to OER awareness among teacher educators related to “F value is 0.61 with significant probability is .807 which shows that ‘F’ value is not significant at 0.05 level of significance” and it can be concluded that there is no significant difference between the OER awareness among teacher educators based on their gender and teaching experience.

Null hypothesis-2 “DIET teacher educators’ awareness of IPR does not differ significantly in relation to their gender and teaching experience.”

Table-6: IPR awareness among DIET teacher educators in relation to their gender and teaching experience

Tests of Between-Subjects Effects					
Dependent Variable: OER awareness					
Source	**Type III Sum of Squares**	**DF**	**Mean Square**	**F**	**Sig.**
Corrected Model	29.385a	4	7.346	1.088	.373
Intercept	12895.202	1	12895.202	1910.327	<.001
Gender	26.372	1	26.372	3.907	.054
Experience	5.049	2	2.524	.374	.690
Gender * Experience	26.937	1	26.937	3.990	.051
Error	330.763	49	6.750		
Total	46356.000	54			
Corrected Total	360.148	53			

R Squared = .082 (Adjusted R Squared = .007)

An analysis of table-6 leads to the conclusion that the ‘F’ Value and significant level related to IPR awareness among teacher Educators in relation to their Gender and teaching experience. The above analysis shows the value of significance between IPR awareness among the Gender and teaching experience as follows:

The Gender of respondents with respect to IPR awareness among teacher educators related ‘F’ value is 3.907 with a significant probability is .057. It shows that the “F value is significant at 0.05 level of significance. Thus the null hypothesis is rejected,” and it can be concluded that there is a significant difference between the IPR awareness among teacher educators of DIET institutes based on their gender.

The teaching experience of respondents with respect to IPR awareness among teacher educators related to "F value is .374 with significant probability is .690, which shows that 'F' value is not significant at 0.05 level of significance and the null hypothesis is here accepted," so it can be concluded that there is no significant difference between the IPR awareness among teacher educators based on their teaching experience.

The gender*experience with respect to IPR awareness among teacher educators related to " F value is 3.99 with significant probability is .051 which shows that 'F' value is significant at 0.05 level of significance." It concluded that there is a significant difference between the IPR awareness among teacher educators on the basis of their gender and teaching experience.

Null hypothesis 3: "The awareness of OER and IPR among DIET teacher educators is not significantly correlated**."**

Table-7: Significant correlation between awareness of OER and IPR

		Awareness of OER	**Awareness of IPR**
Awareness of OER	**Pearson correlation Sig. (2-tailed)**	1	.157 .257
	N	54	54
Awareness of IPR	**Pearson correlation Sig. (2-tailed)**	.157 .257	1
	N	54	54

Table 7 shows the value of Pearson correlation between awareness of OER and IPR awareness is 0.157 with a significant value of .257, which shows the minor positive correlation between the awareness of OER and IPR, but the "value is not significant at 0.05 level of significance, and the null hypothesis-3 is accepted". We may conclude that there is no significant relationship between the OER and IPR awareness among DIET teacher educators.

Discussion

The objectives of the study were to explore the level of awareness towards OER and IPR as the OERs are a type of Open Source that have the power to change academic practice in response to the effects of fast-advancing technology (Hatzipanagos & Gregson, 2015).

The study revealed that 64.8 per cent of teacher educators have low and only 27.8 per cent of teacher educators have a high awareness of OER. However, the awareness of IPR among teachers is low, i.e., 37 per cent and 33.3 per cent high. The extended technological uses in educational curricula reflect more significant social developments, which demand for teachers to acquire fundamental knowledge of intellectual property as a component of digital literacy (Starkey et al., 2010). According to UNESCO, governments, higher education institutions (HEIs), and businesses should collaborate to continuously develop the framework for digitally transforming teaching (UNESCO-ICHEI, 2022). The study reveals a minor but not significant positive correlation between the OER and IPR awareness among teacher educators.

Conclusion

Due to recent major developments in worldwide information availability, ideas concerning the rights and responsibilities of intellectual property are transforming in the educational technology field. Likely, a teacher who lacks this advanced knowledge will not be able to impart technical literacy skills to students, such as protecting one's own ideas, using others' ideas lawfully, and respecting others' intellectual property rights. Studies show that teacher educators differ significantly in computer anxiety based on their region and gender (Saxena, Kumar, & Singh, 2019). The educational community needs to involve in the growing, open education movement, which can create and utilize open resources that contribute to the availability of freely shared information through open licenses that enable usage, editing, translation, enhancement, and sharing by anyone.

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Research Article

Gendered Digital Divide among Secondary Students: The Aftereffects of COVID 19 Pandemic on Offline Education in Greater Guwahati Area

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Abstract

Education can be divided into several contexts: gender being the major one. The present research study has been conducted against the backdrop of the Covid19 pandemic, keeping in mind the intention to study the digital and educational divide on a gender basis and also to find out the aftereffects of gender inequality in both teaching-learning perspectives after returning to traditional classes. The sample consists of 400 students and 40 teachers from the greater Guwahati area to attain their relevant information by the use of a socio-demographic data sheet, a self-constructed questionnaire for students, and an information schedule for teachers. The results revealed inequality among the genders (among males and females) in the case of socio-demographic background. Though in the initial days, slow speed was perceived among males and females but males seemed to outperform females in matters of classroom instruction. A less inquisitive attitude towards online learning among female students is assumed to be the factor for such disparity.

Keywords: Digitalization, Gender disparity, Educational Divide

Introduction

As the grip of the pandemic became stronger, people started adapting themselves to it and continued to work from their homes. Similarly, all educational institutions tried to incorporate the digitization of education and accepted the sudden shift from classroom to online teaching (Das et al., 2020). As now the process of digitization of education entered into the scenario, there were scenes of the digital divide which defined the concept where people neither had equal access nor had equal ability to use ICT. This further enhanced the concept of the variety of digital divides, which took certain specific offshoots as follows: gender divide, age divide, and income divide (Singh, 2010). The utmost concern among the several digital divides is the gender digital divide which implies not understanding the methods and usages of digitalization and moreover not getting equal access to know about it. Men and women are always compared in some or another way, and women's equality in every platform is always compromised. The concept of gender divide has always been a significant inequality, and it has been more hyped by the digital revolution (Saha&Zaman, 2017).

Every human has the right to adhere to education. It is a process that did not gain much importance some four or five decades earlier and was considered rather a choice to opt for it, but in today's arena, it isn't a choice but a basic right for all. The growth of an individual and the gate of opportunities only get opened through education. A country's national development is dependent upon the educational quality its citizens receive (Singh & Rabindranath,2020). Education is a platform of serving everyone equally. Still, women's participation is prohibited. In India, education for girls is still a matter of consideration. The main concern of this paper is to bring to light that during this pandemic, as all the services have transformed their base from offline to online, educational services also had to be a part of these transformations. The educational institution was active by adopting online measures with the effort of not disrupting the learning culture. But many students were unable to be a part of this online teaching-learning process. Hence, many learners were affected during these persistent lockdown periods (Das et al.,2020), and among these learners, the major setback was in the lap of the girl child. According to the latest National Statistical Survey, the reason is that in India, one in every ten households can purchase a computer, desktop, or laptop, and nearly a quarter of all homes have internet facilities in their devices, which includes smartphones as well (NSO,2020). As the girl child faces a lot of challenges in acquiring education (Singh & Rabindranath, 2020), contributing to its first position in the race of educational divides, also being in a household where there is only one device, the male child gets the primary opportunity of accessing it whereas the female child is considered to be of secondary importance because in India the male plays a primary and the female plays a secondary role (Odomore, 2015). Gender disparity in the platform of education has always been a consistent and underlying problem in Indian society, particularly for girls belonging to lower socio-economic backgrounds (Rekha & Devkaran, 2017). Moreover, in this current scenario, the impact of lower socioeconomic status (Gopalan & Misra, 2020) plays a hindrance in many households making it difficult for many bread earners to provide equal accessibility to their learners, thus contributing to a deeper gap in the digital divide. Hence in the era of digitalization of education combined with the gender gap, it has become a questionable issue in the situation of post lockdown where several schools and colleges had opened after a long gap. So, it would be interesting to study the observable effects on the students and how they are coping with the new normal, and whether this disparity persists.

Review of Literature

Das et al. (2020) examined the impact of Covid on sustained online education among students, teachers, and parents of primary, secondary, and tertiary levels. The online survey was used to collect relevant data. The authors highlighted the importance of online pedagogy and its rewarding benefits through a variety of sources but also leave a question of the digital divide in education considering accessibility.

Singh & Rabindranath (2020) examined the gender divide in education to evaluate gender divide in education, emphasizing the need for girl's education. Data were collected from various sources like articles, research papers, journals, the internet, etc., and qualitative research was used to analyses the data. The finding reveals the existence of the gender divide and its effect on girls students. Improving the homogeneity of society through flourishing girls' education is mentioned in this study.

Korlat, et al. (2021) stated in their study that digital learning was immediately required due to the

COVID-19 epidemic, which presented difficulties for all students, but notably for underprivileged groups in a virtual setting. The purpose of this study was to look at gender inequalities in the digital learning environment that students experienced in the spring of 2020 since some studies show that boys and girls continue to use technology and related abilities differently. Biological sex was primarily employed as the only predictor of gender in earlier research looking into gender disparities in digital learning. It has been found that girls outperformed males in terms of perceived teacher support, intrinsic value, and learner engagement, but no significant gender differences were detected in attitudes of competency in digital learning. Their findings also demonstrated the unmistakable advantages of an androgynous gender role self-concept for all examined aspects of digital learning.

Norman, et al. (2022) stated in their study that the COVID-19 epidemic has disturbed approximately 1.6 billion pupils globally and forced the closure of thousands of schools. It has already made the existing digital gaps more difficult and further displaced disadvantaged kids digitally. Various tactics have been employed to address the educational digital gap faced by disadvantaged pupils in an effort to lessen the impact of this problem. In order to better understand this scenario, the current study looks at the digital educational divide for pandemic-vulnerable pupils in terms of access, connectivity, usage, and exploitation. The responses to a survey, which was given to 518 at-risk adolescents in schools between the ages of 10 and 15, were examined. The results show that asynchronous learning is a more powerful concept than synchronous learning and that creativity skills are more important for the learning of vulnerable students than productive skills.

Nayak & Alam (2022) stated in their study that the Covid-19 pandemic and the digital divide negatively impacted the educational system for socially disadvantaged groups like the Adivasis and other vulnerable groups. This research paper tries to analyse the factors combined with worsening the educational system for these groups. The research examines how the Covid-19 epidemic rearranged the pre-existing problems of educational inequality and how the digital divide has developed in a way that has especially impacted young tribal females. The results show that in addition to issues with accessibility and infrastructure, cultural and social factors related to the perceived benefits of education for girls and mindset or beliefs held by parents and teachers regarding the efficacy of digital mode of education delivery also contribute to and reinforce the digital divide for tribal girls living in the hinterlands. The study emphasizes rethinking the digital learning environment and offering policy solutions to address the growing digital gap and educational disparities among socially disadvantaged groups based on the information gathered from the interview.

Guo, C., & Wan, B. 2022, examined that online education has grown in popularity over the past several years in the educational field. The argument over whether online education narrows or expands the gap persists, despite the fact that many people think technology has the potential to reduce inequality. According to the report, there was a digital divide in online education throughout the epidemic. It was mostly discussed in terms of variations in the amount of equipment and network quality, students' capacity for online learning, and their results from offline learning. These results imply that achievement inequalities cannot be closed just through the expansion of online education. The advancement of educational fairness necessitates the efforts of several stakeholders and interventions that are especially geared toward underprivileged pupils.

Objectives

- To study the pattern of digital and educational divide among the secondary students of greater Guwahati in terms of gender amidst Corona Pandemic.
- To identify the aftereffects of such gender disparity on the learners in offline classes at secondary schools.

Research question

- What is the pattern of the gendered digital and educational divide among the secondary students of greater Guwahati amidst the Corona Pandemic?
- Is such a gender disparity creating different parameters of re-adjustment as aftereffects among the learners in the offline classes?

Conceptual Framework of the Study:

The context of the research study focuses on the prevalence of the educational divide due to the existing pandemic triggered by the digital divide. Such digital disparity has given way to an enormous educational gap between males and females owing to various psycho-social perspectives. This phenomenon persists even after schools have reopened, eventually creating an educational lag among female students since some girls could not gather the courage to return to their schools. The rate of regular attendance in online classes has severely impacted their performance in offline physical classroom transactions.

Keeping in view of the prevailing educational scenario, efforts have been made to collect data and information on the existing status of classroom transactions on the basis of gender in the Greater Guwahati area. The responses were collected from the male and female students of classes 8 to 10 studying in Government schools only.

Methodology

Research method

The descriptive Survey method of research has been adopted to conduct the research study as the situational status of education in the government schools was studied. All the necessary data was gathered on the gender responses to education during online and offline classes through the teacher-learner perspective.

Sample and Sampling Technique

The purposive Sampling technique was selected as the sampling technique for making sampling-related decisions. A total of 8 government schools from the greater Guwahati area have been considered for the research purpose. A sample size of 400 students, comprising 200 males and 200 females, was decided, along with 40 teachers, for a better understanding of the data.

Research Tool

The following tools were considered for the research study:

1. A socio-demographic data sheet to collect the demographic profile of the sampled students.
2. Self-constructed questionnaire for students to take an opinion on the recent trend in learning.
3. Information schedule for teachers to extract information on the prevailing gender status in education.

The Data Collection Procedure

After getting approval from the Principals of the Government schools in the region of greater Guwahati, the tools were administered to the sampled students. The responses were collected after the teachers and students were assured of the confidentiality of their respective responses. The necessary scoring of the data and interpretation was done for generalization.

Analysis

Table-1: Socio demographic Profile of students

Demographic variables	Male	Female
Gender	200	200
Category		
General or unreserved	140	133
OBC	35	41
SC	15	13
ST	10	13
Domicile		
Urban	127	115
Semi-urban	73	80
Rural	0	5
Family type		
Joint	71	94
Nuclear	129	106
Siblings		
Yes	155	180
No	45	20
Approximate monthly income		
Above 50,000	45	40
25,000 – 50,000	70	56
15,000 – 25,000	74	86
Below 15,000	11	18
Sources of income		
Only mother	77	91
Only father	71	55
Both the parents	40	33
Other sources	22	21

Table-2: Online learning experiences of students reflecting gender disparity (The learner perspective):

	Favorable	No opinion	Unfavorable
Online experience			
Male	66	65	69
Female	54	55	91
Participation in online platform			
Male	90	20	90
Female	56	47	97
Acquaintance with devices and gadgets			
Male	158	12	30
Female	130	17	53
Accessibility issues (internet, geographical and electricity)			
Male	106	14	80
Female	60	13	127
Familiarity in using apps			
Male	153	13	34
Female	125	11	64
Regularity in online class			
Male	150	0	50
Female	99	10	91

Table-3: Table showing the trend of gender responses in continuity from online learning situations to post pandemic classroom scenario (The teacher perspective):

Themes related to educational divide and gender disparity	Male	Female
Start of online class	Active participation from the first day of online class.	Absence seen in larger percentages during the initial days of online class.
Attendance percentage during online classes	Regularity was observed with a seemingly good percentage.	Irregularity in maintaining attendance affecting the overall female attendance.
Regularity in offline classes	A slow pace was observed in the initial days. With more weeks passing through, a positive trend was observed in their appearance in the school campus.	A much slower pace continues in their presence and participation in the school campus.

Lag observed in educational tasks and classwork	Due to slow momentum in class activities online, they seemed to be lagging in certain areas of their class activities. With continued classroom instruction although, males have better equipped with bridging the essential academic gaps.	The irregularity in attendance affected their grip on academic activities and class works. The persistent gap seems to increase with lower academic output.
Lack of confidence and self esteem	Academic confidence and level of attention was poor due to sudden transition in classroom transaction. Might require some reasonable amount of time to build up the previous momentum.	Academic confidence and focus was very poor compared to the males. Absence from class and inactivity eroded their courage to attend classes again in the offline mode.
Exam anxiety	Lack of a proper routine and classroom discipline has been causing anxiety issues while dealing with evaluation sessions physically after a long time.	Exam anxiety was higher among the females leading to withdrawal from examinations. Such anxiety also drives them to cause further absence in schools.
Maladjustment in physical classroom	Adjustment capacity was mediocre. An urge was observed among the males to attend physical classes for assimilation with the classmates.	Adjustment with the transition was poor. It was observed that females had the urge to avoid more and more physical classroom interactions.
Inability to build emotional rapport with teachers	The emotional element in interaction was missing for both the teachers and the students. After a long disruption and mediation of electronic means, the emotional rapport among the males has taken a backseat.	The same was observed in case of females too. The only factor different from males was that their irregularity negatively impacted their rapport with their teachers.
Physical and mental fatigue	Physical fatigue observed as classes have restrained their freedom compared to online classes	Mental fatigue was observed compared to physical tiredness as the class work seemed too overburdened

Laboratory work	Lag observed in execution of practical classes. Output is negligible	Similar pattern of lag observed.
Time management	Time management skills weakened. The efforts are on to bring them to normal pace of learning within restricted settings.	Time management worsened due to poor participation in class activities. Efforts are on to increase their attendance for discipline and regularity.

Findings and discussion

Opinions were gathered from an equal number of male and female students as well as teachers on the status and quality of education received by the students amidst corona pandemic. The responses were categorized on the basis of their frequency, highlighting their impact on the digital and educational divide between boys and girls. Further revelations on the continuity in disparity in offline classroom mode were also analyzed qualitatively with a brief discussion on the scenario in the government schools of greater Guwahati city. Certain psycho-social factors have emerged as major demarcating determinants of gender experiences in the offline education context.

Discussion on gender disparity owing to the digital and educational divide:

On the assessment of the socio-demographic profile of the sampled students, it was found that few students belonged to reserved and backward communities. Most of the students were from the general or the unreserved section of society. While some girls had residences in rural areas, the majority of the girls and boys belonged to urban and suburban locations. Even most of the girls belonged to joint families and boys to nuclear families. Girls were found to have more siblings than boys. Mothers were the only sources of income for both genders, but girls especially were found to be in the lower economic group. The disparity is evident among the genders in the case of socio-demographic background. Girls are in the inferior category, which might be a major cause for digital disparity on a gender basis.

On taking into account their online class experiences, it was observed that males showed active participation from the first day of online class, and regularity in attendance was maintained. In the case of females, the absence was seen in larger percentages during the initial days of online classes; thereby inducing irregularity in overall female attendance. The overall online experience was very favorable among males supporting their participation in online classroom interaction. The girls showed lesser acquaintance with devices and gadgets compared to boys. The males were also ahead of the girls in using updated learning applications on both mobile phones and laptops. Such digital disparity has, of course, given rise to the educational divide along the lines of gender differences. The unavailability of technological devices and technical assistance has lowered the curve of learning progress among female students, making it an educational divide between males and females in the path of learning (Korlat et al. 2021). It has created an educational lag in the females showing consequences in the offline mode of teaching-learning transaction.

Such a gender disparity puts females in the more disadvantaged category and vulnerable category compared to their male counterparts. Such a disadvantaged state can also be viewed as an extension of the pre-existing gap that exists between the learners on the basis of gender affiliations long before the pandemic. The pandemic has transitioned the school structure into cyberspace, but the girls' problems have not been lodged even an inch considering the change involved (Guo& Wan, 2022).

While there is a host of research done to validate how much technological interventions in the educational scenario have widened the learning gap between girls and boys, there are studies that are in stark contrast to the data we have extracted from the sample data. Ruiz et al. (2020) observed that instruction laced with ICT allowed for more fluidity in the learning of sciences among women when compared with their performance in the traditional methods. The desirability of such a transition did not get affected by gender lines. Social theories could be better suggested for more inclusion of females in the education sector and filling up the digital gender gaps with better policy-making (David & Philips, 2020).

Discussion on the persisting gender disparity in offline classes at schools:

With the reopening of schools after a prolonged duration of COVID threats, students were obliged to make the transition to offline classes again. In this context, a slow pace was observed in the initial days among both male and female students. Although a positive change was observed in the case of males in the later working days. A lag in educational tasks was observed, but with continued classroom instruction, males seemed to bridge the academic gaps better. The irregular attendance broadens the persistent gap among females affecting their academic confidence and retention level. Anxiety issues developed among the students while dealing with evaluation sessions physically after a long time. Exam anxiety was higher among the females leading to withdrawal from examinations and causing further distancing from schools. After a long disruption of physical transactions and mediation of electronic means, emotional adjustment among the males has taken a backseat. The same was observed in the case of females, too, but their adjustment capabilities were poorer, negatively impacting their rapport with their teachers. Females were mentally more fatigued than males, who, on the other hand, were more tired physically. Lag was observed in both genders, equally keeping up with the practical classes. Time management skills worsened in the new restrictive schedule of the schools. Here females were found to be less accommodative in the fixed schedule due to lesser participation in academic interactions.

Such an extensive lockdown period has already accustomed the girls to the so-called "gendered expectation" of doing household chores, taking care of the younger siblings, looking after the house, and other related gender biases in the family. Due to degrading family income among the lower income group due to the pandemic, boys were selected over girls to continue their education after the situation started normalizing (Nayak&Alam, 2022). Girls have been found to be constrained with regard to the learning space when shared with male students in schools both online and offline. Such a shift back and forth into the new digital ecosystem has further impacted the inclusion of girls giving a severe blow to equity in educational opportunities (Mathrani et al. 2020).

Conclusion

In India, women's participation in education is still a matter of consideration. As all the services have transitioned from offline to online, educational services were active by adopting online learning culture. But females were severely affected during the lockdown of schools. A gender gap is still being observed in the status of education even after the reopening of schools. Most importantly, females were less inquisitive towards the online learning trends creating obstacles in their later adjustments in face-to-face interaction with the teachers in the physical classroom settings. The inclusion of technology in education is here to stay, suggesting the new normal in education. Now the time has come to work on social inclusion and develop better policies for implementation.

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ANNEXURE

Participant Demographics Questionnaire

Instructions

Complete the following demographic information. Please note that all personal information will be kept completely confidential, and none of the responses you provide will be connected to your name, email address, or other identifying information.

Socio-Demographic Datasheet

1. Gender
   - Male
   - Female
2. Category
   - General or Unreserved category
   - OBC
   - SC
   - ST
3. Domicile
   - Urban
   - Semi-urban
   - Rural
4. Family type
   - Joint
   - Nuclear
5. Siblings
   - Yes
   - No
6. Approximate monthly income
   - Above Rs. 50,000
   - Rs. 25,000 – 50,000
   - Rs. 15,000 – 25,000
   - Below Rs. 15,000
7. Sources of income
   - Only mother
   - Only father
   - Both the parents
   - Other sources

Student Questionnaire on Recent Trends in Online Learning

Introduction

Thank you for participating in this questionnaire. Your valuable opinions and insights will contribute to our understanding of the recent trends in online learning. Please take a few minutes to answer the following questions. All responses will remain confidential and will be used for research purposes only.

1. How was your online experience in learning during the covid-19 pandemic?
   - Favourable
   - Unfavourable
   - No opinion
2. How would you rate your participation in the different online platforms like Zoom, Google Meet, Teachmint, etc?
   - Favourable
   - Unfavourable
   - No opinion
3. What was the status of the accessibility standards (electricity, internet facilities, geographical concerns) during online classes?
   - Favourable
   - Unfavourable

- No opinion

4. Were you comfortable in using the different applications both in the laptop and mobile phones?
   - Favourable
   - Unfavourable
   - No opinion
5. Would you say that your participation in the online platform was regular?
   - Favourable
   - Unfavourable
   - No opinion

Information schedule for teachers to extract information on the prevailing offline education based on gender status

Thank you, teachers, for participating in this questionnaire, which aims to gather information about the prevailing offline education system based on gender status. The purpose of this research is to understand any existing disparities, challenges, and opportunities related to gender in the field of education. Your responses will be treated confidentially, and the aggregated data will be used for statistical analysis and research purposes only. Please answer the following questions to the best of your knowledge and experience. Please note that the answers need to be gender specific only.

a. Can you state the status of the students on the first initial days of online class and instruction?

b. What was the status of the online attendance of students?

c. What was the status of the regularity of the students in offline classes?

d. Discuss the gap observed in the regular classroom tasks and homework given to the students.

e. Do you think there is considerable deterioration in the students' self-confidence post-pandemic? If yes, why?

f. Have you observed stress and anxiety related to classroom evaluation?

g. What is the quality of adjustment levels among the students in the physical infrastructure as opposed to the virtual environment post-pandemic?

h. Do you think online and virtual classes have disrupted the emotional element of a classroom? If so, why?

i. Have you observed any kind of lethargy or tiredness among the students during long hours of school? Please elaborate.

j. Do you think there is a drift from regular laboratory work?

k. Give your comments regarding the time management skills of the students.

Research Article

Sociological Impact of Mass Media on Youth with special focus on Internet in Kashmir

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Abstract

"Mass media" refers to the forms of communication that reach a large audience. Newspapers, radio, magazines, books, movies, advertisements, television, and the Internet are examples of mass media. In today's era of information age, the internet stands out as an extraordinary technological innovation. This expansive global network of interconnected computers, predominantly relying on wireless communication systems, provides ubiquitous access to diverse forms of interactive communication, overcoming the constraints of physical distance. It has improved every aspect of human life, including how people work, communicate, conduct business, trade, study, teach, and research. The study aims to explore how media is used and how the Internet affects young people. Purposive sampling was used for the current study. The area of study was Srinagar City, and most participants were students from various educational institutions. The interview schedule method was used for the data collection. The study's participants comprised 100 respondents between the age group of 15 - 35. The results demonstrate that the Internet has a positive impact, and young people frequently utilize it for academic and educational purposes.

Keywords: Internet; Mass media; Media; Social; Youth.

Introduction

Humanity had been divided by geography, race, language, culture, distinct historical developments, and traditions that varied from village to village from the beginning of civilization until the start of the industrial revolution. In all communities, past and present, there have long been common ways of living, but a broad popular culture could only emerge once communication had advanced. The evolution of communication directly impacts the history of man (Heintz & Scott-Phillips, 2023). The first requirement of civilization is the ability to communicate more comprehensively and efficiently. (Frank, 1979). New technological methods are appealing and significant in today's world. Our society is changing rapidly, which is tied to and, in some ways, dependent upon the creation of new production methods, standards of living, and other innovations. The societal changes that result from the advancement of communication techniques are even more significant and intricate. The cornerstone of social interaction and the foundation of almost every other technical advancement is communication. (Maciver and Page, 2006). There have been many inventions in the communication field, such as the invention of the alphabet, newspapers, the printing press, the typewriter, the telegraph, the fax machine, the radio, and television. Still, none of these has had such a significant impact in such a short period as the invention of cell phones and the Internet (Vasmatics, 2010; Wei, 2002).

Internet Scenario in India

The idea of the Internet has been growing in India since 1995, but it only really got going in 1998. Silicon Valley employee Sabir Bhatia made history by selling Hotmail to Microsoft in December 1997 for $400 million. Jerry Young and David Fallo raised $ 2 million to launch Yahoo. In the following year, Amazon was launched. According to a NASSCOM (National Association of Software and Service Companies) report, the number of internet users in India went from a pitiful 0.7 million users in November 1998 to over 1.8 million users by the end of the year 2000. With 1.058 billion users as of March 2016, India is currently the second-largest telecoms market in the world. India had about 662 million broadband subscribers as of the end of 2019. Only 19 million of them used fixed-line services, according to a Telecom Regulatory Authority of India annual report. The remaining individuals used wireless dongles and mobile phones to access broadband internet (Akram et al., 2023).

Source: Telecom Regulatory Authority of India, Tech Sci Research

Internet Scenario in Jammu and Kashmir

In 2015, the number of internet customers in Jammu and Kashmir surpassed 35 lakhs for the first time, according to the Telecom Regulatory Authority of India. In this article, Zargar (2021) reported that 59 lakhs of all broadband customers were in Jammu & Kashmir. According to the Telecom Statistics Report of the Ministry of Communications, there were only about 80,000 fixed-line subscribers, according to estimates provided by executives of the three telecom companies providing broadband services in Jammu and Kashmir—Bharath Sanchar Nigam Limited, Reliance Jio, and Airtel—the number of broadband subscribers in the union territory has since nearly doubled to 1.5 lakhs, with the majority of them being fixed-line users. Reliance-owned Jio is the telecom provider that seems to have experienced the most significant growth in wireline subscribers. Jio had 4,128 members when it launched its fiber-to-the-home service in Jammu & Kashmir in September 2019. According to TRAI's monthly Telecom Subscription Data, the number of customers more than doubled in just 14 months, reaching 57,451 in November 2020. In contrast, the government-owned BSNL had 1,13,382 fixed-line subscribers at the beginning of November 2020, but that number fell to 95,714 by the end of the month—a decrease of 17,668 subscribers.

Significance of the Study

A person's life in particular and society at large are being affected by the development of mass media in increasingly apparent ways (Lotz et al., 2022). These developments significantly impact how people work, communicate, conduct commerce, trade, educate, and conduct research. The need for the Internet is increasing every day. It has developed into a vital communication and learning tool among young people. Therefore, conducting an objective study to comprehend how the Internet affects young people in Srinagar City while considering its sociological effects on society is worthwhile. This work is largely based on fieldwork between April 2018 and September 2018.

Review literature

Nature and history of mass media: The communication platforms that transmit knowledge and meanings (contents) between people and groups make up mass media. These communications occur across a common language, set of symbols, conduit (medium), or platform that is equally accessible to all participants. The full range of technologically based communication mediums, from the telephone to sophisticated internet technologies, is a mass media platform. Platforms for mass media can be active or passive. Users who contribute to creating the media material and communications can exchange information through an active media platform. (Bosch, 2022). The most prevalent example of such a platform is the Internet, where we frequently act as users and content creators. When using a passive media platform, such as watching a movie or television program, the user has little to no direct control over the material. Even though this programming is unquestionably helpful, enjoyable, and informative, we can only control what, when, where, and how we choose to watch a program. We are typically passive consumers of media content, and this idea holds for most of the books, periodicals, and albums we purchase (Sterin &Winston, 2017). Religious, political, and economic issues had a significant role in the historical forces that fueled the emergence of mass media (McQuail, 2022).

The Protestant Reformation

People in the Catholic Church in the 16th century relied on priests to explain what the Bible said. Martin Luther, however, objected to some church customs in 1517. He desired a closer connection between individuals and the Bible. Within 40 years, Protestantism, Luther's new branch of Christianity, had taken root in half of Europe. Millions of individuals were urged to read. The Bible, which is by far the best-selling book, became the first mass media product in the West. The spread of the Bible and other books was made feasible by printing and papermaking technology advancements. The printed book made the widespread distribution and interchange of ideas possible.

Democratic Movements

Political democracy was a second factor that encouraged the development of the mass media. The ordinary people of France, the United States, and other nations began to demand and win participation in government starting in the 18th century. They simultaneously want access to previously closed educational institutions as well as literacy. Democratic governments, conversely, were dependent on informed citizens and promoted the expansion of a free press. These days, T.V., in particular, shapes our entire political worldview.

Industrialization of Capitalism

Industrialization fueled by capitalism was the third main factor that fueled the expansion of the mass media. A literate and numerate workforce was necessary for modern enterprises. To conduct business effectively, they also needed quick means of communication. Additionally, it emerged that the media was a significant source of profit. The global CD market generated $32 billion in revenue in 2003. Two-thirds of American magazines' $29 billion in income in 2003 came from advertising. These instances show how the mass media is a significant industry. (Brym and Lie, 2007). It is evident that the media sector disseminates mass culture, and as people continue to watch and use technology, they unwittingly become mesmerized by mass culture. The cultural industry has completely molded and conditioned people's perceptions of reality. Owners, the market environment, and financial support (from capitalists) all impact how the media operates. Information is now more easily accessible due to the development of new media. However, this information is still impacted by capitalism. One must consider who creates, controls, disseminates, and consumes the content in new media.

The primary method of producing information on new media is based on capitalism; advertisements, emails, yahoo, and Google are all products of capitalism and are made to be profitable. Many pieces of information available online are difficult to get and must be purchased. For instance, when conducting research, a web of scientific papers from publishers like Elsevier, Springer, etc., is not open access; accessing these papers requires a subscription. This suggests that knowledge in new media is neither pluralistic nor democratic (everyone cannot access it). Information from new media is accessible, but access is restricted and keyed. The new media are used to make money in the capitalist society. New media and communication technologies exist, but neither the dissemination of information nor access to it is ever democratized or made available to all people because capitalism designed new media to maximize profit. The only way to accomplish this is to impose restrictions on information and transform new media into a platform or medium for advertising that makes money. One supports capitalism by paying for some classified material online (Apuka, 2017).

Table-1: The Development of Mass Media

Table 1 The Development of Mass Media

Year C.E.)	Mass Media
Circa 100	Papermaking developed In China
Circa 1000	Movable clay type used in China
Circa 1400	Movable metal type developed in Korea
1450	The invention of Gutenberg's printing press
1605	First weekly printed newspaper in Antwerp
1833	First mass-circulation newspaper, *New* York *Sun*
1837	Louis Daguerre invents a practical method of photography in France
1844	Samuel Morse sends the first telegraph message between Washington and Baltimore
1875	Alexander Graham Bell sends the first telephone message
1877	Thomas Edison develops the first phonograph
1895	The invention of the Radio by Marconi
1901	Italian inventor Guglielmo Marconi transmits the first transatlantic
1906	First radio voice transmission
1920	First regularly scheduled radio broadcast, Pittsburgh
1925	The invention of T.V. by John Logie Baird
1928	First Commercial T.V. broadcast
1949	Network T.V. began in the United States
1952	VCR invented
1961	First cable television, San Diego
1969	The first four nodes of the United States Defense Department's ARPANET (precursor of the Internet) were set up at Stanford University, UCLA, U.C. Santa
1975	The first microcomputer marketed
1983	The cell phone invented
1989	World Wide Web, conceived by Tim Berners-Lee

Source: Berners-Lee (1999), Croteau and Hoynes (1997:9-10), The Silent Boom" (1998)

The origins of mass media can be traced back to early forms of art and writing and to the invention of printing. The printing press was created by Johannes Gutenberg in 1450, the first printed newspaper appeared in Antwerp in 1605, Marconi created radio in 1895, John Logie Baird created television in 1925, and Tim Berners-Lee created the Internet (also known as the world wide web) in 1989.

Theoretical background

A web of social connections makes up society. There is a significant connection between the individual and society. Structural functionalism is one way to examine how the media interacts with society. The foundation of functionalism is a biological parallel. According to this perspective, society is seen as a complex system of interconnected pieces, each of which performs a distinct function essential to ensuring society's smooth and consistent operation. These are referred to as functions. At two different levels, the uses and purposes of mass communication are examined (Osei-Frimpong et al., 2022).

On the one hand, the mass media's roles in society as a whole (this method is known as macro analysis). However, the approach shifts from a global to a micro perspective to examine how individuals use mass media. At the individual level, Elihu Katz's 1974 Uses and Gratification Approach refers to the functional approach. In its most basic form, this theory holds that how the media affects an audience will depend on the purposes for which they use it and the varied joys and interests (gratification) they derive from it. People use the media for entertainment, information, companionship, and so on (Perse, 2001).

Structure and Features of the Internet

A global network of computer networks makes up the Internet. A set of two or more networks that are electronically connected and capable of communicating with one another is what this phrase indicates in more technical terms (Nath, 2022). They function as a single network as a whole. The computers must, however, be able to communicate in a common language for this to operate. The TCP/IP protocol is the name computer programmers give to the universal language created for the Internet. Transmission Control Protocol/Internet Protocol is referred to as TCP/IP. It is a collection of protocols controlling how information is transferred between computers through networks. I.P. resembles an envelope's address. It specifies where a computer should send a specific message.

TCP divides the data into transmission-efficient packets, which it reassembles at the destination. People can connect to the Internet in one of two ways: by paying an Internet service provider (I.S.P.), a business that connects customers to the Internet for a fee. Many businesses, including several local phone providers, employ I.S.P.s. Second, by using a paid online service like Prodigy or America Online. These services offer a connection to the Internet and some unique features. An individual can use various tools and services for communication and information exchange once they are online. Email, telnet, newsgroups, and the Internet are a few of the most crucial characteristics (Osei et al., 2023).

(a) Email: You can email one or many of the millions of people connected to the Internet. Email operates on a client/server setup. Sending and reading Users using email must access a different computer (the server), which houses their mailbox. Email communications can be more than just text. You can also send attachments like spreadsheets or graphic images. Email is typically quick, affordable, and dependable. It is the internet resource that is used the most. Despite its benefits, email is improper (such as informing someone they have been dismissed) because it is less professional than a printed letter. Email is less private than a letter in an envelope since it can pass through multiple computers and be accessed by other users. Spam represents a constant menace. Spam, the digital equivalent of junk mail, consists of unwanted pitches for get-rich-quick schemes, miracle treatments, and other products that clog people's email inboxes and are laborious to delete.

(b) Telnet: In a technical sense, remote log-in uses telnet. It enables you to "get into" computers at other locations, to put it simply. Once you are "in," you can access various resources, including databases, library card catalogs, weather forecasts nationwide, and the most recent sports scores. In other words, Telnet services enable you to connect to systems on opposite sides of the globe as if they were just a few miles apart (Hughes, 2022).

(c) Newsgroups People can read and post messages on groups of topic-organized electronic message boards known as newsgroups. While some newsgroups focus on current affairs, "newsgroups" refers to topical discussion groups. People interested in the subject write the data or articles that make up the news. The articles are available for others to read and comment on. The newsgroups are located on Usenet, a unique network that is a part of the Internet (Hughes, 2022; Osborne, 2022).

(d) World wide web: A network of information sources called the world wide web (W.W.W.) uses hypertext, which enables users to connect one piece of information to another. Websites are not linear. This implies that the user can move between pieces of information without following a hierarchical path. According to Chaqfeh et al. (2023), a user can jump from the middle of one document to the middle of another. The W.W.W. integrates motion, sound, images, and text. (ibid). Three things flow along communications: people, goods, and information, making communications and communications technology important variables in determining the size of society. Global one-to-one contact is made feasible through email facilities. In many fields, it improves efficiency and helps save time and money. According to et to Kurihara al. (2008), the Internet connects us to instant information exchanges and makes us wealthy in education, academia, healthcare, business, culture, mass media, and entertainment. There have been significant developments in the corporate world in the twenty-first century. These adjustments result from ongoing computer, internet, and communication technology developments. Our culture is transitioning from an information society to a global society thanks to computers and the Internet. The information society blends fundamental change with continuity (Dudeja, 2003). Additionally, the media industries are currently through a phase of change in which outdated technology is being adjusted to suit contemporary interests. The Internet, which uses standard computer modems and outdated telephone wires, is the most fascinating example. Many of us are accustomed to the media environment has undergone a significant transformation due to the development of new media technologies over the past 20 years. The Internet is how most that the majority of us work and live. (Dizard, 2007). The Internet has produced the most significant effects of the computer on society. Internet communication is faster, less expensive, and more dependable than previous communication methods like postal mail or long-distance phone conversations. During the 1990s, internet use increased rapidly, notably in the world. The prior adoption of personal computers, which were used to access the Internet, was one factor in the Internet's quick uptake. (Singhal and Rogers,2001). The education system has undergone substantial changes due to the rapid expansion in the availability of computers and other technologies in classrooms. "All forms of communication, regardless of format" is how "media" is defined. This definition of "media" encompasses many sign systems, including print, graphics, animation, music, and motion pictures. Technology allows students to collaborate, for instance, during group projects when they discuss the subject and how to use technology to address their questions (Gan et al., 2023). Today, working in life is impossible without technical assistance. Without current communication tools, it just is not possible to impart education. Modern technology using computers as a fulcrum quickly replaces traditional classroom instruction (Chandra, 2005). According to the study of Ivwighreghweta and Igere (2014), most pupils have access to the Internet and are proficient users of it. According to this study, most students use the Internet for academic purposes, including gathering reading materials, preparing for exams, and promoting research. The writers made the case that the Internet is now considered a new learning instrument. Most young people are passionate internet users for communication, entertainment, and education. They see the Internet as a versatile medium, and the research has ranked the top five reasons people use it: computer affinity, information, entertainment, avoiding boredom, and online social connection. 2001 (Valkenburg and Soeters). In the late 20th century, Manuel Castells' (1996) sociological work introduced the idea of network society. According to him, a net is founded on microelectronics and supported by information and communication technology. Forms of digital communication characterize the network society, whereas modes of transportation and communication define the industrial society. According to Castells, network societies are developing considerably more quickly than the older societies typical of the industrial age. Castells point out that social changes, not technological advancements, ultimately shape civilization and influence how technology is created. The characteristics of a network society, according to Castells, are: (1) Nodes can engage anytime and anyplace thanks to technical support (2) Infrastructure that controls physical resources via a power grid for information: (3) Because nodes can move around the network and are mobile, communication is not confined by time or geography. "Space of flows" is the term for this. The essential component of the network society is information, which is embedded in horizontally spreading networks. Individualism and communalism are close since people exist in the network, making people more sociable (Castells, 1996; Saha, 2002).

Youth Concepts and Definitions- India and the World

The term "youth" is typically used to describe the time between adolescence and middle age. As defined by various authorities, the defining criteria of youth include age. The U.N. used the 15–24 age range to define youth. The National Youth Policy's initial definition of youth (from 2003) placed them in the 13–35 age range. The National Youth Policy 2014 changed this definition, defining "youth" as anyone between 15 and 29. In order to demonstrate trends and changes over an extended period, we used the youth age range of 15 to 35 in the current study.

In this background, research questions

were identified, which are as follows:

1. What is the purpose of using mass media by youth?

2. Is the Internet a trend or a necessity?

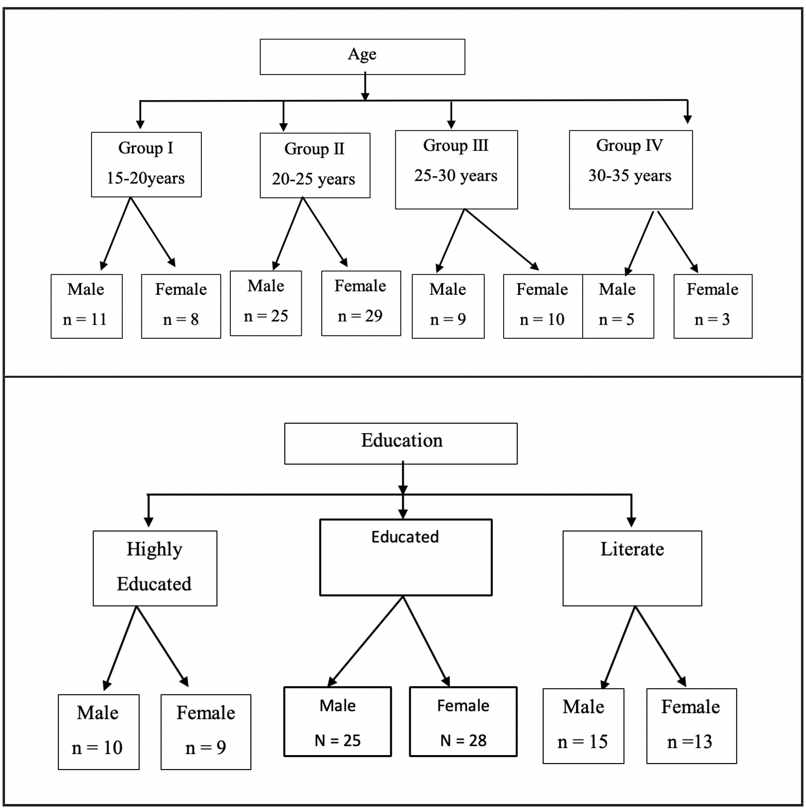
Research Methodology

An exploratory research design has been applied to the current study. The paper is based mostly on fieldwork conducted at several educational institutions in Srinagar. Primary data for this study was gathered through interviews that included both open-ended and closed-ended questions. The majority of the inquiries were objective. The sample area was picked as Srinagar City. Students from universities (University of Kashmir), colleges (Amar Singh College, Women's College), and schools (Burn Hall, Presentation Convent) were chosen as the universe for this study. Secondary data was gathered from books, newspapers, magazines, and journals. One hundred respondents made up the sample. Purposive or judgment sampling was used in the current investigation. The fundamental premise of judgment sampling is that, by using sound judgment and a suitable technique, one can select the relevant cases for inclusion in the sample and produce satisfactory samples in light of one's requirements. The respondents were divided based on sociodemographic characteristics such as gender, age, and level of education. The figure below shows the additional categorization of the respondents' numbers.

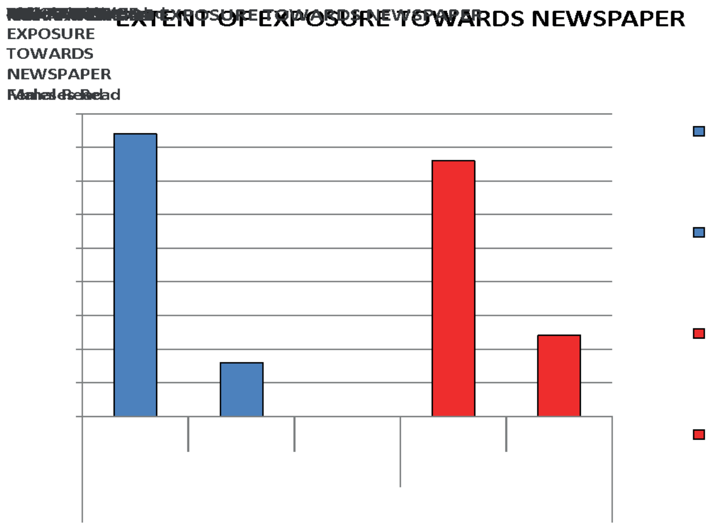
Description of sample

Total number of samples: (N) = 100

Male population (M) = 50, Female population (F) = 50

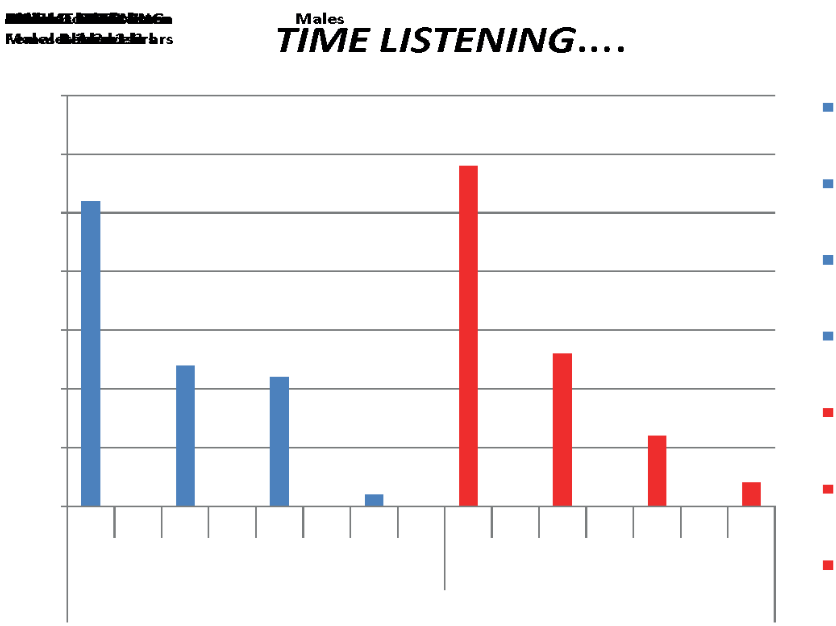


Graph-1: Extent of exposure towards newspaper



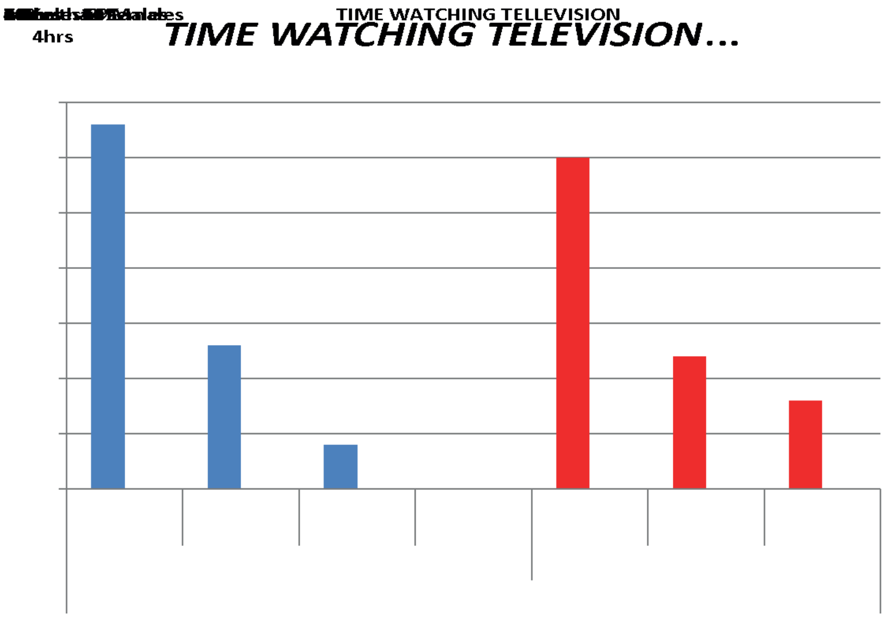
Source: Author's contribution

Graph-2: Extent of exposure towards radio



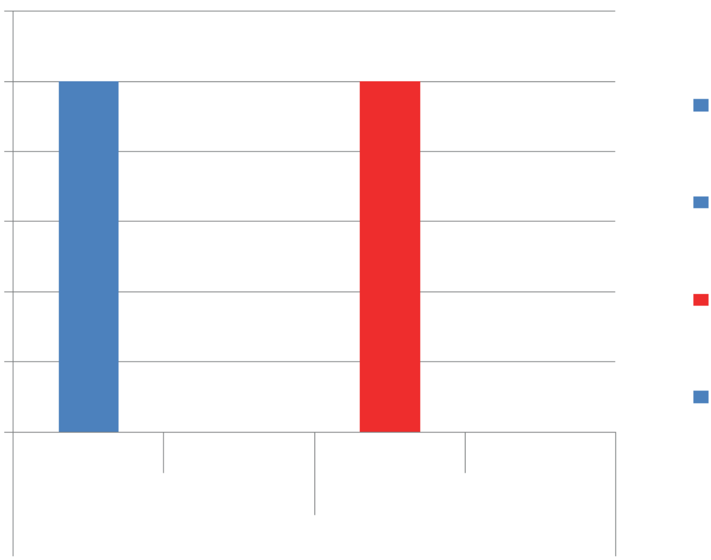
Source: Author's contribution

Graph-3: Extent of exposure towards television



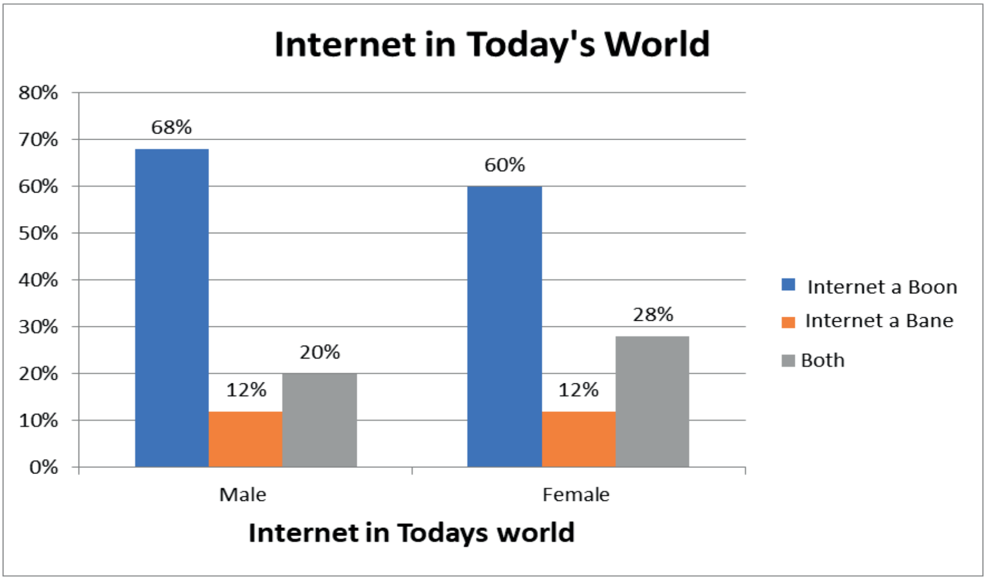
Source: Author’s contribution

Graph-4: Extent of exposure towards the Internet



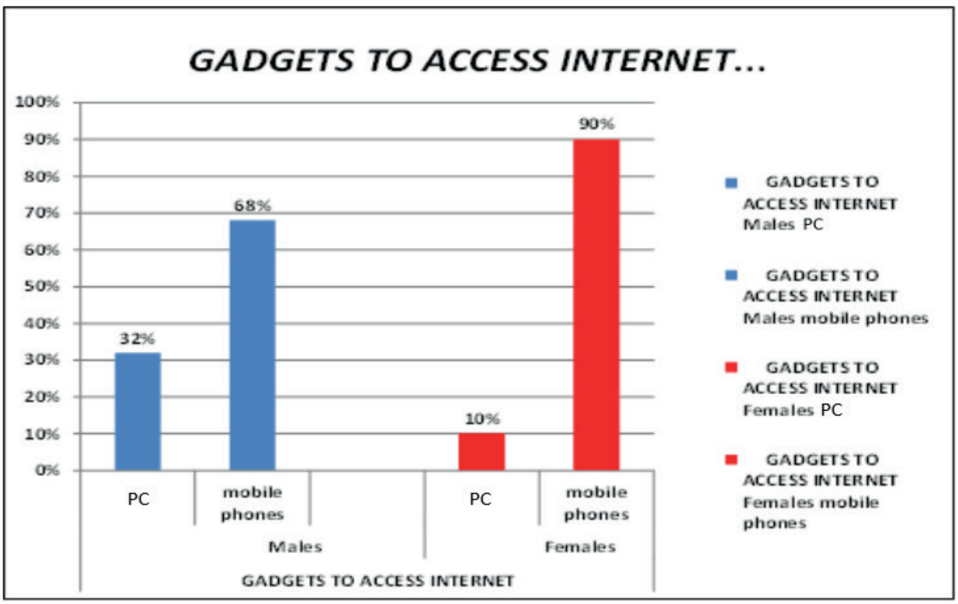
Source: Author’s contribution

Graph-5: Internet in Today's World



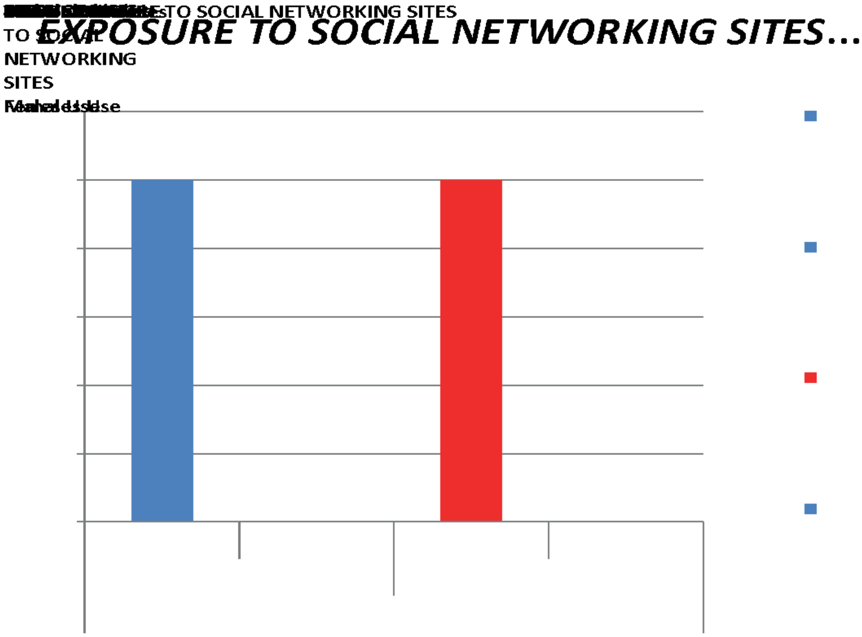
Source: Author's contribution

Graph-6: Gadgets to access the Internet



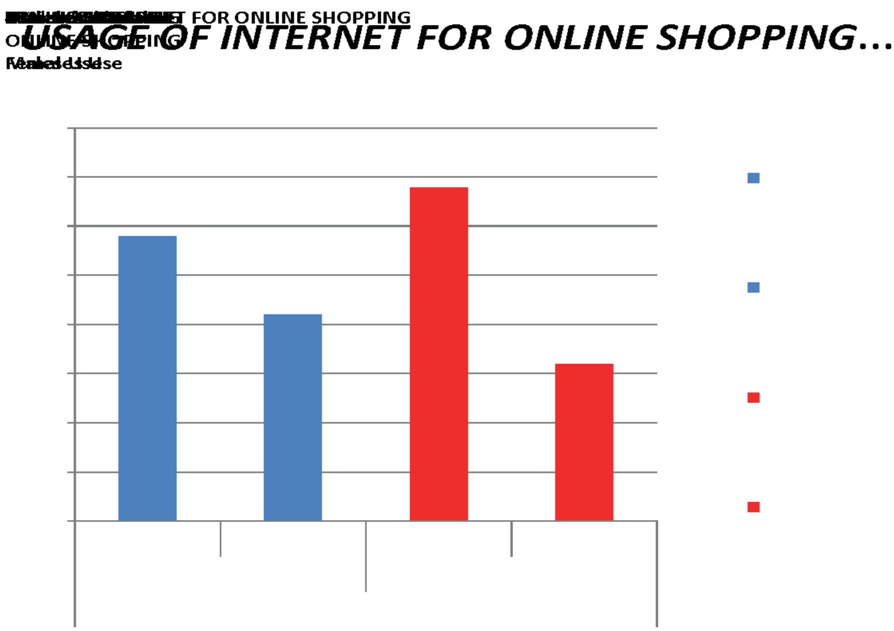
Source: Author's contribution

Graph-7: Exposure towards Social networking sites



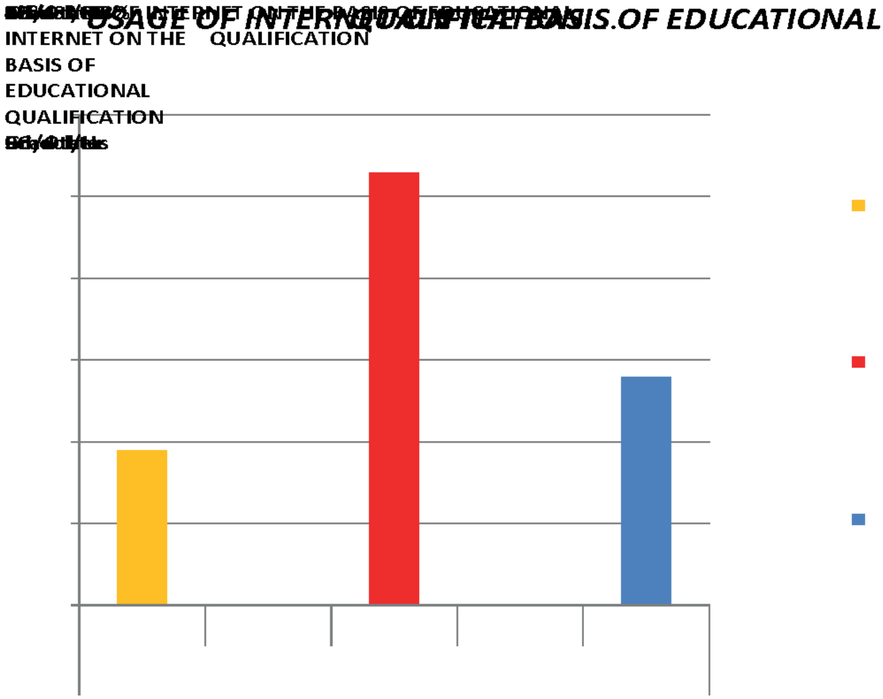
Source: Author's contribution

Graph-8: Usage of the Internet for online shopping



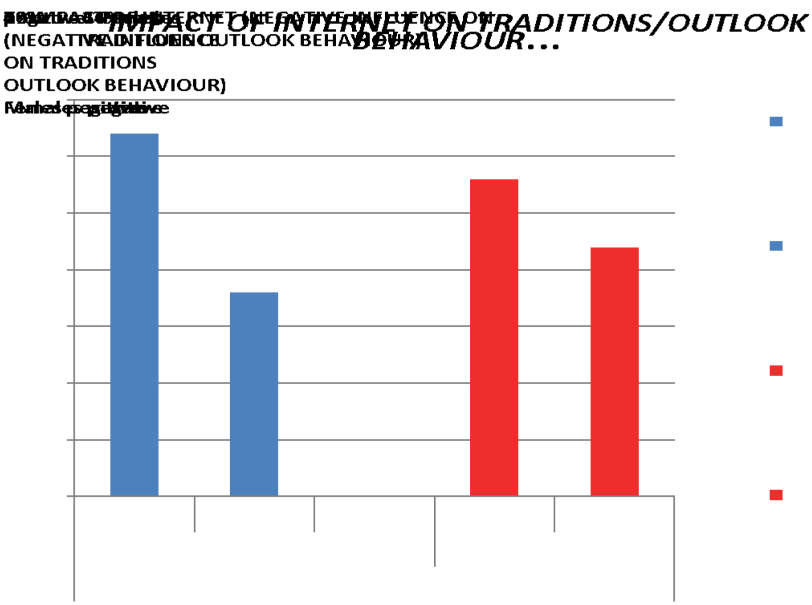
Source: Author's contribution

Graph-9: Usage of the Internet based on educational qualification



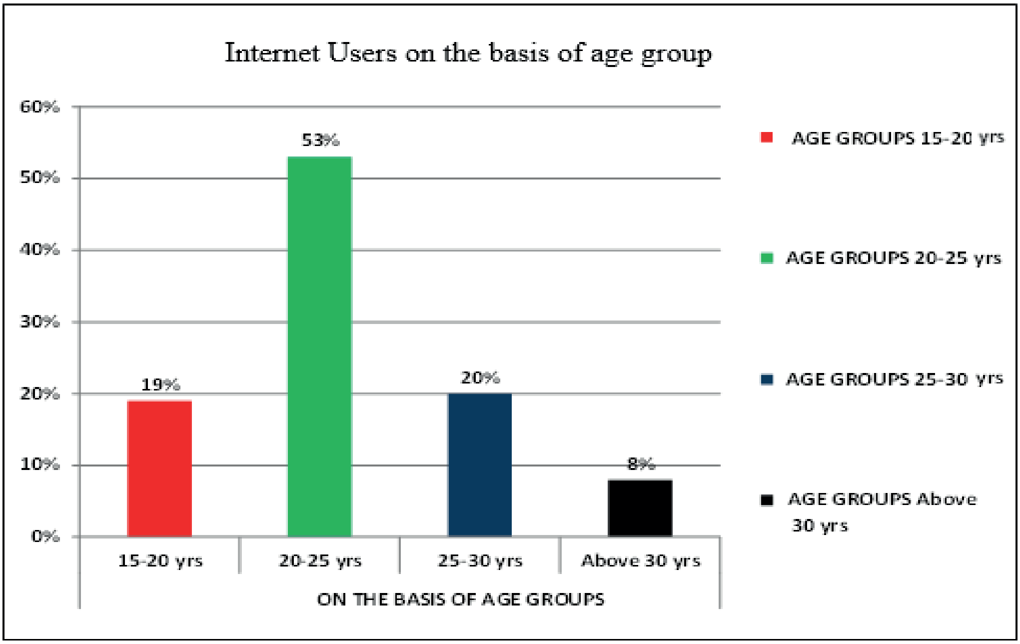
Source: Author’s own contribution

Graph-10: Impact of Internet



Source: Author’s contribution

Graph-11: Internet Users on the Basis of age group



Source: Author's contribution

Findings and Discussion

The current study aims to explore and analyze how the mass media, especially the internet, has affected young people in Srinagar sociologically. The study shows that 84 per cent of males and 76 per cent of females read newspapers. Newspapers are readily available and practical, according to the respondents. It provides news and information about current affairs while allowing one to appear more knowledgeable at social gatherings. According to the study, 58 per cent of female and 52 per cent of male respondents do not listen to radio. Respondents mentioned the absence of radio sets at home as a factor for not listening to the radio. While 48 per cent of the male respondents listen to the radio, they connect their headphones, which operate as an antenna, to their mobile phones to access the radio. From the overall sample, 24 per cent of the male respondents were classed as radio listeners who tune in for less than an hour, 22 per cent tune in for between an hour and two hours, and 2 per cent tune in for more than three hours. Additionally, this study shows that 42 per cent of the female respondents listen to the radio. Out of these, 26 per cent of respondents listen for less than an hour, 12 per cent listen for between one and two hours, and 4 per cent listen for longer than three hours. According to the respondents, radio is still a reliable medium for accessing local music and news. According to the study, 60 per cent of females and 66 per cent of males watch television for between one and four hours per day. According to the respondents, television is currently the best medium with the greatest audience reach for advertisers, introducing new products, and creating new entertainment material. 100 per cent of males and females access the Internet. Respondents stated that they use the Internet extensively daily and thus frequently utilize it for educational and academic purposes. According to the study, 68 per cent of male respondents believe that the Internet is a blessing in today's environment, compared to 12 per cent who think it's a curse and 20 per cent who think it's a mixture of both. While 60 per cent of the female respondents claimed that the Internet is a blessing in today's environment, 12 per cent said it is a curse, and 28 per cent said it is a mixture of both. According to the report, 68 per cent of males and 90 per cent of females use mobile phones to access the Internet for social networking and academic purposes. They said that because they are portable, mobile phones are light and may fit in a pocket or purse. It was discovered that more people own mobile phones than previously thought, and this is because inexpensive smartphones and data subscriptions are readily available. While 32 per cent of males and 10 per cent of females use P.C. to access the Internet to manage their academic work and presentations, respectively.19 per cent of the respondents between the age of 15 and 20 years, 53 per cent, of the respondents between the age group of 20 to 25, 20 per cent of the respondents between the age group of 25 to 30 years and 8 per cent of the respondents between the age group of 30 to 35 years use the internet. It is more common and more well-liked among young people. Online purchasing is done by 68 per cent of females and 58 per cent of males. The outcome shows that younger women outperform their male counterparts. Unsurprisingly, it was shown that women are generally more engaged in internet buying than males. They commonly purchase clothing, footwear, and accessories from online retailers like Flipkart, Amazon, Snapdeal, and Myntra. According to the study, 64 per cent of men and 56 per cent of women believe the Internet has improved society and made it a better place to live. According to the respondents, using the Internet for email, learning, employment, and information research are all possible. While 36 per cent of males and 44 per cent of females believe the Internet harms customs and behavior, respectively. According to the responses, it causes addiction. If they don't go online, they feel irate and cranky, and this is reflected in their behavior. 100 per cent of the males and 100 per cent of the females who responded claimed they use the Internet to access social networking sites. The respondents claimed they exchanged experiences, thoughts, perspectives, and reviews on social networking sites. Millions of individuals use the Internet to connect with others, learn about various topics, and share their experiences and knowledge. They also mentioned using S.N.S. to check on other people's status. According to the respondents, they use social networking sites to strengthen their bonds with friends and family. According to a study, Facebook is the most popular networking site, followed by WhatsApp, YouTube, Instagram, Twitter, and LinkedIn. Furthermore, internet-using students made up 19 per cent of the respondents. 53 per cent of the respondents were graduates, and 28 per cent were postgraduates, making up the majority of the sample. According to the respondents, the Internet has emerged as their most popular tool. In conclusion, it is evident that younger generations, who swiftly adopt new media, use the Internet in all of its forms and that it has become an essential part of their daily lives.

Conclusion

Every culture experience change and no society can be stagnant. The social structure of civilization has completely changed as a result of the transition from nomadic to agrarian to industrial to informational societies. Since then, the pace of technological development has hastened this social shift. With the development of science and technology, mass media can now reach a wider audience with the newspaper, radio, television, and even mobile phones, which offer a variety of services like long-distance calls, music and radio listening, games, photography, voice and video recording, and internet browsing. One of the greatest innovations of all time is the Internet. The way people connect, work, and learn is changing as a result of internet technology. It is a strong tool that unquestionably ushers in a new era. According to the study, 84 per cent of men and 76 per cent of women read the newspaper to be more educated at social gatherings. While 48 per cent of the men and 42 per cent of the women surveyed listen to the radio and use their mobile phones to access the radio by plugging in headphones. The best and most widely used media nowadays is television, which is watched by 66 per cent of men and 60 per cent of women. Radio was not entirely replaced by television, but it did significantly alter how it was used. Both male and female responders who use the Internet regularly are 100 per cent. The study shows that although the use of advanced internet technologies in mass media communication has multiplied, conventional media are still in use. The results appear consistent with Dizard's (1997) assertion that the media industries are through a phase of transition during which outdated technology is being modified to suit contemporary desires. In a similar vein, conventional media have not vanished due to the Internet; rather, their use has evolved. 64 per cent of men and 56 per cent of women who responded believe that the Internet impacts society. The respondents claimed they use the Internet daily, frequently check their emails, and communicate online to save time and money. These results are consistent with the Kurihara et al. (2008) study, which found that the Internet has a positive effect, connects us with instant information exchanges, and makes one wealthy in areas like education, academics, medical treatment, mass media, and Email facilities, allowing for one-to-one communication globally. Both 100 per cent of male and female respondents access the Internet. They said the internet is a blessing today, and it was discovered that they use it for academic and educational purposes. The research by Ivwighreghweta & Igere (2014), which demonstrates how the internet links with quick information, discovering course learning resources, and retrieving pertinent academic materials, is consistent with these findings. This study is a modest attempt to understand how the Internet has affected Srinagar's youth. For a more thorough investigation, there can be other factors that need to be taken into account. It is possible to approach this research from a variety of theoretical perspectives.

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Research Article

Effectiveness of Blended Learning Approach on the Academic Achievements of Learners: A Meta-Analytical Study

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Abstract

This study's major goal was to conduct a meta-analysis of previous research on how well the blended learning strategy affected students' academic success. The samples for this analysis were chosen by the researcher using the purposive sampling method. Keeping in mind that Google search was used to get every study from 2015 to 2021. The researcher chose 20 of these articles to examine how well a blended learning method affected the student's academic successes. The average effect size was established after quantitative data was gathered from particular research publications and transformed into an industry-standard scale, i.e., effect size, using Meta Essentials software. The average impact size across all studies was determined to be 1.46. (large effect size). These results allow us to conclude that blended learning approaches significantly improve students' academic performance.

Keywords: Blended Learning, Meta-analysis, Effect Size

Learning is defined as the concepts of subject matter for students and lecturers, the nature of various concepts connected to the field of data, the objectives of teaching-learning, the nature of teaching, as well as the process of learning. In the traditional method of instruction, the teacher demonstrates to the students a wealth of information related to the subject and makes the erroneous assumption that they are the intended audience for the information. The term "teacher-centered" or "universal teaching method" is used to describe this form of instruction. Teaching methods, approaches, and strategies let the instructor select how to begin the instructional strategy in the classroom so that the student is fully engaged in the strategy (Science Pedagogy, 2018). The National Information Framework from 2005 placed a strong emphasis on learner-centered methods or combining learning techniques to achieve the information's goals. The course material and the technique of its exchange become simple, captivating, and successful with the aid of learner-centered approaches or a blended learning strategy, making it simple to form desired modifications in the behaviour of the learners.

The learner-centered blended learning strategy gives children a chance to gain knowledge and understanding through a variety of experiences, including chatting, listening, speaking, doing practical work, experimenting, observing, and having discussions. In order to satisfy all learners according to their interests, pace, need, aptitude, maturity, and skill, the instructor must employ creative and learner-centered teaching methods when creating the learning environment. Learning interests, aptitudes, motivation, and student's capacity to apply knowledge to novel situations are all influenced by a variety of circumstances. The learning opportunities offered by student-centered pedagogy are adapted to the needs of students from different backgrounds (Science Pedagogy, 2018).

The main positive qualities of the blended learning technique are activity and usefulness. By doing so, both the student and the teacher actively collaborate to create new knowledge. The blended learning strategy makes teaching engaging and effective, which improves the teacher's effectiveness and aids in the achievement of the learning goals. Numerous blended learning strategies are now being used in the sector to enhance learning and raise the bar for education. In the classroom, no uniformity is encouraged rather than uniformity through the blending of various instructional strategies. The blended learning approach is individual, personalized for each learner, and appropriate for their backgrounds, aptitudes, and goals. It is important to use information adaptation techniques that take into account this diversity, including reward-based, project-based, multisensory learning, organizing teaching and learning by defining the required scope, working in teams, cooperative learning, learning through peer teams, team learning, inter-class grouping, multiple age teams, and teaching work that is done through self-learning. Associate degree individualized learning programmes are also established to enable this amount of exposure to the concept in the classroom before the teaching of any subject in blended learning. As a result, "alternative and augmented" communication aid students who are having problems acting on their own or without outside assistance (Science Pedagogy, 2018). The utilization of new techniques and activities by teachers during teaching-learning illustrates the relationship between the mixed-learning approach and new technologies. Additionally, the blended learning approach uses ICT and its fundamentally useful components, like package deals, PPTs, academic films, and learning management tools.

Rationale of the Study

There has been a lot of studies carried out on the meta-analysis in the different research areas. Voyer & Voyer (2014) carried out a study on Gender differences in scholastic achievement: A meta-analysis. Schiefele, Krapp & Winteler (1992) carried out a study on Interest as a predictor of academic achievement: A meta-analysis of research. Lomos, Hofman, & Bosker (2011) studied on Professional communities and student achievement – a meta-analysis. Mehana & Reynolds (2004) carried out a study on School mobility and achievement: a meta-analysis. Schroeder & et al. (2007) studied on A meta-analysis of national research: Effects of teaching strategies on student achievement in science in the United States. These researchers discovered that the results varied greatly, with some meta-analyses displaying moderate results, others displaying extraordinarily high results, and still others displaying very low results. The observation of these meta-analysis-related studies shows that the researcher has worked on projects in various areas. According to the limits of the researcher's knowledge, no researcher has conducted a meta-analysis in relation to the effectiveness of blended learning on academic achievement. As a result, it aroused the researcher's curiosity about what conclusions from his meta-analysis were presented in the study he was examining, which looked at the efficacy of branded education. In an effort to learn more, the researcher tried looking for a meta-analysis of all the studies he had previously included in his study.

Operational Definitions

Blended Learning: Blended learning is learning that combines in-person instruction with online learning. The term "blended teaching strategy" in the current analysis study refers to the numerous teaching modalities in the elect analysis studies.

Effectiveness: Effectiveness is the capacity to produce the desired result or the power to produce it. When an object yields the desired or anticipated outcome, it is said to be effective. Effectiveness in the current analysis relates to the capacity of the blended learning strategy contained in the chosen analysis papers to provide desired results for the learners' educational success.

Meta-analysis: Meta-analysis refers to the methods of applied mathematics used to quantitatively integrate the findings of quantitative analytic assignments (Gupta and Gupta, 2018). Paper meta-analysis in the gift analysis suggests that quantitative integration be achieved by converting quantitative data from elect analysis articles into a uniform scale (effect size).

Research objective

The purpose of the current study was to carry out a meta-analytical assessment of the analysis work pertaining to the effectiveness of the blended learning strategy on students' academic progress. The phrase for the quantitative chemical examination of analytical data is "meta-analysis" (Gupta and Gupta, 2018).

Hypothesis

The blended learning approach has no discernible effect on students' academic achievement.

Sampling and Sampling Techniques

Purposive sampling was utilized in this analysis. As a result, phrases like "blended learning method," "meta-analysis," and "efficacy of mixed learning approach on accomplishment" were used. There were 90 papers available for download between 2015 and 2021. When the researchers started their review, they discovered that the notion had been the main focus of around forty-three investigations. Nobody has quantitative expertise on that. Even though there was a lack of comprehensive knowledge, the remaining twenty-seven pieces of research were detailed and supported this quantitative knowledge. With the use of these insights, a meta-analysis was not feasible. The remaining 20 studies, which gave the information the investigator needed for the meta-analysis, were annexed by the researcher. So that the researchers' analysts pick the final 20 analysis articles and compile a meta-analysis of their findings.

Table-1: Very brief description of selected research papers

S. No.	Publication Month & Year	Volume	Issue	Researcher (s)
1	July, 2015	05	09	M. Deivam and Dr. N. Devaki
2	2015	*Proceedings*		Dhanya Krishnan
3	September, 2016	05	09	Dr.P.S.Chitra and Dr.G.Singaravelu

4	2016	07	35	Khader and Nisreen Saleh Khader
5	December, 2016	13	03	Ya-Wen Lin, Chih-Lung Tseng and Po-Jui Chiang
6	July, 2018	05	01	Amosa Isiaka Gambari, Ahmed Tajudeen Shittu, O. Olufunmilola Ogunlade And Olourotimi Rufus Osunlade
7	November, 2018	*Proceedings*		Thelal Iqab Oweis
8	2018	42	27	Iga Setia Utami
9	September, 2019	05	09	Najeh Rajeh Alsalhi, Mohd. Elmagzoub Eltahir and Sami Sulieman Al-Qatawneh
10	November, 2019	1413	01	F M Hawi And P Sudira
11	December, 2019	19	01	Gie-Ok Noh And Dong Hee Kim
12	August, 2020	13	09	Omar Obaid Alrouji
13	December, 2020	04	02	Barıs Ciftci
14	July, 2020	08	08	Dr. Amaal Al Masri
15	March, 2021	17	04	Najeh Rajeh Alsalhi, Sami Al-Qatawneh, Mohd Eltahir And Khitam Aqel
16	September, 2021	16	09	Athira Balakrishnan1, Sreedharan Nair, Vijayanarayana Kunhikatta, Muhammed Rashid, M. K.Unnikrishnan, P. S. Jagannatha, Viji P. Chandran, Kanav Khera1, Girish Thungaid
17	September, 2021	03	03	Yassine Benhadj
18	November, 2021	12	--	Yuhong Jiang, Yingying Chen, Jiasheng Lu and Yiqing Wang
19	October, 2020	26	01	Cihad Senturk
20	July, 2021	12	07	Dr. Yousef Houssni Zrekat

A brief review of the chosen research papers for the study

Deivam and Devaki in 2015 studied on the efficiency of blended learning in teaching educational psychology to B.Ed. candidates. This study's main objective was to ascertain whether training improved trainees' academic performance in educational psychology. A quasi-experimental research design was adopted for this investigation. 100 student teacher were selected using simple random sampling. Equal randomization groups were created from the experimental group 50 and the control group 50. For the goal of acquiring information, the researcher created and prepared an achievement exam. The words mean, SD and t-test were applied to analyze the collected data. Following data analysis, it was found that student teachers' performance in educational psychology was significantly impacted by blended learning methodologies.

Krishnan (2015) carried out a study

on the Effect of a Blended Learning Strategy on Learning Science. Examining the effects of a mixed learning strategy on secondary-level scientific accomplishment and science process skills was the main objective of this study. In this quasi-experimental design were used, a pre-test, post-test non-randomized control group design adopted. An intentional sampling technique was used to choose an intact group of 36 students as the control group and an intact group of 38 children as the experimental group. A test of science process skills and a test of science achievement were developed and validated by the researcher, and the reliability coefficients (Cronbach Alfa) for each were 0.86 and 0.87, respectively. To better understand the difficulties students had when using the blended learning method, a schedule of interviews was developed. ANCOVA was used to analyse the data. Data analysis demonstrated that science achievement might be improved, and students could become global learners by successfully integrating in-person instruction with online learning.

Chitra and Singaravelu 2016 conducted a study named Potency of Blended Learning In Learning Science. The study's main objective was to evaluate the effectiveness of blended learning in scientific learning. A rational group experimental approach was adopted in the investigation. Sixty ninth-graders from Coimbatore's Gopal Naidu Higher Secondary School served as the study's sample. 30 more students were chosen for the control group, and 30 more were chosen for the experimental group. A self-created achievement test was employed by researchers as a research tool. Achievement contained 25 questions. Using the test-retest approach, the reliability in this study was computed, and the result was 0.76, which is highly significant. To establish the test's validity, the expert judgment of the co-staff members was obtained. T-test, mean, and SD were adopted to analyze the data. After data analysis, it was discovered that blended learning is superior to third-place learning in learning science for learners in standard 9.

Khader (2016), studied on Effectiveness of Blended Learning in Improving Student Achievement in Bani Kenana. This study's main objective was to see if blended learning, as opposed to the traditional method, could boost kids' performance in the third grade. This research employed a quasi-experimental research design. With the aid of simple random sampling, 108 kids (both male and female) in third grade from one school were chosen for this study. For this study, the researcher created a self-made achievement test. There were 20 multiple-choice questions in the sample. A panel of 12 arbitrators examined the reliability of the test components. The taste reliability was examined by applying the taste to an exploratory sample, and the reliability was assessed using the Pearson correlation coefficient of 0.87. The researcher utilized ANCOVA, ETA square, and two-way to examine the data. After analysing the data, it was discovered that using blended learning as a teaching strategy helped students become less burdened by their academic obligations and gave them the opportunity to learn while having fun. This new approach to teaching gave students a chance to interact with others and enjoy themselves while learning.

Lin, Taseng, and Chiang (2016) carried out a study on the Effect of Blended Learning in Mathematics Courses. The main objective of the study was to investigate how the blended learning approach affected junior high school student's academic performance and attitude toward mathematics. The study used a pre-test, post-test, and control group quasi-experimental research designs. Out of the total of 54 students, 27 students were selected for the experiment group and 27 students for the control group. Data was gathered using pre-and post-tests. ANCOVA and MANCOVA were used with SPSS 18.0 to analyze the data. The trial group's students benefited from the mixed learning experience by increasing their learning outcomes and also their attitudes toward studying mathematics in a blended learning atmosphere, it was found after data analysis.

Gambar, Shittu, Ogunlade, and Osunlade (2017) carried out a study entitled Effectiveness of Blender Learning and E-Learning Modes of Instruction on the Performance of Undergraduate. The study's main objective was to determine how well undergraduate students are in the Nigerian state of Kwara. In a quasi-experimental context, the study employed a pre-test, post-test control group design. 35 undergraduates were chosen for the sampling with the aid of randomization. 25 people were exposed to the control group, 30 to experimental group I, and another 30 to experimental group II. The Educational Materials and Methods Performance Test was adopted to collect data (EMPT). A reliability coefficient of 0.71 was generated by the Kuder-Richardson (KR-20) formula. Following data analysis, it was shown that exposing undergraduate students to a blended learning mode of instruction increased their performance.

Oweis (2018) studied the Effects of Using a Blended Learning Method on Students' Achievement and Motivation to Learn English. This study sought to determine how blended learning affected the academic performance and motivation of German Jordan University students to learn English. A pilot case study methodology was employed. 34 GJU third- and fourth-year students were chosen for the first semester based on purposive sampling. 16 students made comprised the experimental group, and the control group received other samples (18 students). Data gathering methods included an English proficiency exam and a scale for gauging enthusiasm to learn the language. By giving the achievement test to 24 University professors, the validity of the test was evaluated. Using the Pearson equation, the reliability of the accomplishment test was evaluated, and the dependability percentage was 0.83. ANCOVA and the mean SD were applied to analyze the data. After data analysis, it was shown that the experimental group did much better than the control group and that each group's motivation to learn English differed noticeably.

Utami (2018) studied on the Effect of the Blended Learning Model on Students' Achievement. The study's main objective was to determine how senior high school student's academic performance. A randomized control group pre-and post-test design was adopted in the investigation. 63 students enrolling in an ICT course were chosen at random. The information was gathered via an objective test with 35 questions. The mean, SD, and t-test were applied to analyze the data. After doing a data analysis, it was shown that the blended learning strategy raised student accomplishment levels over those of the conventional learning model.

Alsalhi, Eltehir, and Al-Qatawneh (2019) studied on the Effect of Blended Learning on the Achievement in Science and Attitude toward Its Use. The main aim of the study was to examine how 9th-grade students' attitudes and science achievement were impacted by blended learning. To conduct the study, a case study with a quasi-experimental design was used. Twelve ninth-grade students were chosen at random. Two groups were made: the experimental group (n=61) and the control group (n=51). A questionnaire and achievement exam were created to collect data. The accomplishment test's reliability was examined by applying the test-retest method, and the coefficient value was 0.88ten members of the university teaching staff were given it to test the taste's veracity. Using SPSS software, Mean, SD, and ANCOVA were utilized to analyze the data. After data analysis, it was discovered that their attitude favored pupils who demonstrated a certain level of academic achievement in a science field.

Hawi and Sudira (2019) studied the Effect of the Blended Learning Model to Improve the Conceptual Understanding of Computer and Network Engineering Students. This study's primary goal was to determine how using a blended learning strategy improved students' conceptual knowledge. For this investigation, the researcher used a quasi-experimental research approach. 58 students were chosen at random; 30 of them were exposed to the experimental group and 28 to the control group. An exam called the essay was employed to collect the data. Data analysis was done using MANCOVA. After data analysis, it was discovered that students who were taught utilizing a blended learning paradigm had a superior grasp of the fundamentals of computer networks.

Noh and Kim (2019) undertook a study entitled Effectiveness of a Self-Directed Learning Program Using Blended Coaching among Nursing Students. The study's primary objective was to determine whether a self-directed learning approach incorporating blended teaching was helpful for nursing students engaged in clinical practise. This study employed a non-equivalent quasi-experimental pre-post-test non-synchronized intervention control group. Convenience sampling was used to select 92 students in total. 47 were regarded as the control group, and 44 as the experimental group. Data analysis revealed that a self-directed learning program with a blended teaching method is an effective educational technique to raise nursing students' happiness with their clinical practice experiences and their skill in putting self-directed learning into practice.

Alroji (2020) study entitled The Effectiveness of Blended Learning in Encouraging Competence in Metagraph Writing. This study's major objective was determining how well-blended learning at Shaqra University improved the English Metagraph writing skills. In this study, the experimental research design was employed. The use of random sampling enabled the selection of 70 students. The experimental group (35) and the control group (35) each received the same amount of the sample (35). (35). Data were gathered using the essay-writing pre- and post-tests given to the participants. Using SPSS, the data was evaluated (version 17). In this investigation, a P-value of 0.05 was regarded as the significant level. Following data analysis, it was found that the control group, which used the traditional teaching approach, performed far better than the experimental group, which used the blended teaching method. This highlights the importance of a blended approach in assisting Saudi students in developing their paragraph-writing skills.

Ciftci (2020) carried out a study on the Effect of Blended Learning on Academic Achievement and Attitude in Social Studies Courses. The study's primary objective was to investigate the efficacy and sustainability of the blended learning approach in social studies lessons. Data were gathered using both the pre-test and the post-test. The data were analyzed using an ANOVA, mean, and SD. Following data analysis, it was shown that, in terms of student accomplishment persistence, blended learning is superior to face-to-face learning.

Masri (2020) studied on Effectiveness of Using Blended Learning for Teaching English Language Vocabulary to First Grade Students. This study's main objective was to evaluate the effects of implementing a blended learning approach in first-grade classes of public schools managed by the Al-Tafila directorate of education. 46 students were assigned to the experimental group, and 46 students were assigned to the control group out of 92 students who were randomly selected. Data were gathered using an English vocabulary exam that was created by the researcher. Using Abel's and Godard Richard coefficients, respectively, the validity and reliability were examined. The test's coefficient value was 0.762. Mean, SD and the t-test were employed to analyse the data. After data analysis, it was discovered that students who used the mixed-learning approach had greater grades than those who used the traditional approach.

Alsalhi, Al-Qatawneh, Eltehir, and Aqel (2021) carried out a study on Does Blended Learning Improves The Academic Achievement Of Undergraduates. The main objective of the study was to ascertain the effects of blended learning on undergraduate students' performance in mathematics (MTH 121) at Ajman University. In the investigation, a quasi-experimental methodology was adopted. Male and female students enrolled in mathematics classes totaling 196 were chosen and divided into experimental (99 students) and control groups (97 students). The researcher created an achievement test to collect data. The test's reliability was examined using the test-retest method, which yielded a coefficient value of 0.801. Also used were the average, standard deviation, the Independent Sample T-test, and one-way ANCOVA. The researchers used the SPSS tool to analyse the study's data. Following data analysis, it was shown that the experimental group had an advantage over the control group on the accomplishment exam due to measurably significant differences between the two groups.

Balakrishnan et al. (2021) conducted a study entitled Effectiveness of Blended Learning in Pharmacy Education. This study aimed to assess how well-blended learning works in pharmacy education. An experimental research design was employed. Using cluster randomization, a total of 241 individuals from 12 colleges were chosen. SPSS version 20 was used for all of the statistical analysis. The data analysis employed means standard deviation, the Sapiro-Wilks test, and the Games-Howell test. To determine the relationship between variables, use Spearman correlation. Mann The Whitney U-test was used to examine the differences in the students' opinions in the WEL and BL groups. The students in the mixed learning group employed all learning and motivational methods more frequently than the students in the didactic and web-based e-learning group, except intrinsic goal orientation, task value, control of learning belief, and help-seeking techniques.

Benhadj (2021) undertook a study entitled A Quasi-Experimental Study on the Impact of Blended Learning on EFL Students' Language Proficiency. The study sought to determine what impact blended learning has on Moroccan high school students' command of the English language. 79 Moroccan first-year bachelorettes in total conveniently, students between the ages of 16 and 18 were chosen to participate in this experiment. 39 students were chosen for the control group, and 40 students were randomly assigned to the experimental group. Pre-tests and post-tests were employed to collect data. Maemillam Publisher created and validated the simple rapid placement and diagnostic test (placement test, 2012). With a score of 0.78, Cronbach Alpha was used to gauge consistency. It was thought to be highly reliable. Mean SD and ANCOVA were employed in this study to analyze the data. Following data analysis, it was shown that blended learning presents a significant chance to inspire students of any gender to study and advance their English proficiency skills.

Jiyang Chen and Wang (2021) carried out a study on the the Effect of the Online and Offline Blended Teaching Model On English as a Foreign Language. The study examined how online and offline mixed learning modes affected students' learning outcomes. The researcher used a hybrid approach to the study, combining qualitative and quantitative research. 95 participants were chosen by means of convenience and cluster sampling. 42 people were recruited for the experimental group, and 53 were chosen for the control group. The data T-test and paired sample test were used for analysis with SPSS 26.0. In this work, Pearson correlation analysis was used to pinpoint the variables influencing various EC and CC pre- and post-test components. After data analysis, it was discovered that the blended exercise was helpful in improving students' listening skills. Additionally, students' attitudes toward learning English by hearing have changed from a generally unfavorable enhancement to one that is more positive. At the same time, student interests have increased, and their learning strategies have become more varied.

Senturk (2020) studied the Effects of the Blended Learning Model on Pre-Service Teachers' Academic Achievements. The primary goal of the study was to investigate how pre-service teachers who had taken the teaching principles and technique courses fared academically and in terms of 21st-century skills. The study employed a pre-test and post-test quasi-experimental research design. A total of 172 pre-service teachers were selected through purposeful sampling. The experimental group was given 86 people, while the control group received 86 participants. The Multidimensional 21st Century Skill Scale and Academic Achievement Test were both used in this study to gather data. The data were analysed using Kolmogorov-Smirnov and Sapiro-Wilk Z-tests. When the data was analysed, it became clear that the experimental group had considerably more academic success and 21st-century abilities than the control group.

Zrekal (2021) studied on the Effectiveness Of Blended Learning In the EFl Context: An Experiment Study At Arab Open University KSA. The study's primary goal was to determine whether blended learning was beneficial, especially in terms of enhancing students' ability to speak English at an Arab institution in Saudi Arabia. They divided into two groups: a control group, which consisted of 30 pupils, and an experimental group (30 students). Data was gathered through an online assignment that was sent via email. The SPSS software was used for data analysis to calculate the Mean, SD, and percentage of achievement scores for each group. After data analysis, it was discovered that blended learning enhances students' informal foreign language acquisition while also helping to improve student learning results.

Data collection

The researcher gathered quantitative data for the current study project from all of the chosen research papers. The following table includes information about that:

Table-2: Details of Quantitative Data of Selected Research Papers

S. N.	Researcher	Group	N	Mean/ Adjusted Mean	SD	F/t
1	Deivan and Devaki (2015)	Experimental	50	38.46	2.22	t=15.11
		Control	50	32.98	1.38	
2	Krishnan (2015)	Experimental	35	38.12	–	F=16.632
		Control	36	33.80	–	
3	Chitra and Singaravelu (2016)	Experimental	30	36.32	3.64	t=14.80
		Control	30	23	3.32	
4	Khader (2016)	Experimental	54	18.13	2.26	F=21.004
		Control	54	15.78	3.10	
5	Lin, Tseng and Chiang (2016)	Experimental	27	64.30	24.39	F=5.23
		Control	27	54.70	28.58	
6	Gambar, Shittu, Ogunlade and Osunlade (2017)	Experimental	30	18.73	–	F=14.035
		Control	25	14.68	–	
7	Oweis (2018)	Experimental	16	32.269	6.609	F=6.253
		Control	18	29.456	5.995	
8	Utami (2018)	Experimental	31	82.5	6.117	t=5.657
		Control	32	72.9	7.328	
9	Alsalhi, Eltehir and Al-Qatawneh (2019)	Experimental	61	16.11	1.67	F=3.054
		Control	51	14.12	1.60	
10	Hawi and Sudira (2019)	Experimental	30	74.86	–	F= 29.063
		Control	28	67.89	–	
11	Noh and Kim (2019)	Experimental	91	8.13	1.17	t=3.10
		Control	91	7.10	1.88	
12	Alrouji (2020)	Experimental	35	30.86	5.801	t=-20.094
		Control	35	20.37	4.551	
13	Ciftci (2020)	Experimental	26	77.69	4.64	F=119.749
		Control	26	63.07	4.69	
14	Masri (2020)	Experimental	46	2.79	1.34	t=5.28
		Control	46	5.82	2.68	
15	Alsalhi, Al-Qatawneh, Eltehir and Aqel (2021)	Experimental	99	16.87	2.10	F=9.657
		Control	97	12.74	1.89	
16	Balakrishnan et. al. (2021)	Experimental	92	39.39	11.02	F=30.50
		Control	86	33.50	6.63	

17	Benhadj (2021)	Experimental	40	39.50	7.51	F=30.29
		Control	39	28.17	8.72	
18	Jiang, Chen, Lu and Wang (2021)	Experimental	42	22.74	2.61	t=7.069
		Control	53	18.77	2.79	
19	Senturk (2021)	Experimental	86	43.04	1.82	t=14.801
		Control	86	34.68	4.90	
20	Zrekat (2021)	Experimental	30	82.40	12.12	t=2.75
		Control	30	73.47	13.03	

The quantitative information gathered from the content analysis of a few chosen research publications is shown in the table above. Maximum data was gathered during the within-content analysis process, accounting for the sample size, mean or adjusted mean, standard deviation, t-value, and F-value.

Data analysis and interpretation

Quantitative information was acquired for the current study project in order to carry out a meta-analysis. Meta-objective analysis's is to statistically combine the results of related study types. Meta-analysis may calculate the average effect size by converting the numerical results from several studies into a consistent scale (Effect Size) (Gupta and Gupta, 2018). The current study used Meta Essentials software to do a meta-analysis on the collected quantitative data. The programme is freely available on the website of the Erasmus Research Institute of Management (ERIM), which is housed at the University of Rotterdam in the Netherlands. This software's unique feature is that it transforms the impact size into the average effect size using little quantitative data from a variety of research (Gangwar, 2022).

The following table displays the findings of the quantitative data analysis performed using Meta Essentials software.

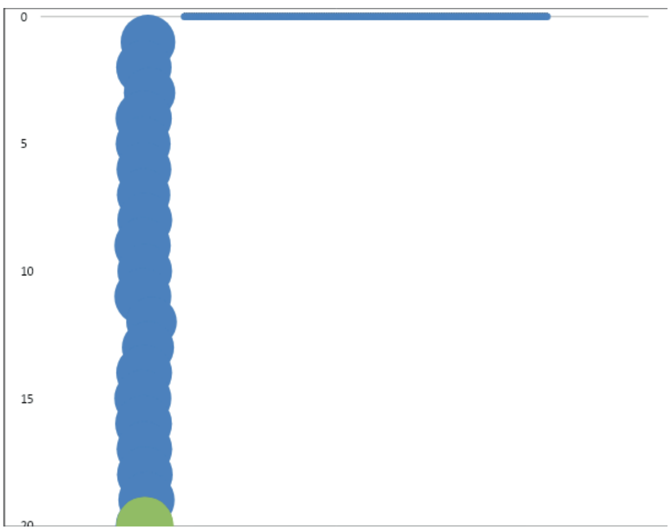
Table-3: Study-wise Individual Effect Size and Average Effect Size

S. No.	Researcher(s)	Effect Size	Interpretation
1	Deivan and Devaki (2015)	3.00	Vary Large Effect Size
2	Krishnan (2015)	0.96	Large Effect Size
3	Chitra and Singaravelu (2016)	3.77	Vary Large Effect Size
4	Khader (2016)	0.88	Large Effect Size
5	Lin, Tseng and Chiang (2016)	0.61	Moderate Effect Size
6	Gambar, Shittu, Ogunlade and Osunlade (2017)	1.00	Large Effect Size
7	Oweis (2018)	0.84	Large Effect Size
8	Utami (2018)	1.41	Vary Large Effect Size
9	Alsalhi, Eltehir and Al-Qatawneh (2019)	0.33	Small Effect Size
10	Hawi and Sudira (2019)	1.40	Vary Large Effect Size
11	Noh and Kim (2019)	0.46	Small Effect Size

12	Alrouji (2020)	4.75	Vary Large Effect Size
13	Ciftci (2020)	2.99	Vary Large Effect Size
14	Masri (2020)	1.09	Large Effect Size
15	Alsalhi, Al-Qatawneh, Eltehir and Aqel (2021)	0.44	Small Effect Size
16	Balakrishnan et. al. (2021)	0.82	Large Effect Size
17	Benhadj (2021)	1.23	Large Effect Size
18	Jiang, Chen, Lu and Wang (2021)	1.45	Vary Large Effect Size
19	Senturk (2021)	2.25	Vary Large Effect Size
20	Zrekat (2021)	0.70	Moderate Effect Size
Average Effect Size		1.46	Vary Large Effect Size

It is evident from the observation of the aforementioned table that all investigations, with the exception of studies (9), (11) and (15), exhibit average to large effect sizes (Cohen, 1988). The average effect size across all studies is displayed in the table's final row with a value of 1.46. The Cohen effect size number displayed in the reference table is more than 1.2. (Cohen, 1988). That means the effect magnitude is really large. Thus, it can be drawn that the blended learning strategy significantly affects the academic achievement of the pupils.

Graph-1: Forrest Plot of Effect Size



It is evident from looking at the effect size forest plot that the scale of the effect size is marked on the x-axis at the top of the plot. The Forest plot's midpoint, except the bottom row, indicates the effect size of a single research with a fidelity interval of 95 per cent. The outcome of the meta-analysis is shown by the lowest row (summary row) of the Forest plot. Two gaps are present around a midway in this Meta-analytical result of Meta-essentials (line 21 in graph 1). With a value of 1.46, this midpoint denotes the average impact size, also known as the combined effect size or the weighted average effect size.

Table-4: Z-value and Significance value

Z-value	5.62
One-tailed p-value	0.000
Two-tailed p-value	0.000

It is clear from Table 4 that the two-tailed significant value of 0.000 at the 0.05 significance level and the z-value of the mean impact size are both zero. This number is significant at the 0.05 significance level because it is less than 0.05. This makes it possible to reject the null hypothesis that the blended learning approach has no discernible effect on students' academic achievement. Therefore, it may be argued that the blended learning strategy significantly affects students' academic advancement.

Research Conclusion and Interpretation

The purpose of the current study was to undertake a meta-analytical investigation of previous research on the impact of blended learning on students' academic progress. The investigator discovered, after examining the quantitative data, that the learners' educational success is significantly impacted by the blended learning technique. In their many meta-analytical studies, these researchers also discovered that innovative and student-centered teaching strategies have a positive and pregnant influence on students' academic achievement at various levels and that these strategies' effects are also very large. The main factor influencing the scope of the current investigation is the organized and uncomplicated way in which the subject matter selected for instruction using a mixed learning strategy was presented while taking into account the learners' age, interest, attitude, and individual differences. Every learner is provided the opportunity and space they need to explore the subject at their own speed. Kids are inherently active, and when learning through blended learning, the child stays active and employs the majority of his or her senses, which facilitates learning. One of the reasons for this analytical volume is also due to the involvement of young people. Additionally, the blended learning approach's concept, which considers both the role of the student and the teacher as a helper, is used in the classroom to construct learner-centered learning systems and learning efficiently in learning ecosystems where the learner is in the lead role. The outcomes of this analysis may even be attributable to this in a substantial way.

Educational Implications

The following are the educational consequences of this analysis work:

For policymakers

According to the study's findings, students improve their tutorial performance by demonstrating information-supported curiosity, self-discipline, and individual variety in a highly stimulating learning environment produced in their classrooms with the use of a blended learning strategy. In light of those findings, this study can provide a platform for increasing the knowledge of academic policymakers and disciplines, enabling them to create curricula that are supported by integrating learning principles while creating curricula for diverse courses.

For lecturers

The findings of the present study

can help instructors choose the most modern teaching techniques. For various subjects, the nature of the subject content is fundamentally different. that the instructor selects entirely unique teaching strategies. The results of the current analysis show that the mixed-learning approach will boost the student's academic accomplishment. Based on this assumption, the instructor will use the mixed learning method to create a significant improvement in the student's accomplishment.

For choosing the best methods for academic analysis

In place of old methods, a blended learning strategy is currently being applied to track students' educational progress. These assessment techniques let the teacher evaluate the student's academic progress as well as his or her own learning so that he can make the required adjustments to the teaching-learning process in his or her discipline (Gangwar and Singh, 2020). According to the National Policy on Education, 2020, professors should employ student-centered and innovative assessment strategies such as rubrics, portfolios, projects, and cluster activities to evaluate students' information in a manner comparable to how data is compiled. Recent research can introduce professors to a blended learning strategy that improves tutorial success. As a result, the instructor will incorporate the proper blended learning approaches, such as concept-related tasks, portfolios, rubrics, etc., at the side of the teaching-learning method for formative analysis of the students' many subject areas.

For book authors

According to the study's findings, a blended learning approach significantly affects how well pupils learn a subject. In this context, our analysis work will also serve as a foundation for book authors of many subject areas to organize the information included in their books in enticing, student-centered, systematic ways that make it simple for students to learn new things.

For alternative researchers

Researchers will also benefit from this analysis's methodology and scope. The World Health Organization is interested in and needs to use meta-analytical analysis research.

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Research Article

Attitude of teachers towards utilization of Information and Communication Technology (ICT) in secondary schools of Assam with special reference to Kamrup District

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Abstract

The use of ICT in Secondary schools is a recent dimension. The utilization of ICT has changed the total scenario of the education system. The attitude of teachers plays a vital role in the utilization of ICT in schools and the teaching process as a whole. The present study tries to investigate the attitude of teachers towards the utilization of ICT in secondary schools of Kamrup district Assam. This study is designed to find out the attitude of secondary school teachers in relation to their ages, gender and working area, i/e. urban or rural. A descriptive survey method has been adopted by the researcher for the study. In order to collect the primary data about the attitude of teachers, an attitude scale was developed by the researcher using Likert 5-point scale and it was standardized by following proper standard procedure. The population of the study was comprised of 3329 secondary school teachers teaching in govt provincialized secondary schools, and the sample of the study was 400 teachers, which is above 10 per cent. The study found various attitude levels among male/female, rural/urban, and junior/senior teachers towards the utilization of ICT in teaching in secondary schools of Kamrup district of Assam.

Keywords: ICT, Attitude, Attitude Scale, Secondary School

Introduction

Technology has always influenced the education system from time immemorial but the introduction of computers, the internet, and other ICT tools have influenced in such a way ICT become an integral part of the education system. Broadcasting technology like television, radio etc., have been used in education for a long but presently, mobile, computers, projectors, interactive whiteboards, Satellite-based network systems, e-learning systems etc., have changed the total scenario for the last two decades. It is seen that Information and Communication Technology (ICT) has played a most prominent role in the development of society in the 21st Century. It is beyond doubt that it has added a new dimension to the whole education system. At present, acquiring information is not merely dependent on hard copy books or reports but can be accessed within moments through ICT gadgets. Now the whole world's information is in the palm of our hand. ICT brings changes, developments, opportunities and facilities to teachers, not only in the teaching process but also in the management and administration of education vastly.

ICT has created such an environment where the teaching process becomes more fruitful, investing less time and less effort. Using ICT tools, teachers can be more competent in delivering information to learners. The requirement is necessary ICT tools and systems and the skill to use ICT in a proper way by the teacher. So, teachers should acquire the knowledge & skill to use the ICT tools. He should possess the right command of when, how and where to use ICT in the teaching process to enhance his teaching quality. Teachers can do best practices of ICT, but it depends on some factors which influence the utilization of ICT in school education by the teachers in the teaching process. Broadly there are two factors, one is external, and the other is internal. The external factors are ICT infrastructure, technical support, financial support, human resource support etc. The internal factor is the attitude of the teachers towards ICT utilization. According to many experts, external factors can be fulfilled in a short period but the attitude of human beings takes time to change.

According to Myers (1996), Severy Brigham and Schlenker (1976) defined attitude as an orientation towards an object in one's environment inferred from behavior. Attitude also can be defined as a predisposition to act in a negative or positive way towards a person, object, idea or event. Here in this research paper, the researcher tried to find out the attitude of teachers towards ICT, whether positive or negative and the difference in attitude in relation to area, gender, and experience among teachers. Many studies show that due to a lack of proper infrastructure and proper training, teachers are not able to use ICT in the teaching process, but on the contrary, in some research, it was also found that teachers are reluctant to use ICT despite having ICT facilities in schools. So, teachers who do not have a positive attitude are not interested in using ICT in the teaching process. Whereas they are using the internet for social sites and other works.

According to the International computer and Information Literacy Study (ICILS), Farallon et al. (2014) and other studies found that teachers from different countries and areas use ICT in different frequency.

Review of Literature

Dedun (2013) in his research work, "A study of teacher attitude towards the use of ICT in classroom of secondary school of Sabarkantha District", tried to focus on the teacher's attitude. The objective of the study was to compare the attitude towards the use of ICT in secondary schools' classroom teaching depending on gender, medium of instruction, and organization type. The researcher collected data from secondary school teachers and found that there was a significant difference between male and female teachers towards the use of UCT. Male teachers have more positive attitudes than female teachers. There was a significant difference between granted school and self-financed schools teachers. The study also showed that there is no significant difference between the attitude of Gujrati school and English medium school.

Mwila, P. (2018) assessed the attitudes of secondary school teachers toward the integration of ICT in the teaching process in Kilimanjaro, Tanzania, in the work "Assessing the attitudes of secondary school teachers towards the integration of ICT in the teaching process in Kilimanjaro, Tanzania." The study discovered that male and female teachers had favourable attitudes toward incorporating ICT into their teaching processes. Furthermore, it was reported that there is a link between a teacher's age group and attitudes toward the integration of ICT in the teaching and learning processes. Based on these findings, the study concluded that ICT integration into the teaching process was heavily influenced by teachers' and students' attitudes toward ICT integration; positive ICT attitudes are expected to promote ICT integration in the teaching and learning process. The study recommended that curriculum developers integrate ICT into a curriculum while taking economic, cultural, political, social, educational, and catalytic rationales into account.

Gibson, P. A. et al. (2014), in their work, 'Changing teachers, changing students? The impact of a teacher-focused intervention on student's computer usage, attitudes, and anxiety' found that technology intervention itself had a positive effect on students' attitudes toward and use of computers for educational purposes. The results suggest that it is possible to increase students' attitudes toward computer use through intense interventions aimed at their teachers.

Buabeng, Charls – Andah (2015) in his study "ICT uses in Ghanaian Secondary School", the researcher primarily tried to investigate Secondary School teacher's perspectives towards ICT use. The result shows teachers' low competence in the use of ICT in secondary school. Moreover, the study indicates that male teachers were more competent in ICT than female teachers. Again, the perceived administrative support for women teachers was more than that of male teachers. This study also shows that there is no significant difference in public and private school teachers' access to ICT, administrative support, self-efficiency, competencies and training.

Emergence of the problem

It is found that in different parts of the world, research was carried out to study the attitude of teacher towards use ICT in teaching (Osodo et.al (20101); Suri and Sharma (2017), Dedun (2013). In Assam, studies have been found to carry out about the attitude of university teachers towards the use of ICT in teaching (Moyuri Sarma (2017); Rahman (2022). It is found that very few studies have been conducted regarding the attitude of secondary school teachers towards the utilization of ICT in school education. The secondary stage is the most important stage where scientific outlook and technological skills should be developed in students. And in Assam, most of the students go to provincialised school, and most of the students are from the lower middle class who goes for vocational course and join new job for livelihood. So, teachers should be willing to use ICT in teaching to make future citizens technologically sound. But the researcher, after visiting the secondary school, came to realize that though minimum ICT facilities are provided to school most of the teachers are not using it. The schools are provided with ICT facilities like 10 computers, laptops, projectors, various software, UPS, generator, computer table-chair and other accessories. The researcher also found that many of the computers are not working properly in most of the schools, both urban and rural schools. It is observed that the computer teacher is using the ICT facility at a regular level. So, the researcher wanted to know whether the teachers have positive or negative attitudes towards the use of ICT in teaching. Whether female and senior teachers have a positive attitude towards it. Considering these, the researcher tried to find out the attitude of secondary school teachers of Assam, with special reference to Kamrup districts.

Area of Study

The area of the study is Kamrup District (both the Kamrup Metropolitan and

Kamrup Rural). Kamrup Metropolitan District has an area of 1528 sq. km and a population of approx. 12,60,419 as per the census of 2011, and Kamrup district has an area of 3105 sq. km and a population of approx. 15,17,542 as per the census of 2011. Kamrup Metropolitan is the most developed district of Assam, where the city of Guwahati and Dispur, the capital of Assam, is situated, and Kamrup Rural district is a rural district similar to another rural district. There is lots of difference between the two districts with respect to the developmental pattern, various facility, amenities, socio-economic conditions of the people etc. So, the researcher found it ideal for the proposed study.

Objectives of the study

The objectives for the study are as follows:

i. To study the Attitudinal level of secondary school teachers towards the utilization of ICT in relation to Rural and urban areas
ii. To study the Attitudinal level of secondary school teachers towards the utilization of ICT in relation to male and female gender
iii. To study the Attitudinal level of secondary school teachers towards the utilization of ICT in relation to their age

Research Questions

i. Is there any comparison of attitudinal level between rural and urban secondary teachers towards utilization of ICT?
ii. Is there any comparison of attitudinal level between male and female secondary school teachers towards utilization of ICT?
iii. Is there any comparison of attitudinal level between more experienced and less experienced secondary school teachers towards utilization of ICT?

Hypothesis of the Study

Three (03) hypotheses were formulated on the basis of the objectives of the study as follows:

i. H_{01}: There is no significant difference in the level of attitude towards the utilization of ICT in between urban and rural teachers
ii. H_{02}: There is no significant difference in the level of attitude towards the utilization of ICT in between male and female teachers
iii. H_{03}: There is no significant difference in the level of attitude towards the utilization of ICT in between junior and senior teachers

Methodology

Method: The researcher has adopted the descriptive survey method.

Population: The population of the study is 3329 teachers teaching in 266 provincialized, Assamese medium secondary schools in Kamrup District (Both Urban & Rural) where ICT facilities are provided by the government. All the teachers, both male, female, senior, and junior, teaching different subjects were considered.

Sample: Out of 3329 teachers, 400 teachers were selected as the sample of the study. Out of them, 200 were from urban areas and 200 were from rural areas. A simple random sampling technique has been adopted by the researcher.

Tools: To collect primary data about the attitude of the teachers, the researcher developed an attitude scale. The researcher followed the 5-point Likert-type scale while arranging the statements of the scale. These 5 points are strongly agree, agree, neutral, disagree and strongly disagree. Initially, 100 statements (62 positive and 38 negative) were considered in the scale in 04 dimensions. Pre-piloting of the scale was done, and as a result, out of 100 items, 63 remained by dropping 43

Items and adding 06 items to the scale. After that, the piloting of the statement was performed by distributing the draft scale to 10 secondary school teachers selected purposively from Assamese medium secondary schools where ICT facilities are provided by the government. It is found that 11 statements were not responded to by many of the teachers, maybe these statements are confusing or not bearing proper meaning or are irrelevant. So, these 11 statements were rejected. Hence, a total of 52 statements remained after the piloting. Try out of the scale was done by administering the scale to 100 teachers of provincialized secondary schools where ICT facilities are provided. Item analysis was done, and the 't' value was calculated, and the item with 't' value greater than 1.96 is only accepted. 42 items were found with a 't' value greater than 1.96. So, the final scale consists of 42 statements (22 positive and 20 Negative). The reliability of the final scale was tested by split half method and found as 0.8162, and content validity and languages of the scale were checked by experts. The score for responses for positive statements was given as: strongly agree-5, agree-4, neutral-3, disagree-2 and strongly disagree-1 and for negative statement reversed way, i.e., strongly agree-1, agree-2, neutral-3, disagree-4and strongly disagree-5.

Procedure of data collection: The researcher personally visited the school teachers and distributed the hardcopy of the tool (attitude scale), and they were told to select their own feeling against all 42 statements. It was also said that their data would be kept as secret.

Data Analysis and Interpretation

General Information about ICT Teachers: Personal information about the teachers is given in Table 1.

Table-1: Personal Information about Teachers

Particulars	Options	No. of Teachers	%
Gender	Female	197	49.2
	Male	203	50.8
Age in Years	20 - 29	42	10.5
	30 - 39	125	31.2
	40 - 49	134	33.5
	50 - 60	99	24.8
Qualification	B A	75	20.5
	B A, PGDCA	392	15.0
	B Sc	19	15.4
	B.A, B. Ed	7	1.6
	B Sc, PGDCA	31	7.6
	B Sc, B Ed	87	21.4
	BA, BED	3	0.7
	M A	35	8.4
	M Sc	16	3.9
	M Sc, B. Ed	24	5.6
	M.A, B Ed.	61	14.8
	M. Sc, M. Phil	1	.2
	MA, PGDCA	1	.2
	MA, PhD	1	.2

Experience in Years	5 - 9	100	22.3
	10 - 13	117	29.3
	14 - 17	23	6.8
	18 - 21	81	20.2
	22 - 25	26	6.5
	26 - 29	42	10.5
	30 - 33	20	5.0
	34 - 37	2	.5

a. Around 49.2 per cent of the teacher respondents are female, and nearly 50.8 per cent are male.

b. The age range varies from 20 to 60 years, and the maximum percentage (58.3) varies from 40 to 60 years of age.

c. 82.2 per cent of teachers are found to be Graduates, 32.9 per cent are postgraduates and the rest 0.2 per cent PhD holders.

d. The experience of teachers varies from 5 to 37 years. 58.4 per cent of the teacher's experience ranges between 5 to 17 years.

Location

The locational information about the teacher is given in Table 2.

Table-2: Residing locality of teachers

Particulars		No. of Teachers	%
Location	Rural	200	50.0
	Urban	200	50.0
	Total	400	100.0
District	Kamrup (M)	200	50.0
	Kamrup Rural	200	50.0

50 per cent of the teachers work in rural areas, and the rest in urban areas. Also, 50 per cent of the teachers are from Kamrup (Metro) and the rest from Kamrup (Rural) district.

Occupation related information

The occupation-related information about the teacher is given in table 3.

Table-3: Occupation-related information about teachers

Particulars	Nature	No. of Teachers	%
Appointment Mode	Contractual	106	26.5
	Permanent	294	73.5
TET teacher	No	251	62.8
	Yes	147	36.8
ICT Training	No	257	64.2
	Yes	143	35.8

Availability of ICT at home	No	27	6.8
	Yes	372	93.0
Subject taught	Arabic	1	.2
	Assamese	70	17.4
	Assamese, Hindi	1	.2
	Assamese, Social Science	1	.2
	Assamese, Social Studies	1	.2
	Computer Science	70	17.0
	Computer Science, Hindi	4	0.8
	Computer Science, Social Science	3	0.6
	English	10	2.5
	English and Social Science	3	0.6
	English, Assamese	1	.2
	General Science	1	.2
	Hindi	18	4.5
	Mathematics	86	21.4
	Mathematics, Science	4	1.0
	Sanskrit	5	1.2
	Science	45	11.2
	Science, Mathematics	8	1.9
	Social Science	12	2.7
	Social Science, English	1	.2

1. 73.5 per cent of teacher respondents are found to be permanent, and 26.5 per cent are on contractual appointment.
2. 36.8 per cent of the teachers are found to be TET-qualified teachers.
3. 93 per cent of the teacher respondents stated that they either possess a computer/Laptop at home.
4. A variety of subjects were found to be taught by the teachers based on their qualifications (vide Table 3).

Objective (i): To compare the Attitudinal level of secondary school teachers towards the utilization of ICT in relation to Rural and urban areas

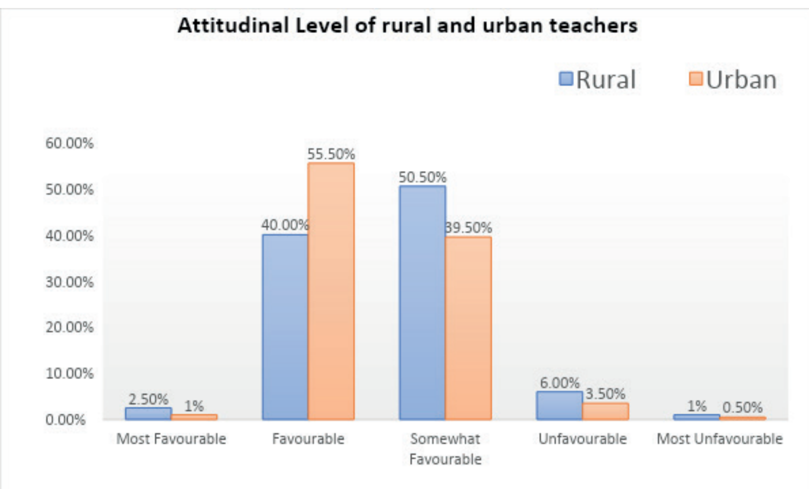
The Attitudinal Level of Rural and urban teachers is given in Table 4.

Table-4: Attitudinal Level of Rural and urban teachers

Range of Z Scores	Attitudinal Level	Rural		Urban	
		No. of Respondents	%	No. of Respondents	%
+2. 68 & above	Most Favourable	5	2.5	2	1.0
+1.38 to +2.67	Favourable	80	40.0	111	55.5
-0.05 to +1.37	Somewhat Favourable	101	50.5	79	39.5
-1.37 to -0.06	Unfavourable	12	6.0	7	3.5
-1.38 & below	Most Unfavourable	2	1.0	1	0.5
		200		200	

It is found that only 2.5 per cent teachers from rural area and 1 per cent of the teachers from urban area have most favourable attitude towards the utilization of ICT. 38.5 per cent from rural areas and 55.5 per cent of the teachers from urban areas have favourable attitudes, and 48.5 per cent from rural areas and 39.5 per cent of the teachers from urban areas have somewhat favourable attitudes (shown in Table 4). Only 3.5 per cent from rural areas and 9.5 per cent of the teachers from urban areas have unfavourable attitudes, and 0.5 per cent from rural areas and 1 per cent of the teachers from urban areas have the most unfavourable attitudes towards the utilization of ICT. The table depicts the attitudinal Level of rural and urban teachers shown in Fig. 1.

Figure-1: Attitudinal Level of rural and urban teachers



Objective (ii): To compare the Attitudinal level of secondary school teachers towards the utilization of ICT in relation to male and female gender

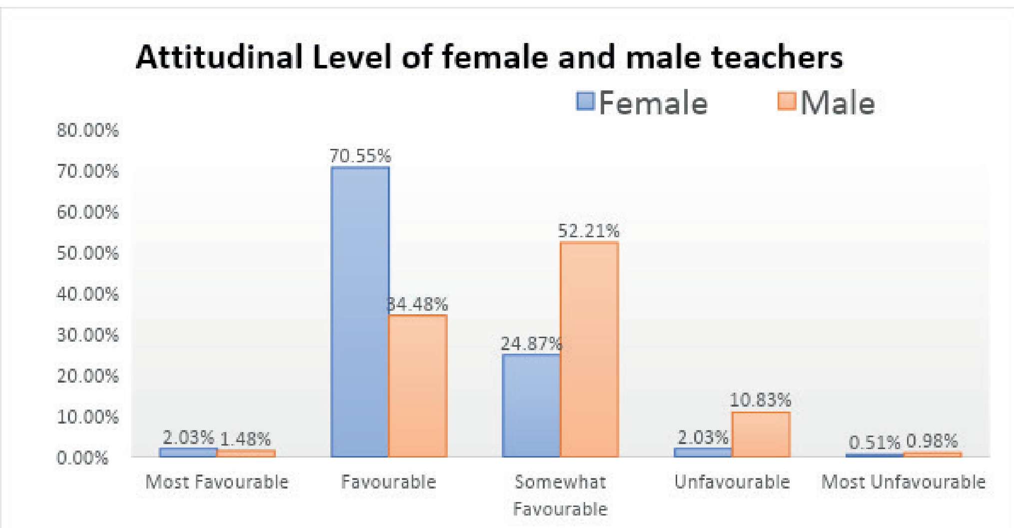
Attitudinal Level of female and male teachers is given in Table 5.

Table-5: Attitudinal Level of female and male teachers

Range of Z Scores	Attitudinal Level	Female		Male	
		No. of Respondents	%	No. of Respondents	%
+2. 68 & above	Most Favourable	4	2.03	3	1.48
+1.38 to +2.67	Favourable	139	70.55	70	34.48
-0.05 to +1.37	Somewhat Favourable	49	24.87	106	52.21
-1.37 to -0.06	Unfavourable	4	2.03	22	10.83
-1.38 & below	Most Unfavourable	1	0.51	2	0.98
		197		203	

It is found that nearly 2 per cent of the female teachers and around 1.5 per cent of the male teachers have a most favourable attitude towards the utilization of ICT; near about 70.6 per cent of the female teachers and around 34.5 per cent of the male teachers have favourable attitude; and 24.9 per cent of the female teachers and around 52.2 per cent of the male teachers have somewhat favourable attitude. Only 2 per cent of the female teachers and around 11 per cent of the male teachers have unfavourable attitudes, and 0.5 per cent of the female teachers and around 1.0 per cent of the male teachers have the most unfavourable attitude towards the utilization of ICT. The attitudinal Level of female and male teachers is graphically shown in Fig. 2.

Figure-2: Attitudinal Level of female and male teachers



Objective (iii): To compare the Attitudinal level of secondary school teachers towards the utilization of ICT in relation to their age

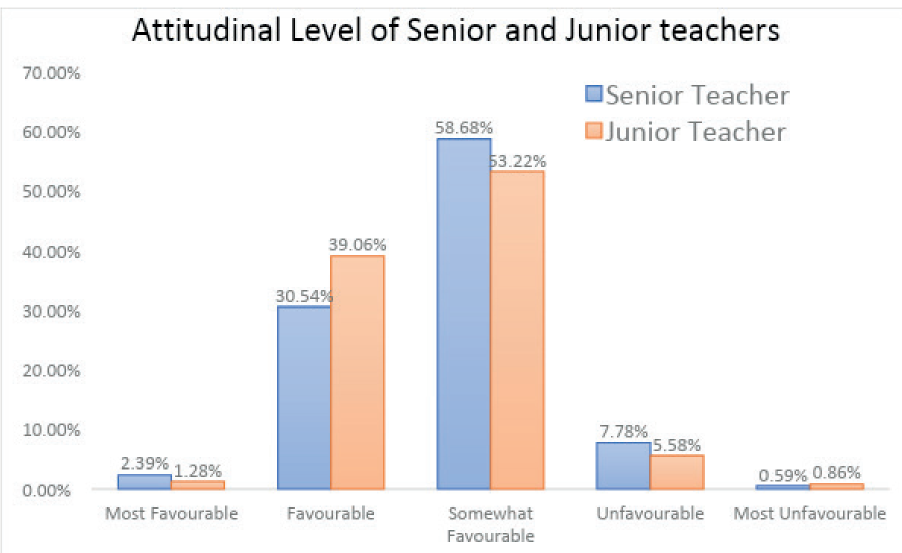
Attitude of senior and junior secondary school teachers towards the utilization of ICT is given in Table 6.

Table-6: Attitudinal Level of senior and junior teachers

Range of Z Scores	Attitudinal Level	Senior teachers		Junior teachers	
		No. of Respondents	%	No. of Respondents	%
+2. 68 & above	Most Favourable	4	2.39	3	1.28
+1.38 to +2.67	Favourable	51	30.54	91	39.06
-0.05 to +1.37	Somewhat Favourable	98	58.68	124	53.22
-1.37 to -0.06	Unfavourable	13	7.78	13	5.58
-1.38 & below	Most Unfavourable	1	0.59	2	0.86
		167		233	

In the present study the teachers who fall in between 20 to 39 years are considered as junior and in between 40 to 60 years is senior teacher. more than 2 per cent of the senior teachers and around 1.5 per cent of the junior teachers have the most favourable attitude towards the utilization of ICT; near about 30.5 per cent of the senior teachers and around 39.6 per cent of the junior teachers have a favourable attitude; and 58.6 per cent of the senior teachers and around 53.2 per cent of the junior teachers have somewhat favourable attitude. Nearly 8 per cent of the senior teachers and around 6 per cent of the junior teachers have an unfavourable attitude, and 0.6 per cent of the senior teachers and around 0.9 per cent of the junior teachers have most unfavourable attitude towards the utilization of ICT. Graphically it is shown in Fig 3.

Figure-3: Attitudinal Level of Senior and junior teachers



Hypothesis (i): H_{01}: There is no significant difference between the attitude of urban and rural teachers towards the utilization of ICT in secondary schools.

In order to justify this hypothesis, collected data are subjected to statistical analysis to test the significance. 't-test is conducted with the available information put forward in Table 7.

Table-7: Attitude of urban and rural teachers towards the utilization of ICT

Category	N	Mean	Standard Deviation	df	't' value	Significance
Rural	200	150.51	15.503	398	0.501	Not Significant
Urban	200	149.86	10.102			

The calculated value of 0.501 is less than the tabulated value of 1.96 at 0.05 level, the null hypothesis is accepted. Thus, it follows that there exists no significant difference between the attitude of urban and rural teachers towards the utilization of ICT in secondary schools.

Hypothesis (ii): H_{02}: There is no significant difference between the attitude of male and female teachers towards the utilization of ICT in secondary schools of Kamrup district.

In order to justify this hypothesis, collected data are subjected to statistical analysis to test the significance. 't-test is conducted with the available information put forward in Table 8.

Table-8: Attitude of male and female teachers towards the utilization of ICT

Category	N	Mean	Standard Deviation	df	't' value	Significance
Female	197	145.27	10.587	398	7.966	Significant at 0.01 level
Male	203	154.95	13.507			

As the calculated value of 7.966 is greater than the tabulated value of 2.58 at 0.01 level, the null hypothesis is rejected. Thus, it follows that there is a significant difference between the attitude of male and female teachers towards the utilization of ICT in secondary schools of Kamrup district.

Hypothesis (iii): H_{03}: There is no significant difference between the attitude of senior and junior teachers towards the utilization of ICT in secondary schools of Kamrup district.

In order to justify this hypothesis, collected data are subjected to statistical analysis to test the significance. 't-test is conducted with the available information put forward in Table 9.

Table-9: Attitude of senior and junior teachers towards the utilization of ICT

Category	N	Mean	Standard Deviation	df	't' value	Significance
Senior teachers	167	151.05	13.140	398	1.124	Not Significant
Junior teachers	233	149.56	13.015			

As the calculated value of 1.124 is less than the tabulated value of 1.96 at 0.05 level, the null hypothesis is accepted. Thus, it follows that there exists no significant difference between the attitude of senior and junior teachers towards the utilization of ICT in secondary schools.

Findings

Following are the findings of the present study

a. Attitudinal level of rural teachers found to be favorable among 93 per cent, and in urban areas, it is 96 per cent.

b. Among the female teacher's attitudinal level is favorable at 97.45 per cent, and that of male teachers is 88.17 per cent.

c. 91.61 per cent of senior teachers and 93.56 per cent of junior teachers have favorable attitude towards the utilization of ICT

d. There exists no significant difference between the attitude of urban and rural teachers towards the utilization of ICT in secondary schools of Kamrup district

e. There exists a significant difference between the attitude of male and female teachers towards the utilization of ICT in secondary schools of Kamrup district.

f. There exists no significant difference between the attitude of senior and junior teachers towards the utilization of ICT in secondary schools.

Discussion

The study shows that all the teachers from the rural and urban areas of Kamrup District have favorable attitudes towards the utilization of ICT in secondary schools. The findings of the present study are supported by findings of different studies as learned from the review of the literature. The findings of the present study that there exists no significant difference between the attitude of urban and rural teachers towards utilization of ICT in secondary school teachers are supported by Aggarwal and Ahuja (2013) in their research study, "Attitude of students – teachers towards the use of ICT and its impact on academic achievement". The findings of the present study that no difference exists between the attitude of the junior (unexperienced) and senior (experienced) teachers is supported by the study done by Ahmed Showkat (2014) in "A study of secondary school teachers' attitude towards information and communication technology (ICT) in Jammu and Kasmir". Again, a significant difference between the attitude of male and female secondary school teachers is found in the study. Female teachers are having more favourable attitude than males as found. This is supported by a research study in Arunachal Pradesh done by Ms. Ligang Suniya (2018). It is also supported by the findings of Angadi (2014), Dedun (2013), Sadik (2006). But on the contrary, the studies like Parmar (2015), Yusuf & Balogun (2011), Tesci (2014) found that there is no gender difference in attitude towards the utilization of ICT in education. It is observed that though ICT facilities are not adequate to meet the needs of students but still the teachers were showing a positive attitude towards the utilization of ICT in secondary schools of Kamrup district in Assam in different dimensions including teaching-learning process, school administration, school-related communication, and personal development.

Conclusion

This study reveals that the attitude of the teacher about the use of ICT in school education depends on how much they are confident about using it in school. And also depend on to what extent teachers are using ICT in their day-to-day life and professional life. From the study, it has been clear that a maximum number of teachers are having computers or laptops for personal use. They are aware of the fact that by using ICT, they can transfer the information to the students in a fruitful manner. And ICT become beneficial for school administration and communicating people too. It is a good sign that teachers from rural areas and senior teachers are also having positive attitudes toward ICT use. It is found that female teachers have a more positive attitude towards the utilization of ICT. As Assam is a state where women are also given priority for all school activities, and it was found during data collection most of the computer teachers were female and were in view that they should be given proper training to use ICT and they use ICT facilities whatever available with the help of other teachers if needed. The result of the study also showed that senior teachers or aged teachers had positive attitudes and there was no significant difference between both groups of teachers. It may be the result of the pandemic situation. Because during the pandemic lockdown, they used online tools and made the best use of ICT to maintain the continuity of course, and the same may be the reason exist no difference in the attitude of rural and urban teachers. During data collection, the researcher got an opportunity to talk to the teachers, and most of the senior teachers, both in urban and rural areas had a view that due to the situation created by Covid19 pandemic, they had to learn how to use ICT tools for teaching purpose. And teachers have a positive attitude to continue the online classes to overcome the natural challenges and maintain the continuity of regular classes. It has been found from the observation during the data collection that most of the computers are not in working condition and not well-maintained too. But it is a good sign that the teachers have a positive attitude, and if proper facilities are provided and improves the maintenance of provided facilities by the concerned authority and proper training is provided to teachers, they can use the best of ICT facilities for teaching as well as for other school activities.

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Annexure

(This is for information only to the reviewer. Not a part of the paper)

Attitude Scale—Statement (42) and Responses

Sl. No.	Statement	Response (Kindy tick one)				
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	ICT tools helps in classroom management					
2.	ICT tools improve the standard of teaching					
3.	Use of ICT tools in classroom would help me to be a better teacher					
4.	I like to encourage my students to use computer					
5.	I do not feel more confident using ICT tools in my classroom					

6.	I can teach better without the help of ICT tools					
7.	Use of ICT has increased my good relation with fellow teachers					
8.	I got easily bored while teaching with ICT tools					
9.	I feel, student get bored when ICT tools are used in classroom					
10.	I feel use of ICT provide better access to information for teaching					
11.	ICT use can make classroom teaching more interesting					
12.	I think ICT can take the place of teacher					
13.	I think ICT cannot replace teacher					
14.	ICT has brought positive changes in education system					
15.	ICT tools can motivate the students to learn					
16.	Use of ICT can make teaching more enjoyable					
17.	I feel use of ICT has no influence in my teaching process					
18.	I can teach better without using ICT tools					
19	Use of ICT in school is just wastage of time					
20.	I do not get time to use ICT tools due to my work load in school timing					

21.	ICT provide new information to teachers for teaching purpose					
22.	One can become better teacher after using ICT tools in classroom teaching					
23.	ICT makes education accessible to all					
24.	Only trained teachers can use ICT properly in school					
25.	ICT based education in the secondary schools is not a matter of importance					
26.	Using ICT, the teachers can be more enthusiastic					
27.	ICT has decreased the book reading habit of students					
28.	ICT has reduced the writing skill of students					
29.	ICT encourage self-learning among students					
30.	It is difficult for me to use ICT tools in my classroom					
31.	Using ICT tools, one can teach more in less time					
32.	ICT is main factor of modernization					
33.	Our future generation should be skilled in use of ICT					
34.	It is not easy to incorporate ICT in secondary schools of Assam					

35.	Use of ICT can increase communication among teachers and students					
36.	Use of ICT can decrease communication between teachers and students					
37.	ICT do not fulfill the intellectual needs of students of secondary school in proper way					
38.	School administration can be more organized by using ICT					
39.	ICT can be used to impart quality education					
40.	Use of ICT tools does not help me in my teaching process					
41.	Training for operation of ICT tools is not important for me to teach in a better way					
42.	Use of ICT increases laziness among students getting all information easily					

Research Article

Technology Enabled Capacity Building for Teachers in Inclusive Evaluation: UDL Best Practice

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Abstract

As we all know, Universal Design for Learning (UDL) is an approach to teaching and learning that gives all students an equal opportunity to succeed. The present study is an experimental attempt to examine the significance of Universal Design for Learning (UDL) principles in inclusive evaluation. To strengthen the difficulties faced by the teachers in inclusive evaluation, the investigator adopted the purposive sampling method in the study entitled "Technology Enabled Capacity Building for Teachers in Inclusive Evaluation: UDL Best Practice." This sampling technique can be effective in exploring anthropological situations where the discovery of meaning can benefit from an intuitive approach. Thirty-two participants of the research were chosen from Noida, U.P government, and non-government schools. Out of these, 15 were male teachers and 17 were female teachers who were made into two groups; the same participants were divided by qualification; 15 teachers were qualified with undergraduate, and the remaining 17 were post-graduate teachers. 16 teachers were employed in government schools, and the other half of teachers (16) were working in non-government schools. The independent variables of the study were teachers' gender, qualification and school of employment. A quasi-experimental design was adopted for the research; there was no control group. The main aim of the study is to analyze the challenges of teachers in the technology-incorporated evaluation process and build digital capacity with the help of Universal Design for Learning (UDL) principles to create an equitable, inclusive learning environment.

Keywords: Teacher competency, Inclusive Education, Technology Enablement, UDL, Capacity Building, and Digital Evaluation.

Introduction

The modern curriculum focuses on student-centric teaching and learning. Many Western countries are providing self-paced learning for their students. This millennium is evidencing great transformation from the ancient teaching method, which was teacher-centric bureaucratese. The technology ensures a global standard in education as reflected in the digital curriculum. As we all know, Universal Design for Learning (UDL) is an approach to teaching and learning that gives all students an equal opportunity to succeed. In short, Universal Design for Learning (UDL) helps in the creation of an inclusive teaching-learning environment. In CAST's Universal Design for Learning: Theory and Practice, assessment is defined as "the process of gathering information about a learner's performance to make educational decisions" (*Salvia* & *Ysseldyke,* 2009). Sustainable Developmental Goals (SDG) 2040 highlights inclusive education; many Acts and policies are supported, including the Rights for Persons with Disabilities (RPwD) Act 2016, National Educational Policy (NEP) 2020. It is high time for educational institutions to look into digital evaluation processes to access inclusive student performance. Several studies focused on digital evaluation in the Western context but, not in the Indian context. While adopting the Western system, teachers of our nation need to be properly trained to meet the challenges. In this context, the present study aims to analyze the challenges of teachers in technology incorporated evaluation process and build digital capacity with the help of Universal Design for Learning (UDL) principles to create an equitable, inclusive learning environment.

Need for the Study

Technology brings the world under one roof; we can learn anything with a finger touch. It laid the foundation for globalization. Thus, globalization in education brings enormous changes to the Indian education system. Our education system is ancient and has a long-rooted history, which is bound by traditional methods of teaching and learning. Great thinkers and philosophers are evident in this traditional curriculum. Westernization of Education seeds the modern curriculum by adopting the traditional method of teaching and learning is also often referred to as the learner-centric method. This leads to technology-enabled classrooms and teachers are trained. Universal Design for Learning (UDL) helps in the creation of inclusive teaching-learning environments in both offline (classroom) and online teaching. During the COVID-19 pandemic situation, online teaching and learning succussed because of this technology enablement in school and higher education, including the research community. It is high time for India, like developing countries, to enable technology in the evaluation process as developed countries. This study mainly aims to build digital competency among inclusive teachers to enable them in the technology-based evaluation process from the primary level itself by scaffolding Universal Design for Learning (UDL) principles.

Objectives of the Study

The following are the major objectives of the experimental study.

- To measure the inclusive teachers' competency in technology-enabled evaluation
- To develop appropriate material to access the inclusive teachers' competency in the digital evaluation.
- To compare the inclusive teachers' competency in digital evaluation based on gender, qualification and type of school they were employed.
- To build digital competency among inclusive teachers to enable them in the technology-based evaluation process by scaffolding Universal Design for Learning (UDL) principles.
- To compare the teachers' digital competency in the pre-test and post-test phases.
- To provide need-based training for teachers on digital evaluation for the fruitful inclusion concept by incorporating Universal Design for Learning (UDL) principles.

Hypothesis of the Study

The null hypothesis framed for the testing of objectives is as follows:

1. There is no significant difference in the teachers' capacity for inclusive evaluation in pre-test and post-test, according to gender.

2. There is no significant difference in the teachers' capacity for inclusive evaluation in pre-test and post-test, according to qualification.

3. There is no significant difference in the teachers' capacity for inclusive evaluation in pre-test and post-test, according to the school.

Review of Literature

Liyan Feng and team 2013 examined the effectiveness of electronic evaluation in 53 schools in Kaohsiung City, Taiwan. They found that 50 per cent of the schools are using digital portfolios for evaluation. A total of 56.10 per cent of the teacher participants of the study reported high professional growth activities. In their study, Fatma Cumhur and Sefika Sumeyye Cam 2021 explored the digital transformation in the assessment and evaluation process with 52 student teachers in the faculty of education in Turkey. A mixed method research design is followed for the study through quasi-experiment. The result reveals that digitalized evaluation is effective and accurate. Similarly, Nonmanut Pongsakdi, Arto Kortelaninen, and Marjaana Veermans (2021) aimed to explore the Enhancement of the skills of teachers in digital assessment tools. About 98 teachers are chosen for the study from Finland. The results of the study highlight that teachers' digital skills depend on their ICT confidence level.

Materials and Methods

Method: Quasi-experimental design is followed for the present study. The participants of the study were chosen by purposive sampling method. The study is new to the Indian context, thus, the researcher chose the purposive sampling method. This sampling technique can be effective in exploring anthropological situations where the discovery of meaning can benefit from an intuitive approach.

Sample: The 32 teachers from various regions of Noida, UP, were identified from the out-reach data record of SASR India, Faridabad, Haryana, as part of Community Promotional Activities. Out of these, 15 male teachers and 17 female teachers were made into two groups; the same participants were divided by qualification; 15 teachers were qualified with undergraduate, and the remaining 17 were post-graduate teachers. 16 teachers were employed in government schools, and the other half of teachers (16) were working in non-government schools. The ethical clearance was also sought for the study.

Material

i. Universal Design for Learning-Digital Evaluation (UDL-DE) Tool.

ii. Universal Design for Learning-Digital Evaluation Training (UDL-DET).

Description

A checklist was prepared with close-ended questions developed by the investigators and was named as Universal Design For Learning- Digital Evaluation (UDL-DE) Tool. The UDL-DE tool has three components i) accountability, ii) student progress, and iii) instruction. These were prepared based on Universal Design for Learning principles; multiple means of engagement, multiple means of action and expression, and multiple means of representation. This UDL-DE tool is administrated to the teachers in the pre-test and post-test phases. The chosen independent variables of the study are teachers' gender, qualification, and school of employment. A quasi-experimental design is adopted for the research; there is no control group. UDL-enabled digital training, named as Universal Design for Learning- Digital Evaluation Training (UDL-DET), is given to the teachers to build digital competency in the inclusive evaluation process. The data collected from the teachers in the pre-test and post-test phases were recorded. Statistical techniques were applied, and the results of the analyzed data were tabulated and presented in a pictorial form.

Limitations of the Study

- The sample of the study is small size. The purposive sampling method limits the participation of the other teachers.
- In quasi-experimental design, participants are not randomized to the intervention named UDL-DET. Thus, this method may lead to systematic biases and influence the group membership. So, further research can be carried out with a true experimental method with control groups.
- The study focused only government, and non-government schools of Noida, U.P.
- Special school teachers are excluded from the study.
- The teachers who were unwilling to participate in the pre-test and the post-test phases were not included in the study.

Result and Discussion

The demography of the teachers is given in Table no: 1 with numbers and percentages.

Table-1: Distribution of Participants with Number and Percentage

S.No	Area	Level	Number	Percentage
1.	Gender	Male	15	47%
		Female	17	53%
2.	Qualification	Under-Graduate	15	47%
		Post-Graduate	17	53%
3.	School	Government School	16	50%
		Non-Government School	16	50%

Figure-1: Distribution of Teachers Based on Gender

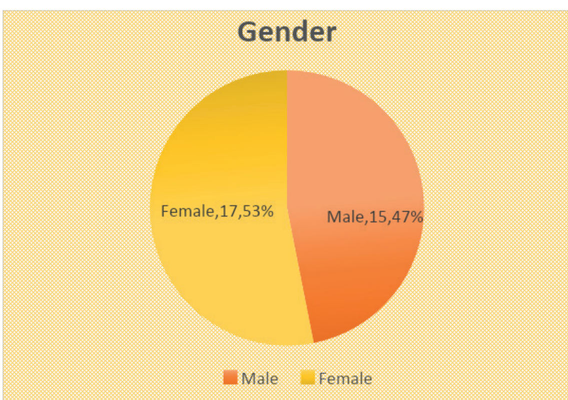

Figure-2: Distribution of Teachers Based on Qualification

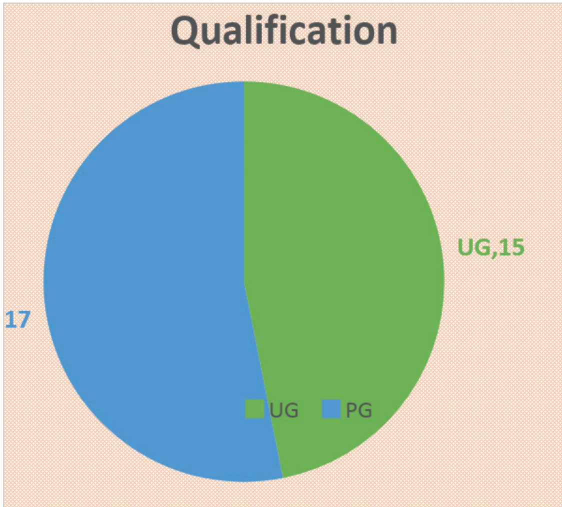

Figure-3: Distribution of Teachers Based on Schools

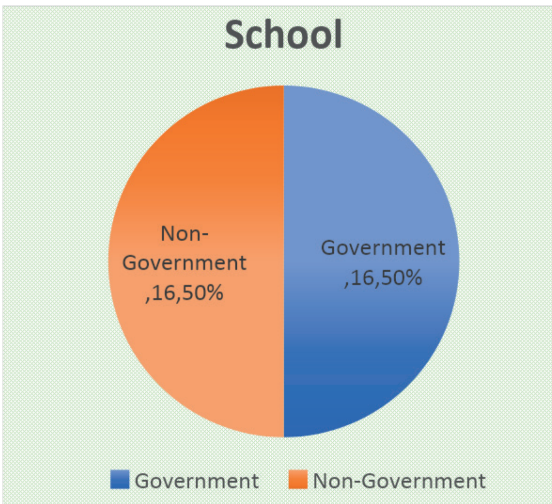

Table-2: Pre-test and Post-test Scores of Teachers in Technology-enabled Inclusive Evaluation Based on Gender

Gender	N	Test	Mean	SD	t-test Significance	P-Value
Male	15	Pre-test	19.13	3.98	-3.42*	.000974
		Post-test	23.47	2.87		
Female	17	Pre-test	17.65	3.95	-3.24*	.001382
		Post-test	23.65	3.08		

*Significant at 0.05 level

Table no: 2 describes the male and female teachers' pre-test and posttest mean scores and SD with t-value in the technology-enabled inclusive evaluation. The male teacher's pre-test mean score was foubd to be 19.13 with 3.98 SD, whereas the female got 17.65 by administrating the UDL-DE tool. This difference shows that both male and female teachers have different levels of competency in digital evaluation. In the post-test, mean scores of males were 23.47, and for females it was 23.65. Female teachers made an extra effort in UDL-DET, which resulted in high post-test scores. The t-value of males was -3.42, and -3.24 for females which were significant at 0.05 level. Thus, the null hypothesis stated that, "there is no significance difference among the teachers' capacity on inclusive evaluation in pre-test and post-test according to gender," is rejected.

Figure-4: Gender-wise Scores of Teachers in Technology-enabled Inclusive Evaluation

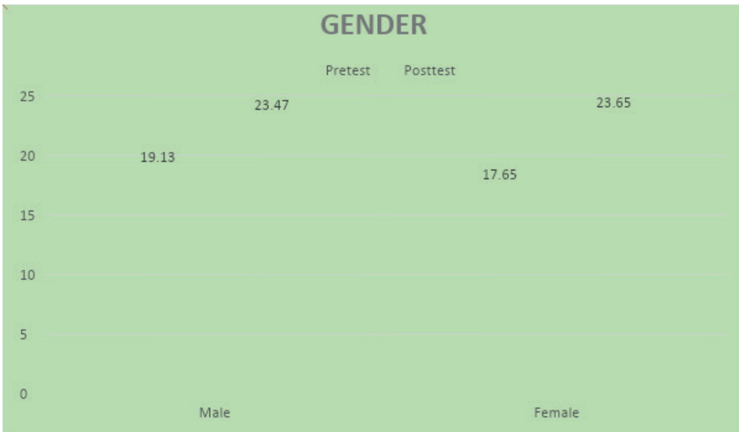

Table-3: Pre-test and Post-test Scores of Teachers in Technology-enabled Inclusive Evaluation Based on Qualification

Qualification	N	Test	Mean	SD	t-test Significance	P-Value
UG	15	Pre-test	17.03	3.79	-3.34*	.001179
		Post-test	21.53	3.52		
PG	17	Pre-test	19.47	3.89	-3.47*	.000756
		Post-test	23.65	3.08		

*Significant at 0.05 level

Table no: 3 presents the teachers' competency in the digital evaluation process based on UDL in the UDL-DE tool. For teachers with UG qualifications, the pre-test mean score is 17.03, and the post-test score is 21.53 with .001179 p-value; for teachers with PG qualifications, 19.47 is the pre-test score, and 23.65 is the post-test score. While analyzing the scores, teachers with PG qualifications got high scores in the pre-test and post-test phases; this may be due to the academic exposure gained as part of the Master's Degree program and the impact of UDL-DET. The pre-test t-vale was -3.34, and the post-test value was -3.47. Both were significant. This significant reference of teachers with UG and PG qualifications made the investigator reject the null hypothesis: "There is no significant difference among the teacher's capacity on inclusive evaluation in pre-test and post-test according to qualification.

Figure-5: Qualification-wise Scores of Teachers in Technology-enabled Inclusive Evaluation

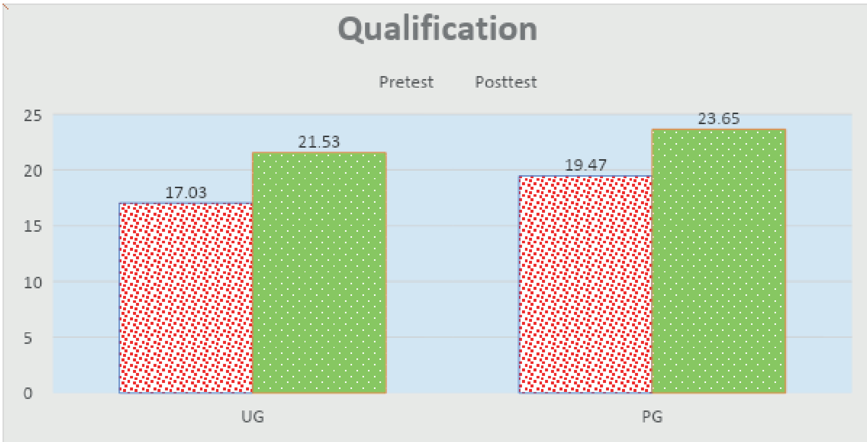

Table-4: Pre-test and Post-test Scores of Teachers in Technology-enabled Inclusive Evaluation Based on the Type of School

School	N	Test	Mean	SD	t-test Significance	P-Value
Government	16	Pre-test	19.44	4.02	-3.46*	.000813
		Post-test	23.69	2.82		
Non-Government	16	Pre-test	17.25	3.73	-3.32*	.001186
		Post-test	21.62	3.72		

*Significant at 0.05 level

Table No: 4 portrays the mean score and SD with t and p values of the teachers scored in the pre-test and post-test by UDL-DE Tool. The government school teachers' pre-test score is 19.44 for non-government school teachers 17.25 with 3.73 SD. The post-test scores are 23.69 for government school teachers with -3.46 t-value 21.62 for non-government school teachers with -3.32 t-value. Both the t-values were significant at 0.05 level. In both the pre-test and post-test phases, government school teachers performed high while compared to non-government school teachers. This shows that government school teachers have more opportunities for refresher and in-service training, whereas the opportunities are minimal for non-governmental school teachers. UDL-DET has a higher impact on government school teachers. Hence, the null hypothesis stated, "there is no significance difference among the teacher's capacity on inclusive evaluation in pre-test and post-test according to school," is rejected.

Figure-6: School-wise Scores of Teachers in Technology-enabled Inclusive Evaluation

Findings and Conclusion

In the participants' group, 47 per cent were male, and the remaining 53 per cent were female teachers from government and non-government schools of Noida, UP. 47 per cent of the teachers were qualified with under graduation, and 17 of them were with post-graduation, which means 53 per cent of the study were participants. 50 per cent of the teachers were employed in government schools of Noida and the remaining 16 teachers were from non-government schools. Several studies focused on digital evaluation in a Western context but, not in the Indian context. While adopting the Western system, teachers of our nation should be properly trained to meet the challenges. Male teachers' pre-test mean score was 19.13 with 3.98 SD, whereas females got 17.65 in UDL-DE Tool. This difference shows both male and female teachers have different levels of competency in digital evaluation. While planning the training program, the stakeholders should give some special focus on female teachers, in a post-test mean score of males 23.47 and females 23.65. Female teachers made an extra effort in UDL-DET, which resulted in higher post-test scores.

For teachers with UG qualifications pre-test mean score is 17.03, and the post-test score was 21.53 in the UDL-DE Tool assessment. .001179 p-value, for teachers with PG qualification also, 19.47 is the pre-test score, and 23.65 is the post-test score. While analyzing the scores, teachers with PG qualifications got high scores in the pre-test and post-test phases; this may be due to the academic exposure gained as part of the Master's Degree program. This shows that UDL-DET has a higher impact among teachers with PG qualifications. Bachelor's Degree programs should strengthen the curriculum with digital evaluation to prepare their teacher trainees to meet the challenges of technology-enabled inclusive evaluation. The government school teachers' pre-test score was 19.44 and for non-government school teachers 17.25 with 3.73 SD. The post-test scores were 23.69 for government school teachers with -3.46 t-value 21.62 for non-government school teachers with -3.32 t-value. Both the t-values were significant at 0.05 level. In both the pre-test and post-test phases, government school teachers performed highly as compared to non-government school teachers. This shows that government school teachers have more opportunities for refresher and in-service training, whereas the opportunities are minimal for non-governmental school teachers. These training programs helped the government school teachers in UDL-DET. The non-government school teachers should also be provide with the same opportunities as government school teachers w.r.t the training programs. Marjaana Veermans (2021) also states that teachers' digital skills depend on their ICT confidence level. Thus, the study helped inclusive teachers to increase their digital competency through UDL-DET.

Suggestions

- Most research studies focused on digital evaluation in a Western context, not in the Indian context. While adopting a Western system of grading, teachers of our nation should be properly trained to meet the challenges.
- While planning the digital training program, the stakeholders should give some special focus and additional training to female teachers and teachers with disabilities.
- The digital training should incorporate Universal Design for Learning principles.
- Bachelor's Degree programs should strengthen the curriculum with digital evaluation to prepare their teacher trainees to meet the challenges in technology-enabled inclusive evaluation.
- Non-government school teachers should also be provided with the same opportunities as that of government school teachers w.r.t training programs like pre-service, in-service and refresher courses.
- The training should be practical rather than theoretical.
- The digital training can be in both the forms; off-line (center or institutional-based) and online with low cost or no cost.

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Research Article

Online Training as a Strategy for Continuous Professional Development (CPD) of Teachers

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Abstract

The role of a teacher is regarded as one of the most demanding professions across the globe. Providing appropriate training to the teacher workforce is imperative to their physical, emotional, and mental well-being (UNESCO ICT Framework for Teachers, 2011). The National Education Policy (NEP) 2020 recognizes the need for Continuous Professional Development (CPD) of teachers on innovative pedagogies and digital technologies, due to which there are several efforts taken up at the national and international levels. During the pandemic, a sudden pressure on teachers and educators to use technology for teaching-learning provided ample opportunity and enhanced the scope of online training. There were a large number of online training planned and executed by various organizations and individuals to build the digital competency of teachers and educators. Several researchers have shown online training as an effective strategy for creating awareness. In the context of India, where there is a dearth of digital infrastructure and digital competencies among teachers and educators, it is essential to study the impact of online training as a strategy for capacity building of stakeholders in the use and integration of Educational Technology (ET) and Information Communication Technology (ICT) for teaching and learning. This research article aims to address this need by exploring the efficacy of online training as an alternative strategy for capacity building in the use of ET and ICT in educational settings. Hence a series of online training programs were conducted, and the response to such training was studied. Though the training was attended by most of the learners - teachers, and educators on their interest and motivation, the number of enrolment in these training programs reveals that there is a demand for online training for upscaling their competencies. The results of the study reveal that the representation of trainees of 36 states/ UTs in some training was encouraging. The data also indicates that participants from only 50 per cent of the states/ UTs participated consistently. Also, the data shows that the modality of communication and advocacy was found to play a crucial role in enhancing participation. Results revealed that nearly 60 per cent of the participants were found to achieve the expected performance in the post-training assessment. It may be interpreted that the online training program is an effective strategy for large-scale capacity building and enhances the overall scope for self-learning modalities. To reach out to a large number of beneficiaries in a very short period without much financial or physical constraint, online training of teachers and educators was found as a better strategy for creating awareness of the use and integration of ET and ICT. The findings of this study have the potential to make a significant impact on educational practices by shedding light on the effectiveness of online training in fostering awareness and proficiency in ET and ICT usage.

Keywords: ICT Training, Online Training, Capacity Building, Continuous Professional Development (CPD), Educational Technology

Introduction

Although the digitalization of education has been at its peak for the last decade, its dissemination has seen exponential progress, especially during the pandemic (COVID-19). The pandemic has compelled teachers and educators to adopt and adapt online and hybrid teaching environments, necessitating comprehensive training to equip teachers with modern digital tools and pedagogical approaches. However, providing such training presents a complex task, as it requires teachers to relearn behaviors, skills, and break patterns to enhance their professional development. This transformation is time-consuming, considering the cognitive and socio-cultural patterns ingrained in their teaching practices over the years (Darling-Hammond, 2017). Despite recognizing the importance of teacher training for technology integration in the classroom, the implementation and management of such interventions have been uneven. To address this challenge, it is crucial to prioritize ongoing professional development programs and support teachers with strategies like mentoring, collaboration, and communities of practice (Zhao et al., 2002). By empowering teachers with the necessary skills, they can effectively leverage technology to solve real classroom problems, enhance students' learning experiences, and advance their competencies (Levin & Wadmany, 2006).

Integrating technology in education and cultivating effective pedagogical techniques further enhance teacher effectiveness (Hattie, 2009; Ertmer, 2005). Policymakers and educational institutions shall invest in evidence-based teacher capacity-building programs to empower a skilled and motivated educator workforce, contributing significantly to the nation's educational excellence (Marzano et al., 2001; OECD, 2019). It is imperative to develop the professional skills of the teachers in light of the enormous number of qualified educators necessary to achieve UNESCO's Sustainable Development Goal 4 (UNESCO, 2017) and implement the recommendations of India's National Education Policy (MHRD, 2020). The COVID-19 epidemic forced a shift towards digital teaching and learning. As a result, the need to build digital competencies of teachers and educators has potentially increased. Along with the present changes in the educational landscape, teachers' roles will continue to evolve. To meet the demands of today's teaching and learning, it is crucial to build the capacity of teachers to flourish in change and innovation.

Online training provides a flexible and accessible platform for teachers, educators, and other learners to acquire the necessary skills and competencies at their own pace and convenience. Therefore, online training can serve as a catalyst for improved pedagogy and enhanced learning outcomes. By identifying the strengths and limitations of such a self-learning strategy, this research can inform the development of more targeted and effective training programs that align with the needs of teachers, educators, and other learners. Ultimately, the goal is to create an educational ecosystem where ET and ICT are seamlessly integrated, enriching the teaching and learning experiences and preparing learners for the challenges and opportunities of the digital age and future skills.

Need for Online Capacity Building on ET/ ICT

According to Fazekas and Burns (2012), as cited in the OECD Report, capacity building refers to the process of learning and knowledge production among various stakeholders in the education sector. Teachers, the main conveyors of knowledge, play a vital role in shaping students' intellectual development. Therefore, providing suitable training and professional development opportunities is essential for their physical, emotional, and mental well-being (UNESCO ICT Framework for Teachers, 2011). Research has shown a positive link between teacher professional development and student achievement in various subjects and grade levels (Darling-Hammond et al., 2017).

The COVID-19 epidemic has affected practically every nation. India had difficulties as a result of the unexpected transition to online education, much like many other nations globally (Dadhe & Patil, 2021). The use of ICT in educational settings has the potential to enhance instruction, performance, and learning (Yadav, 2023). Teachers need to be technologically proficient and have a strong understanding of pedagogy to engage students in ways that help them acquire the necessary information, skills, and attitudes (Mishra et al., 2019). Technology-based pedagogy integration is an important step in establishing ICT capability for education to fulfill demands (Byungura et al., 2016). A dedicated teacher attempts to advance Continuous Professional Development (CPD). The need for professional development stems from teachers' passion for their profession and the ingrained belief that they are lifelong learners (Shankar, 2022). ICT must be significantly integrated into educational settings (Pandey et al., 2022).

The government of India has urged educational institutions to undertake online education using ICT amid the pandemic emergency (Subaveerapandiyan & Nandhakumar, 2021). ICT has changed the globe more than any other contemporary technology. ICTs have had a significant impact on the sphere of education, undoubtedly changing the entire educational process. As a result, if teachers want to effectively employ cutting-edge techniques and technology for aspiring teachers, they must possess a positive attitude in addition to a sufficient understanding of and experience with ICT tools and equipment (Beri & Sharma, 2019). Gupta & Singh (2018) have pointed out that a significant number of teachers and students lack the necessary competency to effectively utilize e-learning tools. This deficiency can hinder the full realization of the potential benefits of ICT in education. Gupta's study (2019) further emphasizes that providing teachers with appropriate training in using e-learning tools and incorporating ICT components into their teaching practices can lead to a substantial positive impact on their knowledge and skills development.

Due to the explosion of emerging technologies, the world is changing rapidly. The world is witnessing these changes, along with developing nations like Indonesia, China, and India, among others. The developing nations must adopt these reforms one at a time to improve the value of education and improve the setting for learning and instruction in the classroom (Sudha, 2019). A majority of the investigations found a favorable correlation between teachers' usage of ICT and their attitudes toward the use of ICT resources (Mukherjee & Maity, 2019). Numerous changes are being made to the Indian educational system. The use of ICT in teaching and learning has begun to become unavoidable. Rashtriya Madhyamik Shiksha Abhiyan (RMSA), an initiative of the Indian government, established the ICT program in all schools (Sudha, 2018).

When investigating strategies to develop teacher competencies in ICT integration, Lim (2007) introduced the concept of MicroLESSONS. These MicroLESSONS were implemented at the National Institute of Education in Singapore, offering a structured 12-lesson module to engage pre-service teachers. By focusing on constructing multimedia packages aligned with constructivist principles, MicroLESSONS aimed to enhance pre-service teachers' clarity and understanding of instructional approaches. Moreover, these micro lessons provided diverse examples of how ICT could be effectively used in classrooms to support student learning.

Self-learning is anticipated to take its rightful position in pedagogical theory and practice. There is a considerable surge in interest in self-learning concerns connected to technology, the fast proliferation of information, and the adoption of a competency-based strategy in specialized instruction and professional development (Kenesbekova et al., 2019). Particularly in light of the Covid-19 epidemic, online learning platforms have taken on an entirely novel position in education (Dilling & Vogler, 2023). Teachers may manage their classes more effectively by taking advantage of online training that will improve their knowledge and abilities (Almutairi, 2022).

Research Questions

This research investigates the role of online training as a strategy for capacity building of teachers and teacher educators in the use of ET and ICT. The primary research questions guiding this study are as follows:

1. Can online training be a strategy for the Continuous Professional Development (CPD) of teachers on the use of ICT?
2. What are the perceived benefits and challenges of using online training as a strategy for CPD?
3. What are the enablers of online training as a strategy for CPD?

Methodology of the study

To study the efficacy of online training as a strategy for capacity building of teachers, a series of online training was conducted, and the feedback of the learners and their performance in the post-training assessment was studied.

For this study, a quasi-experimental design was adopted. Seven online training packages were developed with slide presentations. Each training was conducted for 5 hours spread across five days in online mode through a YouTube channel as a live program and also simulcast through PMeVidya DTH TV channels across the country for wider reach. After the five days (one hour each per day) of training, the recorded videos and slide presentations were uploaded and provided to the learners as self-learning resources. At the end of each training, the post-training assessment was conducted to study the impact of training programs organized in seven cycles for the acquisition of knowledge in the concerned area. The reaction of the learners towards each training was also measured and analyzed through a feedback mechanism.

The purposive sampling technique was adopted for the selection of the sample, as the learners participated on a voluntary basis. The sample selected for the study is given in Table-1 below:

Table-1: Training-wise Selection of Participants

S.No	Titles of the Trainings	No. of States/ UTs participated	No. of Participants
1	Open Educational Resources (OER) and Licenses	18	4,564
2	Digital Tools for Teaching, Learning and Assessment of Specific Subjects	12	68,219
3	Game-Based Learning	32	8,230
4	Digital Pedagogy	36	23,889
5	Multimedia Resources for Teaching, Learning, and Assessment	12	51,135
6	Virtual Labs for Teaching, Learning, and Assessment	36	34978
7	Let's be a Cyber Warrior	9	6005
Total no of participants included in the study			**1,97,020**

Insights on Participation in the Online Training

Seven trainings of five days each were identified randomly for this study. The data were analyzed to understand the participation trend. The information regarding this training was shared officially with the states/ UTs and autonomous organizations and through the social media handles of CIET-NCERT, but participation in the training was voluntary.

Table-2: Training-wise Participation

S.No	Titles of the Trainings	No. of States/ UTs participated	State with max. participation	State with min. participation
1	Open Educational Resources (OER) and Licenses	18	Arunachal Pradesh	Bihar
2	Digital Tools for Teaching, Learning and Assessment of Specific Subjects	12	Karnataka	Nagaland
3	Game-Based Learning	32	Jharkhand	Ladakh
4	Digital Pedagogy	36	Odisha	Dadra and Nagar Haveli, Daman & Diu

5	Multimedia Resources for Teaching, Learning, and Assessment	12	Karnataka	Mizoram
6	Virtual Labs for Teaching, Learning, and Assessment	36	Uttar Pradesh	Ladakh
7	Let's be a Cyber Warrior	9	Bihar	Andaman & Nicobar Islands, Manipur, Sikkim

Insights from the data related to participation reveal the following:

The data entered in Table-2 shows the overall registration of participants in seven trainings. The data reveals that the representation of participants from 36 states/ UTs was witnessed only in one training, i.e., Virtual Labs for Teaching, Learning, and Assessment. However, the data further shows that in training on cyber safety, participants from 9 states/ UTs only participated.

From the data given in Table-1, it is evident that the maximum number of participants were found to be in training on "Digital Tools for Teaching, Learning, and Assessment of Specific Subjects," i.e., 68219. At the same time, the overall minimum participation was found to be in the training "Open Educational Resources (OER) and Licenses," which could attract about 4564 participants.

The data entered in Table-2 reveals that across all the seven pieces of training, the state from which the maximum participation was reported was Karnataka which was 37,924 in training "Digital Tools for Teaching, Learning, and Assessment of Specific Subjects." On the other hand, it may be seen from the data that the minimum participation across the seven training sessions was from the states like Andaman & Nicobar Islands, Manipur, and Sikkim in training "Let's be a Cyber Warrior."

It may be logically reasoned that in the state of Karnataka, a large number of teachers have undergone training on ICT-Basics as part of the implementation of the ICT Curriculum by CIET-NCERT. Also, Subject Teacher Forums (STF) have been created for the use and integration of technology, and the teachers of Karnataka are very active in social media groups. So the information disseminated through multiple modes might have contributed to a higher number of participants from the Karnataka state. In the case of Andaman Nicobar Islands, Manipur, and Sikkim, lack of advocacy, less internet penetration, etc., might have contributed to low enrolment. Though registration in this training was not a mandatory requirement, learners have registered themselves keeping in view their needs and interest. This shows the motivation of the learners to join such online courses. However, the reasons for variation in the training need to be further studied. Such research may support in effective implementation of this training.,

Also, data collected through the feedback mechanism shows that around 97 per cent of the learners have reported that they are interested in joining online courses because of the following reasons:

- Training is free

- No travel involved
- Topics included in the training are the latest areas of knowledge and coming under their interest areas.

From the data, it was evident that around 63 per cent of the participants who missed the live sessions used the recorded videos provided on ciet.nic.in website for self-learning. Also, the participants were of the opinion that the access to the recording of all seven trainings and presentations that were provided as self-learning materials encouraged them to learn at their own pace and appear in the post-training assessment for obtaining a successful participation certificate.

Analysis and Interpretation of Performance in the Post-Training Assessment

The data entered in Table-3 shows the no of registration in each training and the number of participants in the post-training assessment.

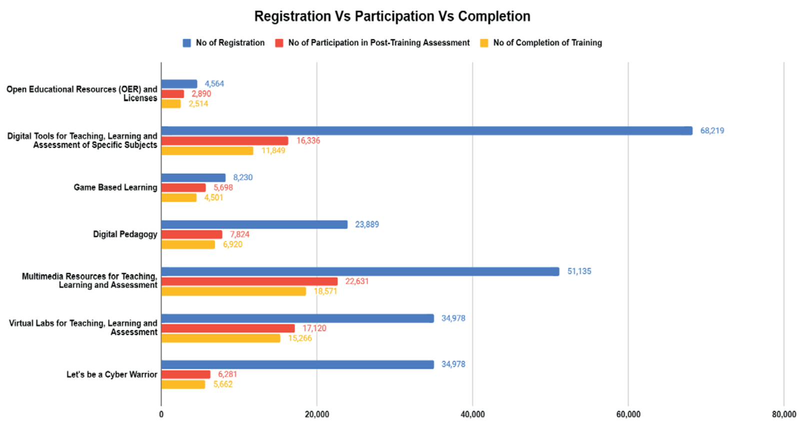
Table-3: Participation in Post-Training Assessment

S.No.	Name of the training programme	No of Registration	No of Participation in Post-Training Assessment
1	Open Educational Resources (OER) and Licenses	4,564	2,890
2	Digital Tools for Teaching, Learning and Assessment of Specific Subjects	68,219	16,336
3	Game Based Learning	8,230	5,698
4	Digital Pedagogy	23,889	7,824
5	Multimedia Resources for Teaching, Learning and Assessment	51,135	22,631
6	Virtual Labs for Teaching, Learning and Assessment	34,978	17,120
7	Let's be a Cyber Warrior	6005	6,281
Total		1,97,020	78,780

The data presented in Table-3 shows that the total number of registrations across all seven trainings was 1,97,020; however, the number of people who have participated in the post-training is only 78,780, i.e., only 39.99 per cent of the registered participants. The maximum registration was received from "Digital Tools for Teaching, Learning, and Assessment of Specific Subjects," i.e., 68,219; however, the number of people who eventually participated in the post-training assessment was only 16,336. On the contrary, "Let's be a Cyber Warrior" training received only 6,005 registrations. Still, the number of people who participated in the quiz was more than the people who registered in the post-training assessment, i.e., 6,281. One of the reasons which were commonly expressed by teachers regarding non-participation in the post-training assessment was a lack of awareness about the method of certification in online training. Many teachers and educators registered and participated in the training, but they missed to understand or follow the assessment strategy. Hence, the following initiatives were planned to be taken for further training:

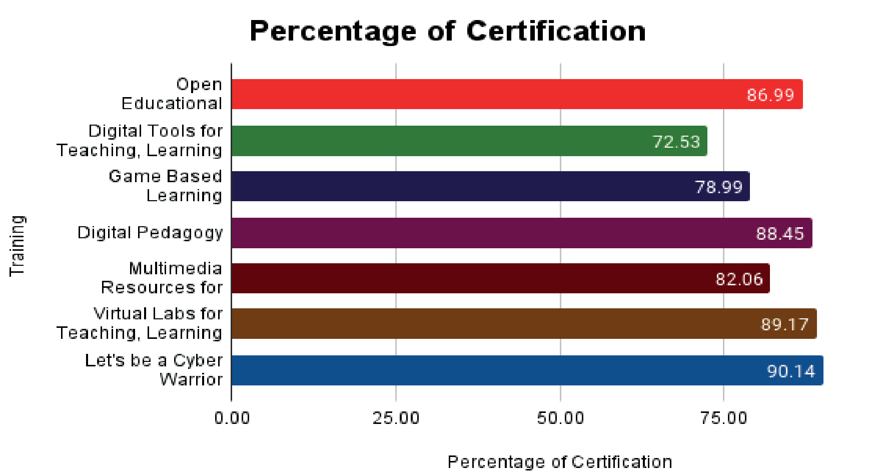
- Banners on missed sessions and assessments are to be circulated among the registered participants.
- Details of the post-training assessment were announced during every session.
- Details of the post-training assessment were elaborated on the event page
- N=1,97,020

Figure-1: Participation in Post-Training Assessment and Completion and Performance



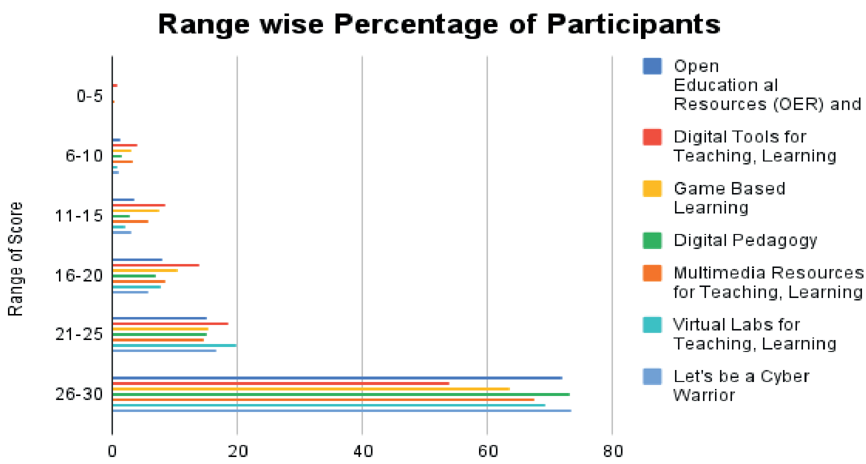
Looking at the scores obtained by the participants, it can be seen from the data that out of 78780 participants who took the post-training assessment, 82.86 per cent of the participants (i.e., 65,283) scored 70 per cent and above in the post-training assessment. This indicates that the information delivered during the training to the participants was well comprehended and imbibed by the majority of them.

Figure-2: Percentage of Completion of the Training



Based on the chart above, the maximum number of participants who scored 70 per cent and above in the quiz were from the "Let's be a Cyber Warrior" training, i.e., 90.14 per cent. In almost all training, the percentage of learners who scored more than 70 per cent is above 70 per cent. This indicates that online training was effective in knowledge acquisition.

Figure-3: Scores in Post-Training Assessment



Based on the chart given in Figure 3, it can be concluded from the results that the majority of the participants obtained scores between the range of 26-30 and 21-25, i.e., nearly 60 per cent, which shows that the online training is effective in developing the knowledge of the learners in the use of ET & ICT.

Conclusion

In conclusion, the integration of ICT in education is a transformative and indispensable aspect of modern teaching and learning practices. To unlock the full potential of ICT, it is essential to invest in the capacity building of teachers, providing them with the necessary training, resources, and support. Moreover, school administrations play a key role in fostering a conducive environment for ICT integration. As educational technology continues to evolve, continuous research and development are needed to equip teachers with the knowledge and skills required to navigate the digital landscape effectively and enhance the overall quality of education. Based on this research, it is observed that online training has created an environment for teachers and other stakeholders in education to learn, use and integrate technology in their self-interest. The data further reveals that in almost all states/ UTs, most participants have also showcased their understanding in post-training assessment. Therefore, well-structured online training can educate the audience about the new-age educational resources and tools to accomplish the teaching-learning objectives in school education. However, there is more scope to make the training intensive and improve to scale up and cover every single school teacher in the country as envisioned in NEP-2020.

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Review Article

Complex Networks, Communities, and Clustering: A survey

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Abstract

This paper is an extensive survey of literature on complex network communities and clustering. Complex networks describe a wide variety of systems in nature and society, especially systems composed of a large number of highly interconnected dynamical entities. Complex networks, like real networks, can also have community structure. There are several types of methods and algorithms for the detection and identification of communities in complex networks. Several complex networks have the property of clustering or network transitivity. Some of the important concepts in the field of complex networks are small-world and scale-free networks, evolving networks, the relationship between topology and the network's robustness, degree distributions, clustering, network correlations, random graph models, models of network growth, dynamical processes on networks, etc. Some current areas of research on complex network communities are those on community evolution, overlapping communities, communities in directed networks, community characterization, and interpretation, etc. Many of the algorithms or methods proposed for network community detection through clustering are modified versions of or inspired by the concepts of minimum-cut-based algorithms, hierarchical connectivity-based algorithms, the original Girvan–Newman algorithm, concepts of modularity maximization, algorithms utilizing metrics from information and coding theory, and clique based algorithms.

Keywords: Networks, Clustering, Communities, Hierarchy, Information, Modularity

Introduction

Complex Networks

Complex networks describe a wide variety of systems in nature and society esp., systems composed of a large number of highly interconnected dynamical entities. The Internet, social networks, business networks, large circuits, networks of chemicals linked by chemical reactions, transportation networks, power networks, networks of citations of documents/ web pages, etc, are some of the popularly cited examples of complex networks. Two of the many important questions in this field are: a) are there any unifying principles underlying the topology complex networks, and b) from the perspective of nonlinearity, how colossal networks of interacting and/or communicating dynamical systems will behave collectively, given their individual dynamics and coupling architecture.

One of the intuitive approaches to capture the global properties of such complex systems is to model them as graphs, where nodes represent the dynamical units, and links/edges represent the interactions between the nodes. It has now been widely recognized that the topology and evolution of real-world complex networks are controlled by various organizing principles of topology and dynamics. Researchers have been addressing structural and topological issues of complex networks, e.g., a) characterization of the complex interconnection architectures to comprehend the unifying principles that are the foundations of real-world complex networks, and b) constructing models to simulate the growth and replicate the structural properties of these complex networks. Researchers have also addressed the complex networks' dynamics, e.g., characterization of the collective behavior of large ensembles of dynamical systems that interact through complex interconnections topology. Some of the important concepts in the field of complex networks are small-world and scale-free networks, evolving networks, the relationship between topology and the network's robustness, degree distributions, clustering, network correlations, random graph models, models of network growth, dynamical processes on networks, etc. [1-4]Network Communities

Community structures are quite common in real networks. Complex networks have a community structure if the nodes of the networks can be grouped into sets of nodes where each set of nodes is densely connected, at least internally. For non-overlapping network communities, the complex network should split into groups of nodes with dense connections internally but sparser connections between the groups. Overlapping network communities are also possible, and they are found in many real-world complex networks, e.g., social networks. An alternative way of expressing the network community concept, inclusive of the overlapping and non-overlapping issues, is that pairs of nodes are more likely to be connected if they are both members of the same community(ies) and less likely to be connected if they are not members of the same communities. The communities can themselves also join together to form meta-communities, and those meta-communities can join together, and so on, in a hierarchical fashion. It is now well accepted that the identification of the community structure of complex networks provides insight into the relationships between network function and topology.

There are several types of methods and algorithms for the detection and identification of communities in complex networks. But, roughly, these methods can be divided into 4 categories (not exclusive):

a) node-centric (algorithms utilizing the information that each node in a group satisfies certain properties), b) group-centric (algorithms utilizing the connections within a group as a whole, i.e., the group as a single entity satisfies certain properties without zooming into node-level), c) network-centric (algorithms utilizing the process of the partitioning of the whole network into several disjoint sets), and d) hierarchycentric (algorithms utilizing the processes of construction of hierarchical structures of communities). There are other categories of algorithms/methods of community detection in complex networks, but they are not being discussed here. The optimal methods to detect network communities vary depending on applications, complex networks, computational resources, etc. Some current lines of research on complex network communities are those on community evolution, overlapping communities, communities in directed networks, community characterization, and interpretation, etc.[5-8].

Figure-1: Communities in Complex Networks [46], 2022

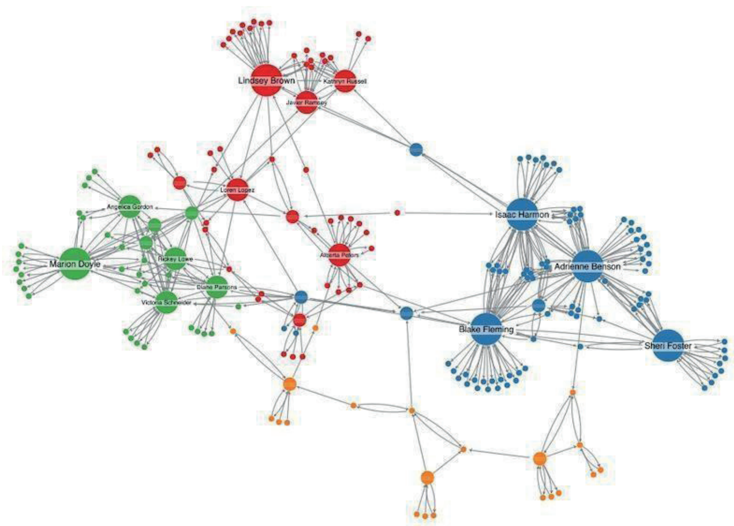
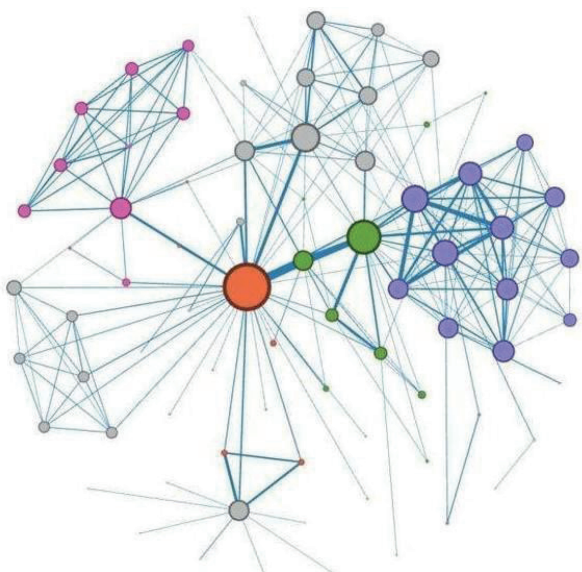


Figure-2: Communities in Complex Networks [47] 2018



Clustering

Several complex networks have the property of clustering or network transitivity. It is the property that two vertices of the network that are both adjacent to the same third vertex have an increased probability of also being adjacent to one another. Clustering of network communities is the task of grouping a set of nodes in such a way that nodes in the same group (cluster) are more similar, in some measure(s), to each other than to those in other groups (clusters), based on the above-mentioned adjacency property. The choice or design of clustering algorithms and their corresponding controlling functions, e.g., distance measure/ norm, threshold/cut-offs for similarity/ dissimilarity measures, number of final expected stable clusters, degrees of randomization, criteria for cluster partitioning or merging, etc., depending on the complex networks being clustered and the nature and function of the communities to be identified in them. The clustering of network communities can also be formulated as a multi-objective optimization problem.

The differences in the cluster/ community models and their properties reflect the differences between the various clustering and network community detection algorithms. Some popular cluster/community models are a) connectivity models, e.g. hierarchical clustering algorithms create models utilizing distance-based interconnections between nodes or already existing communities, b) centroid models, e.g. models those characterize clusters/ network communities by mean vectors computed from set of properties of sets of nodes , c) distribution models based on statistical distributions of the values features of the nodes in multidimensional space, d) density models, based on density or sparseness of connections/ regions in data space, and a very important category e) subspace models e.g. in bi clustering/ co-clustering where clusters/network communities are modeled with respect to both cluster members and pertinent set of features of the nodes, g) graph-based models e.g models/ algorithms based on quasi-cliques- subset of nodes in a graph/complex network, where a significant fraction of node pairs in the subset are connected by edges, considered as cluster/ community seeds for building up larger clusters or communities.

Many of the algorithms or methods proposed for network community detection through clustering are modified versions of or inspired by the concepts of minimum-cut-based algorithms, hierarchical connectivity-based algorithms, the original Girvan–Newman algorithm, concepts of modularity maximization, algorithms utilizing metrics from information and coding theory, and clique based algorithms [9-12].

Research questions and topics in complex network clustering and community detection

The contemporary research questions and topics in this field are generative models, communities in time-evolving networks, characterization, modeling and the analysis of communities, impact of community structure and its dynamics on networked systems, modularity and the use of modularity maximization as the basis for community detection, stochastic strategies (that require little or no information about the network topology at the expense of their performance), recovery of stochastic models (finds the latent partition of networks nodes into the communities which are equal to or correlate with the truth communities used for generation of the given network), overlapping community structures, multilayer community benchmarks, incremental clustering, online/real time community finding, predicting community evolution, measuring the quality of the obtained evolving communities, finding provably optimal algorithms, designing well-controlled benchmark systems on which the proposed algorithms can be tested and compared, modular centrality using local and global strategies, taxonomy of various community detection algorithms, and real-world applications of networked systems.

Classification of Community Detection Clustering Algorithms in Complex Networks

Community detection clustering algorithms in complex networks can be classified as hierarchy-based algorithms, information-theoretic algorithms, modularity-based algorithms, and some other special categories.

Hierarchy based algorithms

A hierarchical clustering method works by means of grouping data into a tree of clusters. It starts by considering every data point as a distinct cluster. Then, it executes the subsequent steps repeatedly. At first, the two clusters which can be closest together are identified. Then, the two maximum comparable clusters are merged. This continues till all the clusters are merged. In hierarchical clustering, the goal is to produce a hierarchical series of nested clusters. A diagram called a Dendrogram (a tree-like diagram that statistics the sequences of merges or splits) graphically represents the hierarchy. It is an inverted tree that depicts the order in which factors are merged (bottom-up view), or clusters are broken up (top-down view).Hierarchy-based algorithms are one of the main types of community detection clustering algorithms in complex networks.

Silva et al. [13] 2007 utilized the concept of topological orders among input data represented as graph and developed an algorithm to obtain clusters in different scales. The algorithm consisted of initially the network construction from input data and, secondly, the hierarchical partitioning of the formed network. The algorithm, although being completely free of the computation of the physical distances among input data, was found to constantly produce a connected graph with heavily linked nodes within a community and sporadically linked nodes among different communities. The authors applied their algorithm to the problem of pixel clustering. Zhang et al.[14] 2007, proposed a hierarchical clustering approach, based on the graph diffusion kernels of networks, to reveal the community organization of different levels of complex networks. They verified the method on some networks with well-known community structures and found that the algorithm is an effective one.

Guang Xu et al.[15] 2012, proposed a new algorithm called Latent Community Discovery, for community detection in complex social networks. Specifically, their algorithm divides the core actors based on a hierarchical probabilistic model and a statistical topic model, which are normalized by the network arrangement in data. Their algorithm is inspired by the Pareto Principle, which accounts for the uneven existence of two different types of network actors, esp. the core actors who typically occupy only a small share of the nodes but have a large influence on the complex network. They tested their algorithm on three large social networks and found its performance competitive to the existing popular algorithms for this category of problems.

de Oliveira et al. [16], 2008 propose a clustering algorithm based on graph theoretic representations and community discovery in complex networks. Initially, they represent the input data as a network and then divide the network into sub-networks to create data groups. In the first stage, each of the nodes has a randomly assigned initial angle. This initial angle is gradually modified according to agreement with the neighbors' angle. Ultimately the network reaches a steady state. In this state, the nodes in the same cluster have comparable angles. This process is repeated and results in a hierarchical and graded divisive clustering. Simulations by the authors demonstrate that this algorithm has the potential to find clusters in different forms, compactness, and proportions. The algorithm also has the capability to generate clusters with diverse refinement grades. Furthermore, the proposed algorithm is also robust and efficient.

Malzer, C., & Baum, M. [17] 2020, in their research, demonstrated the combination of DBSCAN* and HDBSCAN clusters due to the application of an extra threshold value. They also showed the potential benefits of this hybrid approach when clustering data having various types of densities are used. Their approach is beneficial in cases where a low minimum cluster size is required, and avoiding an abundance of micro-clusters in high-density regions is required. Campello et al. [18] 2020, in their review article, discussed the statistical notion of density-based clusters, classic algorithms for deriving a flat partitioning of density-based clusters, methods for hierarchical density-based clustering, and methods for semi-supervised clustering. They concluded with various open challenges associated with density-based clustering.

Information theoretic algorithms

Information Theory involves the quantification of information in a dataset with the help of several statistical measures. The most used information-theoretic measures are Entropy and its variation. Entropy is a measure of uncertainty about a stochastic event or, in other words, it measures the amount of missing information related to an event. The idea of information gave rise to other measures of information like Mutual information, conditional mutual information, divergency, entropy, cross-entropy, joint entropy, and conditional entropy. There are two important issues in clustering: a) how the similarity (or dissimilarity) between objects or clusters in the dataset can be measured, and b) finding out the criterion function that is to be optimized. In both these cases, information theoretic measures are used in information theoretic clustering. Using the essentials of information theory as a clustering criterion takes advantage of the underlying statistical information that the data carries.

Information theoretic algorithms are another major type of community detection clustering algorithms in complex networks. Cravino et al. [19] 2012, employed the overlapping community arrangement of a linkage of tags/labels to improve text clustering. Based on a small data set of news clips/ excerpts, the authors construct a network of co-occurrence of user-defined labels of metadata fields in news excerpts. They describe a weighted cosine similarity closeness measure, which takes into account both the excerpt vectors and the tag vectors. Thereafter, they compute the tag weight using the correlated tags that exist in the discovered community and then use the ensuing vectors, together with a novel distance metric to identify socially biased document clusters.

Yang et al. [20] 2006, proposed an unsupervised graphical clustering algorithm for finding community in complex networks by determining the dissimilarity between nodes and incorporating them into a dissimilarity distance matrix, which when sorted according to the scores, becomes equivalent to an intensity image. The clusters are indicated by dark blocks of pixels along the main diagonal.

It is now acknowledged that trust in electronic commerce has become one of the most significant concerns in online applications, with consumers searching for the best trustworthy of goods and service providers and looking for ways of confirming which service providers are the most trusted. Zhang et al. [21] 2012, have studied the critical problem of trust network and trust community clustering for the analysis of the user's most trusted relationship for electronic commerce applications. In their model, the nodes represent the various subjects involved in the trust, the connections denote relationships, and the weight of the links indicates the strength of the relationships. Initially, the algorithm constructs a trust network having the weight value of links. Subsequently, the clustering properties of the relationship according to the weights and the path lengths are analyzed. Finally, the algorithm categorizes the most trusted subjects for a user to the same cluster. Two metrics, i.e., direct trust information degree and global trust information degree, are utilized to assess trust relationships among the subjects. This principle also gives an efficient shortest-path algorithm to construct trust networks. All the above information generated is incorporated into the clustering algorithm based on the coefficient and path length for the e-commerce trust network community.

Zhang and Zhong [22] 2013, dealt with this problem by considering the aspects of the small-world nature of trust communities and the metric local trust recommendation degree. Piccardi et al. [23] 2011, analyzed the issue of clustering of financial time series based on the network community analysis methodology, i.e., the partitioning of the nodes of a network. A network with n nodes is associated with the set of n time series, and the weight of the link, which quantifies the similarity between the two corresponding time series, is defined according to a metric based on symbolic time series analysis. Thereafter, probing for network clusters leads to the identification of groups of nodes (i.e., Time series) with strong similarity. The authors verify the algorithm on US and Italian stock exchange time series data, and the steadiness of the clusters over time is seen to be satisfactory and better than those achieved using the minimal spanning tree and the hierarchical tree-based algorithms. Piccardi and Calatroni [24] 2010 studied the same problem in its full generality, according to the same methodology, in previous work and found satisfactory results.

Though community detection in social networks is usually based on graph clustering employing the structural information, i.e., linkage structure or node topology, for group identification, but Huang and Yang [25] 2012, used the semantic information present in the posts of social media to find hidden communities in these media. They incorporated the assumption that content issued by users may express relations between users/ entities. This method is suitable for detecting communities in networks that continuously evolve, e.g., social networks.

Liu et al. [26] 2008 applied the concept of network community clustering to an important biomedical problem known as functional analysis of protein cavities. It is known that the functions of a protein are chiefly determined by its structure, and surface cavities i.e. pockets or clefts, are generally considered as possibly active sites where the protein carries out its functions. The authors proposed a feasible solution to the problem of functional assignment by protein cavity clustering, i.e., geometrical clustering based on the geometrical community structure of pocket similarity networks. Firstly, they introduce a pocket similarity network to methodically describe structural correspondence among pockets. The pockets are connected if they have structural similarity beyond a certain threshold. Thereafter, the surface pockets are clustered into structurally related pocket groups via a graded process. The authors then reference these small pocket groups as structural patterns which represent similar functions in different proteins. Their experimental results show that identified pocket groups are biologically meaningful in terms of their functional features.

Rui and FengMing [27] 2011 proposed an algorithm to construct a distributed trust network in information sharing and exchange channels e.g., instant messengers, file-sharing tools, etc. But, it is well known that the formation of the communities is a self-organizing and evolving autonomous phenomenon, being regulated primarily through internal and member dynamics of the community. For example, users join communities based on their interests. These kinds of network communities are highly vulnerable to the spreading of malicious software, pilfering of users' information, and attack by malicious users. Thus, to form safe and reliable communities, the authors present an algorithm by incorporating the trust value of nodes computed based on their past behaviors and constructing the communities based on similarity in trust values.

XIE et al. [28] 2011 propose a new algorithm for detecting community structures in weighted complex networks. The method constructs a weighted complex network with respect to the similarity between document pairs calculated by the cosine function. Then the algorithm searches for the dense sets and applies it to cluster text documents represented by the vector space model. ZHANG et al. [29] 2013, dealt with the issue of trust in e-commerce based on social networks using the metric of trust information degree based on mutual information between subjects. They incorporated their previously developed metrics, direct trust information degree, and global trust information degree, to build trust relations among subjects. Clustering coefficients and global trust information degree were adopted to construct trust communities. Guan-yu [30] 2011 has developed an algorithm (named Mapping Vertex into Vector algorithm) which converts all vertices in a network into vectors and finds the communities in large-scale complex networks through clustering, based on the similarity between these vertex vectors.

You-yuan et al. [31] 2009, addressed the problem of web services clustering with the help of the detection of community structure in complex networks. They did this by proposing an algorithm in which the words are denoted by nodes, and the edge weights of the network are computed from the words' co-appearances. The authors applied the Newmann's algorithm to this network and extracted the clusters of words. Thus service clustering was achieved by using the relationship between the words and the services, and that too with acceptable levels of precision and accuracy, as claimed by the authors.

Modularity based community detection

A network that has been effectively divided into communities has fewer edges between communities than one might anticipate. Simply some careful observers would assert that this proves there is substantial community structure if the number of edges between two groups is only what can be predicted based on accidental chance. On the other hand, it is reasonable to assume that something interesting is occurring if the number of edges between groups is significantly less than what is predicted by chance, or equivalently if the number within groups is significantly larger. Utilizing the concept of modularity, it is possible to quantify the idea that actual community structure in a network relates to a statistically notable arrangement of edges. Modularity is the number of edges lying within groups minus the predicted number in an analogous network with edges distributed at random, up to a multiplicative constant. Positive values of modularity indicate the likelihood of a community structure and are either positive or negative. As a result, one can specifically search for community structure by looking for network divisions that have positive, and preferably high, values of modularity.

Modularity-based community detection is another major type of community detection clustering algorithm in complex networks. Liu and Li [32] 2011, developed a novel metric representation, the co-neighbor modularity matrix, to assess the quality of community/clustering identification, by which the problem of community detection is transformed into that of a problem of clustering of eigenvectors in Euclidean space. Thereafter, the network community architecture is identified with a spectral clustering algorithm. One major advantage of this algorithm is that it is free from the noise generated by the initial mean points of clustering e.g., in the k-means category of algorithms.

Scibetta et al. [33] 2013, addressed the strategy of a division of the network into clusters or district-metered areas for the detection of water losses from water distribution networks since the measurement of incoming/outgoing flows for each cluster or district-metered area allows for a quantification of water losses. The authors use the community detection approach developed in the complex network theory to identify clusters or district-metered areas in water distribution systems. The method aims to find solutions satisfying the constraints of maximization of modularity and the reduction of the number of communities. The authors claim that the method is adequately scalable.

Sharma and Purohit [34] 2013, have also applied the spectral clustering algorithm for tracking community formation in complex social networks. Zhuhadar et al. [35] 2012, have proposed the design of a visual recommender system to recommend learning resources to cyber learners within the same community, by using a community detection algorithm on the large-scale complex networks of cyber learners and learning resources, based on Web Usage data of the subjects. Their algorithm uses a heuristic that initially accomplishes clustering by force-based visualization algorithm. Subsequently, the algorithm utilizes the information on network modularity to choose good decompositions from those found using visualization algorithms.

Yu and Ding [36] 2010 applied modularity clustering objective function for network community discovery. They have shown that a normalized form modularity clustering is equivalent to the prevalent normalized cut spectral clustering. They then use this information to interpret and solve the modularity clustering problem and further corroborate the algorithm on some data collections.

Singh et al. [37] 2020 presented a comprehensive analysis of the dynamic community detection algorithms in terms of computation time and accuracy. In order to provide detailed and extensive analysis, they tested dynamic algorithms on small, medium, and large real-world network datasets. They provided some guidelines that may help to choose the best dynamic community detection algorithms for the given complex dynamic networks based on the analysis results and network properties. Hu et al. [38] 2020 presented a new algorithm based on spectral clustering to detect the communities. Experiments demonstrated that the proposed algorithm exceeded other state-of-the-art community detection algorithms among several real-world networks from diverse domains and synthetic networks. The proposed algorithm provided a high-quality and accurate performance in a wide range of data sets. Al-Andoli et al. [39] 2021 proposed an original deep auto encoder with Particle Swarm Optimization (PSO) and continuation algorithms to reveal community structures in complex networks. Their work also proposed various other methods to work in the absence of continuation and to enable premature convergence.

Other algorithms

It is popularly accepted that social networks offer a dominant abstraction of the organization and dynamics of varied kinds of people or people-to-technology interaction and also endorse the use of collaborative technologies for partnerships among different groups. It is also acknowledged that finding subgroups within social networks is important for understanding and possibly influencing the formation and evolution of online communities. In this context, Sharma and Joshi [40] address the issues of tracking online communities in large-scale complex social networks. They infer the dynamics of the communities to a significant extent from the online interactions of the nodes by tracking the evolution of known sub-communities over time.

Verma and Butenko [41] 2013, use the clique relaxation concept of k-community for network community identification. The clique relaxation of k-community is a connected subgraph such that endpoints of each edge have, at the minimum, k shared neighbors within the subgraph. An important aspect of this method is that it does not use any previous information about the organization of the network. By defining a cluster as a k-community, the proposed algorithm aims to provide a clustering of a network into k-communities with varying values of k.

Lu et al. [42] 2013 proposed a novel Network Community Structure Clustering Algorithm Based on Genetic Theory. Their work puts forward the idea of applying a clustering ensemble-based genetic algorithm in the domain of complex social network mining. Their procedure introduces a clustering ensemble into the crossover operator and then utilizes the clustering information of the parents to generate new individuals. This seems to avoid the problems that are triggered by merely swapping strings between crossover operators without consideration of their contents. In population generation, Markov random walk approach is used to sustain the diversity of the entities as well as the clustering accuracy. The algorithm also uses a local searching mechanism in crossover operators to reduce the searching space and improve the speed of convergence.

Eagle et al. [43] 2012, demonstrate in what way using network community identifying methods can be used to recognize sub-goals in problems in a logic tutor. Then those community structures can be utilized to produce high-level hints among sub-goals. The authors do this by presenting a new data structure, the Interaction Network, for representing interaction data from open problem-solving environment tutors.

Complex networks in education

In their research article, Jacobson and Wilensky [44] 2006 stated the rationale for students to learn new scientific perspectives which are related to the study of complex systems. They discussed various research carried out on issues related to learning these ideas. They also proposed a set of research issues that are related to general design principles to create environments and tools which will be helpful for the students to learn scientific ideas about complex physical and social systems. They discussed five design principles that have the potential to give promising learning sciences research. The five design principles are a) to experience complex systems phenomena; b) to make explicit the complex systems framework; c) to encourage collaboration, discussion, and reflection; d) to construct theories, models and conduct experiments; e) to learn trajectories towards deep understandings and explorations. In their research, they mentioned the importance of mainstream students to actively learning about complex systems in the physical and social sciences. They also stated that research discovering student learning of complex systems, which is conceptually challenging knowledge, may actually help in pushing the boundaries of knowing the kinds of advanced knowledge that students are capable of learning. Additionally, they pointed out that conceptual perspectives and methodologies from complex systems have the ability to influence theory and research problems of fundamental importance to the domain of learning sciences itself.

In their research article, Kunihiko et al. [45] 2016, examined the improvement in collaborative work between faculty and staff in university settings and also identified the strengths and weaknesses of the university by using both SWOT analysis and complex network analysis. Calculating multiple indices of a complex network and analyzing characteristics of the network may be further carried out in the future. This research work is an example of the application of complex networks in the domain of learning more particularly in university education.

Table-1: Classification of the algorithms

Sl no.	Classification	Reference of the paper
1	Hierarchy Based	13. Silva, T. C., & Zhao, L. (2007, October). **Pixel clustering by using complex network community detection technique.** In Seventh International Conference on Intelligent Systems Design and Applications (ISDA 2007) (pp. 925-932). IEEE.
		14. Zhang, S., Ning, X. M., & Zhang, X. S. (2007). **Graph kernels, hierarchical clustering, and network community structure: experiments and comparative analysis.** The European Physical Journal B, 57(1), 67-74.
		15. Xun, G., Yang, Y., Wang, L., & Liu, W. (2012, December). **Latent community discovery with network regularization for core actors clustering.** In Proceedings of COLING 2012: Posters (pp. 1351-1360).

		16. de Oliveira, T. B., Zhao, L., Faceli, K., & de Carvalho, A. C. (2008, June). **Data clustering based on complex network** **community detection.** In 2008 IEEE Congress on Evolutionary Computation (IEEE World Congress on Computational Intelligence) (pp. 2121-2126). IEEE.
		17. Malzer, C., & Baum, M. (2020, September). **A hybrid approach to hierarchical density based cluster selection.** In 2020 IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems (MFI) (pp. 223-228). IEEE.
		18. Campello, R. J., Kröger, P., Sander, J., & Zimek, A. (2020). **Density-based clustering**. Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 10(2), e1343.
2	Information Theoretic	19. Cravino, N., Devezas, J., & Figueira, Á. (2012, June). **Using the overlapping community structure of a network of tags to improve text clustering.** In Proceedings of the 23rd ACM conference on Hypertext and social media (pp. 239-244).
		20. Yang, S., Luo, S., & Li, J. (2006, August). **A novel visual clustering algorithm for finding community in complex network.** In International Conference on Advanced Data Mining and Applications (pp. 396-403). Springer, Berlin, Heidelberg.
		21. Zhang, S., Chen, J., Zhong, H., Fang, Z., & Shi, J. (2012). **Trust network and trust community clustering based on shortest path analysis for e-commerce.** International Journal of u-and e-Service, Science and Technology, 5(2), 31-42.
		22. Zhang, S., & Zhong, H. (2013). **Trust network and small world trust community clustering for E-Commerce**. Int. J. Hybrid Inf. Technol, 6, 1-14.
		23. Piccardi, C., Calatroni, L., & Bertoni, F. (2011). **Clustering financial time series by network community analysis.** International Journal of Modern Physics C, 22(01), 35-50.

		24. Piccardi, C., & Calatroni, L. (2010, February). Clustering time series by network community analysis. In 2010 Complexity in Engineering (pp. 94-96). IEEE.
		25. Huang, H. H., & Yang, H. C. (2012, August). **Semantic clustering-based community detection in an evolving social network.** In 2012 Sixth International Conference on Genetic and Evolutionary Computing (pp. 91-94). IEEE.
		26. Liu, Z. P., Wu, L. Y., Wang, Y., Zhang, X. S., & Chen, L. (2008). P**rotein cavity clustering based on community structure of pocket similarity network.** International journal of bioinformatics research and applications, 4(4), 445-460.
		27. Zhu, R., & Liu, F. (2011, July). **A clustering algorithm of community in distributed network based on trust.** In 2011 Eighth international conference on fuzzy systems and knowledge discovery (FSKD) (Vol. 2, pp. 1070-1073). IEEE.
		28. Xie, J., & Szymanski, B. K. (2011, June). **Community detection using a neighborhood strength driven label propagation algorithm.** In 2011 IEEE Network Science Workshop (pp. 188-195). IEEE.
		29. Zhang, S. Z., Fang, Z. X., Chen, J. G., & Shi, J. (2013). **Community clustering model for E-commerce trust based on social network.** Journal of ZheJiang University (Engineering Science), 47(4), 656-661.
		30. Wang, G. Y. (2011). **Algorithm for Detecting Community of Complex Network Based on Clustering.** Jisuanji Gongcheng/ Computer Engineering, 37(10).
		31. Ou, Y. Y., Zhang, H. S., & Men, H. (2009). **Web Services clustering based on detecting community structure in complex network**. Journal of Application Research of Computers, 6.
3	Modularity Based	32. Liu, J., & Li, L. (2011). **Network community detection based on co-neighbor modularity matrix with spectral clustering.** In Applied Mechanics and Materials (Vol. 55, pp. 1237-1241). Trans Tech Publications Ltd.

		33. Scibetta, M., Boano, F., Revelli, R., & Ridolfi, L. (2013). **Community detection as a tool for complex pipe network clustering.** EPL (Europhysics Letters), 103(4), 48001.
		34. Sharma, S., & Purohit, G. (2013). **A Novel Framework For Tracking Online Community Interaction In Social Network.** International Journal of Information Acquisition, 9(02), 1350011.
		35. Zhuhadar, L., Yang, R., & Nasraoui, O. (2012, December). **Toward the design of a recommender system: visual clustering and detecting community structure in a web usage network.** In 2012 IEEE/WIC/ACM International Conferences on Web Intelligence and Intelligent Agent Technology (Vol. 1, pp. 354-361). IEEE.
		36. Yu, L., & Ding, C. (2010, July). **Network community discovery: Solving modularity clustering via normalized cut.** In Proceedings of the Eighth Workshop on Mining and Learning with Graphs (pp. 34-36).
		37. Singh, D. K., Haraty, R. A., Debnath, N. C., & Choudhury, P. (2020, February). **An analysis of the dynamic community detection algorithms in complex networks**. In 2020 IEEE International Conference on Industrial Technology (ICIT) (pp. 989-994). IEEE.
		38. Hu, F., Liu, J., Li, L., & Liang, J. (2020). **Community detection in complex networks using Node2vec with spectral clustering. Physica A: Statistical Mechanics and its Applications,** 545, 123633.
		39. Al-Andoli, M., Cheah, W. P., & Tan, S. C. (2021). **Deep autoencoder-based community detection in complex networks with particle swarm optimization and continuation algorithms.** Journal of Intelligent & Fuzzy Systems, 40(3), 4517-4533.
4	Other	40. Sharma, S., & Joshi, N. K. **Enhancement of existing clustering algorithm for tracking online community in social network.**

		41. Verma, A., & Butenko, S. (2013). **Network clustering via clique relaxations: A community based. Graph Partitioning and Graph Clustering,** 588, 129.
		42. Lu, N., Jin, Y., & Qin, L. (2013). **Network Community Structure Clustering Algorithm Based on the Genetic Theory. Journal of Advances in Computer Networks,** 1(2).
		43. Eagle, M., Johnson, M., & Barnes, T. (2012). **Interaction Networks: Generating High Level Hints Based on Network Community Clustering.** International Educational Data Mining Society.

Summary and Conclusion

The topology and evolution of complex real-world networks are controlled by various organizing principles of topology and dynamics and happen to be a major research area. Researchers have been addressing structural and topological issues of complex networks as well as complex networks' dynamics for quite some time. Some of the important concepts that have evolved in the field of complex networks are small-world and scale-free networks, evolving networks, the relationship between topology and the network's robustness, degree distributions, clustering, network correlations, random graph models, models of network growth, dynamical processes on networks, etc. Researchers apply several types of methods and algorithms for detecting and identifying communities in complex networks, which can be generally divided into 4 categories. The optimal methods to detect network communities vary depending on applications, complex networks, computational resources, etc. Some current lines of research on complex network communities are those on community evolution, overlapping communities, communities in directed networks, community characterization, and interpretation, etc.

Several complex networks have the property of clustering or network transitivity. Many of the algorithms or methods proposed for network community detection through clustering are modified versions of or inspired by the concepts of minimum-cut-based algorithms, hierarchical connectivity-based algorithms, the original Girvan–Newman algorithm, concepts of modularity maximization, algorithms utilizing metrics from information and coding theory, and clique based algorithms. Consequently, Community Detection Clustering Algorithms in Complex Networks can be broadly classified into Hierarchy Based Algorithms and Theoretic Information Algorithms. Moreover, there has been a lot of research work carried out by eminent researchers in the fields of both Hierarchy Based Algorithms and Theoretic Information Algorithms, as well as Modularity based community detection. Also, in the case of social networks finding subgroups is important for understanding and possibly influencing the formation and evolution of online communities.

Researchers have inferred the dynamics of the communities to a significant extent from the online interactions of the nodes by tracking the evolution of known sub-communities over time. Researchers have also used the clique relaxation concept of k-community for network community identification wherein by defining a cluster as a k-community, the aim is to provide a clustering of a network into k-communities with varying values of k. Work has also been carried out based on genetic theory, and a novel Network Community Structure Clustering Algorithm has been proposed based on it. Apart from these, significant research work has also been carried out based on network community identifying methods that can be used to recognize sub-goals in problems in a logic tutor. Then those community structures can be utilized to produce high-level hints among sub-goals.

As can be seen, community detection in complex networks is an active research area. It has got real-life applications in the fields of large-scale engineering, social media analysis, biomedical data analysis, online education, business and economics, etc. It is hoped that this survey will be of great help to the scientific community and senior researchers.

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Introduction to Artificial Intelligence: Current Developments, Concerns and Possibilities for Education

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Abstract

Artificial Intelligence is shaping the world at a speed much faster than anticipated. Machine learning models are extensively used in banking, e-commerce, healthcare, weather forecasting, etc. ChatGPT is the latest entry in the bloc but the most engaging one so far. The world is abuzz with concerns about AI/ML rendering people jobless. The who's who in the world of technology is warning of potential danger in the exponential growth in learning capabilities of intelligent systems and the concerns related to privacy, ethics, safety, and security. Educationists should also be equipped with the basic know-how of AI and its related fields to have a considered opinion while adopting teaching-learning-assessment. This article discusses the concept of Artificial Intelligence in Education (AIED) and introduces the branches of AI, such as Machine Learning, Artificial Neural Networks, and Deep Learning, as well as their working with examples that educators can relate with. The article also highlights some of the ethical concerns associated with AI.

Keywords: Artificial Intelligence in Education (AIED), Machine Learning, Artificial Neural Network, Deep Learning, Ethical concerns with AI.

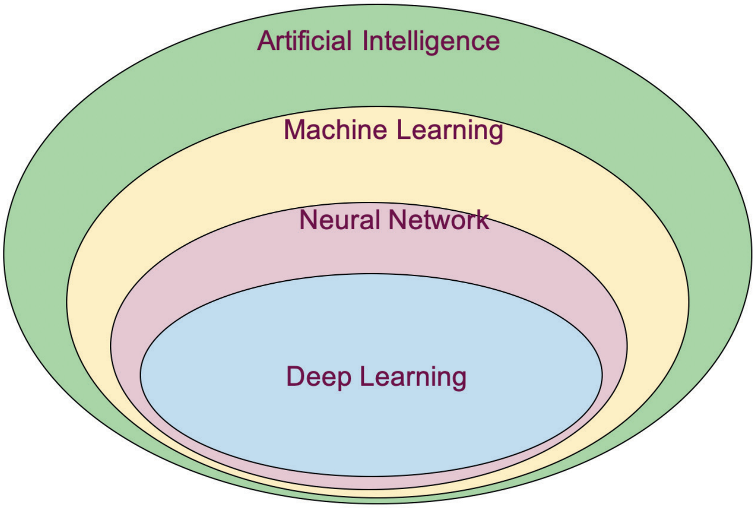
Introduction to Artificial Intelligence

Artificial Intelligence (AI) is the branch of computer science that studies how to use computers to carry out intelligent tasks that are otherwise done by humans (Huang et al., 2019). The term "Artificial Intelligence" was first proposed as early as 1955 (McCarthy et al., 2006), with the premise that if we can precisely describe the features of human intelligence or intellectual activities such as learning, reasoning, judgment, decision-making, etc., then a machine can be made to reproduce it (Wang, 2019). Therefore, early research in AI tried to decode how intelligence processes work in humans so that those could be reproduced or replicated through computers. This was the trend till the twentieth century. But today's AI systems are designed to work in complex domains and scenarios, irrespective of whether they follow a human-like approach or not (Floridi, 2014). AI techniques have evolved over the years to carry out tasks that require some intelligence. Today's advanced AI-based systems are similar to the human mind in certain ways but do not necessarily mimic human behaviour, nor are they identical in all aspects. Different approaches to AI research and their application areas include automated game playing, pattern recognition, data mining, expert systems, neural networks, and the latest deep learning. In 1997, Deep Blue (Campbell et al., 2002) - an AI-based chess-playing software, defeated the then-world chess champion Garry Kasparov. Other examples of AI-based systems we often interact with are:

- Google map - predict traffic, determine the best route, and estimate travel time.
- Personalised recommendation - YouTube recommends videos

based on our search history, Netflix recommends movies/shows based on past viewing data, Amazon/ Flipkart recommends products based on shopping history, and many other parameters.

Figure-1: Relationship between AI, ML, ANN and DL



Many AI subdomains exist today, such as knowledge representation, reasoning, machine learning, computer vision, natural language processing, artificial neural network, deep learning, etc. Figure 1 shows the hierarchical relationship between artificial intelligence, machine learning, neural networks, and deep learning.

The recent progress in the development of artificial intelligence techniques is making our life easier in many ways. They are automating various tasks, bringing efficiency, reducing cost, and playing a vital role in human progress. There is a keen belief among educationists that AI can help improve the teaching-learning processes, too (Chen et al., 2022; Luckin, 2017; Ouyang & Jiao, 2021). Therefore, it is essential for the education fraternity to have a basic understanding of artificial intelligence techniques to explore their possible use cases (Lee & Perret, 2022; Chaudhry & Kazim, 2022).

The remaining sections of this article introduce the basic concepts of Machine Learning, Neural Networks, and Deep Learning from the perspective of a common reader. It then discusses the possible use cases for AI in different aspects of education. The article also highlights the concern around the unchecked growth in AI and its potential implications.

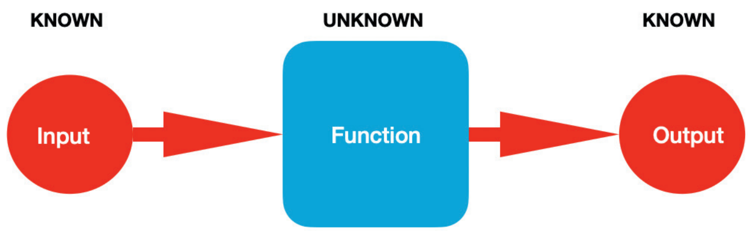
Machine Learning

Machine learning (ML) is the science of teaching computers how to learn from experience. It is the branch of AI that aims to train computer algorithms with lots of examples (data or situations) so that they learn during the training and, once trained, can generate results for unknown data or situations. Also, ML models can continuously learn while being used and improve their performance. Such a model takes a large amount of data as input, processes them, and as output, either predicts an upcoming result or classifies the given data (Valiant, 1984). Today's machine learning techniques exhibit only a limited range of intelligent behaviour, primarily in prediction, classification, clustering, dimensionality reduction, etc.

The statistical techniques used in ML themselves are not new. Instead, they were formulated in the early 20th century. The Improvement in computing power and other advances in computer science have made it possible to utilise those statistical methods in ML algorithms. The learning techniques used in ML models are prominent in three types (Figures 2 - 7), as detailed below.

Supervised learning

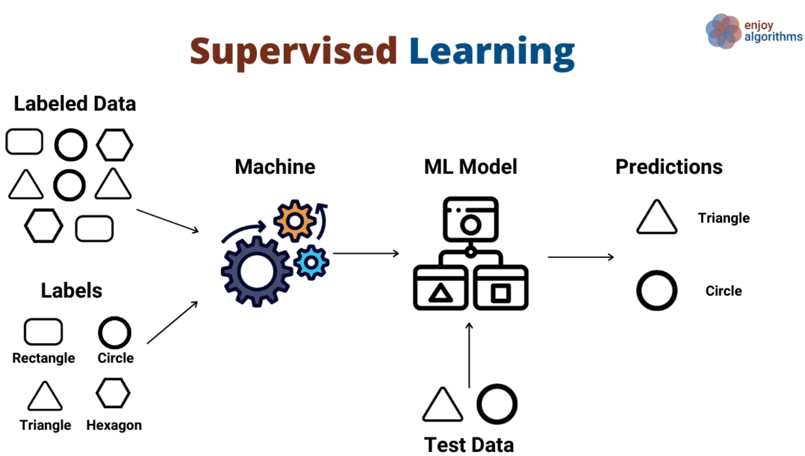
Figure-2: Supervised learning-training process (Raj, 2023)



In the case of supervised machine learning, we have a dataset in which both the input and output are known (called labelled), but the relation (mapping) between input and output is not exclusively defined.

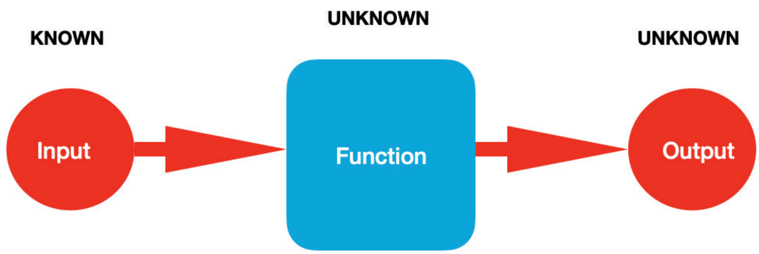
As an example, we have data about student attendance, family details, performance in periodic tests, etc., as input and also the performance in the annual examination as output. However, we don't know the relation between these input parameters and the output. The machine is trained with a large set of labelled data to find the output for an unknown input value after training. In our case, if we feed the machine with another student's input values, it should be able to predict the student's performance in the upcoming final examination. This kind of learning technique is used for classification and regression problems.

Figure-3: Example of supervised learning (Raj, 2023)



Unsupervised learning

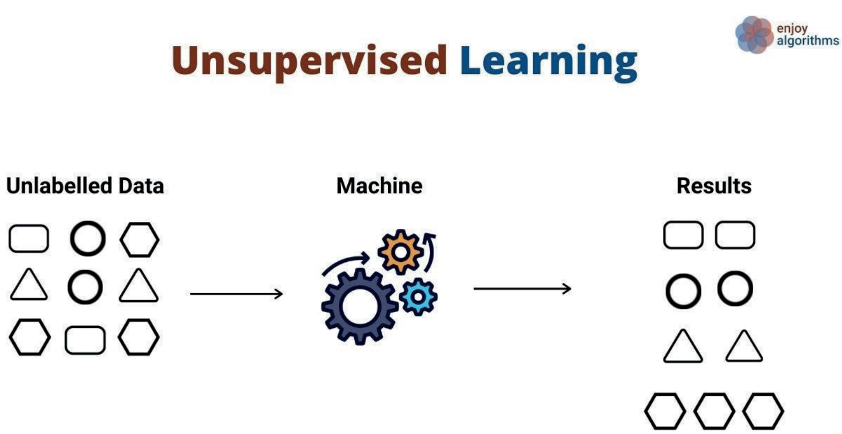
Figure-4: Unsupervised learning-training process (Raj, 2023)



In the case of unsupervised machine learning, we have a dataset in which only the input values are known, but the output and the relation between input-output are not known beforehand (called unlabelled). The machine is trained with a large set of unlabelled data, and during this process, it learns to categorise similar datasets into groups (also called clusters). Once trained, the output is the decision about which cluster the given input best fits into. Human learning is largely unsupervised as we are not exclusively taught everything in life. Instead, we observe the world and discover the structure and phenomena that occur (LeCun & Hinton, 2015).

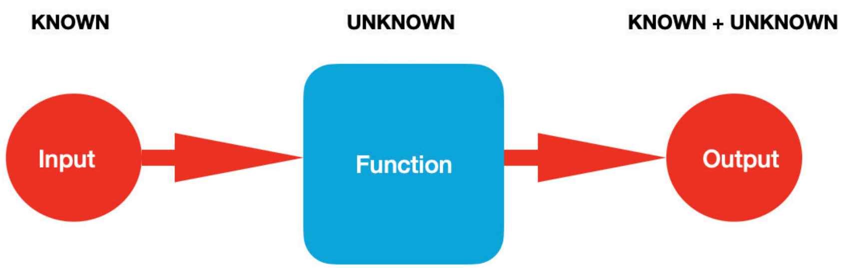
For example, we have data about various learners and their learning behaviours using an e-learning platform like DIKSHA (NCERT, 2023). We can input these data into an unsupervised machine learning model, and it can segregate the learners into different categories based on specific parameters in the given data. Such clusters can help us learn many interesting facts about how learners use an e-learning platform, and accordingly, we can either improve the features of the platform or its contents or both. This kind of learning technique is used for clustering and dimensionality reduction problems.

Figure-5: Example of unsupervised learning (Raj, 2023)



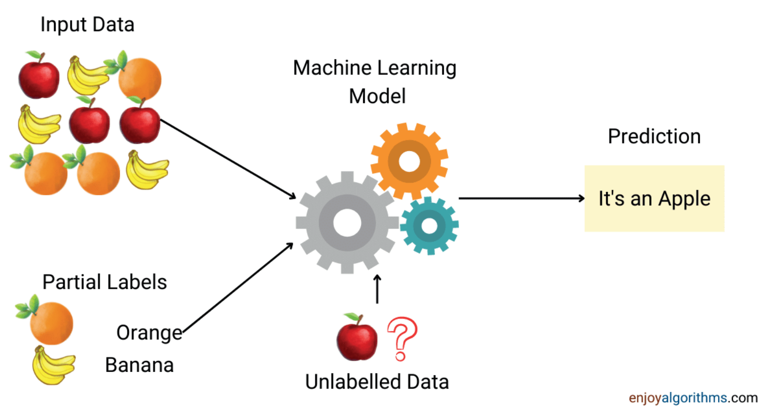
Semi-supervised learning

Figure-6: semi-supervised learning-training process (Raj, 2023)



In the real world, most data collected are unlabelled, meaning the output is unknown a priori. It is costly to manually level such data as it is time-consuming and needs domain expertise. As the name suggests, only a tiny portion of the input data are labelled while the others are not. The model is trained with this small labelled data and then applied to unlabelled data. This process is repeated, and the model starts improving its output.

Figure-7: Example of semi-supervised learning (Raj, 2023)



Supervised learning provides accurate output, but having a vast dataset with labelled output is costly. Unsupervised learning doesn't require any labelled output, but the accuracy is less. Semi-supervised learning takes advantage of both these techniques. Hence, using semi-supervised learning, only a small sample of data is human labelled, and the rest of the unlabelled data are given to the model for labelling.

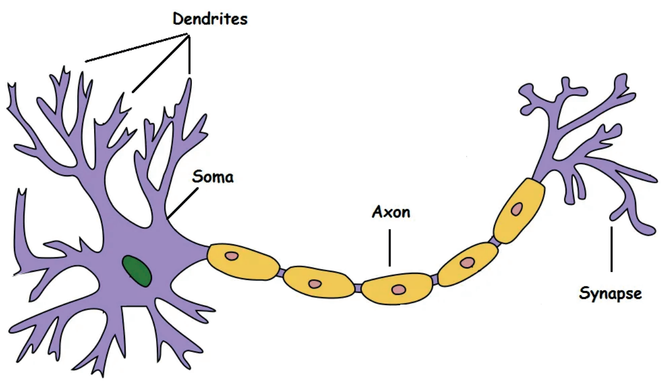
For example, a student's career counselling should ideally be done based on the performance across the years and the student's interest, aptitude, attitude, etc. To conduct career counselling at the end of schooling, it may be easy to collect such data about learners from the school records and through a questionnaire to be filled out by the student. But it requires the expertise and time of a counsellor to analyse all such data and suggest appropriate choices for the learner.

Machine learning can be used in many areas of education, such as predicting student performance (Anozie & Junker, 2006); assessing and grading students (Luckin et al., 2016), improving retention (Đambić et al., 2016); assisting teachers in assessment and other tasks (Celar et al., 2015).

Artificial Neural Network (ANN)

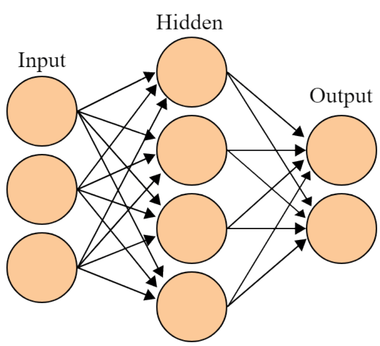
Our brain has many interconnected neurons, which can be considered a neural network. In such neural networks, when the neurons get excited (or activated), they send signals called neurotransmitters to other neurons connected to them. These neurotransmitters change the electric potentials of the receiver neurons. When the electrical potentials cross a limit called threshold, those neurons get excited, and they in turn, send signals further to the neurons connected to them. In a nutshell, a neuron takes input, processes it, and sends the output to the other connected neurons.

Figure-8: A biological neuron (image source: Wikipedia)



This functioning of the biological neural network has been inspiring computer science researchers since the 1940s (Yadav & Kumar, 2015; Pitts, 1943). Attempts to write algorithms that mimic the interconnected structure of neurons in computer-based data processing have led to the creation of a major subfield called Artificial Neural Networks (ANN). The basic element of ANN is also called a neuron or unit. An artificial neural network is created by arranging the neurons and their interconnections into layers called a) the input layer, b) the output layer, and c) one or more hidden layers.

Figure-9: A single layer ANN (image source: Wikipedia)



Deep Learning

All neural networks must be trained with large datasets as they learn during training and ultimately become capable of producing near-accurate results. Deep learning adds multiple hidden layers in the artificial neural network (LeCun & Hinton, 2015). These additional layers in deep learning models make it possible for them to generate results with more accuracy than single-layer neural networks. But deep learning models require to be trained with large datasets for hundreds of hours. Earlier, getting access to very large datasets and their storage took a lot of effort. The processing of large datasets with traditional computer processors wasn't easy either. However, with so many people using social media, doing online shopping, and creating and sharing content through the Internet means the easy creation of enormous datasets quickly. This is one of the reasons why deep learning is gaining popularity and attention.

The training phase of any deep learning model is very resource intensive and time-consuming in the case of massive datasets. The multiple layers in deep learning models mean they require more computing power. The availability of cloud computing resources (compute and storage) and the emergence of a new set of processors called Graphics Processing Units (GPU) has made it possible to develop and train deep learning models. Compared to traditional CPUs, GPUs are cheaper, faster, and capable of real parallel processing.

Deep learning-based models are extensively used in speech recognition (Siri, Alexa, Google Voice, etc.), computer vision (face detection, autonomous cars, robots), Natural language processing, fraud detection, image processing, etc.

Natural Language Processing

Humans communicate with each other in many ways - speaking, listening, writing (text, image, graphics), making gestures, and using sign language. Communication between people reading or writing in different languages (natural languages) is difficult as one may not know the other's language. The vast knowledge base available in the electronic or print format is often created in the languages that are most spoken. These are often not accessible to people who do not know those languages. It is a tedious and expensive task to translate between languages manually. Digital computers are binary machines that do not readily process natural languages. There have been efforts to use computers to process natural languages. However, understanding natural language is not easy for computers. This is because human languages are ambiguous and have imprecise characteristics, such as:

- The meaning of a word can vary depending on the context of use.
- Use of different alphabets at different positions of a word to signify plurality.
- Pronunciation of two or more words can be the same, yet their spelling can be different.
- Slang words and other culture-specific words can have different meanings.

The branch of AI that deals with communication between humans and computers in natural languages is called Natural Language Processing (NLP) (Eisenstein, 2018). NLP uses AI techniques such as machine learning and deep learning (called Neural Machine Translation) to read, understand, and make sense of human languages. Popular applications of NLP include

- machine translation between languages
- real-time speech conversion between natural languages,
- conversion of speech to text and vice versa,
- text summarisation,
- grammar and spelling checking,
- email spam filtering,
- Search by search engines based on keywords given,
- chatbots understand human query responding in natural languages,
- personal digital assistants like Siri, Cortana, Alexa, OK Google,
- conversational agents such as ChatGPT.

The data (text or voice) must be preprocessed to apply an AI-based algorithm for NLP. Following are some of the basic pre-processing activities in NLP (Kibble, 2013):

A. Tokenization - breaking down a sentence and its components into individual words, numbers, punctuation marks, other symbols, and characters. Each of these components is a token.

B. Part of Speech (POS) tagging - categorises every token as a part of speech or into a grammatical area, such as nouns, pronouns, adjectives, adverbs, etc.

C. Stemming and Lemmatization - identifying the root word for a set of words. For example, the root word for run, ran, and running is run.

D. Stop word removal - words such as articles, prepositions, etc. which do not add much value/information to the text.

Language Model

It is a type of machine learning model that predicts the next word(s) in a sequence that is most appropriate to fill in a blank space in a sentence or phrase. It relies upon statistical methods (probability distribution of different available words) and the context to select the next term.

Language models constitute a fundamental part of Natural Language Processing (NLP) as they help machines understand, analyse, and generate human languages. The auto-complete suggestions we see while typing in smartphone work based on language models.

Generative Artificial Intelligence

The application of AI techniques to generate different kinds of texts, audio, video, animation, 2D/3D images, and even programming code snippets is called Generative AI.

A) ChatGPT

A chatbot developed by OpenAI, ChatGPT (2023), has taken the world by storm. Within two months of its launch, it has got 100 million users, which is the fastest technology adoption in history. It can converse with users and generate articles, essays, poems, and even programming codes. The output generated is so impressive that some people find it difficult to distinguish between machine-produced output and those by humans.

Generative Pre-trained Transformer (GPT) that powers the ChaGPT is a language model trained with contents (datasets) collected from billions of websites and web pages.

B) Other Examples of Generative AI

A. DALL-E 2 (2023) is another tool from Open AI, the same organisation that has come out with ChatGPT. DALL-E is a tool to generate art using AI. They claim that based on input given in natural languages, the tool can generate images that appear realistic.

B. Alphacode (2023) from Deepmind can generate professional-grade code in different programming languages.

AI in Education (AIED)

The purpose of bringing AI into education is not to supplant the teacher. Researchers working in Artificial Intelligence in Education (AIED) must focus on areas where AI can alleviate teachers of routine tasks or achieve complex functions which are otherwise difficult. It is a well-known fact that each learner has a unique learning style, preferences, likes/dislikes, varying prior knowledge, and comes from different socio-economic backgrounds. AI can be used to identify these individual traits to build and update a student model for each learner. Such a student model can be used to carry out personalised tutoring by recommending appropriate content, carrying out an adaptive assessment, predicting potential dropouts, and accordingly intervening, etc. (Kučak et al., 2018). The recent advances in NLP in terms of powerful language models are also relevant for education, mainly in the areas of machine translation, speech recognition (for speech-to-text and speech-to-speech conversion), retrieval of information from the web or a content repository, question-answering, text summarisation, etc. This subsection briefly explores some of the areas of education where AI can be of help (Holmes et al., 2002):

A. Support collaborative learning - AI can refer to individual student models and search for other students having similar learning preferences and traits and are best suited for a particular collaborative task. Such learners can be suggested for collaborative work.

B. Monitor and manage student discussion forums - Online courses having more than a few hundred participants can lead to many discussions and questions in forums. AI-enabled chatbots can answer some questions while leaving the critical ones for the teacher to respond to. AI can be used to summarise or club similar questions, thus reducing the number of questions for the course tutor. AI-powered sentiment analysis tools can analyse the discussion posts by students to flag likely dropout cases or inappropriate posts such as racist or sexist remarks or any other emotional traits of a learner that require a teacher's intervention.

C. Continuous and holistic assessment - the importance of continuous assessment rather than a year/semester end test is well known. A learner should not be assessed merely based on the performance in a high stake examination. Such assessment causes undue stress and anxiety and encourages learners to learn what is to be assessed rather than what is required. Easy accessibility of devices and the Internet has provided learners multiple learning opportunities beyond the classroom. Skills, competencies, and certificates earned by a learner from different sources should be acknowledged and duly recorded in a student portfolio. It can be further authenticated using blockchain technologies. This will help create a robust, verified, and in-depth record of a learner's learning experiences, which will be far more realistic than a collection of certificates/

degrees. AI can help in continuous and holistic assessment by asking suitable questions based on the learner's recent learning history. It can assess the learning gap and guide the learner to the appropriate learning resource, a tutorial or a practice test.

D. Learning companion - an Intelligent Tutoring System (ITS) can be a great companion for both a learner and a teacher as it can suggest the relevant learning path; recommend appropriate resources; assist in solving a problem or clearing a doubt; provide timely guidance and feedback; continuously record the learner's interest and progress in the student model (Barbhuiya et al., 2011). ChatGPT and voice assistants such as Siri, Alexa, Google Home, etc., can be used for some of these tasks.

E. Teaching assistant - AI is not going to replace human teachers (Timms, 2016). However, teachers must continuously adapt and evolve to leverage AI in automating some of their work which otherwise takes lots of time. These can include checking the homework, managing attendance, compiling results, etc.

F. Understanding how people learn - Educationists are still exploring to understand the science of learning. The cognitive science and neuroscience domains are still figuring out how we learn about something or someone, how we recall (retrieve) someone we met years ago, or some incident that happened long back, etc. With the shift to online and digital learning, we are generating lots of data about learners' behaviour and performance during learning. Data mining and other AI-enabled data analytics techniques can be used to analyse such data and advance the science of learning.

Concerns around the progress of AI

As discussed earlier, the emergence of cloud computing services, advancements in computer processing capabilities, affordable storage options, generation of huge online datasets, etc., have led to exponential growth in the field of AI, particularly in deep learning techniques. The recent success of deep learning has made AI a hot topic attracting much public attention. We are seeing an unprecedented level of automation in various areas. It is becoming difficult to predict the impact of AI in the near future in the areas of work, healthcare, digital surveillance, cyber warfare, etc. Educators struggle to determine the essential future skills that today's school-going learners should be equipped with.

AI has already started showing impressive results in certain domains. Researchers are working hard to leverage AI in Healthcare (early detection of disease, targeted drug delivery), weather forecasting, defense, legal matters, etc. However, there are concerns about the implications of unregulated research and innovation in AI. Many big names in the world of science and technology, including Stephen Hawking, have warned about possible existential threats to humanity due to advancements in AI. Technology leaders like Elon Musk of Tesla, Apple co-founder Steve Wozniak, Geoffrey Hinton from Google, and many others have already urged to make a pause in the development of powerful artificial intelligence (AI) systems until their alleged safety concerns are addressed by deliberating and devising safety protocols.

AI models are data-hungry, and as a result, there is a tremendous interest in collecting data, including our data. Consider big technology corporations collecting data about our physical activities, medical conditions, and personal and social life, including what we eat, whom we meet, and what we talk about. Such personal data can be exploited and misused if they fall into the wrong hands. In the context of education, people envisage having AI for teaching-learning-assessment, but constant monitoring of student behaviours and achievements can result in severe and far-reaching ethical questions. Governments worldwide are considering regulations and policies to deal with the dangers and pitfalls of AI systems related to ethics, equity, privacy, and humanity at large. The European Union (Hickman & Petrin, 2021) is taking the lead so far in initiating serious attempts to regulate AI and big technology companies. The aim is to break any potential monopoly and ensure the ethical and safe use of AI and related technologies.

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Book Review

Glocal Policy and Strategies for Blockchain: Building Ecosystems and Sustainability

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Blockchain is a technology that allows for the secure and transparent recording and sharing of data without the need for a central authority or intermediary. It is essentially a distributed ledger maintained and updated by a network of computers or nodes rather than a single entity. One example of how blockchain technology can be used in education is through the issuance and verification of academic credentials, such as diplomas or degrees. Traditionally, these credentials are issued by universities or other educational institutions and are often subject to fraud or misrepresentation. Blockchain technology can help to address these issues by providing a secure and tamper-proof way to store and share academic credentials.

In a blockchain-based credentialing system, a student's academic achievements would be recorded and verified on a blockchain ledger rather than on a paper certificate or transcript. The student would have full control over their credentials and would be able to share them with potential employers or other institutions in a secure and verifiable way.

For example, the Massachusetts Institute of Technology (MIT) has developed a blockchain-based system called Blockcerts that allows students to receive and share digital academic credentials. The system is based on the Bitcoin blockchain and uses cryptographic keys to ensure the authenticity and integrity of the credentials.

By using blockchain technology for credentialing, students can have greater control over their academic records and more easily share their achievements with potential employers or other institutions. It also helps to prevent fraud or misrepresentation, as the credentials are verified and secured through the blockchain ledger.

The current book, "Glocal Policy and Strategies for Blockchain: Building Ecosystems and Sustainability" under review, focuses on the intersection of blockchain technology and policy, exploring how governments and other organizations can develop effective strategies for integrating blockchain into their operations while addressing the unique challenges posed by the technology. There are eleven chapters which are organised under different sections.

The first chapter, "Blockchain: A Legal

Perspective," examines the legal perspective of blockchain technology and discusses the opportunities, risks, and challenges associated with its use. It follows a three-pronged approach, discussing legal and regulatory compliance issues, business applications, risks, and their mitigation, as well as the potential for using the technology for the public good.

The second chapter, "A Blockchain-Based Tourism Industry: How Promising Can It Be?", discusses that Blockchain technology has the potential to transform the tourism industry by improving trust, automating processes, and reducing costs through its characteristics such as decentralization, disintermediation, security, transparency, and immutability. However, the adoption of blockchain in tourism is limited due to several challenges, including a lack of awareness and expertise, high energy consumption, and regulatory frameworks for data management and income taxation. Despite these challenges, the potential benefits of blockchain technology make it an essential area to watch in the future for the tourism industry.

In the third chapter, "Strategic Planning and Policy Framework for Implementation of Blockchain Technology in Education in India," the authors discuss the potential of blockchain technology in various sectors, including education, and the Indian government's initiatives toward its adoption. This chapter highlights the strategic planning and policy framework for implementing the technology in India and provides an overview of its current status and challenges in education. The authors of this chapter aim to showcase the multidimensional use of blockchain and its potential for future growth in India.

Chapter 4, "Investigation of Purchasing Applications After Digital Change in Industrial Markets," discusses how the demands and needs of consumers in global markets have changed due to cultural interaction and increased use of the Internet for online shopping, leading to a rise in the demand for fast delivery and product diversity. The text also mentions how companies have started using online web pages in supplier selection and exploring the purchasing processes in industrial markets and the impact of digital transformation on them.

Chapter 5, "From Black to Green: Eco-Friendly Learning With Blockchain Technology," discusses the potential use of blockchain technology in education systems and how it can be designed to create environmentally-friendly learning environments. Despite concerns about the energy consumption and emissions associated with blockchain, the authors suggest that there is not enough data to support this claim. The chapter outlines a framework for integrating green technologies and blockchain in education and presents suggestions for creating eco-friendly learning environments.

The 6th chapter, "Blockchain: An Exploratory Review of Applications in Marketing," explores the potential of blockchain technology and its strategic benefits, including the ability to revolutionize existing business models and speed up processes while reducing transaction costs. It emphasizes the importance of business professionals understanding the implications of blockchain technology and integrating it into strategic initiatives. The chapter explains blockchain in the context of business strategies and provides examples of its applications.

In Chapter 7, "Augmenting Learner Support Services with the Use of Blockchain Technology", the author explores the potential applications of Blockchain technology in managing internal processes in education, specifically in Open and Distance Learning systems and learner support services in India. It discusses the introduction and recent developments of Blockchain, as well as the strategies of the Indian government to adopt it, while also addressing the challenges of implementation and the implications of using Blockchain technology in education.

Chapter 8, "Get Ready for Blockchain Technology: A Probe Into Its Potential for Indian Schools", is about how blockchain technology could potentially improve schooling in India by providing enhanced digital accuracy, openness, cost-saving operations, and a constructivist learning paradigm. The author proposes a Framework for Blockchain Implementation (FBI) in school operations to contribute to the effective implementation of the technology. The article is desk research that reviews existing literature and evaluates the potential of blockchain technology in Indian schools.

Chapter 9 looks into the "Potential of the Internet of Things (IoT) and Blockchain Technology in the Collaboration and Integration of the Retail Supply Chain" and reports that the use of Industry 4.0 technologies in supply chain management has become a popular topic due to their ability to enhance efficiency, performance, and sustainability. However, the retail industry is facing challenges related to collaboration and integration, and this study uses a literature review to explore the potential of technologies such as IoT and blockchain to address these challenges. The study identifies various characteristics, themes, and potential solutions for collaboration and integration in the retail supply chain and provides recommendations for small and medium-sized enterprises.

The authors of Chapter 10, "Internal Audit Functions in Cyber Security Governance: Turkey's Bank Sector Case", discuss the growing concern over cyber-attacks in the banking sector due to the increased use of technology and digital transformation. It emphasizes the need for validation of cybersecurity governance mechanisms to ensure financial transactions occur within acceptable risk levels. The article proposes exploring blockchain technology as a potential solution for implementing continuous audit methods in cybersecurity governance.

The last chapter of this book, "The Impact of Blockchain Technology on Accounting, Auditing, and Assurance Practices: Turkey Case", reviews national and international literature to examine the impact of blockchain technology on accounting, auditing, and assurance practices. The advantages and disadvantages of blockchain technology are evaluated, and it is concluded that blockchain has a significant effect on these practices.

To sum up, the book is an excellent resource that focuses on exploring the intersection of blockchain technology and policy. The book covers a range of topics, including the potential applications of blockchain in both the public and private sectors, legal and regulatory compliance issues, business applications and risks, and the potential for using blockchain technology for the public good. The book also examines the impact of blockchain technology on accounting, auditing, and assurance practices. The book aims to provide insights into effective strategies for integrating blockchain technology into organizations while addressing the unique challenges posed by the technology. This book can be a useful resource for policymakers, business leaders, academics, researchers, and anyone interested in understanding the potential impact of blockchain technology on various industries and its associated legal and regulatory issues. The book covers a broad range of topics related to blockchain technology, including its applications, challenges, and opportunities in different sectors, making it a valuable resource for individuals seeking to gain a deeper understanding of this emerging technology. Additionally, the book's examination of the impact of blockchain technology on accounting, auditing, and assurance practices could be particularly useful for professionals working in these fields.

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