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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

अयं निजः परो वेति गणना लघु चेतसाम।
उदारचरितानां तु वसुधैव कुटुम्बकम्।

("He, who perceives the distinction of 'mine' and 'other' , has a narrow mind.
But for those with a noble character, the entire world is one family.")

... Maha Upnishad

As we step into 2024, the New Delhi Leaders' Declaration (NDLD) (https://www.g20.in/en/index.html) of the G20 summit held on 9-10 September, 2023 in New Delhi provide a beacon of light to the people and the planet. The G20 accounted for "85% of global GDP, 75% of world trade and 2/3rd of world population". 'Vasudhaiva Kutumbakam', which is part of India's cultural heritage and was the central theme of the G20, is interwoven into the recommendations of the NDLD. The recommendations included on issues of 'sustainable, green and inclusive growth', 'quality education', 'digital infrastructure', 'climate action', etc. On quality education, it recognizes the importance of "foundational learning (literacy, numeracy, and socio-emotional skills) as the primary building block for education and employment"; reiterates the "commitment to harness digital technologies to overcome the digital divides for all learners"; extends "support to educational institutions and teachers to enable them to keep pace with emerging trends and technological advances including Artificial Intelligence (AI)"; emphasizes "expanding access to high-quality Technical and Vocational Education and Training (TVET)"; reaffirmed the "commitment to promote open, equitable and secure scientific collaboration" and encouraged "mobility of students, scholars, researchers, and scientists across research and higher education institutions" and emphasized the "importance of enabling life-long learning focused on skilling, reskilling, and upskilling especially for vulnerable groups".

The NDLD sees potential in technology for bridging digital divides besides being a tool for rapid transformations for inclusive and sustainable development. It further talks about "creating digital public infrastructure (DPI), which is safe, secure, trusted, accountable, inclusive and capable of delivering services at societal-scale." In also recognises "the importance of data" and their role in development. It also emphasises the flow of data across borders within the applicable legal frameworks. The NDLD also "welcomed India's plan to build and maintain a Global Digital Public Infrastructure Repository (GDPIR), a virtual repository of DPI, voluntarily shared by G20 members and beyond." It also took "note of the Indian Presidency's proposal of the One Future Alliance (OFA), a voluntary initiative aimed to build capacity, and provide technical assistance and adequate funding support for implementing DPI in Low/Middle Income Countries (LMICs). It also welcomed the "G20 Toolkit on Cyber Education and Cyber Awareness of Children and Youth." It recognises the immense potential of the AI and thus recommends "promoting a responsible AI for achieving SDGs."

This shared commitment of the G20 countries was presided over by Bharat. India is taking some definite steps to turn India's economy into 22 trillion dollar economies by 2047, when India will be celebrating the centenary year of her freedom from British colonialism. The EdTech industry is going to play a crucial role in this

transformation. EdTech's role will not only be through the market alone but as NDLD above says the EdTech will become a tool for this transformation as well. The EdTech industry was valued at over 2.8 billion USD in 2020 which is estimated to become close to 10 billion USD in 2025 (https://www.statista.com).

So, what will drive this market? What innovations will fuel this transformation? It is hoped that with the continuous evolution of technology, the perennial contradictions arising from delivering uniform instructions to a class with diverse students, each possessing a unique learning style, can be effectively reconciled. Some of the areas where we can see these innovations in education are discussed below.

Artificial Intelligence (AI) and machine learning are set to revolutionise learning. Both are capable of providing personalised learning experiences, either by intelligent tutoring and adaptive assessments or by analysing students' data to tailor instructional content to suit the learning styles of the individual students. The immersive technologies in form of virtual and augmented reality contents help students and teachers to go beyond the textbooks to learn new concepts and engage in complex simulations. One of the important roles that technology has played historically in education has been towards equitable education. Assistive technologies, such as speech-to-text and text-to-speech applications, are making education more accessible to Divyang children. Blockchain technology is truly disrupting the older ways in the manner in which it secures and verify academic records and thus bring transparency and trust in the educational system. This not only streamlines the hiring process for the employers but also a sense of empowerment to students by giving them greater control over their academic achievements.

In this latest edition of the Indian Journal of Educational Technology (IJET), different types of articles such as general articles, research articles and book review have been included to cover various aspects of educational technology. General articles explore the topics such as cyber safety and ICT competencies. Some of the contents range from the impact of multimedia and gaming on the dynamics of learning and teaching to the perceptions and attitudes of pre-service and in-service teachers towards the integration of Information and Communication Technology (ICT). This issue of the IJET also inquire into the challenges and prospects of implementing ICT in remote tribal areas, scrutinizing the efficacy of the Government of India's digital initiatives, such as DIKSHA. It continues to survey the impacts that the pandemic had on educational technology per se. Further, it critically reviews the praxis of flipped learning, investigates the role of social media in reshaping teaching and learning habits, and explores how social media content responded to the debates on history textbooks. Additionally, the issue probes instructional strategies in the context of the digital technology, assesses the perception of Geographic Information Systems (GIS) by school teachers, and deliberates on the broader implications of Augmented Reality in teaching. It also engages with the ethical dimensions of Artificial Intelligence in education, examines assisted technologies, scrutinizes the integration of robots into the Indian educational landscape, and explores diverse models of technology-mediated learning.

(ABHAY KUMAR)
Editor

Research Article

Effect of Branching Programme on Achievement of Primary Students on L.C.M and H.C.F

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Abstract

Mathematics as a subject is very important and a strong foundation in mathematics ensures better academic performance and a confident personality. A strong foundation of computation skills and understanding of mathematical concepts must be developed during primary school. To achieve this goal the teaching should be individualized so that students can learn, understand, and practice Mathematical concepts at their own pace and using their specific learning styles. Mathematics learning can be made an individualized and joyful experience for students by using the Branching programme as a teaching-learning strategy. The present paper presents the research done to study the impact of the Branching programme on the learning and understanding of two basic concepts of mathematics-L.C.M. and H.C.F. The researcher has developed the branching programme and tested its efficacy of it on students' achievement. The finding shows that the programme was found to be effective for grade five children. Presentation of the concepts of L.C.M and H.C.F. in the form of small frames along with practice questions and providing immediate reinforcement and remedial material proved to be beneficial for the students.content and comes out with a significant sprucing up of student's achievement.

Keywords: Programmed Instruction, Intrinsic Programming, Achievement, Primary Education

Introduction

Primary education is the most important stage in a child's education as it lays the foundation of skills, capabilities, and interests that will help build the career of the child, considering its relevance curriculum, methodology, pupil-teacher relationship, and learning environment must be all designed in such a way that they provide freedom to students and give him practice in hiking abilities and other various skills. Any fears, phobias, or negative conditioning if developed in this stage will have a damaging effect on the child's future so the teachers, parents, and educationists have to build a positive, cordial atmosphere in the primary classrooms and save the child from developing any negative attitude. Primary education mainly emphasizes the three R's -reading writing and Arithmetic. Education Commission (1964-66) suggested that Mathematics should be taught as a compulsory subject at primary level.

Mathematics is an important subject due to its professional, disciplinary, intellectual utilitarian and aesthetic value from ancient times to present times. Mathematics is a fundamental subject needed for students to learn along with languages.

The aims of mathematics teaching at the primary level are-

- To initiate their interest in learning mathematics
- To develop a conceptual understanding of the basic concept and terminology of mathematics.
- To inculcate a love for mathematics.
- To introduce them to mathematical games, puzzles, recreations, hobbies & activities.
- To develop and sustain their confidence in solving mathematical problems
- To ensure their efficiency in fundamental processes.
- To make them aware of the practical relevance and use of mathematics in daily life.
- To make them aware of language & symbols of mathematics.
- To provide a proper framework for learning mathematical concepts in higher classes.
- To cultivate in them the qualities like punctuality, persistence efforts, tolerance autonomy in doing their work sincerely and dedicatedly.

Status of teaching Mathematics at the primary level

Primary mathematics generally introduces students to the number system, and four basic skills addition, subtraction, multiplication, and division. In addition to this as we move further on the ladder, students are made familiar with the concepts of fractions, multiples, factors, decimal numbers, lowest common multiple, highest common factors, simple interest, and basic geometry. The teaching in Indian schools is group classroom teaching generally applying a deductive approach involving the presentation of examples by teachers on a blackboard and students following the teacher's steps and doing lots of practice in their practice books. With the recent emphasis on child psychology use of manipulation in mathematics has increased but students are not getting the freedom to move at their own pace and little scope is there for exploration and, experimentation. They are forced to follow a set pattern and if mistakes are made either they are scolded for it or they are told the correct responses without explaining to them where they are wrong. Our classrooms and evaluation system are not flexible enough to cater to individual differences. With inclusive education coming into force we more urgently need to have teaching methods that help meet the individual needs of learners and help each child to learn using his style, learning by his mistakes, and moving at his own pace. In the words of B.F. Skinner's "mistakes are the gateway to student's mind". We need methods that explain to the child how he is thinking and what needs to be rectified. In one of his articles, B.F. Skinner stated his experience in a mathematics classroom he visited. He found the problem in the classroom was that students were making their efforts and solving the problem given by teachers but they were not getting immediate reinforcement. This was one of the causes that students lose interest, their errors accumulate, and due to lack of remedial teaching, their achievements decrease. We need a process to provide immediate feedback to students' efforts that helps them to feel motivate on moving towards the right path and understand their mistakes and learn from them if they are wrong. Such a process and mechanism is not possible in traditional classroom with inappropriate pupil teacher ratio. It is essential that we adapt individualized learning.

We need strategies that follow the given principles-

- Principle of freedom
- Principles of immediate reinforcement
- Principles of self-pacing
- Principle of self-evaluation
- Principle of learning by doing

To improve the present status programmed instruction can prove beneficial. The material in programmed instruction can be arranged in different ways leading to different styles of programming linear, branching, and mathetics.

Concept of Programmed Instruction

In programmed instruction a logical sequence of information is presented in the form of small units at a time to individual units, students make an active response to each unit and they get immediate knowledge of whether their result is correct. In programmed learning each student works at his own best pace, which makes the learner's experience an individual affair. Programmed instruction makes the learning an interesting and motivating activity by providing immediate feedback and it boost student's confidence on his abilities and skills. As defined by Markle programmed instruction is the strategy of individualized learning in which material is prepared in a way to provide small content to the students at one time that is easy to comprehend and then assessing his/her learning of that content. Programmed instruction makes learning individualized as every student is able to learn at his/her own pace and feel motivated due to its self-evaluation feature Programmed instruction cans be provided to students in the form of books, self-learning modules or in e-form. Various formats of programmed instruction are available like linear programming, branching programming and mathematics.

Branching programme

In the present study researchers have developed a Branching programme for teaching a topic on mathematics because branching programme is well suitable for learning of mathematics because it does not ignore student's mistakes but try to make students understand the mistake and learn from them. It provides the features of sub-looping and sub branching similar to hyperlink feature of HTML language. It helps the students to comprehend and practice the previous concepts that are necessary to learn the new concepts.

Statement of the problem

The study aims to develop teaching-learning strategies for selected topics in mathematics at the primary level which will aid to understand the concept more clearly and make the teaching-learning environment more conducive.

More specifically the problem is stated as under "Effect of Branching Programme on achievement of Primary students on L.C.M and H.C.F"

Objectives

The objectives framed in the present study are :

- To develop programmed material (Branching programme) for teaching L.C.M and H.C.F.
- To apply programmed material (Branching programme) developed in the real classroom situation.
- To test the efficacy of programmed material (Branching programme) on L.C.M and H.C.F.
- Hypotheses
- For the third objective of study five null hypotheses were framed.
- Review of Related Literature
- Wangila M.J, Martin W & Ronald M. (2015) studied the impact of

programmed learning material instruction developed on the topics of atom and periodic table on the attitude of students towards these topics. Instructional software was developed and a Students' Attitude Determination Questionnaire (SADQ) was constructed. The sample included 300 students. The results indicated a significantly higher attitude in the experimental group after the intervention programme.

- Sambasivarao, Rachumallu. (2020) study reveals that the use of a programmed instruction strategy improves achievement in mathematics. The study was conducted in Andhra Pradesh, India on students of the class eighth. The study was quasi-experimental. This study also indicated the positive effect of programmed instruction material on achievement in Mathematics
- Kurbanoğlu, İzzet & Taskesenligil, Yavuz & Sozbilir, Mustafa. (2006) researched to compare the success of programme instruction and the traditional approach to teaching stereochemistry. The sample included forty chemistry teacher trainees from a state university in Turkey. The tools included programmed frames on the topic of stereochemistry and a stereochemistry achievement test. Results indicated the effectiveness of the prepared programme.

Bhatia (1992) did a research to identify and remediation of learning issues in Mathematics with the help of programmed learning material . The sample included fifty class-five students. The results revealed that students who received programmed instruction performed better in post-test and programmed instruction worked effectively as a remedial tool.

A review of related literature supports the view that programmed instruction is an effective teaching strategy and helps enhance conceptual understanding and improve achievement. The review also shows that there are few studies related to the development of programmed instruction material for Mathematics at the primary level and many fundamental topics in Mathematics need to be included in such studies so the researchers undertook the study.

Methodology

The present study is experimental and a randomized pre-test post-test control-group design was used.

Design of the study:

The design employed during the implementation and evaluation of the strategy is a randomized pre-test post-test control-group design -

Experimental group R O1 X O2

Control group R O3 O4

Where O1O3 - PRETEST

O2O4 -POSTTEST, X -INTERVENTION PROGRAMME

Sample and sampling

The sample was selected in two phases-

Phase 1- During field testing for the preparation of the final draft of branching programmes developed on L.C.M and H.C.F sample of 51 students of the class fifth were selected.

Phase 2- In this phase sample was selected to test the effectiveness of the branching programme on L.C.M &H.C.F was 80.

For the selection of samples in the second phase, two-stage sampling was done

1st stage – In the selection of schools

2nd stage – In the selection of students and allotment of groups in selected schools

In the first stage, as the programme was developed in the English language so two English medium schools Dabble College and Delhi Public School were selected

through a purposive sampling procedure.

In the second stage, random sampling was done. The two groups were divided in the class by odd, even method. Then lottery method was used to decide the groups.

Tools

The tools constructed for the presented research are -

- Branching programme on L.C.M & H.C.F
- Achievement test 1 & 2 on L.C.M and H.C.F (pre-test and Post-test)

Statistical techniques employed:

The statistical techniques employed were mean, standard deviation, correlation, and C.R value.

Results and Interpretation

The main purposes of the present study were to develop the teaching-learning strategies for mathematics at the primary level & test their efficacy. The teaching-learning strategy selected was "branching programmed instruction". The branching programme was developed and then the experimental design was implied to test its efficacy.
Five null hypotheses were framed for each programme and subjected to tests to find the results. The level of significance was considered at .05.

✤ Hypothesis 1

"There is no significant difference between mean scores of pre-test of control and pre-test of the experimental group."

Table-1 : 't' test for the mean scores of pre-test of experimental group and pre-test of control group

Sl.No	Group	N	M	S.D	SE_D	C.R
1.	Control{Pre-test}	40	13.325	2.44307	.57778039	0.302883 *
2.	Experimental {Pre-test}	40	13.5	2.717465		

*not significant

Table 1 indicates that the critical ratio value calculated between the mean scores is not found significant at a .05 level of significance. Hypothesis 1 is accepted. This is attributed to the fact that the students were randomly selected for both groups.

✤ Hypothesis 2

"There will be no significant difference between the mean scores of pre-test and post-test of control group"

Table-2 : 't' test of mean scores of pre-test and post-test of control group

Sl.No	Control group	N	M	S.D	r	SED	C.R value
1.	Pre-test	40	13.325	2.44307	.568776	3.535896	.11312 *
2	Post-test	40	12.925	4.29990			

*not significant

Table 2 shows that mean of the post-test scores is slightly lower than the mean of the pre-test scores but the calculated CR value is not significant. Therefore hypothesis no. 2 is retained.

✤ Hypothesis 3

"There will be no significant difference between mean scores of pre-test and post-test of the experimental group"

Table-3 : 't' test of mean scores of pre-test and post-test of experimental group

Sl.No	Experimental group	N	M	S.D	R	SED	C.R value
1.	Pre-test	40	13.5	2.717465	.683996	1.96361098	2.4826 *
2.	Post test	40	18.375	2.467091			

*significant

Table 3 shows that the mean of the post-test score of the group that received intervention is more than the mean of its pre-test scores and the calculated C.R value (2.4826) is found significant. Therefore hypothesis no. 3 is not accepted.

It shows that the programme developed on L.C.M and H.C.F has helped to enhance the understanding level of students.

✤ Hypothesis 4

"There is no significant difference between mean scores of post-test of the control group and mean scores of post-test of the experimental group"

Table-4 : 't' test of mean scores of post-test of experimental group and post-test of control group

	Group	N	M	S.D	SED	C.R value
1.	Experimental {Post-test}	40	18.375	2.467091	.7837083	6.95411 *
2.	Control{Post-test}	40	12.925	4.299900		

*significant

Table 4 shows that the difference in the means of above-stated groups is found statistically significant.

Therefore hypothesis no.4 is not accepted. It can be concluded that the group that received the intervention programme scored higher compared to the group that was taught by the traditional method. This can be attributed to the fact that the experimental group studied the programme developed on L.C.M and H.C.F which resulted in a better understanding of the concepts.

✤ Hypothesis 5

"There is no significant difference between the mean of 'd' scores of the control & experimental group."

Table-5 : 't' test of mean of 'd' scores of experimental group and 'd' scores of control group

	Group	N	M	S.D	SE_D	C.R
1.	Experimental 'd' scores	40	4.95	1.907475	.59646398	8.55039 *
2.	Control 'd' scores	40	-.15	3.254583		

*significant

Table 5 shows that the mean of the 'd' scores of the group that received intervention programme is significantly higher (C.R value =8.55039) than the mean of the 'd' score of the control group.

Therefore hypothesis number 5 is rejected.

It reflects that the group that received the intervention programme developed a better comprehension of the concept and was able to apply the understood concepts in solving the related problems.

According to the results, it can be said that the branching programme developed on L.C.M and H.C.F was found beneficial for the children in comprehending the related concepts.

Discussion

The topic of L.C.M and H.C.F is important in primary and elementary Mathematics. Factors and multiples are generally introduced in class three or some schools in class four along with the concepts of prime numbers and co-primes. Later on, L.C.M. and H.C.F. were introduced and different method to calculate them is included in the syllabus of class five. The L.C.M. and H.C.F. form the basis of calculations that the students study in higher classes so students must get good practice in computational skills in L.C.M. and H.C.F. Researcher has come across only one study by Shah (1981) who developed a programmed learning material on the same topic.

To test the efficacy of these programme five null hypotheses were framed.

The findings of the study concerning hypothesis number 1 show that the initial level of both groups was the same. The pre-test was administered before classifying the students in both groups and this classification was done using random methods. Only nineteen students from eighty students secured more than 60 per cent marks in the pre-test and the highest score gained was nineteen which was secured by only two students. This shows that the computation of L.C.M. and H.C.F. by students involves lots of errors and they need more practice in it.

For hypothesis number 2 results signify that students who did not receive the intervention did not show any improvement in the achievement of concerned concepts. This is because the control group was taught the topic by the traditional method. Nearly fifteen students out of forty gained fewer marks in the post-test. This can be attributed to the fact that as there was a difference of only a fortnight between pre-test and post-test so students were not enthusiastic about doing the similar test again. It was found that although students have studied the topic in their regular classes their achievement in the test was very low. Only two individuals in the pre-test and four in the post-test achieved more than 70 per cent marks. The minimum score gained was five. This indicates that students do not well understand the methods to calculate L.C.M. and H.C.F.

The results of the study concerning hypothesis number 3 imply that the students who received the intervention gained significantly more in the post-test than in the pre-test. This can be attributed to the fact that they were given the intervention programme. The gain in post-test supports the fact that programmed learning material developed in the study is effective in making students understand the topics of L.C.M. and H.C.F. The results can be correlated with the results of Shah (1981) who developed the programmed material on L.C.M. and H.C.F. and the results revealed favourable reactions from both the students and teachers.

The analysis of scores shows that the maximum gain of ten marks was achieved by the student who was one of the low scorers in the pre-test this supports the fact that programmed instructional material is beneficial for the low achievers also. Though there is a gain of marks in the post-test but none of the students secured 100 per cent marks this may pertain to the fact that students were asked to study the programme in their classroom only and for a specific period. If the students are allowed to study the programme as and when suited to them in their favourable conditions their achievement will surely be higher. In all nearly 72 per cent of students i.e. twenty-nine students out of forty secured above 70 per cent marks in the post-test.

Regarding hypothesis number 4 findings reveal a superior performance on the part of the experimental group in comparison to the control group. The experimental group gained higher in the post-test because they studied programmed instructional material. This result is also in favour of the positive role played by the branching learning material in making the pupil better understand the methods to calculate L.C.M. and H.C.F. and in helping them gain proficiency in the skills to calculate L.C.M. and H.C.F.

The results for hypothesis number 5 prove that the students who studied through developed programmed learning material on selected topics showed significant improvement in their performance in comparison to the students of the control groups. As the experimental group studied the programmed learning material so there is an enhancement in their post-test scores. This enhancement in the post-test led to a rise in the mean of the "d" scores whereas the control group performed almost the same in the pre-test and post-test.

Thus it can be said that the branching programme developed was effective in helping the students to conceptualize the concepts and developing their skills to solve the sums related to the topic. The result of the study can be correlated with many studies by Winnle, Sharma (1981), Davies (1982), Inamdar (1981), Mehta (1985), Rao (1983), Prabha (1992), and Bharitya. All of them developed programmed learning material to teach various topics on mathematics at different levels and found it effective; students involved benefited from the programmed learning material.

Educational Implications and Recommendations

The result of the research indicates that the branching programme is effective in improving the student's achievement in mathematics and developing interest in the subject. Further research can be done by developing the intrinsic programme for other topics of Mathematics at the primary level and also extended to the secondary level. The researcher developed the intrinsic programme in the form of a module; the research can be forwarded by developing e-modules or computer games based on the concept of a branching programme.

Conclusion

Branching programmed learning material prepared on the topic L.C.M. and H.C.F. have been found effective for grade five children. Post-test scores comparison of the experimental group with their pre-test scores revealed that students gain efficiency in calculating L.C.M and H.C.F. by different methods. Presentation of the concepts of L.C.M and H.C.F. in the form of small frames along with practice questions and providing immediate reinforcement and remedial material proved to be beneficial for the students.

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Research Article

Student Teachers Perception towards the Self-Blend Model of the Blended Learning Approach

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Abstract

Recognizing the Self-Blend Model (SBM), this paper is an attempt to report improved student teachers' perception through implementing the Blended Learning Approach (BLA). ODM allows students to work at far-flung places and materials are primarily delivered through the online platform with the assistance of teachers. Students are allowed to interact with teachers in the regular classroom and on online platforms too if they have doubts. The online learning management EDMODO (ED-LMS) was used and the intervention lasted for eight weeks. 54 student teachers were used as samples for the study and the methodology used was the experimental method (Awad Soliman Keshta, Ismail Ibrahim Harb 2013). A quantitative analysis non-parametric test was used to analyze the student teachers' perception towards SBM by Blended Learning Approach (BLA). The perception scale was comprised of the following dimensions Gen (general), II (Improved interactivity), KD (knowledge design), MU (Material Used), TA (technology assistance), and PS (predominant satisfaction). The student teachers showed approving perception in the direction of the use of BLA for the SBM. The experimental group students of College XXX1 of Education showed higher positive performance than the control group students of College XXX2 of Education from Pondicherry, India. The result of the study shows that student teachers developed a positive perception of BLA. Hence the study recommends that stakeholders implement BLA in the teaching and learning process.

Keywords: Perception, Self-Blend Model, Blended Learning Approach

Introduction

According to UNESCO, 1998 report teacher is the source of revamping the world with new innovative technologies that enhance pupil-based learning rather than teacher-focused method. In pupil-based learning interactive learning and active learning is practicable. To meet the demands of the learning community of the present generation it is necessary to integrate powerful pedagogical practices. The powerful pedagogical practices include the integration of new technical knowledge in the field of education to enhance the learning process which is a continuous process. Technology undergoes continual changes every day according to the needs of society. Therefore, new changes appear in society as well as in the education system also. Designing and implementing educational programs through information and communication technology is widely accepted for successful reforms in the field of education. At the same time, a teacher cannot be substituted by any newer electronic gadgets. Electronic gadgets can play a supplementary role

along with the teacher to enhance the learning experiences. The teacher can even teach more effectively without using technology in a conventional classroom. Nowadays students are called "digital natives" because they think and process information differently, and they learn (Prensky, 2001). So it is necessary to effectively integrate the technology into the conventional classroom which will help to develop and design an innovative teaching method called the Blended Learning approach (BLA) it includes the Blend model (SBM) which has the advantage over a single way of teaching (Cabero Almenara & Marin-Diaz, 2018). In this current science study, the subject was used to teach student teachers using various technological tools to bring out their improved pedagogical performance (Charles R Graham, 2006). To encourage independent learning in science, the inquiry aspect of science should be related to the structure of scientific knowledge and the investigative strategies of science. The teaching-learning process in the teaching of science has to be designed in such a way that student teachers should recognize conflicts and inconsistencies in their thinking (Bellefeuille, 2006). This study analyses the perception of student teachers towards learning by SBM. So student teachers should connect the relationship between the new science and technology about everyday living with the immediate surroundings so that students will develop engrossment towards safety sustainability. The inclusion of technology-enhanced learning with the assistance of teachers. This can be attained through BLA without a complete loss of direct participation and online learning.

Literature Review

Literature related to the Blended Learning Approach (BLA) and Perception towards the Blended Learning Approach was collected and tabulated below.

Table-1 : Studies related to BLA and Perception towards BLA

Area	Author and year	Study Area	Findings
Blended Learning Approach (BLA)	Riffell and Sibley (2003)	Hybrid course formats to increase attendance in undergraduate environmental science courses	This research mainly focuses on increasing students' enrollment and attendance for natural science courses. In this study, the researcher taught science courses by a hybrid method which contains traditional passive lecture classes and online assignments simultaneously. The result reveals that the completion of assignment rate is high through online mode compared to passive lectures. The study also shows that student attendance was effective in the BLA method.
	Robinson (2004)	Interpreting the teaching and designing experience of teachers in the BL course	The study recognized that when faculties experienced BLA three major benefits of BLA were noted classroom time was effectively used; the barriers of students were easily resolved; both teachers and students easily met their needs. The study also observed a positive correlation between BLA and university administration support.

	Lim and Morris (2009)	BL Environments impact on learning outcomes.	The researcher examined how students' learning in a Blended Learning environment is influenced by learning styles, instructional design, and learning involvement. The findings of the research reveal that the Blended Instruction method improved pedagogical practices in learning communities, the study also reveals that students perform effectively when the presence of a teacher was included.
Perception Towards BLA	Leh (2002)	Action research based on hybrid courses.	The students who studied in a hybrid course acquired knowledge in a better manner, online discussion messages were used as data in this study along with interviews and surveys. To analyze the data both quantitative and qualitative methods are used. The study shows that students and teachers both were highly motivated.
	Humbert and Vignarein (2005)	Case study for students learning through BLA.	Students' perception of towards BLA is viewed positively in this study. The study reveals that students are more comfortable learning through BLA and are satisfied with the teacher's performance.
	Judy Drennan & Jessica K (2005)	Students' attitudes towards flexible OL in management education.	Students' satisfaction with the direction of online learning was examined in this study, the technology acceptance model was developed to collect data from the students to identify the positive perception of technology as an innovative learning style. This study is closely related to the present study. The result of the study suggests that students' satisfaction is influenced by positive perceptions towards technology and self-learning mode.
	Buket and Meryem (2006)	Students' views on BLA	The performance of students of ICT conducted in this study was satisfactory and they enjoyed taking part in the BLA. Their performance and participation in BLA affected their views about BLA.
	Delialioglu and Yilderum (2007)	Interactive learning in BL Environment and perception of students.	It shows that the presence of the internet will enhance the student's performance in hybrid learning. Also, meta-cognition and the inclusion of collaborative learning will bring an authentic learning environment.
	Robert G. Farmer (2009)	Use of wiki as an effective online learning tool.	The use of an online tool called wiki was used as a collaborative learning tool in this study. The effectiveness of knowledge creation was evaluated and also interactivity was analyzed.

	Dhanya Krishnan (2011)	Effect of BL on Science Process skills and science achievement.	The study revealed that Blended Learning is more effective than the conventional method in enhancing science process skills and science achievement among secondary school students.
	Sreekala, Maria JAM, Arul T.S (2015)	Transforming pedagogy through the social learning platform	The researchers examined the BLA on M.Ed. students of Pondicherry University, India, and reveals that students' perception towards integrating technology in the classroom is benefited more when compared to the traditional teaching method.

Student Teachers Perception

Learning experiences acquired by student teachers through BLA were evaluated through factors like II (Improved Interactive), KD (Knowledge design), MU (Material Used), TA (Technology Assistance), and PS (Predominant Satisfaction). II refers to the learning experience gained by students' teachers as the interaction between student and student and between Students and teachers also includes social interaction. Learning activities undergone by student teachers are referred to as KD. TA refers to the significant usage of technology integration during the learning process in BLA. The student teachers benefited and gained learning experiences in BLA are referred to as PS. Therefore, in this study, the term perception refers to the improved learning experiences attained by student teachers Riffell and Sibley (2003).

Self-Blend Model

Self The blend Model (SBM) provides an opportunity for student teachers to gain knowledge beyond the classroom teaching-learning process. They should attend traditional classes and also select related courses by an online method which will enhance their learning. According to Trust et al., 2016 this method is different from the online driver model as the students can learn from remote places and their learning materials will be distributed online mode also the contents will be clarified by the teachers to students if they have any trouble learning.

Purpose of the Study

The objective proposed for this study is

- The perception towards BLA was studied in both experimental and control group student teachers earlier and subsequent execution of BLA with dimension Gen (general), II (Improved interactivity), KD (knowledge design), MU (Material Used), TA (technology assistance), and PS (predominant satisfaction).

Hypotheses framed are

The pre-test and post-test scores of students' perceptions in the experiment group will be significant in their mean difference.

The pre-test and post-test scores of students' perceptions in the control group will be significant in their mean difference.

Methodologies and Techniques Research Design

For quantitative research analysis, a quasi-experimental design was used. The experimental and control groups were taken as intact groups for this study. In this study, two groups are not randomly selected and routine class

schedules will be distributed to the two groups. BLA and student teachers' perceptions of BLA were the variables used. BLA was used as an experimental method to teach science and the conventional method was used for the control group. The same teacher taught both the experimental and control groups for about two months. Student Teachers of Teacher Education Colleges from Pondicherry were the population of the study.

Perception Scale on BLA

A Perception scale on BLA was constructed and validated by the researcher for the present study. This tool was developed by (Robert G. Farmer, 2009) and modified appropriately for use in the present study to seek student teachers' perception of BLA. The dimension of the tools is retained as such. The number of questions and the wording of some of the items under each dimension were changed. The perception scale on BLA was developed to understand the perception of student teachers' on BLA. It described the design and validation of a perception scale to meet the assessment need in education. Hence in the present study, the researcher constructed and validated a perception scale to seek perception towards BLA. The dimension of the perception scale was explained below.

- Some items related to the general usage of computers and integrating technology for BLA were used as dimension G (General),
- II (Improved Interactivity) refers to the perception of students towards interaction between teacher and students and peer to peer.
- KD (Knowledge design) refers to the students learning activity during BLA,
- U (Material Used) refers to the student's perception of the material used in BLA,
- TA (Technology Assistance) is the use of technology during the course and
- PS (Predominant Satisfaction) refers to the student's participatory level and how much they are convinced with learning through BLA.

A total of 50 items were present in the perception scale and each item was assigned a five-point scale in the limits of 1- 5 viz., Strongly disagree (1), Disagree (2), Neutral (3), Agree (4) and Strongly agree (5). Content validity was established by experts from Pondicherry University and Teacher Education Institution who were exposed to online learning platforms. Based on their suggestions, seven items were deleted and 43 items were retained in the perception scale. This scale was administered to student teachers of teacher education institutions to check the average time taken for the test and its reliability. Since the average time taken by the student teachers to complete the perception scale is 30 minutes, the duration was fixed to be 30 minutes. 't' value for each item in the perception scale was calculated and presented in Table 2 below.

Table-2 : The t-value for each item in the perception scale

Item Number	t-value	Significance	Item Number	t-value	Significance
	5.674	0.01		5.835	0.01
	7.536	0.01		9.014	0.01

	7.815	0.01		7.1	0.01
	5.95	0.01		9.466	0.01
	4.337	0.01		6.81	0.01
	3.56	0.01		8.128	0.01
	6.527	0.01		7.991	0.01
	9.033	0.01		11.825	0.01
	6.625	0.01		7.535	0.01
	4.365	0.01		6.039	0.01
	4.572	0.01		5.744	0.01
	6.171	0.01		6.414	0.01
	7.132	0.01		7.599	0.01
	6.901	0.01		6.941	0.01
	5.183	0.01		8.144	0.01
	3.991	0.01		7.713	0.01
	7.427	0.01		8.158	0.01
	5.777	0.01		7.677	0.01
	6.603	0.01		8.795	0.01
	4.624	0.01		10.314	0.01
	7.246	0.01		7.99	0.01
	6.967	0.01			

Table 2 represents the t- t-value for each perception item from items 1 to 43 and each value is significant at 0.01 level (p-value is 0). Hence the items are significant and restored for the study.

Reliability

The reliability of the developed tool was found to be 0.972 which was tested using Cronbach's Alpha coefficient the perception scale was an excellent measure of reliability and a total of 43 items were restored.

Validity

The tool with 50 items was presented to a panel of experts which included teacher educators and internal and external doctoral committee members. The panel of experts was requested to give suggestions and comments on the structure and appropriateness of items. The panel scrutinized the tool and expressed satisfaction with the content of the tool. Based on their suggestions, seven items were deleted and 43 items were retained in the perception scale. Some of the items were restructured and refined based on the suggestions of the experts. Hence face validity and content validity were established by experts.

Implementation

The constructed Perception scale was administered as a pre-test to

assess their perception of BLA for the experimental group and the same tool was administered to the control group to assess their perception of BLA. The duration of the test was 2 hours. All the necessary directions were given to the students before administering the test. The scores obtained are termed pre-test scores of student teachers in the experimental and control groups.

The intervention was carried out for thirty-one classes each comprising one hour. The intervention was carried out for two months. The schedule and time allotment for BLA and conventional learning are given below.

Table-3 : BLA schedule

SCHEDULE	FACE-TO-FACE ACTIVITIES	ONLINE LEARNING ACTIVITIES
Week 1 (5 Hours) **Unit – 7 - FACIL EQUIPMENT AND MATERIALS FOR TEACHING SCIENCE** Structure and design of general science laboratory-physics and chemistry laboratory-Organization and maintenance of laboratory	3-hours Lecture. Introduction to Edmodo learning platform and common Mail Id. Structure and design of general science laboratory.	2-hour Online activity. Demonstration (To sign up for Edmodo), Discussion
Week 2 (5 Hours) **Unit – 7:** Preparation of Indents-Stock – registers to be maintained, storage of chemicals, and apparatus organization of practical work.	3-hours Lecture. Indent preparation, Stock registers, storage of chemical apparatus.	2-hour Online activity. Audio-visual presentation. Reflection and review of Week 1 face-to-face lecture.
Week 3 (6 Hours) **Unit –7:** Improvisation of apparatus and use of science kits- Discipline in the laboratory – Accidents and First-aid.	3- Hours Lecture.	2-hour Online activity. Brainstorming method, Discussion, Demonstration, and Quizzes.
Week 4 (5 Hours) **Unit-9: EVALUATION IN SCIENCE** Purpose of evaluation – achievement tests .written and practical construction and use of tests- diagnostic test remedial teaching.	2-hours Lecture. Purpose of evaluation – achievement tests written and practical construction and use of tests. Diagnostic test remedial teaching.	3-hour Online activity. Audio-visual presentation (CD, Powerpoint presentation, Flip chart, and web-based training) on Standardized and teacher-made tests. Reflection and review of Week 3 activity.
Week 5 (4 Hours) **Unit-9:** Written and practical construction of a good test and use of tests, diagnostic test-remedial teaching	2-hours Lecture. Written and practical construction of a good test and use of tests. diagnostic test- remedial teaching	2-hour online activity. Discussion group, Audio-visual presentation, Reflection on week 4 activities. Reflection and review of Week 4 face-to-face lecture.

Week 6 (4 Hours) **Unit 10: SCIENCE PEDAGOGUE** Science Teacher – academic qualifications, professional growth- special qualities required of a science teacher Education of science teachers- in–service training	3-hour Lecture. Science Teacher – academic qualifications, professional growth, special qualities required of a science teacher Education of science teachers– in-service training	2-hour online activity. Mobile teaching. Audio-visual presentation for the science teacher. Demonstration and Discussion. Reflection and review of Week 7 face-to-face lecture.
Week 8 (2 Hours) **Unit-10:** Evaluation of a science teacher – self-evaluation – evaluation by the pupils	1-hour Lecture. Evaluation of a science teacher – self-evaluation – evaluation by pupils	1-hour online activity. Discussion and quizzes. Reflection and review of Week 5 face-to-face lecture.

To execute the BLA and to teach science ED-LMS was used. The teaching-learning process will be safe and secure for teachers and students on this platform. The mostly constructivist approach of learning different activities is possible in this online platform (Anders, 2018). Students and teachers can post files, videos, photos, and links on the platform; it is a secure platform due to the secret code given by the teacher to the students. Teachers can even fix assignments. Quizzes online and assessments were also made and badges were also awarded to the students based on their progress.

Figure-1 : Snap Shot of Online Interaction between students and Teacher

The figure-1 shows the teaching-learning interaction in online mode for both teacher and students. Improved interactivity used will be one of the main components of BLA. It provides an opportunity for all the participants to interact with the teacher in a safe and secure platform and the teacher's interaction with the students regarding the next class she is going to take. The teacher doing blended teaching is bound to be constantly in touch with the students and other stakeholders related to teaching (Snodin, 2013). Before starting the class, the teacher gives a gist of what she is going to teach, what activities are to be done, and what her expectations are from the students

to attend a scheduled class. After and before teachers upload reading materials for the students in ED-LMS.

Immediately after the intervention post-test was administered on the perception of the experimental and control group students. The scale for the pre-test and post-test remains the same. The test administered is scored and named as post-test scores of perceptions of Blended Learning.

Data Analysis and Discussions

Non–Parametric Tests of Variable Perception

Non-parametric tests distribution-free statistics and used for small samples. Hence the sample size was small in this study Wilcoxon Signed rank test equivalent to the paired sample t-test and Mann Whitney U test which is equivalent to the independent sample t-test are used. Wilcoxon signed-rank test is found to be more powerful when compared to paired sample t-tests for small samples. In this study, the investigator used these tests because of a small sample and it satisfies the following assumption.

1. Small sample size
2. Ordinal level of measurement.
3. Rank ordering of data
4. Unequal variances across groups

2. Non-Parametric Test for Experimenta Group

To find out the remarkable difference between the pre-test and post-test for both the experimental and control groups, Wilcoxon Signed Rank (WSR) Test is used. In this type of analysis, the results of the two groups are ranked as positive rank and negative rank. The rank cannot be assigned for the smaller of two sums and rejected if the difference scores of 0.

Hypothesis 1

To find out the remarkable difference between the pre-test and post-test both alternate and null hypotheses were formulated for the experimental group.

H01: The pre-test and post-test scores of students' perceptions in the experiment group will have no significance in their mean difference for BLA using SBM.

H1: The pre-test and post-test scores of students' perceptions in the experiment group will have significance in their mean difference for BLA using SBM.

The null hypothesis indicated that pre-test and post-test scores of students' perceptions in the experiment group will have no significance in their mean difference for BLA using SBM and is tested and findings are tabulated in Table-4.

Table-4 : Experimental group Perception Scores

Test	Group	Rank	N	Mean Rank	Sum Rank	z Value	Significance p
Pre-test - Post-test	Experimental group	Negative	0[a]	0	0	4.7	0.00
		Positive	29[b]	15	435		
		Ties	0[c]				
		Total	29				

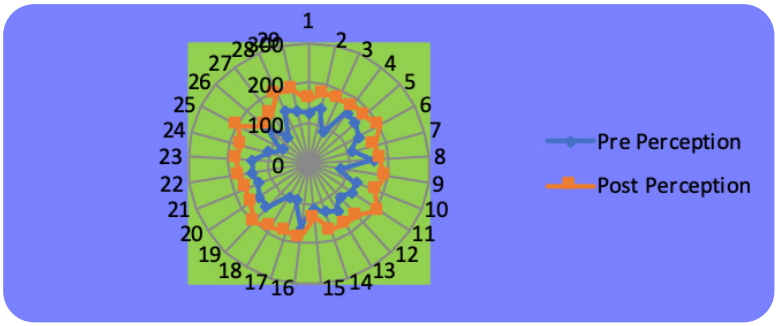
(a. Post-test < Pre-test. b. Post-test > Pre-test. c. Post-test = pre-test)

The value of test statistics (Z) according to the WSR test for perception scores in the experimental group is 4.703 and its associated p-value is (0.000) which is less than (0.05). Consequently, the null hypothesis is rejected. Therefore, the study concludes that the performance of the experimental group was improved in the post-test when compared to the pre-test.

Discussion

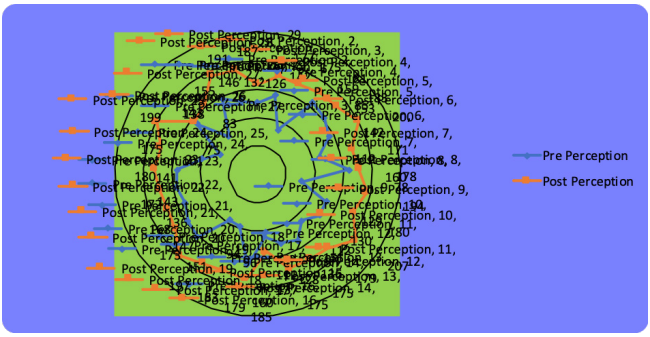
From this study, it is shown that the incorporation of innovative technology like BLA using SBM has improved the performance of the students. The experimental group which underwent treatment for BLA has shown remarkable improvement in the perception towards BLA when compared to the control group which was taught through the conventional method. Many research findings support that the perception towards BLA for teaching and learning purposes is high when compared to the conventional method. The result of this study is closely related to Robert G. Farmer (2009) implemented study on the use of an online tool called wiki was used as a collaborative learning tool in this study, the effectiveness of knowledge creation was evaluated and also interactivity was also analyzed. The study reveals that the learning outcomes of the students were increased based on their interactivity and perception towards online collaborative learning tools.

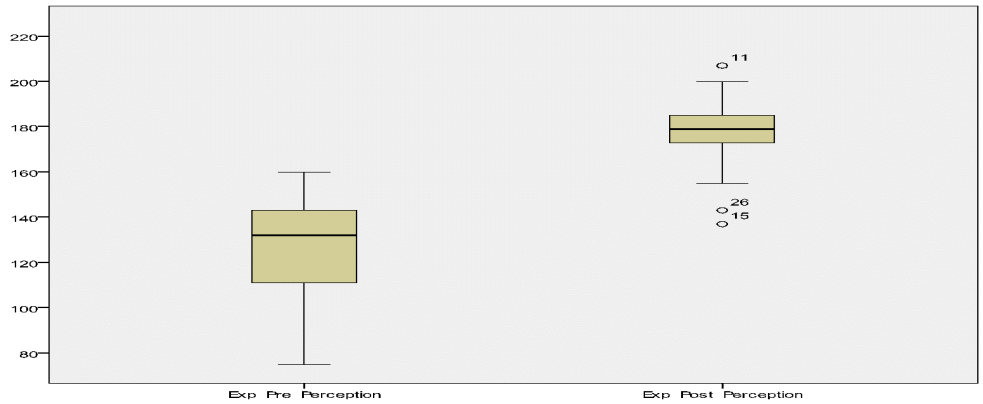
Figure-2 : Radar chart of experimental group perception scores



From the graphical representation using a radar chart, the scores are represented from 0 to 250 and the number of students was also distributed around the circle from 1 to 29 from the graph it is clear that the scores of post-test are high when compared to the pre-test. Therefore, from the radar chart, it is concluded that the performance of the experimental group was improved in the post-test perception when compared to the pre-test perception.

Figure-3 : Box Plot of experimental group perception scores





(X-axis = Experimental group pre-perception and post-perception Y- axis = Perception scores)

The box plot diagram representation was used to compare the mean scores of the pre-test and post-test groups of the experimental group. From fig. 3 it is also represented that the perceptions of students towards BLA were high in the post-test when compared to the pre-test.

Non- Parametric Test for Control Group

Hypothesis 2

To find out the remarkable difference between the pre-test and post-test both alternate and null hypotheses were formulated for the control group.

H02: The pre-test and post-test scores of students' perceptions in the control group will have no significance in their mean difference for BLA using SBM.

H2: The pre-test and post-test scores of students' perceptions in the control group will have significance in their mean difference for BLA using SBM.

The null hypothesis indicated that pre-test and post-test scores of students' perceptions in the control group will have no significance in their mean difference for BLA using SBM and is tested and findings are tabulated in table-5.

Table-5 : Control group Perception Scores

Test	Group	Rank	N	Mean rank	Sum rank	z value	Significance p
Post-test-Pre-test	Control group	Negative	10[a]	8.8	88	1.77	0.07
		Positive	14[b]	15.14	214		
		Ties	0[c]				
		Total	24				

(a. Post-test < Pre-test. b. Post-test > Pre-test. c. Post-test = pre-test)

The value of test statistics (Z) according to the WSR test for perception scores in the control group is -1.77 and its associated p-value is (0.07) which is greater than (0.05). Consequently, the null hypothesis is accepted. Therefore, the study concludes that the performance of the control group does not have a remarkable improvement in the post-test when compared to the pre-test.

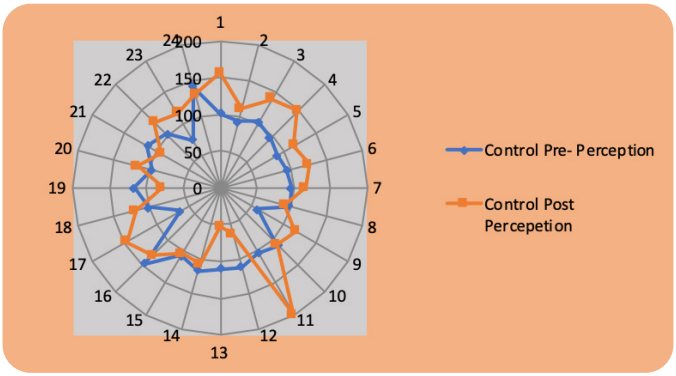
Discussion

For the control group, only conventional

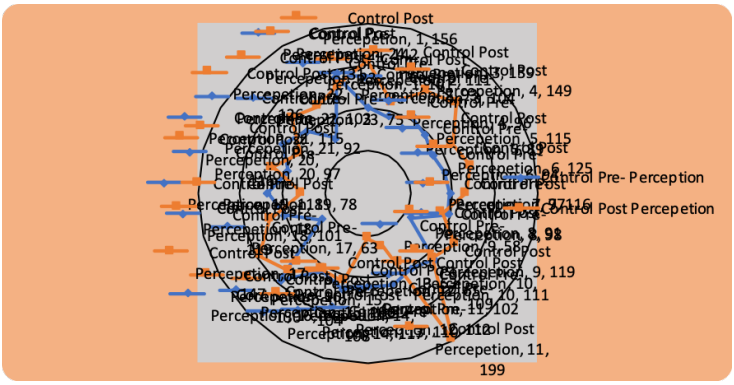
classroom teaching was used for the teaching and learning process. It is shown that the student's perception towards BLA is not improved in the post-test when compared to the pre-test (Z = -1.77 and p= 0.07 greater than 0.05). Hence, it is concluded that the control group does not have a remarkable improvement in the perception scores in the post-test as compared to the pre-test. This result is supported by Riffell and Sibley (2003).

The result reveals that the completion of assignment rate is high through online mode when compared to passive lectures. Further, the study also reveals that student attendance was effective in the BLA method.

Figure-4 : Radar Chart of Control group perception scores.



The perception scores of the pre-test and post-test of the control group are shown diagrammatically in the radar chart. The scores are marked from 0 to 200 starting from the central point to the outer line of the web. The number of students is distributed from 1 to 24 around the circle. From fig. 4 it is shown that the student's perception towards BLA is not improved in the post-test when compared to the pre-test. The radar graphical representation shows that there is no significant difference between pre-test and post-test perception scores.



Delimitations

If the study would have been conducted for the wider samples of different regions it would have given generalized results which would have given scope for comparison with other results. The study is confined to a few topics in the teaching of physical science at B.Ed. level. The same study can be extended to other topics in the teaching of physical science and other subjects at

different levels like schools and other higher education institutions also (Thai et al., 2017). As Blended Learning Programme describes learning events or activities in two different situations in which e-learning is integrated into traditional forms of teaching, it allows the utilization of many methods and resources that are derived from multiple information sources. The teacher adopts the material and method according to the situation. Therefore, it unstructured learning environment, which characterizes BLA and it allows students to learn in the way that best suits them. So the attempt to study is objective in nature.

Recommendation and Educational Implications

From the study, it is revealed that the integration of SBM improved the Perception rate of the student teachers in the experimental group. Moreover, in the present scenario, the learning communities are well-developed to learn more comfortable with the integration of technology into their day-to-day life. Therefore, the teachers in the classroom should prefer different learning strategies like small group interaction, discussion, debate, video conferencing, mobile learning, mobile apps, and reflective practices to make learning more interesting. NEP 2020 also suggests using a Blended learning approach as the blend of online and face-to-face learning will ensure active engagement of students and teachers in the learning process.

Conclusion

The study concludes that statistical analyses carried out for the experimental group revealed that BLA using SBM is more effective than the conventional method of teaching for improving student teachers' perception of the teaching of physical science. In this method, the role of the teacher was transferred from teacher-specified practice to learner-specified practice. The incorporation of appropriate and suitable technology in the conventional classroom empowered every student teacher as an active participant in learning (García-Martín & García-Sánchez, 2013). Therefore, educational institutions should look beyond the traditional boundaries of classroom teaching by integrating all possible pedagogical practices with new technologies to maximize educational achievement. The study concludes that the technologies used in classrooms by teachers by not effectively integrating them with pedagogical practices may not bring out the expected results of teaching. The technology used in BLA provides more information to the students. Information acquired through online resources cannot fully replace the teacher and their relationships in the teaching and training process. Teaching is only replaced by learning through active engagement and interaction. Therefore, BLA using SBM is intended to allow them to develop their basic cognitive concepts as well as their practical skills in the teaching and training process.

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Research Article

Attitude of Teachers and Students towards Online Examination during the COVID-19 period: A Study

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Abstract

Covid-19 pandemic had paused our day-to-day life for a while when the whole world was shuttered by its devastation. For every country, the economy and education have remained the utmost priorities in matters of development. It is of no exception for our country that the most prominent sectors affected by Covid-19 were the economy and education. The most vulnerable was the student community because the offline classes were stopped and its related issues. Due to this, the mode of examination was online only. Several kinds of problems came to the forefront while analysing the advantages and disadvantages of online examination. The present study attempts to know the attitude of students and teachers towards online examinations. The investigator, by using a purposive sampling method, selected 256 undergraduate students and 80 teachers from different colleges in the Nagaon district of Assam. The data were analyzed by using a simple frequency percentage, Mean, and SD.

Keywords: COVID-19, Online examination, Students, Teachers, Attitude.

Introduction

The COVID-19 pandemic was caused by a virus named Corona, which has affected all the people of the universe irrespective of gender, culture, race, socio-economic status, region, occupation, community and so on. It is one of the biggest pandemics regarding the number of people affected worldwide. The virus was first detected in Wuhan City, Hubei Province, China and the first detected case was discovered on 17th October 2019. India was no exception, and it took no longer for her to be affected by COVID-19 within a very short period of its inception. As a result, the Indian Government announced the first lockdown phase from 25th March 2020 to 14th April 2020 and its second subsequent one from 15th April to 17th May 2020. As a result, all the businesses, industry along educational institutions from pre-primary to higher education were shut down. Though online learning is not a very new concept in our education system, the closing of educational institutions gave a strong reason to implement and use online education as the only alternative left to be adopted both for teachers and learners. Various online platforms like WhatsApp, Google Classroom, Webex, Telegram, Zoom, etc, were used for the very first time largely for conducting classes, examinations, evaluations, seminars, conferences, workshops, orientation programmes, refresher courses, and faculty development programmes (FDP) etc. The teaching-learning process was quite affected for various reasons like poor connectivity, lack of electronic gadgets, untrained teachers to conduct online classes, lack of motivation, interest, attention, etc.

Conducting examinations online is not very old, especially in countries like India. The entire setup had to be designed in a newer and separate way.

The question papers were available online, and the students within the given time frame had to write and complete their answers, then upload them online and also submit hard copies of the answer sheets to their educational institutions if required and instructed by the respective institutions. Moreover, some institutions conduct examination through multiple choice questions (MCQs), which the students had to attempt online only. Some educational institutions (specially the privately run institutions) made very effective attempts to let the students easily handle the entire process of online examination by giving tutorials (online) and mock test and the final examinations were conducted in the same way as they were practised previously. The higher educational institutions had even to conduct viva-voce and internal assessment examinations by online mode. Various universities in India conducted M.Phil ad Ph.D viva-voce during Covid-19 period through online mode, which gives a new dimension to shift teaching-learning and research from offline to online mode.

Review of Related Literature

Bachhar, Anindita and Das Mitu (2021) in the study found that there existed no difference in the attitude of students (gender, qualification, and habitat). Some insufficient technical structure makes the offline examination more comfortable and reliable than online mode**.** Mondal Rimi (2021) conducted a study to know the attitude of college and university students towards online examination. The study reported that there was no difference between the attitudes of college and university students towards online examination. But, significant differences were found between the attitude of boys and girls of colleges towards online examination. However, the attitude of university boys and girls showed no difference. Khan, M et al. (2020), made a study on Students' Perception towards E-learning during COVID-19 Pandemic in India. The study reveals the preferences of students for e-learning as it provides them much freedom to connect with their teachers, fellow students and engage with their study materials at the comfort and flexibility of space and time .This findings is based on usefulness, self-efficacy, ease of use of students as regards e-learning. Therefore, necessary measures should be adopted for improving the quality of E-learning to help with better learning of students during the phase of COVID-19 pandemic. Elsalem, Lina et.al (2020) in the study found that online examination had more benefits than offline traditional examinations. It was found efficient regarding time, effort and money spend on the entire process of the examination. Elzainy, et.al (2020) made a study to know the experience of E-learning and online assessment during Covid-119 pandemic. The samples were selected from college of Medicine, Qussim University. E-learning was found to be very effective and beneficial. Digital learning environment was found very impressive and students were highly satisfied regarding online assessment. Adanir, Gulgun. Afacan. et.al. (2020) found learners' changed perceptions according to gender, major and prior online course experience variables. The Turkish learners found online examination less stressful, reliable and fairer than the Kyrgys students.

Needs and Significance of the Study

Covid-19 is the largest pandemic ever faced by humanity. The teaching-learning process was affected badly by it. Examination is the process to evaluate students' academic progress and achievement. It is also necessary to promote them from one standard to another. The Covid-19 pandemic along

with other aspects of teaching-learning also left no exception to convert the traditional offline examination to online, which was not very obvious both for students and teachers to accept easily. Therefore, to know the attitude of students and teachers towards online examination is very important as it will open various positive and negative aspects of the same. This will be helpful to wipe out the negative impacts and work on them to make online examination as fruitful and useful as offline. If we are able to do it, conducting online examination in better ways in near future (whether any pandemic situation will be there or not) will be possible. This will also make online examination as a substitute of offline examination in its true sense. With these things in mind, the investigator conducted the present study.

Objectives of the Study

1. To know the attitude of students towards online examination.
2. To know the attitude of teachers towards online examination.
3. To know the challenges faced by students and teachers regarding online examination.

Hypotheses

H_1: The attitude of students towards online examination is positive.

H_2: The attitude of teachers towards online examination is positive.

Methodology of the Study

Descriptive survey method was used for conducting the study. The sampling method selected by the investigator was purposive sampling method. The total undergraduate population of the selected colleges were 1280. Among them, 650 were boys and 630 were girls. The investigator selected 20 per cent students i.e., 256 students as samples for the study. 20 per cent boys (130) and 20 per cent girls (126) were taken. Moreover, 80 teachers' samples were selected for the study.

An attitude scale was prepared by the investigator for conducting the study. It was a Likert type scale having 20 statements to know the attitude of both students and teachers. There were alternatives namely Strongly agree, Agree, Undecided, Disagree and Strogly disagree against each statement. The respondents had to put tick mark in any one alternative in every statement. 5,4, 3,2 and 1 marks were given in the alternatives Strongly agree, Agree, Undecided, Disagree, and Strongly disagree respectively and the reverse pattern that is 1,2,3,4,5 marks were given in the alternatives Strongly disagree, Disagree, Undecided, Agree and Strongly agree respectively.

Moreover, a questionnaire was prepared to know the challenges faced by students and teachers. A total 32 questions were incorporated and every question had two (2) options- 'Yes' and 'No'. The respondents had to select any one option from the two. For the response 'Yes' 1 mark and for 'No' 0 mark was given and the number and percentage of positive and negative attitude were determined.

Before finalising the questionnaire and attitude scale, a pilot study was conducted on samples of students who were of same nature selected for the study. The questionnaire included 45 questions of closed form and 50 statements. In order to test the content validity of the questions and statements, it was applied on 100 students before final execution. After getting responses from that group, the tools were given to experts and on the basis of suggestions, modifications were done and final form was prepared.

Scoring weightage of the attitude scale

For interpretation of attitude levels, raw scores were converted into Z-scores and attitude levels were determined accordingly and that procedure was made similar to that one adopted in scoring the items of the try-out attitude scale.

Table-1 : Assignment of attitude levels

1.	Range of Z-scores	Attitude level
2.	+.22 to +2.60	Positive
3.	-.80 to -4.53	Negative

Reliability co-efficient of the attitude scale was calculated with the help of Split-half method and Test-Retest method which were found 0.92 and 0.86 respectively.

Table-2 : Gender-wise frequency and percentage of the Sample (Students)

Sl. No	Respondents' demographic information	Frequency	Percentage
	Gender		
1.	Male	130	50.78
2.	Female	126	49.22
3.	Total	256	100.00

Figure-1: Gender-wise distribution of the Sample (Students)

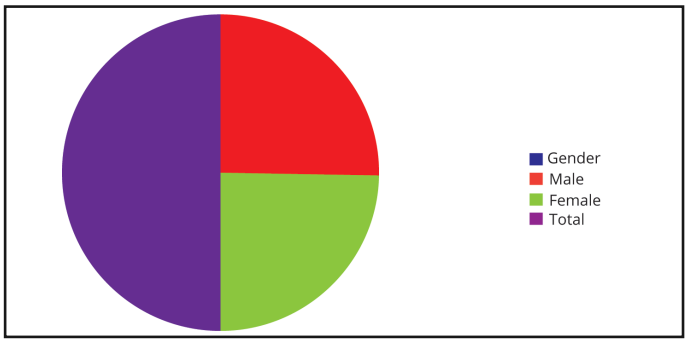


Table-3 : Locality-wise frequency and percentage of the Sample (Students)

Sl. No	Respondents' demographic information	Frequency	Percentage
	Locality		
1.	Urban	150	58.59
2.	Rural	106	41.41
3.	Total	256	100.00

Figure-2: Locality-wise distribution of the Sample (Students)

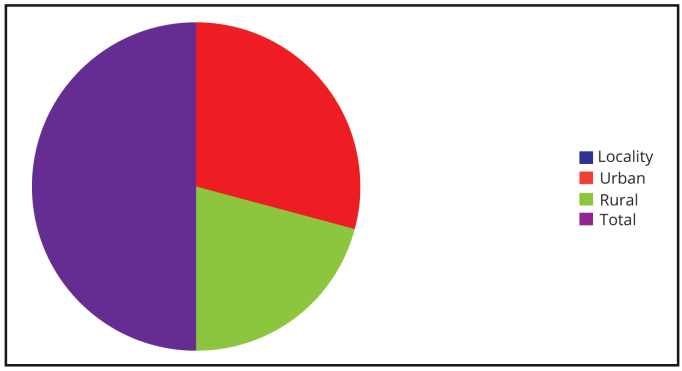


Table-4 : Gender-wise frequency and percentage of the Sample (Teachers)

Sl. No	Respondents' demographic information	Frequency	Percentage
	Gender		
1.	Male	34	42.50
2.	Female	46	57.50
3.	Total	80	100.00

Figure-3: Gender-wise distribution of the Sample (Teachers)

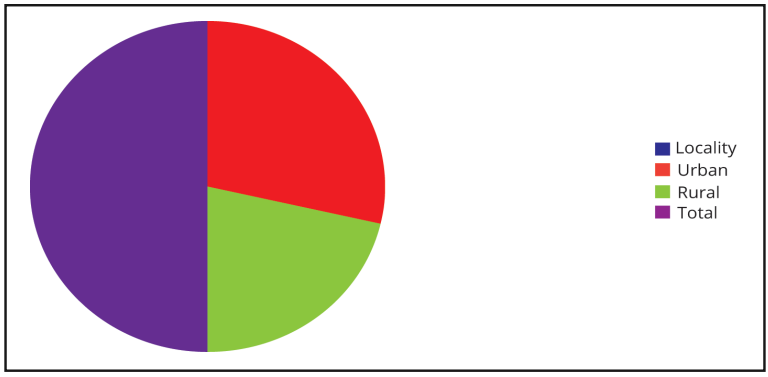
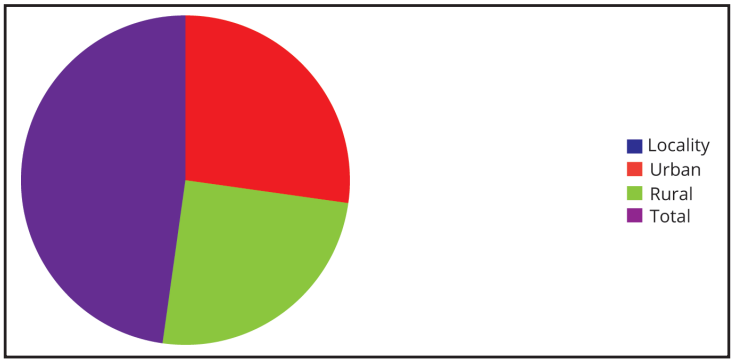


Table-5 : Locality-wise frequency and percentage of the Sample (Teachers)

Sl. No	Respondents' demographic information	Frequency	Percentage
	Locality		
1	Urban	42	52.50
2	Rural	38	57.50
3	Total	80	100.00

Figure-4 : Locality-wise distribution of the Sample (Teachers)



Analysis and Interpretation of Data

Analysis of data for the present study were done objective wise. Different statistical methods like Simple frequency percentage (per cent), Mean and Standard Deviation (SD) were used.

Objective 1: To know the attitude of students towards online examination.

H_1: The attitude of students towards online examination is positive.

Table-6 : Attitude of students towards online examination (Gender wise)

Sl. No.	Statements	SA		A		UD		DA		SD		M		SD	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F
1.	Online examination is easy to appear than offline examination.	55	52	37	30	13	10	15	18	10	16	3.86	3.67	3.56	3.44
2.	There is no need to maintain discipline of examination hall in online examination.	57	50	39	30	10	12	14	18	10	16	3.91	3.28	2.08	3.46
3.	It is difficult to clear doubts in online examination.	45	52	34	30	20	21	20	17	11	10	3.63	3.86	3.36	3.52
4.	Online examination is only suitable to colleges of urban areas.	20	23	25	27	20	22	45	43	20	11	2.84	3.06	2.65	2.76
5.	Conducive home environment is needed for online examination.	50	55	37	35	18	10	15	25	10	1	3.78	3.55	3.49	3.65
6.	Online examination makes students nervous.	40	38	37	32	23	20	20	25	10	11	3.59	3.48	3.31	3.23
7.	Getting enough confidence in online examination is tough.	45	50	37	36	23	20	15	10	10	10	2.01	3.93	3.64	3.52
8.	Result of online examination is not satisfactory.	25	35	20	12	25	10	35	10	25	11	2.88	2.25	2.72	2.71

9.	Internet connectivity is very crucial in online examination.	70	76	27	35	18	10	10	4	5	1	4.13	4.44	3.76	3.99
10.	Good ICT tools are needed for online examination.	68	70	36	35	20	10	4	9	2	2	4.26	4.28	4.43	3.76
11.	Online examination is costly.	42	38	38	28	10	12	20	20	20	28	3.47	3.06	3.28	3.12
12.	Online examination is suitable to bright students.	52	45	28	34	15	8	15	18	20	21	3.59	3.51	3.40	3.17
13.	Online evaluation of answer scripts is not easy.	45	50	23	42	17	8	10	15	35	11	3.25	3.83	3.16	3.54
14.	Online examination can not take the place of offline examination.	70	67	35	43	15	10	10	4	5	2	4.30	4.34	3.76	3.91
15.	Online examination is very erratic.	55	60	35	42	10	10	18	7	12	7	3.79	4.12	3.52	3.76
16.	Cheating can be easily done in the online examination.	70	75	45	43	8	5	5	2	2	1	4.35	4.5	3.97	4.04
17.	Prior instructions are needed before appearing online examination.	76	80	45	41	5	3	2	1	2	1	4.46	4.57	4.01	4.09
18.	Online examination is time consuming.	60	65	44	42	10	5	12	7	4	7	4.10	4.20	4.18	3.83
19.	It is easy to conduct online examinations at any time of the academic year.	70	65	35	39	10	17	11	4	5	1	4.20	4.29	3.83	3.86
20.	Online examination saves the money and energy of college administration.	45	50	23	42	17	8	10	15	35	11	3.25	3.83	3.16	3.54

* Strongly agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly disagree (SD)

From Table 6 it is revealed that regarding easiness to appear online examination than offline examination maximum number (Male 55, Female 52) students are strongly agree with Mean 3.86 (Male) and 3.67 (Female) and SD 3.56 (Male) and 3.44 (Female). 57 Male and 50 Female students strongly agreed with the fact that there is no need to maintain discipline in the examination hall during online examinations, with Mean values of 3.91(Male) and 3.28 (Female) and SD 2.08 (Male), 3.46 (Female). 45 Male and 52 Female students also strongly agreed that it is difficult to clear doubts in the online system of examination (Mean of Males 3.63 and 3.86 for females; SD of Males 3.36 and for females 3.52). Regarding the fact that online examination is suitable for colleges of urban areas, the highest number of responses are found in the disagree category (45 Males and 43 Female students with

a Mean of 2.84 for Males and 3.06 for female students; SD 2.65 (Males) and 2.76 (Female). The statements in which students strongly agreed apart from the above mentioned are requiring a conducive home environment for online examinations (Males 50, Female 55), becoming nervous to appear online examination (Male 30, Female 38), tough to get enough confidence in online examination (Male 45, Female 50), how crucial internet connectivity for appearing in online examination (Male 70, Female 76), need of ICT tools (Male 68, Female 70), costliness of online examination (Male 42, Female 38), suitability of online examination for bright students (Male 52, Female 45), online examination which can not take the place of offline examination (Male 70, Female 67), erratic nature of online examination (Male 55, Female 60), easy use of cheating (Male70, Female 75), need of prior instructions to appear in online examination (Male 76, Female 80). On the other hand students have agreed in some statements like time-consuming nature of online examination (Male 60, Female 65), easiness of conducting online examination in any time of the academic year (Male 60, Female 65) and money and time saving nature of this form of examination (Male 40, Female 45).

Table-7 : Attitude of students towards online examination (Locality wise)

Sl. No.	Statements	HA		A		UD		DA		SD		M		SD	
		U	R	U	R	U	R	U	R	U	R	U	R	U	R
1.	Online examination is easy to appear than offline examination.	65	40	59	25	11	10	17	16	8	15	4.42	3.55	3.72	3.35
2.	There is no need to maintain discipline of examination hall in online examination.	67	40	40	25	10	10	23	16	10	15	3.87	3.56	3.58	3.35
3.	It is difficult to clear doubts in online examination.	65	42	34	25	20	21	20	15	11	7	3.81	3.87	3.52	3.49
4.	Online examination is only suitable to colleges of urban areas.	25	15	25	24	20	22	55	40	25	5	2.80	3.04	2.58	2.74
5.	Conducive home environment is needed for online examination.	60	45	40	30	20	10	20	20	10	1	4.37	3.92	3.42	3.58
6.	Online examination makes students nervous.	45	28	47	30	23	20	25	20	10	8	3.61	3.47	3.35	3.18
7.	Getting enough confidence in online examination is tough.	55	40	40	30	25	20	17	6	13	10	3.71	3.79	3.43	3.49
8.	Result of online examination is not satisfactory.	30	32	30	10	25	5	45	7	25	7	3.07	2.22	2.83	2.75

9.	Internet connectivity is very crucial in online examination.	85	66	30	30	18	5	12	4	5	1	4.19	4.47	3.82	4.03
10.	Good ICT tools are needed for online examination.	75	57	46	30	20	12	4	5	5	2	4.21	4.27	3.81	3.86
11.	Online examination is costly.	25	15	40	25	10	12	50	30	25	24	2.93	2.78	2.76	2.63
12.	Online examination is suitable to bright students.	20	15	30	30	15	8	60	40	25	13	2.73	2.94	2.54	2.73
13.	Online evaluation of answer scripts is not easy.	55	40	30	40	17	8	13	10	35	8	3.38	3.89	3.25	3.66
14.	Online examination can not take the place of offline examination.	80	55	40	37	15	12	10	1	5	1	4.20	4.59	3.82	4.26
15.	Online examination is very erratic.	21	10	37	32	10	12	57	55	12	5	2.73	3.10	2.58	2.69
16.	Cheating can be easily done in online examination.	76	65	50	35	8	3	7	2	7	1	4.17	4.52	2.81	2.71
17.	Prior instructions are needed before appearing online examination.	86	70	50	31	5	3	3	1	6	1	4.38	4.58	3.96	3.99
18.	Online examination is time consuming.	68	55	45	32	10	5	15	7	6	13	3.91	4.20	3.64	3.79
19.	It is easy to conduct online examination in any time of the academic year.	78	55	40	29	12	17	11	4	10	1	4.30	4.25	3.75	3.83
20.	Online examination saves the money and energy of college administration.	55	45	33	32	17	8	10	10	35	11	3.42	3.85	3.28	3.57

* Strongly agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly disagree (SD)

From Table 7 it is revealed that regarding easiness to appear online examination than offline examination maximum number (Urban 65, Rural 40) students are strongly agree with Mean 4.42 (Urban) and 3.55 (Rural) and SD 3.72 (Urban) and 3.35 (Rural). 67 Urban and 40 Rural students strongly agreed with the fact that there is no need to maintain discipline in the examination hall during online examinations with Mean values of 3.87 (Urban) and 3.56 (Rural) and SD 3.58 (Urban), and 3.35 (Rural). 65 Urban and 42 Rural students also strongly agreed that it is difficult to clear doubts in the online system of examination (Mean of Urban 3.81 and 3.87 for Rural; SD of Urban 3.52 and for Rural 3.49). Regarding the fact that online examination is suitable for the colleges of urban areas, the highest number of responses are found in the disagree category (55 Urban and 40 Rural students with a Mean of 2.80 for Urban

and 3.04 for Rural students; SD 2.58 (Urban) and 2.74 (Rural). The statements in which students strongly agreed apart from the above mentioned are requiring a conducive home environment for online examinations (Urban 65, Rural 40), tough to get enough confidence in online examinations (Urban 55, Rural 40), and also Strongly Agree category (Urban 40, Rural 30), how crucial internet connectivity for appearing in online examination (Urban 85, Rural 66), the need of ICT tools (Urban 75, Rural 57), online examination which can not take the place of offline examination (Urban 85, Rural 55), easy use of cheating (Urban 76, Rural 65), the need of prior instructions to appear in online examination (Urban 86, Rural 70), time-consuming nature of online examination (Urban 68, Rural 55), easiness of conducting online examination in any time of the academic year (Urban 78, Rural 55) and money and time-saving nature of this form of examination (Urban 55, Rural 45). Most students agreed (Urban 47, Rural 30) regarding becoming nervous about appearing online examination, along with those in the Strongly Agree category (Urban 45, Rural 28). In some statements, students disagreed regarding the costliness of online examination (Urban 50, Rural 30), the suitability of online examination for bright students (Urban 60, Rural 40) and the erratic nature of online examination (Urban 57, Rural 55).

So, analysing all the statements and responses towards them by both students regarding gender (male and female) as well as locality (urban and rural), it can be concluded that students have positive attitude towards online examination as in maximum number of statements they either strongly agree or agree towards the facts incorporated in the statements and that is why the hypothesis formulated for objective 1 is proved.

Objective 2: To know the attitude of teachers towards online examination.

H2: The attitude of teachers towards online examination is positive.

Table-8 : Attitude of teachers towards online examination

Sl. No.	Statements	SA		A		UD		DA		SD		M	SD
		N	%	N	%	N	%	N	%	N	%		
1.	Online examination is easy to appear than offline examination.	35	43.75	20	25	5	6.25	10	12.5	10	12.5	3.75	3.53
2.	There is no need to maintain discipline of examination hall in online examination.	40	50	20	25	0	0	10	12.5	10	12.5	3.87	3.64
3.	It is difficult to clear doubts in online examination.	45	56.25	20	25	8	10	2	2.5	5	6.25	4.22	4.37
4.	Online examination is only suitable to colleges of urban areas.	23	28.75	20	25	5	6.25	20	25	12	15	3.27	3.06

5.	Conducive home environment is needed for online examination.	40	50	23	28.75	4	5	10	12.5	3	3.75	4.08	3.74
6.	Online examination makes students nervous.	35	43.75	21	26.25	10	12.5	12	15	2	2.5	3.93	3.60
7.	Getting enough confidence in online examination is tough.	43	53.75	20	25	2	2.5	10	12.5	5	6.25	4.07	3.76
8.	Result of online examination is not satisfactory.	43	53.75	23	28.75	3	3.75	5	6.25	6	7.5	4.15	3.81
9.	Internet connectivity is very crucial in online examination.	65	81.25	10	12.5	0	0	2	2.5	3	3.75	4.2	4.26
10.	Good ICT tools are needed for online examination.	56	70	10	12.5	2	2.5	8	10	4	5	4.32	3.98
11.	Online examination is costly.	34	42.5	23	28.75	5	6.25	10	12.5	8	10	3.81	3.55
12.	Online examination is suitable to bright students.	34	42.5	24	30	6	7.5	10	12.5	6	7.5	3.87	3.58
13.	Online evaluation of answer scripts is not easy.	47	58.75	24	30	3	3.75	4	5	2	2.5	4.37	3.96
14.	Online examination cannot take the place of offline examination.	43	53.75	23	28.75	5	6.25	5	2	4	5	4.2	3.83
15.	Online examination is very erratic.	45	56.25	24	30	4	5	3	3.75	4	5	4.28	3.90
16.	Cheating can be easily done in online examination.	46	57.5	26	32.5	2	4	4	5	2	4	4.37	3.96
17.	Prior instructions are needed before appearing online examination.	46	57.5	23	28.75	2	4	6	7.5	3	3.75	4.28	3.91

18.	Online examination is time consuming.	34	42.5	24	42.5	5	6.25	6	7.5	11	13.75	3.8	3.55
19.	It is easy to conduct online examination in any time of the academic year.	54	67.5	21	26.25	0	0	2	4	3	3.75	4.51	4.09
20.	Online examination saves the money and energy of college administration.	43	53.75	23	28.75	2	4	10	12.5	2	4	4.18	3.82

* Strongly agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly disagree (SD)

From Table 8 it is revealed that regarding easiness to appear online examination than offline examination maximum number 35 (43.75 per cent) teachers are strongly agree, 20 (25 per cent) agree, 5 (6.25 per cent) undecided, 10 (12.5 per cent) disagree and 10 (12.5 per cent) Strongly disagree with Mean 3.75 and SD 3.53. 40 (50 per cent) teachers are strongly agreed, 20 (25 per cent) agree, 10 (12.5 per cent) disagree and 10 (12.5 per cent) Strongly disagree with Mean 3.87 and SD 3.64 with the fact that there is no need of maintaining discipline in examination hall during online examination. 45 (52.65 per cent) teachers are also strongly agreed, 20 (25 per cent) agreed, 8 (10 per cent) undecided, 2 (2.50 per cent) disagreed and 5 (6.25 per cent) Strongly disagreed that it is difficult to clear doubts in online system of examination (Mean 4.22 and SD 4.35). Regarding the fact that online examination is suitable to the colleges of urban areas, 23 (28.75 per cent) Strongly agree, 20 (25 per cent) agree, 5 (6.25 per cent) undecided, 20 (25 per cent) disagree and 12 (15 per cent) Strongly disagree with the Mean of 3.27 and SD 3.06. The statements in which the teachers strongly agreed apart from the above mentioned are requiring conducive home environment for online examination 40 (50 per cent), online examination makes students nervous (35, 43.75 per cent), tough to get enough confidence in online examination (43, 53.75) getting not enough satisfaction in online examination results (43, 53.75 per cent), how crucial internet connectivity for appearing in online examination (65, 81.25 per cent), need of ICT tools (56. 70 per cent), costliness of online examination (34, 42.5 per cent), suitability of online examination for bright students (34, 42.5 per cent), tough to evaluate online examination (47, 58.75 per cent), online examination which cannot take the place of offline examination (43, 53.75 per cent), erratic nature of online examination (45, 56.25 per cent), easy use of cheating (46, 57.5 per cent), need of prior instructions to appear in online examination (46, 57.5 per cent), time-consuming nature of online examination (34, 42.5 per cent), easiness of conducting online examination in any time of the academic year (54, 57.5 per cent) and money and time saving nature of this form of examination (43. 53.75 per cent). So, analysing all the statements and responses towards them, it can be concluded that teachers have positive attitude towards online examination as in all the statements the number is highest in the categories of Strongly agree and agree regarding their responses and that is why the hypothesis formulated for objective 2 is proved.

Objective 3: To know the challenges faced by students and teachers regarding online examination.

To analyse this objective, a questionnaire was prepared by the investigator to know the challenges faced by teachers and students regarding online examination. Separate questions for teachers and students were incorporated and number and percentage of Yes and No responses against each question were determined and presented in Table 8.

Table-9 : Challenges faced by teachers regarding online examination

Sl No.	Questions	Yes		No	
		N	%	N	%
1.	Do you find out the real achievement of students through online examination?	56	70	24	30
2.	Is online examination is cheating free?	67	83.75	13	16.25
3.	Do you find Bandwidth problem to conduct online examination?	46	57.50	34	42.50
4.	Do you find enough IT resources for smooth conduction of online examination?	56	70	24	30
5.	Do you find it difficult to evaluate answer scripts of online examination?	58	72.50	22	27.50
6.	Do you find problem to get connected with online examination appearing students?	32	40	48	60
7.	Is there any problem to clear doubts of students during online examination?	50	62.50	30	37.50
8.	Are you satisfied with the results of online examination of students?	54	67.50	26	32.50
9.	Is it easy to conduct internal assessment of students through online mode?	56	70	24	30
10.	Is it easy to take Viva-Voce and presentations of students through online mode?	49	61.25	31	31

Table 9 shows that 56 (70 per cent) teachers replied Yes and 24 (30 per cent) No regarding getting the real achievements of students through online examination. 67 (83.75 per cent) thought that online examination is cheating free and 13 (16.25 per cent) did not. 46 (57.50 per cent) teachers found Bandwidth problem to conduct online examination and 34 (42.50 per cent) have not found the same. 56 (70 per cent) teachers found enough IT resources for smooth conduction of online examination, whereas 24 (30 per cent) have not found. 58 (72.50 per cent) teachers found it difficult to evaluate the answer scripts of online examination and 22 (27.50 per cent) did not find it difficult. 32 (40 per cent) teachers found it difficult to get connected with online examination appearing students and 48 (60 per cent) did not find it difficult. 50 (62.50 per cent) teachers found it problematic to clear doubts

of students during online examination and 30 (37.50 per cent) did not find it difficult. 54 (67.50 per cent) teachers were not satisfied with the results of online examination of students and 26 (32.50 per cent) teachers were satisfied. 56 (70 per cent) teachers found it easy to conduct internal assessment of students through online mode and 24 (30 per cent) found it difficult. 49 (61.25 per cent) teachers thought that it was easy to take Viva-voce and presentations of students through online mode and 31 (38.75 per cent) teachers replied negative.

Table-10 : Challenges faced by students regarding online examination

Sl. No.	Questions	Yes		No	
		N	%	N	%
1.	Is it easy to appear in online examination in remote areas?	167	65.23	89	34.77
2.	Do you find any problem to appear in online examination due to poor internet?	150	58.60	106	41.40
3.	Do you have time shortage in online examination?	130	50.78	126	49.22
4.	Is there any problem of clearing doubts of question papers from teachers in online examination?	159	62.11	97	37.89
5.	Do you feel confident to appear in online examination?	56	21.87	200	78.13
6.	Do you have lack of proper home atmosphere to appear in online examination?	100	39.06	156	60.94
7.	Do you get enough instructions to appear in online examination from college authority?	126	49.22	130	50.78
8.	Are you satisfied with the results of online examination?	210	82.03	46	17.97
9.	Do you find any problem during online submission of answer scripts?	180	70.31	76	29.69
10.	Do you concentrate in online examination?	189	73.83	67	26.17
11.	Is online examination a costly affair for students?	210	82.03	46	17.97
12.	Do you get connected with your teachers during online examination?	180	70.31	76	29.69
13.	Do you face any problem to appear in online examination due to the lack of knowledge to use technology?	176	68.75	80	31.25
14.	Do you get proper motivation to appear in online examination?	211	82.42	45	17.58

Table 10 shows that 67 (65.23 per cent) students replied Yes and 89 (34.77 per cent) No regarding the ease of appearing in online examinations in remote areas. 150 (83.75 per cent) found problems appearing in online examinations due to poor internet and 106 (58.60 per cent) did not. 130 (50.78 per cent) time shortages in online examinations, and 126 (49.22 per cent) had not found the same. 159 (62.11 per cent) had problems clearing doubts about question papers from teachers in online examinations, whereas 97 (37.89 per cent) did not. 56 (21.87 per cent) replied Yes regarding feeling confident to appear in an online examination, and 200 (78.13 per cent) replied negative. Regarding the lack of a proper home atmosphere to appear in the online examination,100 (39.06 per cent) replied Yes 156 (60.94 per cent) replied No. 126 (49.22 per cent) got enough instructions to appear in the online examination from college authorities and 130 (50.78 per cent) did not find it difficult. 210 (82.03per cent) students were satisfied with the results of the online examination, and 46 (17.97 per cent) replied No. 180 (70.31 per cent) students found a problem during the online submission of answer scripts and 76 (29.69 per cent) students replied that No. 189 (73.83 per cent) students replied Yes regarding concentrating in online examination and 67 (26.17 per cent) replied No. 210 (82.03 per cent) replied Yes regarding whether online examination a costly affair for students and 46 (17.97 per cent) replied negatively. 180 (70.31 per cent) students replied Yes regarding getting connected with teachers during online examinations and 76 (29.69 per cent) replied No. 176 (68.75 per cent) students replied Yes regarding facing any problem appearing in online examinations due to the lack of knowledge to use technology and 80 (31.25 per cent) replied No.

Conclusion and suggestions

The COVID-19 pandemic has disrupted the normal living styles of all categories of people. From business to marketing, health practices to hygiene, celebrations to public gatherings, all these have experienced a changed outlook. People in every respect have to face depression, anxiety, and tensions etc, that cause mental disturbances. The students and teachers are the biggest victims as they are involved in the teaching-learning process. But the fact is that we have to face reality and there is no way out. Despite having so many difficulties, we have to take online education as an alternative way to carry on our teaching and learning. If so happens, then there will be very little mental tension to take our teaching-learning process even in the time of the pandemic. But, for this, the need of the hour is to redesign the entire process to cope up with online education.

The first and foremost thing is to train our students and teachers for online learning. They should be trained enough to appear and to evaluate students. For students who will appear in the online examination should be given mock practices before the final examination.

Various educational institutions release videos including instructions for students on how to give online examinations right from logging in to submitting papers online. Similarly, such practices for teachers to check the examination papers online and give marks, grades etc, will be of great use.

The online examination can be conducted by including both multiple-choice questions and open-ended questions. Especially for the lower grade students, MCQs are very helpful. For reading comprehension, spelling test etc., online platform like ZOOM is very helpful.

Poor network is a great issue for most of the students in remote areas. The students, in due course of time are unable to submit their answer scripts online. In such cases, there should be a gap of time between writing the answers and submitting papers. Moreover, there should be an alternative way to submit the papers both online and offline submission of hardcopies in the respective educational institutions.

The educational institutions themselves should open helpline numbers to help students especially during the time of submitting online papers. Due care should be taken so that every possible instruction can be given in that direction.

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Research Article

Digital Divide: A Comparison of Undergraduate Female Student's Use of Social Media Platforms in Urban and Rural Areas

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Abstract

The Covid-19 pandemic has contributed to the increase in online education and subsequent social media use among the student communities globally. The use has drastically changed the everyday life patterns concerned with their education, communication, and entertainment needs. Research shows that social media platforms provide formal and informal learning opportunities influencing higher education. They offer a space for collaborative learning, sharing, and communicating with not only friends but also teachers. However, access and use vary among student communities based on gender, class, nationality, and language. Understanding students' experiences using social media platforms is vital beyond the barriers mentioned above. In the given context, the study contributes to understanding female students' engagement and participation with social media platforms. It tries to determine if there are differences in access use and purpose of use of social media platforms among urban and rural women students. This study identifies the digital divide in terms of urban-rural and locates the need to empower rural female students by requiring knowledge and skills as part of their educational curriculum in higher education institutions.

Keywords: Social Media Platforms, Digital Divide, Women Students, Rural-Urban Divide, Digital Literacy

Introduction

Internet use, particularly social media platforms, is growing more widespread among student groups worldwide in the post COVID-19 context. Social media platforms include wikis, video-sharing sites, photo-sharing sites, bookmarking sites, and social networking websites (Chugh and Ruhi 2019, Chugh, Grose, & Macht, 2021). Students' engagement with social media platforms is found to contribute positively and negatively to their academic performances. Initially, social media engagement of student communities was not welcomed and was seen as a hindrance to their academic performances. However, the scope of these platforms is increasing in terms of catering to not only the social networking of its users but also their education, information, and entertainment needs. Today, it isn't easy to find a youngster who does not have a Gmail, Facebook, or Twitter account, which they use to communicate with friends, express or share their thoughts, and utilize for other purposes. Social networking platforms primarily enable students to engage in both formal (like studying course material) and informal (like searching everywhere for valuable

information) learning environments (Zachos, Paraskevopoulou-Kollia, & Anagnostopoulos, 2018). The impact of social media on universities is currently the subject of an increasing number of studies (Hamadi, El-Den, Azam, & Sriratanaviriyakul, 2022). In the post-Covid-19, the usage is increased adoption of online technologies in teaching and learning processes. They are used extensively among academicians to interact, collaborate and connect further. The research findings by Khan, Ashraf, Seinen, Khan, and Laar (2021) indicate that social media played an essential role during the pandemic because it provided opportunities for students to enhance collaborative learning. In an era when social media is an inherent part of academic communities, it is crucial to understand the nature of engagement of students, their usage patterns, purpose, and existing barriers against access and use. The present study aims to identify if any differences exist in terms of access, use, and purpose of use of social media platforms by women students from rural and urban regions.

Literature Review

The increasing demands of communication and information needs have enhanced the use of online platforms. According to the Digital 2022 Global Overview Report, out of the 1.40 billion population of India as of January 2022, it is estimated that 658.0 million internet users, which is 47 per cent (Datareportal, 2022). In India, the top 5 social media platforms (including messaging applications) are WhatsApp, with 534.30 million active users; Instagram, with 503.37 million active users; Facebook, with 491.53 million active users; Telegram, with 374.40 million active users, and Facebook Messenger, with 324.39 million users (The Global Statistics, 2022). In this context, the COVID-19 pandemic has contributed to the increase in online education and subsequent social media use among the student community globally. Social media platforms are used more in educational settings (Busque & Mingoia, 2021). Social media offers a platform for learning that makes it simple for students to communicate with their peers and topic experts and benefits their collaborative learning (Khan, Ashraf, Seinen, Khan, & Laar, 2021).

Much of social learning takes place in social media networks, contributing to the informal learning of student communities. According to research by Hamat and Hassan (2019) of 6085 students at a Malaysian university, writing, communication, vocabulary growth, and reading were the areas of proficiency the students benefited the most from social networking. A study by Madhusudan (2012) on exploring the use of social networking sites by research scholars of the University of Delhi states that they are used in their communication for research work, and most respondents preferred the social media platforms Facebook and ResearchGate for academic purposes. In a review of social media usage in higher education from the 77 articles published from 2010 onwards, Zachos, Paraskevopoulou-Kollia, & Anagnostopoulos (2018) find that Facebook and Twitter were identified to be the essential online social media platforms for educational purposes.

According to the literature, students naturally and frequently utilize social media platforms as an informal academic tool to collaborate with classmates, plan class projects, and exchange course-related information (Bosch, 2009; Madge, Meek, Wellens & Hooley 2009; Selwyn 2009, Hamadi, El-Den, Azam, & Sriratanaviriyakul, 2022). The incorporation of social media in higher education classrooms is motivated by a desire to improve student learning outcomes, particularly

by encouraging pedagogical approaches like collaborative learning (Hamadi, El-Den, Azam, & Sriratanaviriyakul, 2022). This has created a paradigm shift in higher education, altering teaching, learning, and research. As a result of these technological advancements, many higher education institutions (and educators) are now under pressure to keep up with the world of social media users and applications (Selwyn, 2012). However, not all students have similar social media experiences regarding access and use based on gender, race, nativity, and other related socio-economic and cultural factors.

Significance of the Study

The gap between people who have access to and ability to use technology and those who do not is known as the "digital divide." Students who used computers and associated technologies growing up have an edge since they have the necessary technical abilities to take advantage of technology for learning. As per Neilsen's Bharat 2.0 internet study, almost 60 per cent of the rural population still does not actively use the Internet. Urban India continues to lead the world in the percentage of people who use the Internet actively, with a share of 59 per cent, leaving behind rural India with 41 per cent (Dey, 2022). Due to the digital divide, the adoption of technologies has not achieved the desired results (Faloye & Ajayi, 2021). Basharat, Ahmad, & Ahmad (2019) observed the existence of the digital divide among college students in the Kashmir district of Jammu and Kashmir in a study. According to the survey, students from metropolitan backgrounds use digital content more frequently than students from rural areas.

However, globally access to technology by students was not equal since the lack of infrastructures, such as broadband and wireless Internet, as well as lack of knowledge and the absence of training institutes in rural areas as compared to metropolitan areas, create a disparity in access to the Internet. A study in Afghanistan found that inadequate internet/Wi-Fi, electricity, technological gadgets, infrastructure, time, and confidence towards use primarily hinder the use of ICTs in a university (Hashemi, Na, Noori, & Orfan, 2022). Jones, Johnson-Yale, Millermaier, & P'erez (2022) found differences in Internet usage among American college students based on race and gender in the study. College students use social networking websites for discussion, learning activities, and fun (Dhanyasree & Sharma, 2019).

Compared to men and boys, there is a significant difference in the adoption and usage of digital technology among women and girls (OECD, 2018). Considering rural female students, access to digital gadgets has improved during the Covid-19 period. This is an increase compared to previous years; however, the reason and purpose of the access are to be explored. The access to online platforms for education by female students, more specifically from rural regions, is low compared to urban male and female students. Gender discriminatory practices impact access to technology. This gender digital divide can have broader consequences in ensuring equal learning opportunities for women students. However, it is essential to understand the online social media usage patterns and purpose of use by rural women students compared to urban women students. This can pave the way to impart structured digital literacy programs to rural female students based on the observed trends.

Objectives of the Study

1. To determine if there are any differences between urban and rural women students' access to social media platforms.

2. To compare the usage patterns of social media platforms by urban and rural women students.
3. To determine if there are any differences between urban and rural women students' purpose of using social media platforms.

Hypotheses

H01 - There is no significant difference in the mean score of social media usage for education and information purposes by women students in relation to their urban-rural nativity.

H02 - There is no significant difference in the mean score of social media usage for entertainment purposes by women students in relation to their urban-rural nativity.

Methodology

The study uses a quantitative survey method to collect data from the samples taken for the research. The study's primary objective is to compare female students' access and use of social networking sites in rural and urban regions. Using purposive sampling, rural college students (60) studying in Tirunelveli, Tamil Nadu and urban college students (60) studying in Chennai, Tamil Nadu, a total of 120 students were involved in the study. A self-made closed-ended questionnaire was used to collect data from the samples. It consisted of two scales to measure the usage frequency of social media platforms and the related purpose of use. The scale measuring social media usage for education and information purposes contains 13 items with Cronbach's alpha = 0.791, and the scale measuring social media use for entertainment needs consists of 8 items with Cronbach's alpha = 0.836 each with 5 alternative responses measuring the frequency of use.

Using the Statistical Package for the Social Sciences (SPSS) the collected data are analysed through frequency and percentages along with a t-test for measuring mean differences between the urban and rural women students using independent samples 't' test.

Findings and Discussion

Analysis of Objective 1

According to the data presented in Table 1 (n=120), access to the Internet by means of smartphones is high (91.7 per cent) among rural female students. However, the use of the Internet through laptops/desktops is high (18.3 per cent) among urban women students compared to rural.

Table-1 : Frequency of access to Internet by the respondents

Access to Internet			
Gadgets used in Internet access	**Nativity**		**Total**
	Rural	**Urban**	
Smart Phone	55	49	**104**
	91.7%	81.7%	**86.7%**
Laptop/Desktop	5	11	**16**
	8.3%	18.3%	**13.3%**
Total			**120**
			100.0%

The data presented in Table 2 (n=120) shows the internet usage per day by the respondents. It is observed that internet usage for more than two hours per day is high among urban women students (71.7 per cent) compared to rural women students (43.3 per cent).

Table-2 : Frequency of Internet access hours per day

Nativity	Internet access hours per day			Total
	Less than 1 hour	1-2 hours	More than 2 hours	
Rural	12	22	26	**60**
	20.0%	36.7%	43.3%	**100.0%**
Urban	2	15	43	**6 0**
	3.3%	25.0%	71.7%	**100.0%**

According to the data presented in Table 3, affording high monthly data charges is limited among rural women students, in terms of 71.7 per cent recharging within Rs. 300 per month. Most urban women students, 40 per cent, state they recharge above Rs.300 per month.

Table-3 : Frequency of average amount used for data recharge per month

Recharge Amount	Nativity		Total
	Rural	Urban	
Below 100	2	3	**5**
	3.3%	5.0%	**4.2%**
101-200	14	16	**30**
	23.3%	26.7%	**25.0%**
201-300	43	17	**60**
	71.7%	28.3%	**50.0%**
301 & Above	1	24	**25**
	1.7%	40.0%	**20.8%**
Total			**120 (100%)**

In a post-Covid-19 pandemic scenario, the increase in smartphones and onlineclasses have enhanced the access of smartphones in rural regions. However, personal desktops or laptops are beyond affordability for rural women students. Access is by means of shared smartphones, where a single phone is used by the entire family. This impacts the usage time and time of use of the gadgets. The duration of use depends on the type of gadgets used, the strength of the network, data quality, and recharge capacity. Female students in rural regions state that problems of the poor network in their villages reduce their usage hours. Many times, they had to wait for their parents'

phones in the evenings. Data recharge is not a priority for women students in rural regions.

Analysis of Objective 2

The data presented in (Table 4) shows several differences in social media usage patterns of rural and urban women students. The rural women students who do not use Facebook are (72.80 per cent). Twitter is (78.20 per cent), Moj is (78.2 per cent), and Josh is (80 per cent). On the contrary, the number of urban women students who use social media platforms is high: Sharechat (72.30 per cent), Facebook (69.40 per cent), and Twitter (67.7 per cent) for more than two hours per day.

Table-4 : Usage of social media platforms

Media Type	Percentage not using		Percentage of respondents using social media platforms					
		Less than 1 hr		1-2 hours		Above 2 hours		
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
WhatsApp	0.00%	0.00%	47.20%	20.00%	27.30%	27.70%	25.50%	**52.30%**
Instagram	**41.80%**	7.70%	34.50%	23.10%	16.40%	32.30%	7.30%	36.90%
YouTube	9.10%	1.50%	**56.30%**	43.10%	20.00%	21.50%	14.60%	33.90%
Facebook	**72.80%**	15.30%	10.90%	13.80%	1.80%	1.50%	14.50%	69.40%
Twitter	**78.20%**	21.50%	12.70%	10.80%	0.00%	0.00%	9.10%	67.70%
Telegram	**70.90%**	13.80%	16.40%	23.10%	1.80%	1.50%	10.90%	61.60%
Sharechat	52.70%	10.80%	25.50%	13.80%	7.30%	3.10%	14.50%	**72.30%**
Moj	**78.2%**	23.1%	7.3%	1.5%	1.8%	0.0%	0.0%	46%
MX TakaTak	**80.0%**	23.1%	3.6%	3.1%	0.0%	1.5%	16.4%	72.3%
Josh	**80.0%**	23.1%	3.6%t	1.5%	0.0%	1.5%	16.4%	73.8%

Youtube, Whatsapp, and Instagram use are high compared to popular social media platforms like Facebook and Twitter. The use of social media platforms is high among urban women students and this indicates more communication, opportunities, collaborative learning and development. In a study among a sample of 3000 students in the USA, Dahlstrom, Boor, and Grunwald (2011) report that 90 per cent of them use Facebook, whereas 37 per cent use Twitter as a communication tool. The majority of rural women students 72.8 per cent do not use Facebook for several reasons like fear of security, lack of adequate knowledge and skills, language barriers and social stigma based on gender. Also access of YouTube is high compared to other social media platforms among rural women students. YouTube usage towards accessing entertainment content can have its own consequences good or bad. Navigating entertainment content with adequate knowledge and skills is a dire requirement owing to the trends in addiction and diversion of young people.

Analysis of Objective 3

Table-5 : Social media use for education and information purpose

Constructs	Never	Rarely	Sometimes	Often	Very Often	Mean	SD
I see online course contents	12.5%	17.5%	25.8%	23.3%	20.8%	**3.23**	1.306
I watch education contents	8.3%	15.0%	34.2%	23.3%	19.2%	**3.30**	1.185
I send educational content to my friends	5.8%	13.3%	32.5%	29.2%	19.2%	**3.43**	1.120
I watch online news	7.5%	10.8%	49.2%	20.0%	12.5%	**3.19**	1.040
I search for Employment details	10.0%	21.7%	37.5%	22.5%	8.3%	2.98	1.088
I see competitive exam details	13.3%	17.5%	36.7%	22.5%	10.0%	2.98	1.159
I see personality development details	12.5%	12.5%	25.8%	38.3%	10.8%	**3.23**	1.184
I see nutrition and health tips	7.5%	10.8%	33.3%	37.5%	10.8%	**3.33**	1.056
I see beauty tips	10.8%	20.0%	26.7%	30.8%	11.7%	**3.13**	1.185
I see cooking contents	7.5%	13.3%	28.3%	30.0%	20.8%	**3.43**	1.179
I chat with my friends	7.5%	5.8%	25.8%	27.5%	33.3%	**3.73**	1.200
I find new friends	32.5%	25.8%	24.2%	8.3%	9.2%	2.36	1.269
I keep in touch with family abroad	26.7%	9.2%	19.2%	19.2%	25.8%	**3.08**	1.548

According to the data presented in Table 5, the use of social media for educational and informational needs is high among students, with a mean score greater than three. Usage of online platforms for educational needs like accessing online course content (mean =3.23), watching education content (mean =3.30), and sending education content to friends (mean =3.43). The use of online platforms in accessing online news (mean=3.19), accessing nutrition and health tips (mean =3.33), accessing beauty tips (mean =3.13), and accessing cooking content (mean =3.43) is high above three. The use of online platforms for communication purposes among women students includes chatting with friends, with a mean value of 3.73 and keeping in touch, with the family, with a mean value of 3.08.

Table-6 : Social media use in education and information

Nativity	N	Mean	SD	t-value	Sig (2-tailed)
Urban	60	44.12	8.614	-3.449	0.001
Rural	60	38.67	8.746		

$H0_1$ Testing – Table 6 shows that urban women student's mean score of social media use in education and information is 44.12 and the mean score of rural women students is 38.67. It is also seen that the calculated value of t (120) =-3.449 and the associated significant value is 0.001 (p,0.05). Thus, t is significant at 0.05 level and the null hypothesis H01 is rejected. It is concluded that there is a statistically significant difference between the mean values of urban and rural students' use of social media platforms for education and information purposes.

Table-7: Social media use for entertainment purpose

Constructs	Never	Rarely	Sometimes	Often	Very Often	Mean	SD
I use film-related content	20.0%	13.3%	25.0%	15.8%	25.8%	**3.14**	1.457
I watch web series	12.5%	16.7%	30.0%	22.5%	18.3%	**3.18**	1.268
I play online games	53.3%	11.7%	22.5%	1.7%	10.8%	2.05	1.346
I hear songs/ music	5.8%	5.8%	25.8%	25.0%	37.5%	**3.83**	1.172
I upload short videos	10.8%	14.2%	35.0%	13.3%	26.7%	**3.31**	1.302
I upload posts/ status	9.2%	15.8%	25.8%	24.2%	25.0%	**3.40**	1.273
I watch celebrity's details	23.3%	18.3%	27.5%	12.5%	18.3%	2.84	1.402
I watch sports	20.8%	22.5%	25.8%	11.7%	19.2%	2.86	1.392

As per Table 7, the use of online platforms for accessing film-related content (3.14), watching web series (3.18), and watching/listening to film songs/music (3.83) are found to be higher, with a mean score greater than three in each case.

Table-8 : Social media use in entertainment

Nativity	N	Mean	SD	t-value	Sig (2-tailed)
Urban	60	27.53	7.043	-5.242	0.000
Rural	60	21.67	5.055		

$H_0$2 Testing – Table 8 shows that urban women student's mean score of social media use in entertainment is 27.53 and the mean score of rural women students is 21.67. It is also seen that the calculated value of t (120) =-5.242 and associated significant value is 0.001 (p,0.05). Thus, t is significant at 0.05 level and the null hypothesis H02 is rejected. It is concluded that there is a statistically significant difference between the mean values of urban and rural students' use of social media platforms for entertainment purposes.

Educational Implications and Conclusion

The study contributes toward understanding the nature of engagement and participation of urban and rural women students on social media platforms. The education sector is witnessing increased use of information communication technologies in teaching, learning, and administration processes. Knowledge and skills in using these technologies by student communities can enable them to explore more learning and development opportunities. The study shows that access and use of social media platforms for education and development are not equal for all, especially rural women students. The barriers in the poor network, lack of individual gadgets, and higher data costs impact access and use. Though similar levels of undergraduate education, urban-rural demography determines the nature of access and related opportunities. This creates the need for digital literacy, ensuring safe and informed navigation on online platforms. Another significant finding of the study is that social media platforms are highly used for entertainment and communication compared to educational purposes. This necessitates appropriate digital literacy programs for students to use digital skills for education and development. Structured digital literacy programs based on the needs of both urban and rural women students will serve the purpose.

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Research Article

Models of E-learning Readiness in Higher Education: A Systematic Review

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Abstract

The models of E-learning Readiness (ELR) are basically designed to understand the process of obtaining the basic information necessary for measuring ELR among participants. They help organizations to identify the requirements for designing, developing and implementing E-learning. These models not only help the organizations to identify the degree of ELR but also to identify the factors or areas where the organization is weak. The present study reviews the models of E-learning Readiness (ELR) with the help of a small-scale literature review on Models of ELR. The purpose of the current study was to make an analysis of the existing ELR models in the literature. The researcher visited various online databases to collect studies. In addition to that, the researcher also did a manual search in the reference list of various studies in the related field for the addition of additional studies. By following an appropriate strategy, the researchers selected 07 ELR models for the current study. The current study reveals that Technology, Skills, Attitude, resources and human resources, Infrastructure, Flexibility, Support, Pedagogy, Management, Evaluation, Continual Improvement, Culture, Budgeting, Curriculum, Awareness, Law and Regulation, Content and Policy have been used on a larger scale for the development of the ELR models. Further, majority of reviewed studies have used various statistical techniques like regression analysis, Confirmatory Factor Analysis (CFA) and Exploratory Factor Analysis (EFA) for developing the models.

Keywords: Information and Communication Technology, E-learning, E-learning Readiness, E-Learning Readiness Models, Higher Education

Introduction

The Higher Education system of India after independence has grown significantly and is now one of the world's largest education systems. After Independence, this sector has seen a remarkable increase in the number of Universities and colleges (Sheikh, 2017). According to the AISHE report 2019-20, the total enrolment in HEI stands at 3.85 crore as compared to 3.74 crore in 2018-19. This significant increase in enrolment leads to a high student-teacher ratio where the teacher is unable to cater to the needs of students and as a result, leads to significant deterioration in the quality of higher education. Imparting quality education empowers the nation in each and every aspect. There are many ways through which quality education can be imparted, and technology is considered the best and most effective medium for delivering quality education and increasing the learner's knowledge (McCombs and Liu, 2007; Gold, 2001; Bates, 2005). Without technology, the common masses and institutions

have very low chances of addressing the challenges and issues of the 21st century, like access to quality education, the increasing cost of education, the inability to communicate effectively, difficulties in collaborating with others, etc. Technology has transformed our classrooms and has removed the limitations of time and space. The use of Information and Communication Technology (ICT) has reformed the process of teaching and learning. It has expanded the opportunities for learning and increased the access to the educational resources (Talebian, 2014). Its use is considered as a new era in the field of education. It has changed the thought pattern and has improved the quality of existing educational models and has provided new training models for improving the quality of education. These models have suggested new methods of learning where the learner is playing an active role and the main emphasis is laid upon self-directed, flexible, and independent learning (Allahi & Sanayei, 2009). ICT consist of a set of technological tools and resources that are used in communicating, creating, disseminating, storing, and managing the information (Toro & Joshi, 2012; Ansah, 2013; Thamarana, 2015). It also help in recording and broadcasting the content, gathering, processing, storing, and presenting the information (Lubbe and Singh, 2009; Ansah, 2013). ICT enhances the learning environment and facilitates the active and collaborative learning. It is being recognised as a catalyst for change and has the ability to impact every aspect of the society (Amutha, 2020). The ICT based systems and various digital tools like discussion forums, digital portfolios, digital libraries, teleconferencing etc. has made E-learning a reachable approach to everyone today. E-learning is a flexible learning system suitable for distance learning, but it can be used in face to face mode also (Pavel et al., 2015). The success of it depends on the self-motivation of the learners to study effectively. During COVID19 pandemic especially in the lockdown period, the conventional mode of teaching was replaced by E-learning. E-learning played an important role in supporting the entire education system and became one of the best preferred approach for academics (Samir et al. 2014). Considering the time, location and health, E-learning was found to be the only feasible option during lockdown period. It increased the effectiveness of knowledge and skills by providing access to a massive amount of data, and by enhancing the collaboration and strengthening the teaching and learning (Maatuk et al., 2021).

E-learning

E-learning is an innovative approach which is being used to provide well designed, learner-centered, interactive, and facilitated learning environment to anyone, anytime and at anyplace by using the resources and attributes of various digital technologies along with various forms of learning materials suited for open, flexible, and distributed learning environment (Khan, 2005). It refers to delivering instructions and information through electronic means which is supported by digital tools and media (Basak et al., 2018; Hoppe et al., 2003; Liu and Wang, 2009; Sharma and Kitchens, 2004). E-learning is considered as the intentional usage of networked ICT for learning purpose. "The term E-learning comprise of lot more than online learning, virtual learning, distributed learning, networked or web based learning" (Naidu, 2003). "E-learning is an effective learning mechanism created by combing digitally delivered content with (learning) support and services" (Mason & Rennie, 2006). It is being considered as a new version of learning in distance education which is applied via Internet technologies and involves the educational activities, which do not

require the physical presence of the teacher and learner at the same time and place (Nehru, 2013). E-learning has changed the way teaching and learning takes place in universities. The University Grants Commission recently announced to allow HEI's to teach 40 per cent of the course syllabus through online mode even after the COVID19 pandemic. For reshaping higher education, 900 autonomous colleges will be offering courses and degree in online mode from July 2022. The assessment for these courses will be carried out through online mode by National Testing Agency (NTA). This increasing acceptance and adoption of E-learning has given rise to development of many E-learning readiness (ELR) models.

The theory of cognitive research suggests that E-learning and various other multimedia modalities has the ability to enhance learning. It empowers the universities to deliver the enhanced learning opportunities through a variety of modalities that help in increasing the student access to and the success in higher education (Coopasami et al., 2017). E-learning has many features and components like "ease of use, interactivity, multiple expertise, collaborative leaning, authenticity and learner-control". These components and features continue to improve with the advent of development in internet (Khan, 2005). E-learning ensures that the learners are actively involved in the process of teaching and learning as the learning takes place with the combination of text, audio, video, collaborative sharing, and interactive graphics. It caters to a wide range of learning styles by employing a large amount of interactive content available on the internet (Songkram et al., 2015). E-learning has led to lower the cost per student while enhancing the quality of teaching and learning (Songkram, 2015). To improve the quality of teaching and learning and also to meet various challenges of higher education, the stakeholders should be ready to embrace E-learning. The readiness for E-learning i,e. E-learning Readiness (ELR) evaluates stakeholders' preparedness for accepting and using for E-learning in their day to day activities. It includes various factors like Technological, Psychological, Infrastructural readiness etc.

E-learning Readiness

E-learning readiness (ELR) refers to the physical and mental readiness of an organization for an E-learning experience (Rohayani, et al. 2015; Borotis & Poulymenakou, 2004; Nwagwu, 2019). It implies the capability of an organisation and capacity of educational stakeholders for participating in an electronic environment (Khan, 2005). When introducing E-learning in an educational institution, it is expected that the educational institution should be prepared with adequate technological facilities, environmental and other facilities also (Nwagwu, 2019). For measuring the ELR of an institution, there are various factors that need to be assessed. Rohayani, et al. (2015) revealed in their study that there are various E-learning factors that determine ELR, i.e., technological, content, human, and the financial support. These factors should be taken seriously when an educational institution considers E-learning as a feasible choice for delivering the instruction and training (Eslaminejad, 2010). E-learning enables educational institutions for making them capable of training learners and the workforce spread over remote areas. It capacitate higher education institutions (HEI) with the dynamic knowledge and skills and increases efficiency that too at reasonable cost (Bailey & Chambers, 1996; Lane et al., 2014). There is a need to have a proper guidance to managers of institutions of higher learning to conduct readiness assessment before

adopting E-learning (Clark & Mayer, 2008). Before the institution starts to implement and take necessary benefits from E-learning, it should assess its readiness for E-learning (Saekow & Samson, 2011) and plan for training programmes that will help faculty members gain confidence in using this platform and increase their ELR (Vijaya Lakshmi, et al., 2020).

Why Models in ELR?

According to Gage & Berliner (1992), "a model is considered as a picture or visual aid where the main concepts and variables are highlighted in a process or a system". It makes easy to understand a domain of knowledge on the basis of its visual expression because the models have the ability to provide useful and accurate representation of knowledge which is required to solve problems in an area. The models can be defined as the representation that helps to define, analyse, and communicate a set of concepts. Chapnick (2000) states that a model helps in answering questions like "Can we do this?", "If we can do this, how.....are we going to do it?" & "What are the outcomes and how do we measure them?". The E-learning models are basically a theoretical construction that helps practitioners to design effective learning experiences for their students taking part in E-learning courses (Theriault, 2015)..

The theory of E-learning is based on the cognitive science principles that describes the usefulness of educational technology in enhancing the effective learning (David, 2015; Wang 2012). The models of E-learning play an important role for the development and enhancement of E-learning process (Suryawanshi & Suryawanshi, 2015). The learning theories and ELR models have significantly influenced the implementation of E-learning (Aguti, 2015) and they ensure the effectiveness of the educational process (Shurygin et al., 2021). The models of ELR are basically designed to understand the process of obtaining the basic information of participants necessary for measuring ELR. They help the organizations to identify the requirements for the designing, developing and implementing E-learning. These models not only help the organizations to identify the degree of ELR but also to identify the factors or areas where the organization is weak (Napitupulu et al., 2019). Identifying of the weak areas helps the organization to improve and to frame suitable policy and strategy for successful implementation of E-learning. The ELR models not only differ as per the method of implementation, effectiveness, and efficiency of education but it also differs on the basis of economic factors (Oketch, et al., 2014).

Objectives

Development of models to understand factors of ELR helps in increasing effectiveness of E-learning. Keeping this in mind, the purpose of the present study is to identify the factors of ELR and to find out the statistical techniques used to develop and test the models of ELR. The researchers studied the existing literature on ELR Models.

Methodology

The keywords "Models of ELR" "E-learning Models in Higher Education" were targeted on various research databases. These databases included Google Scholar, SSRN, Researchgate, Academia, JSTOR and ERIC. In addition to that, the researchers used snowball technique to explore more literature from references cited in various studies. By following this appropriate strategy, the researchers selected 07 ELR models for the current study. The details of all these models in presented in table 1.

Table-1: Models of E-learning Readiness

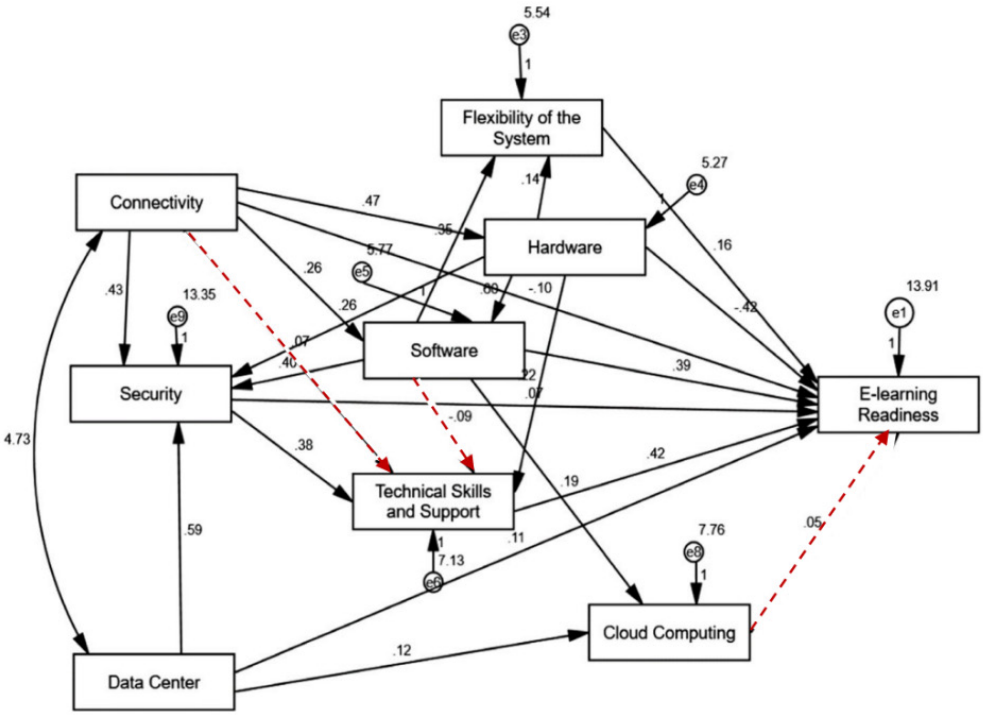
Sl. No.	Author and Year of Publication	Title of the Study
1.	Al-araibi et al., (2019)	"A model for technological aspect of e-learning readiness in higher education"
2.	Alshammari & Adaileh (2018)	"E-Learning Readiness: A Scale Development in Saudi Higher Education Institutions"
3.	Wibowo and Laksitowening (2015)	"Redefining E-Learning Readiness Model"
4.	Oketch et al., (2014)	"E-Learning Readiness Assessment Model In Kenya's' Higher Education Institutions: A Case Study Of University Of Nairobi"
5.	Darab and Montazer (2011)	"An eclectic model for assessing E-learning readiness in the Iranian universities"
6.	Onyait & Lubega (2011)	"E-learning Readiness Assessment Model: A Case Study of Higher Institutions of Learning in Uganda"
7.	Aydin & Tasci (2005)	"Measuring Readiness for e-Learning: Reflections from an Emerging Country"

Discussion

I. Al-araibi et al., (2019) model of ELR

The researchers aimed to test and propose a model of ELR and explore the technological factors that impact ELR. For this purpose, they proposed a model of ELR by conducting the study on 374 academic staff members of 06 Malaysian Public Universities. For the development of the model, the researchers used 08 technological factors like Software, Hardware, Security, Cloud Computing, Connectivity, Data Center, Flexibility of the system and Technical Skills & Support. The researcher used Systematic Literature Review (SLR) and Delphi technique for identifying the factors. Upon testing the model, the researchers revealed that the final model consisted of 07 technological aspects i,e. "Software, Hardware, Security, Connectivity, Data Center, Flexibility of the system and Technical Skills & Support" which have significant effect on ELR while the aspect of 'Cloud Computing' doesn't have significant effect on ELR. The developed model of ELR will highlighted the technological factors which must be considered for assessing the ELR. Besides this, the model will be helpful for understanding the technological requirements for implementation of E-learning.

Figure-1 : ELR model proposed by Al-araibi et al., (2019)



II. Alshammari & Adaileh (2018) model of ELR

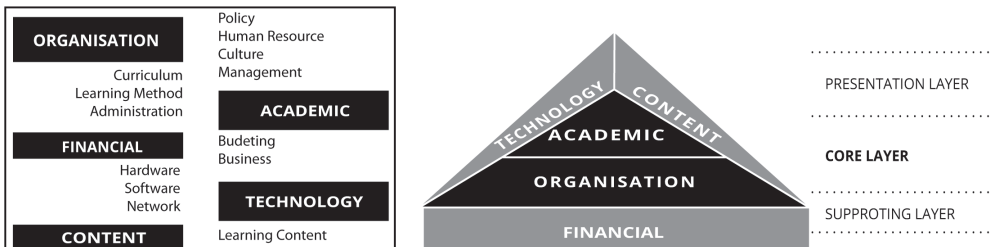
Alshammari & Adaileh (2018) developed a model of ELR on the basis of attributes of teachers, students, and administrators. For the development of ELR model, the researchers used various factors like "Institutional Policy and Business Strategy, Pedagogy, Technology, Interface Design, Management, Administrative and Resource Support, and Evaluation and Continual Improvement". For testing the model, a research tool was developed and to confirm its items "Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)" were conducted. Besides that, they also calculated construct and discriminate validity, reliability and composed reliability, and average variance extracted (AVE). The researchers also used KMO for sampling adequacy and Bartlett test of Sphericity. Upon testing of the model and its factors, the researchers revealed that 05 dimensions i,e. "Pedagogy, Technology, Interface Design, Management, Administrative and Resource Support" are capable of measuring the ELR in higher education institutions. These dimensions/factors serve as aspects for measuring ELR.

III. Wibowo and Laksitowening (2015) model of ELR

Wibowo and Laksitowening (2015) proposed an ELR model to identify factors of ELR that need to be prioritized in the implementation of E-learning. For the development of the model, the researchers used 14 factors i,e. "Administration, Budgeting, Business, Culture, attitude, Curriculum, Hardware, Human Resource, Learning Content, Learning Method, Management, Policy, Network and Software." For testing the model, 109 participants were selected consisting of faculties, education experts, policyholders and E-learning

enthusiasts. Correlation analysis was used to see the relationship and interdependence among the factors of ELR. The model categorizes ELR factors into 05 domains and 03 layers based on institution. Core layer included organization and academic domains, the supporting layer covered the financial domain and the presentation layer included the technology and content domain. This model of ELR was tested by using Product Moment Correlation and Pearson Correlation Factor (PCF) was used to pair each factor with all other factors. PCF was tested in between "Learning methods and Curriculum", "Learning methods and learning content" and "Culture and human resource". The researchers claimed that when the institution starts to implement E-learning and prepares for one factor, it should also consider the readiness of correlated factors. The developed model of ELR is effective to those institutions who have implemented E-learning but haven't tested the effectiveness of E-learning in improving the quality of education.

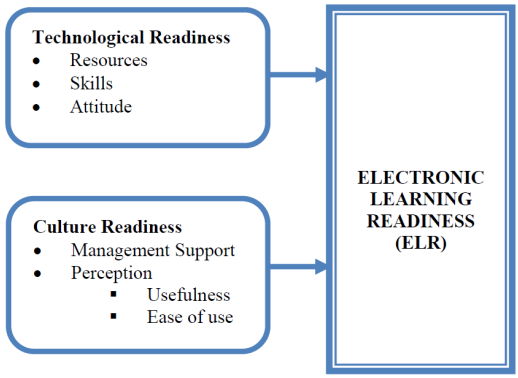
Figure-2 : ELR model proposed by Wibowo and Laksitowening (2015)



IV. Oketch et al., (2013) model of ELR

Oketch et al., (2013) developed a model of ELR for assessing the ELR of faculties in HEI's of Kenya. The University of Nairobi was used as the sample of the study. The aim and objective was to carry out diagnostic assessment of ELR among faculties and to determine the factors that influence ELR. For development of the model, the researcher used four main parameters which are "technological readiness (Chapnick ,2000) with sub factors as resources, attitude and skills; (Aydin and Tasci, 2005), culture readiness (Borotis and Poulymenakou, 2004; Kaur and Abas 2004), content readiness (Borotis and Poulymenakou,2004 ; Chapnick ,2000; Psycharis, 2005)". The demographic variables include age, gender, and level of education. Multiple linear regressions were used to develop the ELR model. For testing the model, regression analysis, coefficient of determination and Analysis of Variance was used. According to the regression equation established, when technology readiness, content readiness, culture readiness, gender, age, and education level were a constant of Zero, the ELR was 2.082. Further, while taking all the independent variables at zero, a unit increase in technological readiness, content readiness and culture readiness will increase the ELR to 0.450, 0.000 and 0.163 respectively. At 95 per cent level of confidence and 5 per cent level of significance, technological readiness, content readiness and culture readiness had 0.000, 0.993 and 0.009 level of significance. The model revealed that Technological and Cultural Readiness are important factors for determining ELR. The Content Readiness and the demographic factors have no significance in determining ELR. The developed model was found to be statistically significant in determining the ELR of faculties.

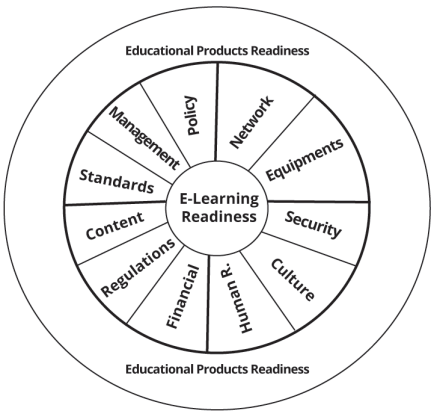
Figure-3 : ELR model proposed by Oketch et al., (2013)



V. Darab and Montazer model of ELR

Darab and Montazer (2011) developed a model to assess ELR in HEI's of Iran. The model was developed by reviewing various models in the literature. A comparison of models was carried out and a model was prepared. The ELR model consisted of 08 factors divided into two sections i.e., educational processes and educational products. These 08 factors were "Law and Regulation readiness, Management readiness, Supervision readiness, Communication network readiness, Cultural readiness, Content readiness, Support readiness, Assessment readiness, Human resources readiness, Educational Policy readiness, Standards readiness, financial readiness, Security readiness and Equipment readiness. The E-learning model developed by the researchers was sent to 100 national experts for the purpose of validation. The researchers developed a research instrument for testing the model which was tested for the reliability aspects and EFA was also carried out to determine the value of each indicator for the proposed model. In the final phase of model development, the researchers determined the weight of each criteria and index for the model by applying Fridman's non-parametrical variance analysis. The proposed model was validated, and it was found that the factors significantly help in determining ELR. However, the developed model has been tailored with the local characteristics of the country.

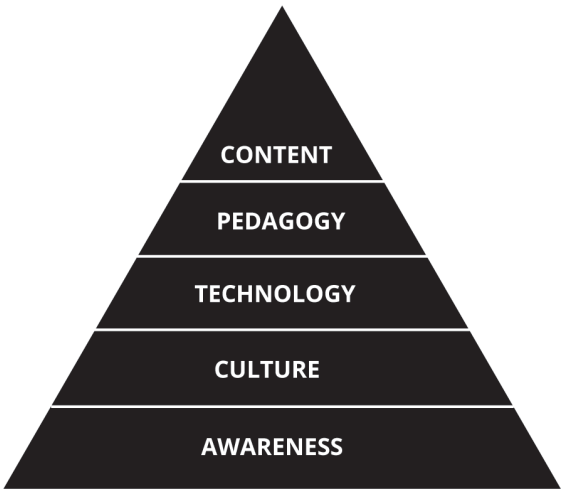
Figure-4 : ELR model proposed by Darab and Montazer (2011)



VI. Omoda-Onyait and Lubega (2011) model of ELR

Omoda-Onyait and Lubega (2011) investigated the ELR of Ugandan HEIs. The researchers aimed at developing a model for ELR assessment which will be benefiting the other developing countries which were exploring the use of E-learning. The model was developed by reviewing the existing ELR models. To develop the ELR model, the researchers applied a questionnaire having 04 attributes i,e. "Availability of resources, Attitude towards E-learning, Resistance to change and Usefulness of the new technology" on 100 respondents. These 100 respondents comprise of students and staff members selected from distance education and ICT departments. For data analysis, Wilcoxon signed rank test was used to identify interaction and interrelationships within the variables. The analysis of data and review of existing ELR models led to the development of ELR model. The developed model consisted of 05 factors of ELR "Content, Pedagogy, Technology, Culture and Awareness". The developed ELR model is five layered triangle, and its each layer represents an attribute which can be used to measure the readiness of an institution towards E-learning. The proposed model has Awareness at the base which is considered as an important factor for ELR. It is followed by Culture of the educational institution. This is followed by Technology available in educational institution then Pedagogy which can match the technology and at the top of the model is Content. The developed model has been found effective on Ugandan HEI's. This model of ELR assessment will work like a guide for institutions and organizations in embracing the E-learning technology.

Figure-5 : ELR model proposed by Omoda-Onyait and Lubega (2011)

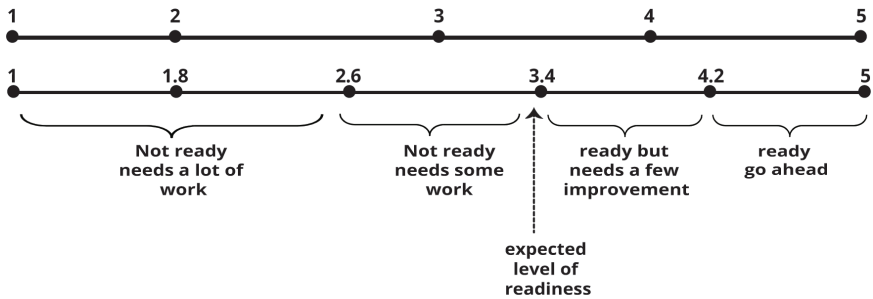


VII. Aydin & Tasci (2005) model of ELR

Aydin & Tasci (2005) carried out a study to measure the ELR in companies of Turkey. The study aimed at identifying the factors that can be used to assess the ELR in the companies. To assess the ELR of companies, the researcher's used four factors i.e., Technology, Innovation, People and Self Development. Further, each factor had three different constructs i.e., resources, skills and attitude. On the basis of these 04 factors of ELR, the researchers developed a five point likert scale consisting of 30 items. The instrument developed by the researchers was used on 100 companies. The researchers identified 3.41 mean score as the expected level of

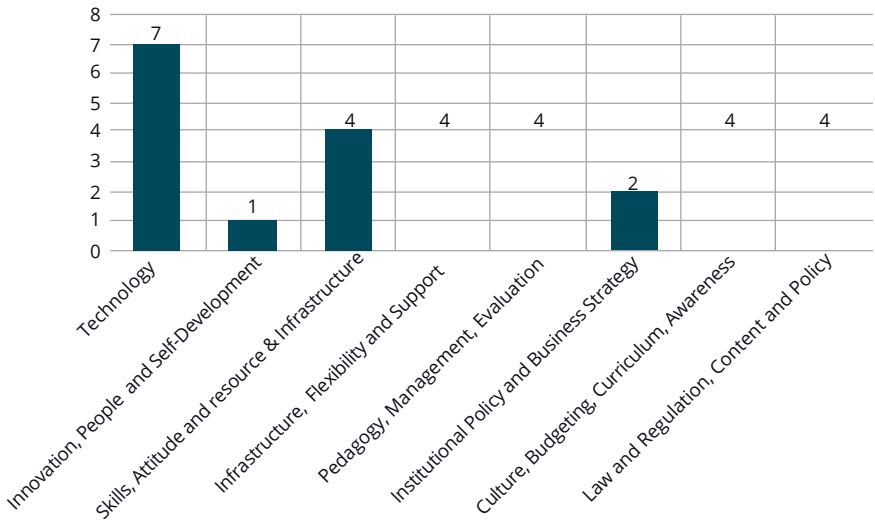
readiness. On the basis of the study, the researches generated an assessment model of ELR which is coded into 1, 2, 3, 4, 5 as in a five point likert scale. The researchers reveal the mean score of respondents between 1 – 2.59 indicates 'not ready needs a lot of work', the mean score of 2.6 – 3.3 indicates 'not ready needs some work', the mean score of 3.4 – 4.1 indicate 'ready but needs a few improvement' and mean score of 4.2 – 5 indicate 'ready go ahead'.

Figure-6 : ELR model proposed by Aydin & Tasci (2005)



The Figure 7 provides a brief description of factors considered for development of ELR models. From the 07 reviewed ELR models, it was found that there are many factors which were considered for development of ELR models. The studies used " Technology, Innovation, People Self-Development, Skills, Attitude, Human resource, Infrastructure, Flexibility, Support, Pedagogy, Management, Evaluation, Continual Improvement, Institutional Policy, Business Strategy, Culture, Budgeting, Curriculum, Awareness, Law and Regulation, Content and Policy" as various factors of ELR. After reviewing the ELR models, the current study concludes that Technology, Skills, Attitude, Human resource, Infrastructure, Flexibility, Support, Pedagogy, Management, Evaluation, Continual Improvement, Culture, Budgeting, Curriculum, Awareness, Law and Regulation, Content and Policy have been used on a larger scale for the development of the ELR models.

Figure-7 : Factors considered in ELR models



Conclusion

The current study was conducted to examine and review the existing models of ELR. The ELR models developed during the period of 2005-2019 were included in the present study. Various statistical techniques like regression analysis, CFA, EFA were used to develop the models. In these models, various dimensions like Technology, Innovation, People and Self-Development, Organization, Academic and Financial, Content, Policy, Culture, Regulation, Management, Standards and Security, Administrative and Resource Support, Assessment, Supervision and Environment, Training and Acceptance, Business, Resource and Human Resources and Awareness & Awareness were considered to be significant in studying the ELR of stakeholders.

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Research Article

Effectiveness of Flipped Classroom Technique in Enhancing Academic Achievement of B.Ed Students: An Action Research

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Abstract

The Flipped classroom appears to be one of the contemporary fashions in teaching-learning process. This very concept is based on the idea of active learning and student engagement. The objectives of the present paper are to investigate the overall Effectiveness and Perception of Flipped Classroom Technique in Enhancing the Academic Achievement of B.Ed. 1st Semester Students. The instructional tool used in this present study was Flipped Classroom Technique. Achievement Test was used to collect pre and post-test data to assess the student's achievement in the subject Contemporary Indian Education (CE), which is being taught in 1st semester B.Ed., Department of Education, Tezpur University, Assam. The result of the study concludes that the Flipped Classroom Technique is more effective in enhancing the overall academic achievement of B.Ed. 1st semester students with regard to mean level pre-test and post-test scores. Further, in terms of perception most students responded favourably to the fact that the flipped classroom supported their learning.

Keywords: Flipped Classroom Technique, Academic Achievement, Perception, Effectiveness, Contemporary Indian Education, Pre-test and Post-test.

Identification of the Problem

We have consistently observed for the last three years that most of the students in our Department were not techno-friendly during the teaching-learning process. As a result, we have mostly been using the lecture cum discussion methods during the teaching-learning process. However, we found that only through this method were the students not interactive and participated in the classes. Students were not able to answer during the question-answer session. They remain passive throughout the class. Being a Teacher Education Department, we offer a two-year B.Ed. Program. The main objective of this program is to prepare teachers with all requisite knowledge, skills, attitudes and behaviour. This objective can only be fulfilled through effective two-way teaching-learning experiences. We found traditional lecturer and other similar methods were not equipped with the requisite skills, which resulted in a lack of motivation and an inability to develop their teaching skills, which further led to unsatisfactory academic achievement.

Keeping in mind different teaching pedagogy, investigators thought to adopt Flipped Classroom Technique as a teaching pedagogy in 1st semester of two year B.Ed program to motivate these students towards the use of technology as their learning style, which may result in a stepping stone to increase their academic performances. Therefore, researchers decided to undertake an action research study on the topic titled "Effectiveness of Flipped Classroom Technique in Enhancing Academic

Achievement among 1st Semester B.Ed. Students of Education Department, Tezpur University, Assam".

Theoretical Perspectives of the Flipped Classroom

Digital expansions in India have extended a great thrust in the last decade. The Indian government has taken indispensable steps to digitise the campuses of higher education. This will smooth the field for all learners in relation to internet connectivity. India's initiative to make web-based resources available for the higher education segment started in the 1990s. Some top institutions of higher education, like IIT, UGC, NPTEL, CEC were the early contributers to web-based education (Dangwal & Mishra, 2020). However, with the advent of web 2.0 tools and high penetration of internet services, there is a rapid increase in the web resources created by Indian contributors. These developments set the stage for making it possible to implement technology dependent vibrant and pertinent teaching learning techniques like Flipped Classroom Model. As per the study conducted by (Srinivasan, S. & Kumar, H., 2020) suggests that Flipped Classroom Model has been effective in creating excitement and motivation in students. Most important observation from the research is that Flipped Classroom Model is not just changing the sequence of teaching but it calls for a mindset change in teachers and students to implement it at a curriculum level. Similarly, in one study it was also found that the flipped learning model can empower instructors to make the move from educator driven guideline to student focused learning (Syam, 2014).

For learners who couldn't attend the class live video recordings and screen casting software was means to record lectures, demonstrations, and slide presentation with annotations and posted them for the learners to watch and deliver (Hamdan et. al., 2013), this concept of Flipped classroom was first introduced by Jonathan Bergmann and Aaron Sams. The Flipped classroom seems to be one of the latest fashions in teaching-learning process. Flipping the classroom refers to another form of Blended Learning where a student is tasked with homework usually via a video or audio file. The classroom time is spent clarifying and applying new knowledge through problem solving and discussion method. Flipped instruction is also known as backwards classroom, reverse instruction or reverse teaching. The conception of Flipped Classroom is developed on the idea of active learning and student engagement. The classroom becomes a workshop where interaction among Educator and students takes place. Students are encouraged for individual inquiry and collaborative effort. Class time is no longer used to discourse, but instead is used for activities and problem solving (Tucker, 2012). According to Bishop and Verleger (2013), "communication between teachers and trainees will occur and will create an active learning in the classroom". Moreover, (Wilson, 2013) also agreed that the practice of flipped classroom will upsurge learners communication skills and progress their performance. Likewise, another study conducted by (Gurpreet, K., 2018) titled Effect of flipped classroom model and problem solving strategies on achievement and student engagement in mathematics in relation to critical thinking. In the study he found that the achievement of groups taught through flipped classroom model, problem solving strategies were found significantly higher than that of group taught through traditional teaching strategy in mathematics.

The flipped classroom is the antithesis of the traditional classroom transaction. According to Bergmann and Sams

(2012) "lecturers use video lectures outside the classroom and use in-class time for doing assignments or active learning activities such as problem-based learning". Kim et al. (2014) also stated that "flipped classrooms are also considered blended learning environments, using both online and face-to-face methods in teaching and learning". However, it is seen that the online element of blended classrooms usually occurs during class time, along with student-teacher collaboration (Torrisi-Steele & Drew, 2013).

Objectives

1. To investigate the overall Effectiveness of Flipped Classroom Technique in Enhancing the Academic Achievement of B.Ed. 1st Semester Students.
2. To know the Perception of Students towards
    - Using the Web-Based Instructional Videos.
    - Using E-Contents for better Understanding of the Content.
    - Activities during Flipped classroom Session Increase Students Understanding of Key Concepts

Hypothesis

There will be no significant mean scores difference between the achievement scores of the experimental groups at pre-test and post-test level (i.e. before and after intervention).

Methodology

As per the nature of study the investigators used experimental method. This is an experimental type of research.

Sample and Sampling Technique

The study was conducted on students of B.Ed. (1st Semester), Department of Education, Tezpur University, Assam. Sample is representative to the population, but in action research is limited to single class. Whole class which constitutes forty-four students was taken for the action research. Purposive Sampling Techniques was undertaken in the present study considering the lack of motivation and unsatisfactory academic achievement among learners as observed by investigators.

Design of the Study

The paradigm of the present study is given in Table 1.

Table-1: Paradigm of the Design of the Study

Purposively Assigned Treatment Groups	Pre-test	Independent Variable	Post-test
Experimental Group	P_1CE	Teaching through Flipped Classroom Technique (FCT)	P_2CE

The details of the abbreviations used in the above table are given below:

FCT – Flipped Classroom Technique

P_1CE- Pre-test (Contemporary Indian Education)

P_2CE- Post-test (Contemporary Indian Education)

Variables of the Study

Flipped Classroom Technique (FCT) was taken as Independent variables. In the

present study, Academic Achievement of the paper Contemporary Indian Education among B.Ed. (1st Semester) students were considered as Dependent Variables.

Tools Used

The study, being an experimental one, necessitated two types of tools as follows:

i. Instructional tool and

ii. Testing tool

The detailed descriptions of such tools are given below:

i. Instructional Tool

The instructional tool was used to impart instruction to the treatment group. The instructional tool used in this present study was Flipped Classroom Technique.

ii. Testing Tool

1. Testing tool is based on selected concepts from CE paper. The selected items were not only convergent in nature but also were seeking divergent answers. The following test was administered.
2. Achievement Test was employed to collect pre and post-test data, to assess the students' achievement in the subject Contemporary Indian Education (CE) which is being taught in 1st semester B.Ed. An extended-response essay test was used having five items. Scoring was done through analytical scoring method by giving suitable weightage to all learning outcomes. Five categories were decided to evaluate the answers; all the elements were given equal importance. A model answer along with a suitable scoring key was provided to all evaluators.
3. Observation was also conducted to gather supporting evidence to students' response. The researchers kept a dairy of observation notes and discussions. After each informal observation the researcher recorded their observation in their dairy.

The perception scale Students' Perception Scale towards Flipped Classroom was constructed following Likert type to study the perception of students regarding Flipped Classroom Technique to teach the subject Contemporary Indian Education. Approriate steps were followed for standardization of the tool. A total of 25 items were prepared initially. However, finally 10 items were retained after consulting experts in the field of tool construction.

Results and Discussions

Objective No. 1

To investigate the overall Effectiveness of Flipped Classroom Technique in Enhancing the Academic Achievement of B.Ed. 1st Semester Students with regard to pre-test and post-test scores.

Table-2: Depicts the Effectiveness of Flipped Classroom Technique in enhancing the overall Academic Achievement of B.Ed. 1st Semester students with regard to mean level pre-test and post-test scores

No. of B.Ed. Students	Test	Mean	SD	't' value
44	Pre-test	12.9	1.32	9.31
44	Post-test	17.1	2.70	

From the above table no. 2, it is observed that the mean score of the pre-test is 12.9 and the standard deviation (SD) of the pre-test score is 1.32. The mean score of post-test is 17.1 and the standard deviation (SD) of the post-test is 2.70. Hence, in the post-test the academic achievement scores of 1st Semester B.Ed. students is increased by 4.2, the 't' value is 9.31 which is significant at 0.05 level which indicates that there is a significant difference between pre-test and post-test score. The academic achievement of B.Ed. 1st semester students is improved significantly after teaching through the Flipped Classroom Technique Intervention Programme. Hence the hypothesis as done previously is rejected.

Discussion of the Result (Objective no. 1)

The above result states that the FCT is more effective in enhancing the overall academic achievement of B.Ed. students. Thus findings from this study shows that active learning strategies through flipped classroom technique increases student academic achievement while promoting important 21st century skills such as collaboration, communication, and critical thinking. The flipped or upturned classroom is a novel and prevalent instructional model, which promotes activities traditionally conducted in the classroom (e.g., content presentation) transfer to home assignments and activities (Bergmann & Sams, 2012; Sohrabi & Iraj, 2016). Since classroom time is not used to transmit knowledge to students by means of lectures, the teacher is able to engage with students by means of other learning activities such as discussion, solving problems proposed by the students, hands-on activities, and guidance.

Result of the present research is also line up with that of prior literature like Sedraz, Erik, Lins, Cavalcanti, and Fernando-da, (2018) showed "flipped learning to be the cause behind increased self-regulation in learning among students". Similarly research conducted by (Jwair, 2018) also expressed that the FCT is dominant to improve students' self-regulation than traditional method. They supported that students' self-regulation gained higher scores after they experienced FCT.

Almost 80 per cent of students reported that their interactions with peers and teachers during class time were more positive in flipped classes than in traditional courses. Unlike traditional teacher-centered instruction, in which students were treated as empty vessels that passively absorb information (Betihavas et al., 2016), flipped classrooms are centered around the students – not the teacher (Bergmann & Sams, 2012). Therefore, many researchers agree that student-centered learning theories (e.g., active learning, collaborative learning) can be more fully utilized in the flipped classroom (Betihavas et al., 2016; Lai & Hwang, 2016; Sohrabi & Iraj, 2016). The very cause of Flipped Classroom Technique is more effective maybe use of video contents in teaching learning process, which was well supported by (Bishop and Verleger, 2013), who stated that to meet the flipped classroom criterion, out-of-class activities must include video lectures. The present study is also very much adeptive in the use of video content by teachers and students. Further according to Smith (2013), it is better to use video lectures, since students prefer streaming content as an out of- class activity. Similarly, Battaglia and Kaya (2015) reported that students mainly focus on videos rather than text readings during out-of-class study. To illustrate the effectiveness of the Flipped Classroom Model, (Janotha, 2016) studied to what extent FCT affected the academic achievement of scholars. The test scores of the experimental group gained from the national standardized test were compared to those of the control group, and it was seen that the

students in the experimental group achieved higher academic performance than the students in the control group (Janotha, 2016). Conversely though, the results of related studies in the relevant literature reflect that the Flipped Classroom Model increases students' academic accomplishment (Janotha, 2016; Pierce & Fox, 2012; Talley & Scherer, 2013; Zengin, 2017).

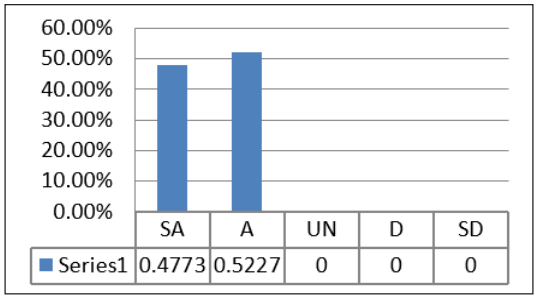
Objective No. 2: To know the Perception of Students towards:

(a) using the Web-Based Instructional Videos

Table- 3: Use of Web-Based Instructional Videos

Strongly Agree (SA)	Agree (A)	Undecided (UN)	Disagree (D)	Strongly Disagree (SD)
21(47.73%)	23(52.27%)	0	0	0

Figure-1: Perception of Students towards using the Web-Based Instructional Video



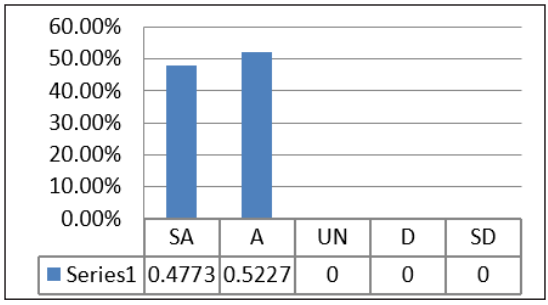
Responding to objective 2a, 21 participants (47.73 per cent participants) out of 44 participants strongly agreed that they learned more from web-based instructional videos using Flipped Classroom Technique. Further 23 participants (52.27 per cent participants) also agreed that they learned more from web-based instructional videos using Flipped Classroom Technique. There were no single respondent in other response categories.

E-Contents Useful to Help Students Better Understand the Content.

Table-4: E-contents useful for better understand the content

SA	A	UN	D	SD
18 (40.91%)	24 (54.54%)	2(4.54%)	0	0

Figure-2: Perception of Students towards E-Contents useful to help Students Better Understand the Content



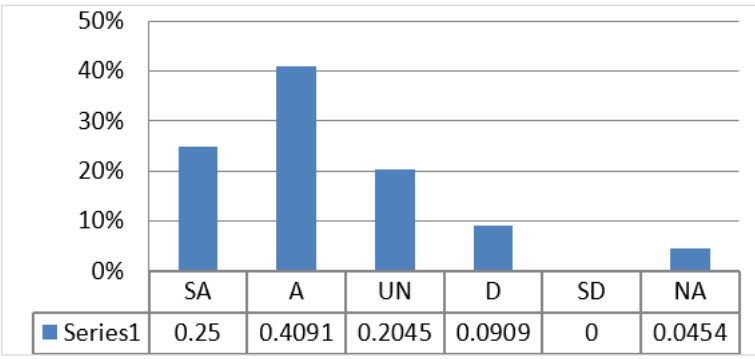
Responding to statement against 2 b, it was found that18 participants (40.91 per cent participants) out of 44 participants strongly agreed that e-contents was useful to help them better understand the content taught through Flipped Classroom Technique. Further 24 participants (54.54 per cent participants) out of 44 participants also agreed that that e-contents was useful to help them better understand the content taught through Flipped Classroom Technique. Under Undecided category there were only 2 (4.54 per cent) responded. Additional there were no single respondent in other two response categories i.e. disagree and strongly disagree.

Activities during Flipped classroom Session Increase Students Understanding of Key Concepts

Table-5: Activities during Flipped classroom Session Increase Students Understanding of Key Concepts

SA	A	UN	D	SD	NA
11(25%)	18(40.91%)	9(20.45%)	4(9.09%)	0	2(4.54%)

Figure-3: Perception of Students towards Activities during Flipped classroom Session Increase Students Understanding of Key Concepts



Above objective 2 c, depicts that 11 participants (25 per cent participants) strongly agreed that flipped classroom session increased their understanding of key concepts in teaching-learning of subject Contemporary Indian Education. It was found that 18 participants (40.91 per cent participants) out of 44 participants also agreed that Flipped classroom session increased their understanding of key concepts in teaching learning of subject Contemporary Indian Education. Under Undecided category there were 9 (20.45 per cent) respondents. And under Disagree category there were 4 participants (9.09 per cent) and under Strongly Disagree there were no responded. In this particular item it was also found that 2 participants (4.54 per cent) student didn't respond.

Discussion of the Result (Objective no. 2)

From the above result it was found that majority of the students liked using the web-based instructional videos as their teaching learning means. Technology and social media work in hand-in-hand in the Flipped Classroom. To create learning materials educators develop video using numerous technologies that is then uploaded to social media sites

such as WhatsApp and YouTube. The use of video to deliver content has become gradually more visible for educators in various courses. Franciszkowics (2008) argues that visual media is critical in courses where there are multiple steps that go into problem solving. Videos can be used to provide scaffolding for students through problems by modelling expert problem-solving strategies (Franciszkowics, 2008).

Again it was found that more than majority of students strongly agreed that the e-contents provided to them were useful to develop their understanding of the content. In subjects like Contemporary Indian Education, where content is structured in an order, it is obligatory that students have a robust comprehension on the pre-requisite skills (Overmyer, 2010). One of Mastery Learning's utmost flaws is that it takes major classroom time to implement (Guskey, 2007). Teachers have conventionally valued the principles of Mastery Learning since its inception in the last 1960's by Benjamin Bloom, but have not ever been practiced effectively. The Flipped Classroom provides learners with proper time to develop improved understanding of the content.

Furthermore, it was also found that the e-contents materials helped students to learn at their own pace. Students also report that in a flipped course they are more likely to engage in collaborative decision making with other students; use class time to engage in critical thinking and problem solving; and have greater opportunity to work at their own pace. In the Flipped Classroom pupils have amplified flexibility to pace the sequencing and delivery of their instructions. Students have the facility to pause, rewind, replay, and even fast forward their video lessons delivered in the course. Copley (2007) found that undergraduate and Master level students often listened to podcasts of discourses they had already attended.

The findings exhibited that majority of the participants responded positively that the flipped classroom supported their learning. Students found that they had further opportunities to communicate with their classmates and teacher, finish their homework in class, and to engage in meaningful classroom events.

Educational Implications

The effect of Flipped Classroom Technique on Academic Achievement is a considerate topic with implications for instructors, students, parents and society, as a whole.

The significant difference between the academic achievement test performances of the students widens the scope of Flipped Learning's effectiveness as applied in institutional settings.

The study draws attention of parents, as almost all the students at School or University level are engrossed with usage of technology even at home also. Devotion of large number of hours with technology can be blended along with academic purposes. Thus especially, parents should be trained to monitor their kids' interaction of multimedia for the academic uses.

The positive result of this study may also help students to engage in collaborative decision making with other students, use class time to engage in critical thinking and problem solving, and have greater opportunity to work at their own pace anytime- anywhere.

Conclusion

The raid growth of technology has sparked a revolution in the world of education, and India is of no exception. (Flumerfelt and Green, 2013) stated that nowadays the use of technology plays an important role in teaching and learning. Similarly in context of present

study research done by (Herreid and Schiller, 2013) showed that flipped classroom is generally seen as capable of improving students' achievement, improve communication and promote teamwork. It is true that the Flipped Learning Model is not the only way to facilitate good teaching. However, effective teaching is better enabled and flourishes more readily in flipped classrooms which support the 21st century education where students are active learner. The Flipped Classroom is a significant shift in the way students traditionally function in a classroom. The general focus of the flipped classroom in this study was to make the learning environment more students centered by moving the learning from a passive format to an active one. Students in a flipped classroom are able to work at their own pace which is great for differentiated learning and engage with their peers in a more interactive, meaningful way when they're in the classroom. This strategy is effective in making teaching and lecturing more exciting and interesting form the one hand, and making the learner positive and responsible for the learning process from the other hand. Flipped instruction produces a learning atmosphere where mastery learning feedback and corrective measures can be used to enhance academic achievement for all students.

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Research Article

Facilitating positive attitude in students: A study of critical e-learning factors

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Abstract

Planning the implementation of e-learning requires study of various factors that play a key role in its success. Although many studies on e-learning factors have been conducted from time to time, the majority of them aimed at identifying critical success factors based on literature review or through surveys, while only a few studied the impact of critical success factors on other variables. (Farid et al., 2018; Qammach and Al-Sharifi, 2021). The present study aims to analyze the impact of critical success factors on students' attitudes towards e-learning. Through the questionnaire, a total of 300 respondents were reached, out of which 221 responded giving a response rate of 74 per cent. Analysis of data was done using IBM SPSS and AMOS graphics. Findings reveal that University Support has a positive impact on students' attitudes towards online learning, whereas, technology issues have a negative impact on students' attitudes towards e-learning. Instructor support is seen to have an insignificant impact on students' attitudes towards e-learning. Only three critical factors have been tested in the present study to study their impact on students' attitudes, while future studies can involve even more factors. The study holds importance for all stakeholders in the education industry.

Keywords: University Support, Technology, Instructor Support, Students' Attitude, Critical Success Factors.

Introduction

In recent years, online learning is gaining momentum in schools and colleges around the world due to its feature of flexibility and student-centric approach. However, it is very important to pre-plan the implementation process of online learning as an unplanned effort can be a waste of time, effort, and knowledge. The adoption and implementation of e-learning need careful analysis of critical success factors of e-learning. A lot of previous research has tried to draw attention to some critical success factors that can improve the performance and success chances of online learning.

According to the Center for Management and Organization Effectiveness, 2022, "Critical Success Factors refer to those specific elements or action areas that require focus and should be implemented for achieving strategic goals". In the context of e-learning, Critical success factors refer to those factors that help to accelerate the success of online learning by achieving planned learning outcomes. These factors can include a wide variety of elements but frequently include, student-related factors, instructor-related factors, technology-related factors, and university-related factors.

For the purpose of study, students' perception of e-learning will be

analysed. Students are the end users of e-learning, and satisfying them should be one goal of effective e-learning. If students' attitudes are positive, they will accept e-learning, and it will be easier to engage them leading to better learning outcomes. A study of critical success factors of e-learning is important as e-learning requires a strong base to function effectively, which is possible only if certain elements are actively engaged in the learning environment like competency of students and instructors, reliable technology, quality content, supportive institutional policies, etc.

The present study will aim at recognizing the frequently prioritized critical success factors of e-learning and analyzing their role in influencing students' attitudes towards e-learning. The study is important for higher educational institutes in planning the successful implementation of e-learning through focused investment in the critical success factors of e-learning as they result in positive attitude of students which result in increased student acceptance of online learning and thereby better learning outcomes.

Literature Review

The study has collected literature reviews from the period 2007 to 2020 which dealt with the study of key factors pertaining to e-learning implementation, key factors related to e-learning adoption, and key factors impacting the success and effectiveness of e-learning especially in higher education. The following table highlights various studies that investigated the Critical Success Factors of e-learning:

Table-1: Showing Review of Literature related to Critical Success Factors of e-Learning

S. No.	Author (yr.)	Title	Purpose	Methodology	Findings
1.	(Qammach and Al-Sharifi, 2021)	The Impact of Critical Success Factors for E-Learning on Strategic Performance: An applied study in a sample of the faculties for the University of Baghdad	To test the impact of critical success factors for e-learning on the strategic performance of a sample of Baghdad University faculties.	Survey	There is a correlation and a statistically significant effect between the critical success factors for e-learning with its dimensions (information technology, the teaching staff) and the strategic performance with its dimensions
2.	(Priatna *et al.*, 2020)	Key Success Factors of e-Learning Implementation in Higher Education	This study aims to analyze the Key Success Factors (KSFs) of e-learning implementation	Multi Attribute Utility Theory Approach	The dominant factor that needs attention is organizational aspect, while other factors are technology and human resource.
3.	(Alqahtani and Rajkhan, 2020)	E-learning critical success factors during the covid-19 pandemic: A comprehensive analysis of e-learning managerial perspectives	To identify the critical success factors for E-learning during COVID-19	Analytical Hierarchy Process	Technology management, support from management, increased student awareness to use E-learning systems, and demanding a high level of information technology from instructors, students, and universities were the most influential factors for E-learning during COVID-19.

4.	(Raman et al., 2019)	Investigating Key Factors for successful e-learning implementation	To identify the critical success factors of e-learning	Extensive Literature Review	The CSFs are teacher's characteristics (teacher's attitude, teacher's computing or technical skills, interaction among teacher-students, teaching style, knowledge in e-learning content development and self-efficacy), student's characteristics (attitude, computer competency, interaction, self-efficacy, motivation and cultural and social norms), information technology infrastructure (internet accessibility, reliability and availability), design and content (perceived ease of use and perceived usefulness) and organization characteristics (training and support).
5.	(Kasani and Mourkani, 2019)	A research synthesis of critical success factors of e-learning: A model development	To identify critical success factors of e-learning to develop a model for e-learning success	Review	E-learning success factors include three dimensions: Structural dimension (including: organizational, educational, content, support, and system quality); Content or behavioral dimension (including factors: learner and teacher); and the contextual or environmental dimension (including factor: technology)
6.	(Cheriyan, 2018)	Critical Success Factors for E-learning: An Indian Perspective	This paper attempts to identify the critical factors attributing to the success of e-learning in higher education sector through a student perspective.	Survey Principal Component Analysis	The study identifies five factors as critical in the success of e-learning viz. technological support, e-learning resources, e-learning support and training, characteristics of student, and characteristics of instructor in their order of relative importance with technological support being the most critical factor
7.	(Farid *et al.*, 2018)	Critical Success Factors of E-Learning Systems: A Quality Perspective.	To identify CSFs through review and identify their impact on e-learning quality	Review and Survey	Perceived usefulness, lack of learning objects in local languages, quality of educational system, Lack of instructional designer, lack of instructional design process and information quality have emerged as top critical factors hindering the quality of e-learning.

8.	(Anggrainingsih et al., 2016)	Determining eLearning critical success factor at Sebelas Maret University using Analytical Hierarchy Process (AHP)	To determine the Critical Success Factors of the UNS e-learning implementation using Analytic Hierarchy Process Citations (AHP).	-	The most important factor is Technology, followed by the E-learning Development, Students' characteristics, Lecturer's characteristics, and Management Support.
9.	(Basak, Wotto and Bélanger, 2016)	A Framework on the Critical Success Factors of E-Learning Implementation in Higher Education: A Review of the Literature	This paper presents a conceptual framework on the critical success factors of e-learning implementation in higher education, derived from an in-depth survey of literature review.	Review	The proposed conceptual framework on critical success factors of e-learning include Technological Factors, Institutional factors, Pedagogical factors, Ethical factors, Resource factors, Evaluation Factors, Management factors, Social Interaction Factors
10.	(Gamage, Fernando and Perera, 2014)	Factors affecting to effective eLearning: Learners Perspective	To explore the dimensions of effectiveness from learners' perspective catering to the current demand.	Interview and observation (Qualitative methodology)	Identified 10 factors that affect e-learning effectiveness, out of which the top 5 are as follows: Interactivity, Collaboration, Motivation, Network of Opportunities, Pedagogy. The remaining 5 factors are Content/Material, Assessment, Usability, Technology, Support for Learners
11.	(Cheawjindakarn, Suwannatthachote and Theeraroungchaisri, 2012)	Critical Success Factors for Online Distance Learning in Higher Education: A Review of the Literature	The aim of this paper is to specify the Critical Success Factors (CSFs) for Online Distance Learning (ODL) in Higher Education (HE).	Review of Literature	The critical success factors of ODL include institutional management, learning environment, instructional design, services support, and course evaluation.
12.	(Fitzpatrick, 2012)	Key Success Factors of eLearning in Education: A Professional Development Model to Evaluate and Support eLearning	The purpose of this paper is to introduce the KSF (Key Success Factors) model of eLearning to support and evaluate eLearning in secondary schools.	In-depth Interview	Dominant factors of e-learning are technology, human, design, support, and evaluation.
13.	(Musa and Othman, 2012)	Critical Success Factor in E-Learning: An Examination of Technology and Student Factors	To examine the e-learning critical success factors (CSFs) as perceived by students.	Survey	Internet browsing speed and instructor participation in discussion groups are most critical factors for e-learning.

14.	(Rijal & Wardani, 2012)	Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty	It aims at identifying the Critical Success Factors that aim to influence the acceptance of e-learning in developing nations.	Interview Delphi and AHP method	Technology awareness, motivation, and changing learners' behavior are prerequisites for successful e-learning implementations.
15.	(Bhuasiri *et al.*, 2012)	Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty	To identify multiple factors that influence the success of e-learning systems.	Delphi and AHP	Technology awareness, motivation, and changing learners' behavior are prerequisites for successful e-learning implementations.
16.	(Selim, 2007)	E-learning critical success factors: an exploratory investigation of student perceptions	To identify and measure its Critical Success Factors (CSFs) from student perceptions.	Survey	The surveyed students indicated that instructor characteristics factor is the most critical factor followed by support and technology. The Student characteristics factor was perceived as the least critical factor to the success of e-learning.

Research Gap

Although there are a lot of studies on critical success factors of e-learning, no study has tried to investigate the relationship between critical success factors of e-learning and students' attitudes towards e-learning. Moreover, most studies are review papers and lack empirical investigation. As such,, there is a need to explore the role of critical success factors of e-learning in developing positive attitudes of students towards e-learning.

Research Objectives

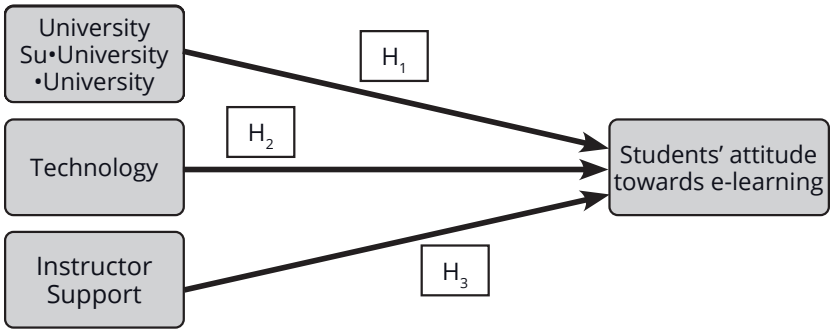
The study aims at fulfilling the following objectives:

1. To analyse the impact of university support on students' attitudes towards online learning
2. To analyse the impact of instructor support on students' attitudes towards online learning
3. To analyse the impact of technology issues on students' attitudes towards online learning.

Conceptual Framework and Research Hypotheses

The most frequently identified critical success factor in past literature has been technology (indicating technology issues or technology support), followed by university support, and instructor support. Thus, based on a detailed analysis of the literature review, three factors, technology, university support and instructor support, have been chosen as the critical success factors for further analysis of their impact on students' attitudes towards online learning.

Figure-1: Shows Conceptual Framework proposed for the Study



Source: Self Constructed The study will involve the perception of students as well as analysis of students' attitudes towards online learning. Students are the end users of e-learning system. Students' acceptance of online learning is important to fully realize the benefits of online learning, which can only be possible if they have a positive attitude. If students' attitude towards e-learning is positive, it makes them more interested and motivated to learn, whereas, if the students' attitude towards e-learning is negative, it can create hurdle in achieving learning outcomes. According to Maheshwari Greeni, 2020 Students who enjoy their courses have stronger intentions to use e-learning in future also.

H_1: University support positively influence students' attitude towards e-learning

University Support is also an essential component of e-learning system. Without university support, it might not be possible for e-learning to be successfully implemented at ground levels. According to Maheshwari Greeni, 2020 Students intentions to use e-learning system in future are influenced by the level of institutional support provided to them. The present study will aim to understand if university support influence students' attitude towards e-learning.

H_2: Technology issues negatively influences students' attitude towards e-learning

The term 'technology' can include variables indicating technology management or lack of technology management in the form of technological barriers and issues. According to Zalat et al., 2021, the highest barrier in accepting e-learning included insufficient or unstable internet connectivity, inadequate computer labs, lack of computers/laptops, and technical problems. Technology Support implies managing technology in a way that the technological barriers in e-learning system are minimized and the benefits of e-learning technology can be fully realized. Proper management of technology is important as it ensures uninterrupted internet access, reliability on technology, better browsing speed, etc. Technology has been identified as an important factor in majority of studies (Raman et al., 2019); (Anggrainingsih *et al.*, 2016); (Gamage, Fernando and Perera, 2014); (Fitzpatrick, 2012); (Priatna *et al.*, 2020); (Selim, 2007); (Musa and Othman, 2012); (Qammach and Al-Sharifi, 2021); (Basak, Wotto and Bélanger, 2016); (Kasani and Mourkani, 2019); (Alqahtani and Rajkhan, 2020). According to Taat & Francis, 2019, Technology support plays a vital role in e-learning adoption and implementation. It is the lack of technology support that leads to technical issues and challenges that hinder the success of e-learning process. The present study will aim to analyze the impact of technology issues on students'

attitude towards online learning.

H_3: Instructor Support positively influence students' attitude towards e-learning

For e-learning to be effective, support of instructors to students in online learning environment is essential. Instructor characteristics include their Attitude, technical skills, interaction, participation, teaching style, knowledge of content development on online learning platforms and self-efficacy. (Raman et al., 2019); (Anggrainingsih et al., 2016); (Kasani and Mourkani, 2019) and such characteristics should be utilized to support students' learning in virtual environment. Instructors should guide and encourage students to boost their motivation to use e-learning (Taat & Francis, 2019). The present study will aim to analyze whether instructor support influences students' attitude towards e-learning.

Research Methodology

Data and sample**:** Primary data have been collected through an online questionnaire distributed to graduate students of different colleges in Western U.P. using purposive sampling. Purposive sampling is used as the study aimed at collecting the responses of only those graduate students who have taken online courses in their colleges. Self-constructed questionnaire is made to measure the constructs of proposed conceptual framework using detailed review of past literatures. A total of 300 respondents were reached out of which 210 responded resulting in response rate of 74 per cent. The data were coded and checked for outliers and missing values before proceeding for further analysis.

Variables of the study: The study aimed at studying variables four variables which includes university support, instructor support, technology issues, and students' attitude towards e-learning.

Scales of measurement: All variables were measured using 5-point Likert scale, where 1 meant "strongly disagree" and 5 meant "strongly agree". The questions were self-constructed through variables identified from past literature.

Statistical techniques: Analysis of demographic and study habits was done using SPSS 20. Structural equation modelling was used to study structural relationships between the variables. For Structural equation modelling, AMOS Graphics was used.

Results and analysis

57.5 per cent males and 42.5 per cent females participated in the survey, out of which majority of students took online classes in regular mode.

Table-2: showing Factor items reliability and validity through Average variance extracted (AVE) and construct reliability (CR)

		Cronbach alpha	Factor loadings	AVE	CR
University Support	US2	0.841	.505		
	US3		.520		
	US4		.759		
	US5		.837		
	US6		.773		
	US7		.810	0.491	0.857

Instructor Support	IS1	0.781	.503		
	IS2		.562		
	IS3		.800		
	IS4		.524		
	IS5		.629		
	IS6		.552		
	IS7		.780	0.601	0.818
Technology issues	T1	0.808	.737		
	T2		.711		
	T3		.738		
	T4		.648		
	T6		.747		
	T7		.664	0.498	0.858
Students' Attitude towards e-learning	SA1	0.802	.734		
	SA2		.767		
	SA3		.791		
	SA4		.518		
	SA5		.738	0.487	0.838
Overall reliability		0.804			

Source: IBM SPSS Statistics

The reliability of constructs is checked using Cronbach alpha which is within acceptable limits of 0.6 to 0.8 for all items indicating internal consistency of the scale. Factor loadings are at least 0.5. The value of AVE should be at least 0.5 and the value of CR should be at least 0.7. Approximately all factors fit in the criteria.

Structural equation modeling

The study uses AMOS graphics for studying the hypothesised relationships which gives the following results:

Table-3: showing the hypothesised relationships tested using AMOS

Hypothesis	Path	Path coefficient	Critical Ratio	p value	Direction	Decision
H_1	US □ SA	.242	4.492	***	Positive	Supported
H_2	T □ SA	-.236	-3.767	***	Negative	Supported
H_3	IS □ SA	0.051	0.913	0.361	Positive	Not Supported

*** Significant at 0.001 level

Source: AMOS Graphics

It can be observed that University Support (US) influence students' attitude towards e-learning (SA) in a significant positive way. (r= 0.242; CR= 4.492), thus, H_1 is supported. T represents technology issues due to lack of technology support which negatively impacts students' attitude towards e-learning (SA), thus supporting H_2 (r= -0.236; CR= -3.767). Instructor Support (IS) does not significantly impact students' attitude towards e-learning (SA) and hence, H_3 is not supported (r= 0.051; CR= 0.913).

Discussion

The impact of critical success factors of e-learning on students' attitudes has not been studied beforehand. Findings indicate that critical success factors play an important role in shaping students' positive attitudes towards e-learning. Active support from universities in the field of e-learning helps to develop positive attitude towards e-learning in the mind of students, whereas, the role of instructor support is insignificant in influencing students' attitude towards e-learning. Lack of technology support results in technology related issues and challenges which negatively influence students' attitude towards e-learning usage. There should be an active effort to mitigate technological issues in e-learning, as well as proactive university support in planning e-learning in universities.

Research Implications

The research can be beneficial as it pinpoints the basic requirements for successful implementation of e-learning in Higher education, through active university support and technology support. Many studies have identified critical success factors of online learning from time to time, but rarely have they tried to analyse their impact on students' attitude towards e-learning. The research is valuable to all stakeholders, but most importantly to the universities in planning the implementation of e-learning. E-learning can only be effective if it is wholeheartedly accepted by the students. Positive attitude of students towards online learning is possible only if university provides enough support in e-learning implementation, and by mitigating the technical barriers in e-learning.

Limitations and Scope of future study

Due to time constraint, the present study has considered only three critical success factors including instructors support, technology support and university support, while future studies can involve analysis of other key factors also in understanding their role in students' acceptance of online learning by developing their positive mindset towards e-learning. Moreover, the study has taken place in western Uttar Pradesh and can involve analysis in other geographical areas to check the replicability of results. Future studies can extend to analysis of more critical success factors and even involve model proposition.

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Table Legends

Table 1 shows the review of the literature collected relating to critical success factors of e-learning. The researcher has reviewed sixteen past studies relating to key factors for e-learning success, key factors for e-learning quality, key factors for e-learning implementation, key factors for e-learning acceptance etc. Most studies have explored critical factors, while the impact of these factors on other variables has been rarely studied.

Table 2 shows the calculation of important values like construct reliability and average variance extracted which is important to validate the constructs. It also depicts Cronbach alpha and factor loading values calculated using IBM SPSS. AVE shows convergent validity and ideally, all calculated values of AVE are 0.5 or more. Cronbach alpha shows internal consistency of scale and ideally, all values are between 0.6 to 0.8. Construct reliability is also an indicator of internal consistency of scale and all calculated values are ideally above 0.7 assuring internal consistency.

Table 3 shows the hypothesis testing conducted using AMOS graphics. Initially, AMOS has been used just to test the presence and direction of the relationship between the variables although, it can also be used for creating an SEM model.

Figures Legend

Fig. 1 shows the conceptual framework for the study. The variables have been chosen based on a systematic review of past literature. The framework reflects the potential hypothesis that will be tested in the study. All variables have already been explored in previous studies as critical to the success of online learning and hence are taken for analysis.

Research Article

Exploring the Role of Social Media in Adolescence Ecology

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Abstract

A qualitative study was conducted in Delhi/NCR to understand the role of social media in adolescence ecology. The objectives of the study were to study the change in parenting and teaching styles due to social media, to explore the usage of social networking sites among adolescents and to explore the positive and negative aspects of social media and how it impacts adolescents/students. For the same, research was conducted across adolescents in the age group of 15-19 (questionnaire), few teachers (detailed interviews) and few parents (detailed interviews).

The key findings highlighted that most adolescents find that social media has positive effects on their lives as it helps them academically, maintains social relationships and is a good leisure activity. Most parents think that social media has helped their children in their studies owing to YouTube educational channels and quite a few educational sites. Teachers had mixed opinions on social media usage with the preference being given to conventional classrooms, but they do agree it helps to motivate students. One flip side being observed is the rigour of doing research is reducing among students as social media becomes the norm for research.

Keywords: - social media, Adolescents, Education, Technology, Teachers

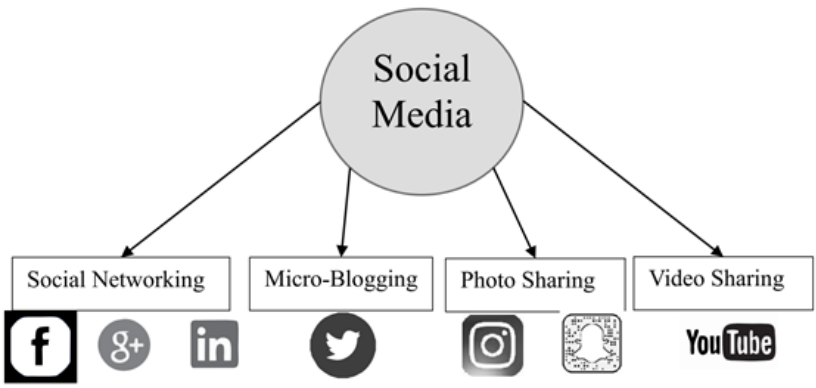
Introduction

Adolescence is the period of development and growth that occurs between childhood and adulthood. Any individual between the ages of 10 and 19 is considered an adolescent by the World Health Organization (WHO). This age group falls within the WHO's definition of young people, which includes those aged 10 to 24. Adolescence may be a period of confusion as well as discovery. As teenagers develop their sense of self, they may have to make tough decisions concerning academics, friendship, sexuality, gender identity, drugs, and alcohol. Most teenagers have an egocentric outlook on life, which often fades as they become older. They are frequently preoccupied with themselves and assume that everyone else, from a closest friend to a faraway crush, is also preoccupied with them. Insecurities and emotions of being judged may be prevalent. Peer groups, romantic interests, and appearance, which teenagers regard as increasingly essential during this period, typically take precedence over parental relationships. The goal of adolescence is for a child to grow into a young adult mentally and socially. Breaking out from their childhood bond and stability helps youngsters to grow independently and form their own distinct personalities by gaining freedom and responsibility and differentiating themselves from their parents and upbringing.

Commitments, personal objectives, motives, and psychological well-being are all important parts of forming self and identity during adolescence. Adolescents crave autonomy, especially

from their parents, as well as growing commitments to social aspects of identity and increased needs for peer relationships. Similarly, across roles and relationships, self-evaluations become more diverse and nuanced. Adolescents also frequently report greater self-consciousness and are more concerned with and interested in others' perceptions of self (Pfeifer & Berkman, 2018).

Whether for personal usage, business, education, or job prospects, social networking is the next wave of communication. Individuals or groups in any part of the world can now access someone's information and communicate through social networking sites thanks to technological advancements (SNS). The number of people who utilise social networking sites is steadily increasing. According to the Nielsen Company, global consumers spent more than five and a half hours on social networking sites like Facebook and Twitter in December 2009, an increase of 82 per cent from the same time the previous year when users spent just over three hours. There are positive and negative aspects to everything. Even when it comes to social networking, there are benefits and drawbacks to using the sites. Some of the benefits of using social networks include the ability to communicate with someone who is located thousands of miles away in a matter of seconds if they have an Internet connection and a networking device such as a computer, cell phone, netbook, tablet, or game consoles such as the Xbox or Wii. Another advantage is that a message can be simply communicated to a large audience. One can also send a private message to a single individual or to a specific group of people. One of the most significant disadvantages of utilising social networking websites is that most people are unaware of the risks they face when they disclose personal information on these sites. Strangers, stalkers, and hackers may be able to use personal information for malicious purposes (Miah et al., 2013). Here is the current landscape of social media, as described by Bhusan and Kumar (2018). Social Media can be categorised into four broad areas, namely social networking on platforms such as Facebook, WhatsApp, Instagram, etc. Micro-blogging platforms such as Twitter, photo-sharing apps, and finally video sharing platforms such as YouTube.



Adolescents' learning and daily experiences have been profoundly altered by social media (Lu, Hao, & Jing, 2016), posing enormous difficulties and opportunities in terms of health and education (Radesky, Schumacher, & Zuckerman, 2015). According to a recent meta-analysis, current studies all

pointed to a minor deleterious impact of social media on adolescent academic achievement (Huang, 2018). However, this finding may not be universal or cross-cultural (e.g., Greenhow & Lewin, 2016; Junco, 2012b; Junco, Heiberger, & Loken, 2011). For example, a recent study found that Facebook participation had both positive and negative effects on Asian college students' academic engagement (Luo et al., 2020).

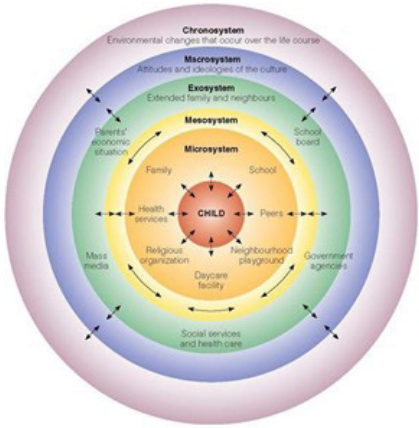
According to Sebre & Miltuze in 2021, Erik Erikson, known as the "godfather of identity theory," developed his theories on identity development after working with traumatized war veterans who had lost their sense of psychological completeness, coherence, and consistency—in other words, their identity. Erikson then applied his findings from his work with war veterans to the adolescent's desire for identity formation (Erikson 1959). "The conscious sensation of having a personal identity is founded on two simultaneous observations: the perception of oneself sameness and continuity in time and space, and the awareness that others recognize one's sameness and continuity," he speculated (Erikson 1968, p.50). James Marcia (1966) operationalized Erikson's theoretical framework, developing a model that can be tested in empirical investigations and is based on two specific elements of identity development: self-exploration and commitment.

Self-exploration is the process of considering and evaluating many ideas and alternatives. Commitment is defined as having a somewhat steady sense of one's own self-defining ideas, values, and ambitions, which are frequently examined in relation to one's professional aspirations. The period of exploration that precedes commitment is known as a "moratorium," and it is during this time that one can explore and experiment with several potential identities.

The impact of social media on youth extends to a crucial aspect of adolescent development: the building of one's own distinct identity. As a result, social media gives adolescents a place to practice skills relevant to identity development. Researchers discovered that students who voiced their thoughts on social media were happier, according to a longitudinal study of 219 freshmen at a state university. Another study discovered that adolescents who communicated more online had more "self-concept clarity," or a better understanding of who they were. This self-awareness is beneficial to one's mental health. Because social media gives teens the "autonomy to explore and experiment with their identities in a space of their own, where they have control over what, how, and with whom they share information," a 2020 research article on teens and social media concluded that it had the potential to be especially important during COVID-19, when real-life opportunities for identity formation were limited. Many of the technologies that adolescents use is connected to social media, which can be divided into two categories: social networking (e.g., Facebook) and virtual communication (e.g., Twitter) (e.g., gaming). "A growing body of research has provided support for reciprocal links between media use and user characteristics (which can include developmental phases),"

As per Bronfenbrenner (1977), child development can be divided into 5 ecological systems namely Microsystem, Mesosystem, Exosystem, Macrosystem and Chronosystem. As per this model of child development, Microsystem has the most profound impact on a child (in this case adolescent) which includes family members (parents, siblings), school and most importantly teachers and nearby environment.

Figure-1: Bronfenbrenner Ecological systems for Child Development

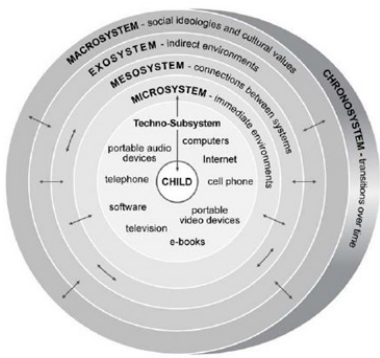


According to Zhou et al., in 1970, through seamless access to information in learning groups and other educational institutions, social media platforms played a critical role in education (Greenhow & Robelia, 2009). Even while the personalisation of these services got 'little' or 'no' research to impart soft and practical skills to freshmen teens, the usage of social media platforms like Facebook and YouTube for learning has attracted attention. Several studies have found a beneficial link between social media use and academic achievement (Kolhar et al., 2021; Lavuri et al., 2019).

Ecological system theory provides a conceptual framework to organise and understand the role of social media in adolescent ecology. Ecological framework is a prerequisite of the techno-subsystem to explore the role of internet usage during childhood.

Recent research conclusions support the ecological assumption that childhood Internet use varies as a function of context. Murphy and Beggs (2003) concluded that home–based computer use was child-centred, gave space for exploration, resulted in incidental learning, also gained expertise in some areas, and occurred in a context with consistent access to technology . whereas school–based computer use, in contrast, was teacher–directed , which did not allow for exploration, as it was focused on purposeful learning as there was limited access to technology. In the recent times of pandemic, children engagement in online communication increased manifolds.

Figure-2: Ecological Techno-subsystem



The ecological techno – subsystem, emphasizes the role of technology in child development, encourages holistic exploration of the use of Internet . This will provide a theoretical framework for examining the role and impact of technological advances especially after pandemic times in the coming years.

Rationale of the study

Social media has become an important component of today's generation's daily lives social media has both beneficial and negative effects on a teen's identity, academics, and relationships; it is up to future generations to ensure that it does not become a dominating force. During COVID time, social media became a norm in the lives of adolescents and as we are coming out of the COVID pandemic, it is very hard to disassociate it from the life of children now. Hence, the present study will try to find out the role of social media in adolescence ecology now that we are coming out of COVID-19 pandemic.

Operational Definition

For the study, the age of adolescence is defined as 15-19 years.

Research objectives

- To study the change in parenting and teaching styles due to social media.
- To explore the usage of social networking sites among adolescents.
- To explore positive and negative aspects of social media.

Primarily, the focus of research and the lens for adolescence is on Micro-system affecting child development where researchers have interviewed students themselves, their parents, and teachers in school.

Research hypothesis

These were some of the primary research hypotheses that were evaluated using the research.

- Adolescents do not realize the negative effects of social media and feel that it has had only a positive influence.
- Teachers have a strong belief that social media has a lot of negative effects on adolescent students.
- Parents have a cautious approach to social media, and whether it is helpful or not still needs a lot more exploring.

Research Methodology

For the study, adolescents were defined as individuals in the age of 15-19 years. The study investigated the usage of social networking sites by adolescents and the positive and negative aspects of social media. The study also explores the change in parenting and teaching styles due to social media. This research is a qualitative study where data was collected and verbatims analysed.

Description of Sample

The sample consisted of 30 adolescents, irrespective of their gender, in the age group of 15- 19 years; 05 parents and 05 teachers were selected from Delhi and NCR. The total sample size constitutes 40 participants. The schools chosen for this study were primarily private schools in the Delhi/NCR region. The adolescents should have used social media, irrespective of whether they sign in through their parents' ID or any other family member or any known. The participants from the higher and middle-income groups are selected for the study. This research was conducted at the beginning of the year when primarily students were studying from home or partially going to school. Most data collection has been influenced by the same and leverages online

interviews and questionnaire filling up by the participants (adolescents, parents, and teachers).

Pilot Study

Prior to the full research study being undertakwas a short pilot study was undertaken, which helped standardise the interview and questionnaire guides. This was conducted on a small sample of 3 students, one teacher and one parent.

Tools used for Data Collection

Interview Schedule: To collect the data for the present study, two structured interview schedules were developed for the parents and teachers respectively. For the parents, 10 questions were framed to study the changing pattern in parenting style due to social networks to fill the generation gap. 8 questions were prepared for the teachers to study the change in teaching strategies due to social media influence. These were qualitative questions where in answers were sought from the teachers and parents respectively.

Questionnaire: A questionnaire was made containing two sets of questions. Section one contains questions related to demographic and usage of social networking applications among adolescents while the second set of questions were related to how social media affects (positive and negative impacts) adolescents and their surroundings. The data was collected through Google Form (no sign-in needed) by adolescents ranging from 15- 19 years. Online mode was primarily used for data collection.

Observations and Interpretation

In the present study, an attempt has been made to understand the role of social media by gathering information from adolescents, parents and teachers using interview schedules and questionnaires. The present study was designed to study several variables related to adolescents in a sample of 40 participants where 30 were adolescents in the age range of 15-19 years, 5 were parents and 5 were teachers, irrespective of their gender. The data was analyzed qualitatively, and the findings were categorized below.

Adolescents

Adolescents can use social media to establish online identities, engage with others, and form social networks. These networks can be a significant source of support for teenagers, especially for those who are excluded. Social media is also used by teenagers for entertainment and self-expression. Furthermore, the platforms can educate teens on a range of topics, including healthy behaviors, by exposing them to current events, allowing them to interact across geographic barriers, and exposing them to current events. Humorous or distracting social media, as well as social media that gives a genuine connection to peers and a large social network, may even help young people avoid many mental illnesses (Staff, 2022).

Table-1: Reactions of adolescents to some questions to assess their viewpoint on social media

S. No.	Statement	Strongly Agree	Agree	Disagree	Strongly Disagree	Didn't respond
1.	Do you think social networks helps you in some studies?	12 (40%)	6 (20%)	9 (30%)		3 (10%)

2.	Do you think using social networks has any positive impact on your life?	18 (60%)	3 (10%)	3 (10%)		6 (20%)
3.	Do you think social media impact your life negatively?		6 (20%)	9 (30%)	15 (50%)	

Table above gives reactions of adolescents to some of the questions around the social media. Specifically, their agreement or disagreement to statements such as "social media impact on students, life and any side effects or negative effects students may have noticed". Section below covers this area in more detail.

Dependency on technology

Most of the participants responded that they spend around 4-5 hours on social media. More than 50 per cent responded that they mostly use Instagram among other social media apps. The other social media application among adolescents which is very popular is WhatsApp. Most of the participants (50 per cent) responded that they don't get affected when they don't use social media while some responded (30 per cent) that they feel relaxed and use social media as leisure. Only 20 per cent responded that they feel anxious when they don't use social media.

Awareness among parents

Great advancements and unforeseen challenges have come with modern technology. One of the most difficult of these challenges is ensuring that our children understand how to use the internet in a safe and productive manner. In this process, the question of whether parents should supervise their children's internet usage is important (Capriola, 2019). Most of the participants said that their parents are aware of which social media applications they operate.

Reasons for usage of social media

Social media is a platform for socially connecting with friends and family. Social media not only plays a role for entertainment but also plays an important role in academics. Most of the participants responded that they use social media for academic purposes as well. 60 per cent of them responded that social media does help them with their studies as well; however 30 per cent of them disagreed with this aspect of social element.

Positive impact of social media

Most of the participants responded positively to this part. They strongly agree that social media has positive effects on their life. They all agreed on the following statements:

- Meeting new people helps you socialize
- Keeping in touch with friends is convenient
- Learning technology becomes easier and flexible
- You are never alone and have a social presence.

Negative effects of social media

Most of the participants responded that social media has not affected them negatively while six participants agreed

that social media has negative effects too. The following are the statements that they have agreed on to:

- Reduction in focus
- Decreases/ destroys social skills
- There is no concept of privacy
- Mental health issues
- Over-reliance on social media identity and loss of self-identity
- Social Media addiction

Teachers

The relationship between a teacher and a student was generally defined as a formalized interpersonal association between an authority figure and a subordinate who interact on nearly a day-to-day basis (Larson, Wilson, Brown, Furstenberg, & Verma, 2002; Bartlett, 2005).

In the past two decades, classroom management has gone from a recognition-and-punishment intervention-based paradigm to a focus on prevention through the development of classroom communities in which norms are established, and academic routines promote constructive work. The present study has examined the five aspects of teachers' point of view regarding teaching style and the effects of social media on adolescents' identity.

Preference of classrooms

In traditional classrooms, student-teacher interaction is more, and the classes have more hands-on activity while in online classes, face-to-face interaction does not take place, and the classes are less engaging. According to the teachers, conventional classrooms are more preferred with the use of technology in physical mode instead of solely depending on the online classrooms.

Positive effects of social media

Social media plays an important role in today's world. It has impacted society positively, and as far as adolescents are concerned, social media has a positive impact on them as well. The teachers feel that students get motivated and fostered to learn. One of the teachers believes that social media improves the creative element among students. According to the teachers, social media adaptation in learning helps boost the academic performance of students.

Negative effects of social media

Regardless of the positive effects, social media affects students negatively on a larger scale. Teachers feel that social media causes distraction as students lose their concentration on their studies and enjoy browsing social media. Two of the teachers believe that social media reduces the learning and research capacity of students as students use social media extensively and gather information instead of looking for it in books and journals. In addition, it affects the health of the students as well (both physical and mental health).

Student-teacher relationship

For engaging and interactive classrooms, a positive student-teacher relationship is a key factor. Also, adolescents who share a positive bond with teachers may interact more freely and comfortably with them. According to the teachers, social media has a negative impact on student-teacher relationships in terms of interaction, as well as student behavioural and learning outcomes. One of the teachers feels that social media impacts the student-teacher relationship positively, as out-of-class communication and support are present through social media.

Safeguard measures for students

Measures suggested by teachers to safeguard students from getting influenced by social media include:

- Encourage non-media activities/ plan more physical activities.
- Accompanying and discussing the media content (including sensitive issues such as substance abuse and other inappropriate content) with adolescents.
- Limiting the time duration for usage of social media by adolescents.
- Connect physically (face-to-face) with adolescents and have meaningful interactions.
- Conduct self-appreciation activities to boost adolescents' confidence.

Parents

Parenting styles and the qualities of parent–child relationships have long been researched areas in developmental and family psychology. Parenting styles, according to a previous study, are important family context elements that are linked to parent–adolescent relationships (Shek, 2002). The present study has examined the five aspects of parents' points of view regarding the effects of social media on adolescents' identity.

Awareness about child-friendly networking sites

In today's environment, it's difficult to avoid social media. Everyone, from children to the elderly, uses social networking sites. Social media sites are now mostly used to scroll through for entertainment and information. People built social networking sites to enable them to communicate and interact more with one another through the internet. It has since been proven to be a vital instrument for global communication. All five parents were aware of the social networking sites that their children use.

Positive effects of social media

The availability of social media has a positive impact on adolescents according the parents. They said that during COVID-19, social media helped their children to continue their studies. Two of the parents mentioned that their children get help from YouTube when they have doubts in any topic. One of the parents mentioned that social media helps their child to gain knowledge and create awareness of the world.

Negative effects of social media

Even with its positive effects, social media can have a negative effect, too. According to the parents, their children are neither negatively impacted by social media nor do they feel they are missing out on their parenting while comparing it to social media. They think that social media may have a negative impact in the following aspects:

- less quality time with family
- less concentration in studies
- more screen time, as some of the social sites are very engaging

Parent-child relationship

The parent–adolescent relationship is one of the most important relationships in the life of an adolescent. During this stage, many changes take place in the parent–adolescent relationship. Differences in opinion may at times exacerbate conflict between adolescents and their parents. Most of the parents reported that their relationship gets affected with their children due to social media. The reasons added by them are (a) advancement in cognitive skills so parents have to have more knowledge to overcome the gap, (b) parents

themselves remain busy in social media, (c) Adolescents themselves get involved in social media and give less time to the family.

Safeguard Measures for adolescents

Measures given by the parents to save their children from excessive use of social media are as follows:

- A schedule should be made for every family member to use social media as the leisure time
- check their phones on a regular basis
- educate children the difference between real and fictional world
- set an age-limit for children to use social media
- keep one-dialogue with the children about their daily life, romantic relationships, peer relationship, social media sites and app usages

Conclusion

In this research, the role of social media in was examined and facts related to the positive and negative effects of social media on adolescents, change in parenting and teaching styles due to social media and the usage of different social media networks by adolescents were looked at.

According to the data collected, it can be concluded that with the evolution of social media and technology, a varied range of change could be seen in parenting styles, teaching styles and children's preferences. Though parents and teachers do not promote extensive use of social media among adolescents, they themselves use it for various purposes. Both the research hypotheses of teachers and parents namely, "Teachers have a strong belief that social media has lot of negative effects impact adolescent students" and "Parents have a cautious approach to social media and whether it is helpful or not still needs lot more exploring" both stand true and there needs to be more observations and time gapped studies to truly understand the impact social media has on students.

Adolescents use social media extensively and with no time as a limitation for other purposes such as social media scrolling, entertainment, etc., rather than study. The use of social media for long hours may distract their focus from their studies, and eventually affect their academic performance. As per the research, the hypotheses "Adolescents do not realize the negative effects of social media and feel that it has had only a positive influence" stands false and there are a few students who do realize the negative effects of social media though the degree of the realization may be different.

Some ways to safeguard adolescents from getting influenced or addicted to social media were also mentioned in the study. Though social media has both positive and negative impacts, if used properly and appropriately can turn out to be a boon for society and the education sector at large.

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Research Article

Relationship between Attitude towards ICT and Techno-Pedagogical Skills of Rural Secondary School Teachers of West Bengal Board

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Abstract

The present study mainly investigates the relationship between Attitude towards ICT and Techno-Pedagogical Skills of rural secondary school teachers of West Bengal Board. In this study 210 rural secondary school teachers were randomly selected and research design adopted was descriptive survey. For collecting data, "Scale to Assess Techno-Pedagogical Skills" (SATPS), standardized by the researcher with content validity and reliability co-efficient of 0.56, and "Ict Attitude Scale for Secondary School Teachers", standardized by Saini, S. (2015) were used. The results revealed that the attitude towards ICT of rural secondary school teachers is positive and it doesn't differ significantly with respect to their area of discipline, but it differs significantly with respect to their teaching experiences. On the other hand, the techno-pedagogical skills of rural secondary school teachers are at moderate level and don't differ significantly with respect to their area of discipline and teaching experiences. Finally, a positive correlation between attitude towards ICT and the Techno-pedagogical skills of rural secondary school teachers has been found. So, as per the present study, it can be said that the techno-pedagogical skills positively depend upon the attitude towards ICT of rural secondary school teachers of West Bengal board.

Keywords: Attitudes towards ICT, Rural Secondary School Teachers, Techno-Pedagogical Skill, West Bengal Board.

Introduction

Now-a-days, technology is playing a pivotal role in every aspect of human life so much that even a moment of our life seems lame without technology. As the education system is an integral part of our life so at present technology is immensely unavoidable for the education system. On the other hand, present generation learners, considered as digital natives, always want to be in front of technology and they enjoy dealing with technology. So, it is the need of hour that teacher must have appropriate knowledge of an adequate use of technology in the teaching-learning process.

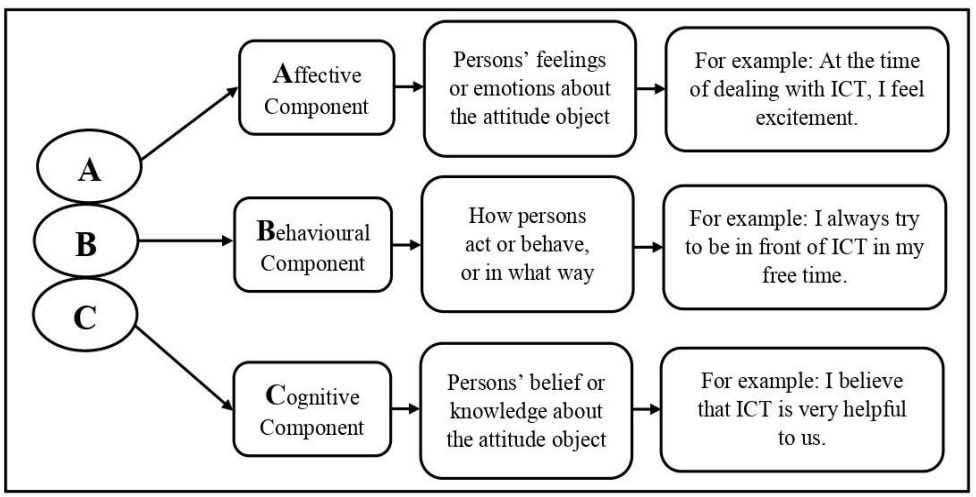
A framework was developed in 2006 by Punya Mishra and Mathew J. Koehler, known as Technological Pedagogical and Content Knowledge (TPACK) framework, which includes three broad knowledge areas, these are Technological, Pedagogical and Content. When it comes to an integrated form, it is called TPACK which is different in nature from those knowledge bases in isolated form (Mishra and Koehler,2006). Techno-pedagogical Skills has been originated from this concept of TPACK. We know that when teachers apply knowledge in a practical field, they perform skills. That's why, at the time of application of TPACK in a real classroom situation,

teachers perform techno-pedagogical skills.

According to Subasini and Jeyanthi (2019) "techno pedagogy is the art of incorporating technology in designing teaching-learning experiences so as to enrich the learning outcomes." Also, they considered it as "hybrid approach of meta-teaching." As per Rao and Jalajakshi (2021) when a teacher integrates technology and pedagogy into the classroom then "it's made him or her a techno pedagogue" and there is an extreme need of techno pedagogues as per the present scenario for an effective and enjoyable learning environment. Also, they believed that technology only can promote universal access to education.

According (Buabeng-Andoh, 2012; Thappa and Baliya, 2021; Hew and Brush, 2007), there are many factors of teachers' personal level that influence them to use ICT in the teaching-learning process, and one of those factors of personal level is teachers' attitudes towards ICT. 'Attitude' is lexically considered as "a settled way of thinking or feeling about something." That's why, Hogg and Vaughan (2005) defined attitude as "a relatively enduring organization of belief, feelings, and tendencies towards socially significant objects, groups, events or symbols." According to Saul McLeod (2009) there is an attitude structure of human beings and it has three (3) components; A, B and C. That is, 'A' for the Affective component, 'B' for the Behavioural component and 'C' for the Cognitive component and it is known as ABC model of Attitude.

Figure-1: ABC model of Attitude



On the other hand, we know that there are three (3) types of attitudes i.e., Positive Attitude, Negative Attitude and Neutral Attitude. A positive attitude is favourable to people, situations, objects or events. A negative attitude is unfavourable and people with a neutral attitude don't give so much importance to people, situations, objects or events. Here ignorance takes place.

The present study mainly deals with two variables i.e., attitudes towards ICT and techno-pedagogical skills of secondary school teachers. As the previous studies (Buabeng-Andoh, 2012; Thappa and Baliya, 2021; Hew and Brush, 2007) showed that attitudes towards ICT affect the teachers' use of ICT in teaching-learning

process, it can be predicted that there should be an effect of Attitudes Towards ICT on Techno-Pedagogical Skills of secondary school teachers. Therefore, a typical effort has been made by the researcher to attempt a study on the level of Techno-Pedagogical Skill in relation to Attitudes Toward ICT.

Review of Related Literatures

In teaching profession, teachers' attitude is one of the most important factors for providing quality teaching (Bhargava and Pathy, 2014; Cate and Glock, 2019; Dkhar, 2014; Nagase et al., 2020; Parvez and Shakir, 2013; Sivakumar, 2018; Singh, 2021). So, to find out whether any relation exists between Attitudes Towards ICT and Techno-Pedagogical Skills, some related literatures were reviewed. These are as follows:

Bhargava, (2021) revealed no significant difference was observed in Techno Pedagogical Competency between male and female secondary school teachers. But ICT Teaching attitudes of male and female secondary school teachers significantly differed from each other and finally, there was no significant relationship between Techno Pedagogical Competency and ICT Teaching Attitude among secondary school teachers.

Manikandan (2021) found that there was an influence of ICT awareness and attitude towards ICT on the skill of using ICT among secondary school teachers. Also, the level of attitude towards ICT among secondary school teachers was favourable and the level of ICT skill among secondary school teachers was high.

Beri and Sharma (2019) revealed the statistically significant difference in Techno-pedagogical and content knowledge (TPACK) Competencies of teacher educators were observed with respect to the locality of college i.e., rural and urban.

Guru and Beura (2019) revealed that the techno pedagogical competency level of urban higher Secondary School teachers is higher than rural higher Secondary School teachers.

Parkash and Hooda (2018) found that the techno pedagogical competency of urban Government and private Higher Secondary School teachers is better than rural school teachers because the facilities are available more in Urban schools as compared to rural schools.

Daling (2017) recognised that the teachers who are more experienced in ICT, had greater confidence, and effective performance in teaching-learning process and the level of ICT skills also influenced the teachers' attitude towards using the information and communication technology.

Yerdelen-Damar et al. (2017) found that the teachers who had more positive attitudes towards technology had higher self-efficacy beliefs about TPACK.

Avidov-Ungar & Iluz (2014) showed that attitude of teacher educators towards the use of ICT was positive and the level of their technological pedagogical knowledge was relatively high.

İPEK et al. (2014) found that the teacher candidates who have more interest in using computers have more positive attitudes than those who are not interested in using the computer.

Sethi (2014) recognised that if the teachers can develop a positive attitude towards technology and they will become friendly with the technology integrated teaching-learning environment.

Whyte (2014) organized a course on digital technologies for language teaching on 24 pre-service teachers to make them techno-pedagogically competent. After attending the course, pre-service teachers felt that they learned new ICT skills and they understood the utility of ICT clearly

for language teaching. Their attitude towards the integration of ICT into the teaching-learning process had also changed.

Rastogi and Malhotra (2013) revealed that there is a strong positive relationship between the possession of ICT skills by teachers, their attitude towards ICT and the actual implementation of ICT in classroom teaching. It means the implementation of a new curriculum with ICT strongly depends upon the attitude of teachers. So, not only the ICT knowledge and skills are sufficient but also teachers have to develop and imbibe the right attitude towards ICT.

Sathiyaraj (2013) showed that the maximum number of teachers (97.0 per cent) had a neutral attitude towards using new technology. But there was a significant and positive relationship between techno-pedagogical competency and attitude towards using new technology.

After reviewing the aforesaid related literatures, it must be undoubtedly admitted in a word that somehow attitudes towards ICT play a critical role in teachers' technology integrated teaching performances in a real classroom situation. But there was no study found so far which combined the variables Attitudes Towards ICT and Techno-Pedagogical Skills of secondary school teachers together as well as there is no study found which dealt to find out the relationship between Attitudes Towards ICT and Techno-Pedagogical Skills of Rural Secondary School Teachers.

Previous studies, like Beri and Sharma (2019), Guru and Beura (2019), Parkash and Hooda (2018), Yieng and Daud (2018) showed that rural teachers are less competent in techno-pedagogical skills than urban teachers and also, they found the less availability of ICT equipment as well as less use of ICT in education purposes in the rural institutions. So, there is a need to conduct a study to find out the attitudes toward ICT of rural secondary school teachers, and its relation to their techno-pedagogical skills.

Again, the present study differs from the rest of the previous studies in terms of population and sample.

Objectives of the Study

1. To find out the Attitude Towards ICT among Rural Secondary School Teachers with respect to the background variables; Area of Discipline (Language / Social Science / Science) and Teaching Experience (Below 5 years / 5 to 10 years / Above 10 years).
2. To find out the level of Techno-Pedagogical Skills among Rural Secondary School Teachers with respect to the background variables; Area of Discipline (Language / Social Science / Science) and Teaching Experience (Below 5 years / 5 to 10 years / Above 10 years).
3. To find out the relationship between Attitude Towards ICT and Techno-Pedagogical Skills of Rural Secondary School Teachers.

Hypotheses of the Study

H_0-1: There is no significant difference in Attitude Towards ICT among Language, Social Science and Science Rural Secondary School Teachers.

H_0-2: There is no significant difference in Attitude Towards ICT among Rural Secondary School Teachers with respect to their teaching experiences i.e., Below 5 years, 5 to 10 years and Above 10 years.

H_0-3: There is no significant difference in Techno-Pedagogical Skills among

Language, Social Science and Science Rural Secondary School Teachers.

H_0-4: There is no significant difference in Techno-Pedagogical Skills among Rural Secondary School Teachers with respect to their teaching experiences i.e., Below 5 years, 5 to 10 years and Above 10 years.

H_0-5: There is no significant relationship between Attitude Towards ICT and Techno-Pedagogical Skills with respect to the area of discipline of Rural Secondary School Teachers.

H_0-6: There is no significant relationship between Attitude Towards ICT and Techno-Pedagogical Skills with respect to the teaching experience of Rural Secondary School Teachers.

Research Design

To fulfil the objectives of the present study, the researcher adopted a Descriptive Survey Design for conducting research.

Population for the Study

All the Rural Secondary School Teachers of West Bengal Board of Secondary Education (W.B.B.S.E.) of Kharagpur Sub-Division, West Bengal were considered as the population for the present study.

Sample for the Study

In order to find out the results of this study, 210 rural secondary school teachers of W.B.B.S.E. boards from the Kharagpur sub-division, West Bengal were selected as a sample through random sampling method.

Tools Used

1. To assess the level of Techno-Pedagogical Skills of Rural Secondary School Teachers, a self-made five (5) point Likert-type scale was developed, named "Scale to Assess Techno-Pedagogical Skills" (SATPS).

   It was standardized by using content validity and using the split-half method with a reliability coefficient of 0.56. This scale contains 52 items. The maximum value of this scale is 260. The level of techno-pedagogical skills with very low, low, moderate, high and very high was calculated for those teachers who scored 52 to 93, 94 to 135, 136 to 177, 178 to 219 and 220 to 260 respectively.

2. To assess the Attitude towards ICT of Rural Secondary School Teachers, a tool titled "ICT ATTITUDE SCALE FOR SECONDARY SCHOOL TEACHERS" was used.

   It was standardized by Sunanda Saini in 2015. The items of this scale are 34 and the maximum value of this scale is 170. The score of negative, neutral and positive attitude was calculated for those teachers who scored 34 to 80, 81 to 125 and 126 to 170 respectively.

Data Analysis and Interpretation

To find out the results of Objective 1, the mean value of the attitude towards ICT of rural secondary school teachers was calculated which is mentioned in Table 1 and to find out the significant differences in attitude towards ICT among rural secondary school teachers concerning the background variables; area of discipline and teaching experience were calculated by using F-test, mentioned in Table 2 and Table 3.

Table-1: Nature of attitude towards ICT among rural secondary school teachers

Variable	Nature of Attitude	No of Teachers (N)	Percentage of Teachers	Mean value of Attitude (M)	Remarks
Attitude towards ICT	Positive (126 to 170)	168	80%	137.00	Positive Attitude towards ICT
	Neutral (81 to 125)	42	20%		
	Negative (34 to 84)	00	0%		

The results in Table 1 clearly indicate that there are 80 per cent and 20 per cent of rural secondary school teachers with positive and neutral attitude towards ICT respectively. The overall attitude of the teachers is positive with a mean value of 137. One thing that is remarkable, there is none with a negative attitude towards ICT.

Table-2: Difference in attitude towards ICT among rural secondary school teachers with respect to their area of discipline

Variables			N	Mean	SD	F-value	Remarks
Background		Dependent					
Area of Discipline	Language	Attitude towards ICT	78	134.87	13.24	1.98	$H_0$1 is accepted at a 0.05 level
	Social Science		68	137.32	13.85		
	Science		64	139.25	12.19		

The results in Table 2 clearly indicate that the calculated F-value is 1.98 which is less than the table value at a 0.05 level of significance. Thus, the null hypothesis is accepted.

It can be interpreted from the results that there is no significant difference in attitude towards ICT among language, social science and science rural secondary school teachers. So, the area of discipline is not a factor that affects the attitude towards ICT of rural secondary school teachers.

Table-3: Difference in attitude towards ICT among rural secondary school teachers with respect to their teaching experience

Variables			N	Mean	SD	F-value	Remarks
Background		Dependent					
Teaching Experience	<5 years	Attitude towards ICT	70	138.91	13.09	3.47	$H_0$2 is rejected at a 0.05 level
	5-10 years		50	139.24	13.45		
	>10 years		90	134.26	12.77		

The results in Table 3 clearly indicate that the calculated F-value is 3.47 which is higher than the table value at a 0.05 level of significance. Thus, the null hypothesis is rejected.

It can be interpreted from the results that there is a significant difference in attitude towards ICT among rural secondary school teachers with respect to their teaching experience. So, the teaching experience is a factor in the present study that affects the attitude towards ICT of rural secondary school teachers.

To find out the results of Objective 2, the mean value of the level of techno-pedagogical skills of rural secondary school teachers was calculated which is mentioned in Table 4 and to find out the significant differences in Techno-pedagogical skills among rural secondary school teachers concerning the background variables; area of discipline and teaching experience were calculated by using F-test, mentioned in Table 5 and Table 6.

Table-4: Level of techno-pedagogical skills among rural secondary school teachers

Variable	Level of TPS	No of Teachers (N)	Percentage of Teachers	Mean value of TPS (M)	Remarks
Techno-Pedagogical Skills (TPS)	Very High (220 to 260)	10	4.76%	147.45	Moderate level of TPS
	High (178 to 219)	62	29.52%		
	Moderate (136 to 177)	46	21.90%		
	Low (94 to 135)	52	24.76%		
	Very Low (52 to 93)	40	19.05%		

The results in Table 4 clearly indicate that there are 4.76 per cent, 29.52 per cent, 21.90 per cent, 24.76 per cent and 19.05 per cent of rural secondary school teachers with very high, high, moderate, low and very low levels of techno-pedagogical skills. The overall level of techno-pedagogical skills of rural secondary school teachers is moderate.

Table-5: Difference in techno-pedagogical skills among rural secondary school teachers with respect to their area of discipline

Variables			N	Mean	SD	F-value	Remarks
Background		Dependent					
Area of Discipline	Language	Techno-Pedagogical Skills	78	144.79	50.62	0.19	$H_0$3 is accepted at a 0.05 level
	Social Science		68	149.53	49.33		
	Science		64	148.46	45.22		

The results in Table 5 clearly indicate that the calculated F-value is 0.19 which is less than the table value at a 0.05 level of significance. Thus, the null hypothesis is accepted.

It can be interpreted from the results that there is no significant difference in techno-pedagogical skills among language, social science and science rural secondary school teachers. So,

the area of discipline is not a factor that affects the techno-pedagogical skills of rural secondary school teachers.

Table-6: Difference in techno-pedagogical skills of rural secondary school teachers with respect to their teaching experience

Variables			N	Mean	SD	F-value	Remarks
Background		Dependent					
Teaching Experience	<5 years	Techno-Pedagogical Skills	70	152.88	49.62	1.93	$H_0$3 is accepted at a 0.05 level
	5-10 years		50	153.40	48.53		
	>10 years		90	139.91	46.91		

The results in Table 6 clearly indicate that the calculated F-value is 1.93 which is less than the table value at a 0.05 level of significance. Thus, the null hypothesis is accepted.

It can be interpreted from the result that there is no significant difference in techno-pedagogical skills of rural secondary school teachers with respect to their teaching experience. So, the teaching experience is not a factor that affects the techno-pedagogical skills of rural secondary school teachers.

To find out the results of Objective 3, the correlation between attitude towards ICT and techno-pedagogical skills of rural secondary school teachers, the mean value of the attitude towards ICT and techno-pedagogical skills were calculated. Also, the correlation between the two means was calculated by using Pearson's Product Moment Method. The results are given in Table 7 and Table 8.

Table-7: Correlation between Attitude towards ICT and Techno-Pedagogical Skills of rural secondary school teachers with respect to their area of discipline

Area of Discipline	N	Variables				Co-relation (r)	Remarks
		Attitude towards ICT		Techno-Pedagogical Skills			
		Mean	SD	Mean	SD		
Language	78	134.87	13.24	144.79	50.62	0.73	Positive
Social Science	68	137.32	13.85	149.53	49.33	0.86	Positive
Science	64	139.25	12.19	148.46	45.22	0.78	Positive

In Table 7, the calculated coefficient of the correlation values between attitude towards ICT and techno-pedagogical skills of language, social science and science rural secondary school teachers are 0.73, 0.86 and 0.78 respectively.

It can be interpreted from the results that there is a highly positive correlation between attitude towards ICT and the techno-pedagogical skills of rural secondary school teachers with respect to their area of discipline.

Table-8: Correlation between Attitude Towards ICT and Techno-Pedagogical Skills of rural secondary school teachers with respect to their teaching experience

Teaching Experience	N	Variables				Co-relation (r)	Remarks
		Attitude towards ICT		Techno-Pedagogical Skills			
		Mean	SD	Mean	SD		
<5 years	70	138.91	13.09	152.88	49.62	0.84	Positive
5-10 years	50	139.24	13.45	153.40	48.53	0.86	Positive
>10 years	90	134.26	12.77	139.91	46.91	0.69	Positive

In Table 8, the calculated coefficient of the correlation values between attitude towards ICT and techno-pedagogical skills of below 5 years, 5 to 10 years and above 10 years teaching experienced rural secondary school teachers are 0.84, 0.86 and 0.69 respectively.

It can be interpreted from the result that there is a highly positive correlation between attitude towards ICT and the techno-pedagogical skills of rural secondary school teachers with respect to their teaching experience.

Thus, it can be said that the techno-pedagogical skills of rural secondary school teachers mainly depend upon their attitude towards ICT, and It can be assumed that with a positive attitude towards ICT, rural secondary school teachers perform in the teaching-learning process as more techno-pedagogically skilled persons concerning the background variables; area of discipline as well as teaching experience.

Major Findings

- A positive attitude towards ICT of rural secondary school teachers of West Bengal Board has been found.
- Attitude towards ICT among language, social science and science rural secondary school teachers of West Bengal Board doesn't differ significantly.
- Attitude towards ICT among language, social science and science rural secondary school teachers of West Bengal Board differs significantly with respect to their teaching experience.
- Techno-pedagogical skills of rural secondary school teachers of West Bengal Board is at moderate level.
- Techno-pedagogical skills among language, social science and science rural secondary school teachers of West Bengal Board doesn't differ significantly.
- Techno-pedagogical skills of rural secondary school teachers of West Bengal Board doesn't differ significantly with respect to their teaching experience.
- A positive correlation between attitude towards ICT and the techno-pedagogical skills of rural secondary school teachers of West Bengal Board has been found with respect to their area of discipline.
- A positive correlation between attitude towards ICT and the techno-pedagogical skills of rural secondary school teachers of West Bengal Board has been found with respect to their teaching experience.

Educational Implications

As per the recommendations of NEP 2020 and the needs of the modern digital era, technology integrated quality teaching-learning process is required for quality education. So, for quality in learning outcomes at the school level, techno-pedagogical skills are an important measure to the secondary school teachers as well as to all those stake holders who are related to the present education system. Even, though the attitude towards ICT is playing a vital role in the technology integrated teaching-learning process, a favourable attitude of secondary school teachers is also required at present.

- While implementing various educational policies related to ICT integration in education, all the stakeholders should focus on the appropriate and quality implementation of technology in education for quality in learning outcomes.
- The different orientation programs must be organised to maintain the positive attitude towards ICT of secondary school teachers on a regular interval.
- At the time of developing curriculum, the curriculum planner must plan and develop the updated technology integrated lessons and activities keeping in mind the opportunities for ICT accessibility by the teachers and learners.
- At the time of implementing the curriculum in a real classroom situation, teachers must plan the appropriate and updated technology-oriented lessons and activities as per the individual differences of the learners.
- Conduction of different training programs related to ICT integration in education for school teachers should be made mandatory for enhancing their techno-pedagogical skills.
- The adequate opportunity to use the ICT must be provided to the students to clear the concept about their lessons, anytime and anywhere.
- Technology mediated teaching-learning process should be provided to the students on a regular basis to involve them as active participants in the present teaching-learning process.
- As a professional, a teacher shapes the learners through his/her instruction. By the use of modern technological tools, resources and devices teachers make the learners aware of the use of technology along with its advantages and disadvantages. So, there is a need to teachers to improve their techno-pedagogical skills as they are the role model to the learners in this context.

Conclusion

The present study mainly aimed to find out the attitude towards ICT and the level of techno-pedagogical skills as well as to find out the relationship between attitude towards ICT and techno-pedagogical skills of rural secondary school teachers. It was an important survey in the rural context. The findings of this study indicate that rural secondary school teachers need to be more techno-pedagogically skilled for being competent teachers. Also, attitude towards ICT should be made more positive, as the relationship between attitude towards ICT and techno-pedagogical skills is positive. Thus, it can be said that with an appropriate attitude and adequate techno-pedagogical skills, rural secondary school teachers will become able to provide sound teaching-learning situations as per the present scenario.

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Research Article

GIS in School: Geography Teachers' Perceptions towards Geographic Information System

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Abstract

The use of Information Technology and Communication in general and GIS in particular is an important tool that is used to understand today's complex world and help to solve the problems related to spatial interaction. Today GIS has penetrated different aspects of life and it is the result of extensive acquisition of digital computers by business, trades, schools, institutions, universities, researchers, teachers, teacher educators, policy makers and households. The use of GIS as a pedagogic tool in geography classroom enables students to better understand the spatial interaction and relationship that exist on the surface of the earth by using technology. A sample of 20 Post Graduate Teachers (PGTs) teaching geography at senior secondary level was purposively selected through questionnaire and interview schedule.

The result shows that majority of the teachers were interested to get trained in GIS, so that they could be able to incorporate GIS in their teaching learning process with proper command. The paper highlights that time to time in-service training programmes need to be organized in GIS for the teachers to enhance their learning and also up to date with latest technology in the field of GIS.

Keywords: Geography, Geography Education, GIS, Pedagogic Tool, Perceptions, Spatial Interaction

Introduction

"This is a call for geography and environmental educators to think critically about the value of GIS." (Bednarz, 2004, p.192)

Geographic Information System (GIS) is a computer based medium through which geographic information in a map is stored, visualized, manipulated and analyzed. It is a means of assembling and analysing various kinds of spatial data that is available on the surface of the earth. 'Many systems have been evolved for natural- resource management and land-use planning at the different levels such as, regional, urban, state and national levels of government agencies. 'Most of the systems rely on data that comes from existing maps or on data that is mapped readily' (Shelton & Estes, 1981). The function of GIS is one of the most important contributions of the latest technology used by the teachers to create, manage, analyze and display natural as well human phenomenon or geographic data on the map. One of the important exciting uses of GIS in classroom occurs when teacher collect, create and manage their own geographic data with their students. The collected data then compiled and use with the help of GIS to analyse and display the results. GIS is used in geography classroom and it enables students to

comprehend the spatial relationship that exist on the surface of the earth. Spatial interaction and analysis such as selection of location in terms of site and situation change over time and influence and impact the environment that play an integral part in GIS use in geography classroom.GIS was first time introduced in Indian school curriculum as a part of geography at senior secondary stage under the flagship of National Curriculum Framework for School Education-2000 (NCFSE-2000). Existing NCERT Syllabus for secondary and senior secondary classes' volume-II (NCF-2005) on geography education at senior secondary stage suggests that there seems to be a lesser focus on GIS as a core objective and it needs to get more coverage in the coming days. GIS applications play an important role and may help teachers how to implement constructivist and inquiry-based learning environment in the classroom. Despite its potentials, most of the schools still lack of the essential infrastructure and resources and teachers fail to use GIS effectively in their class with proper command and effective skills. Nevertheless, it is very difficult to process of geographical data and GIS is difficult to use without proper understanding and skills of the computer and at the same time it also needs sound understanding about different packages of the GIS like ERDAS, Arc View etc. The interest in the incorporation of GIS into senior secondary school is mushrooming as teachers can learn multiple benefits and use of GIS in school education. "Its display of spatial data helps students to recognize and comprehend spatial patterns, while the variety of data and subject matter demonstrate real world complexities (Kerski 2003)". GIS is a very useful pedagogic tool for the teachers willing to use more student-centred approach for teaching students who play pivotal role in the teaching-learning process, inspiring and motivating students so that they can think critically (Fitzpatrick & Maguire 2000). Due to its interactive nature, GIS makes geography and other subjects interesting and informative for the students. GIS keeps students motivated for asking questions, creating, managing, analyzing, displaying and interpreting map on the basis of information available to them.

Review of Literature

Siljeg, S., Milanovic, A. and Maric, I. (2022) aimed to explore teachers and students attitudes towards the possibilities to implement GIS in secondary schools in Croatia. 96 teachers who taught geography and 611 students who opted geography were chosen for the study from Croatia. The results of the study highlight that both students and teachers showed positive attitudes towards implementation of GIS in their geography classes while teachers perceived higher importance of introducing GIS in their classes as compared to the students.

Incekara, S. (2012) conducted a study entitled "Do Geographic Information Systems (GIS) Move High School Geography Education Forward in Turkey? A Teacher's Perspective". 183 geography teachers were chosen for the study from 50 different provinces in Turkey. The result reveals that most of the respondents know about GIS but they did not have sound understanding how to use GIS as a pedagogic tool in their geography classes.

Pandey, A. (2011) explored the role of GIS in geography teaching in schools. She explained that there was lack of connectivity between schools and university level related to GIS and without these linkage most of the teachers of geography failed to understand how to adopt GIS effectively as a pedagogic tool in their classes. She suggested that for the effective implementation of GIS in schools, there is an urgent need to have

a proper connection and coordination between schools and universities.

Demirci, A. (2009) examined geography teachers' attitudes towards GIS and how these teachers approach new technology in their teaching learning process in 200 private secondary schools in Turkey. He found that geography teachers had positive attitudes towards GIS. Study revealed that understanding of GIS and its used by the geography teachers in the classroom was minimal which shows that there is an urgent need to train their geography teachers, so they can integrate GIS in their geography classes in Turkey in the future.

Lam, C.C., Lai, E. & Wong, J. (2009) explored the use of GIS in geography curriculum at secondary level in the schools of Hong Kong. They had conducted 28 geography teachers' interviews from different secondary schools in Hong Kong. Despite the fact that GIS was found to be an important geographical skill for the teachers, the study also reveals that in Hong Kong the use of GIS in geography teaching was very low.

Significance of the Study

There is even more compelling reason for concern with regards due to the lack of understanding and skills of computers among teachers. Due to this the teachers are not in the position to make teaching-learning process interesting, informative and innovative as such there is no meaningful learning to get to know more about GIS. It is generally observed that some of the geography teachers of government schools do not have working knowledge of computer with proper command. In the absence of adequate knowledge of computer, it's a matter to reflect how can teacher deals/teaches GIS that is completely based on the system i.e., computer. Due to ignorance and reluctance towards modern technology, indifferent attitudes of the geography teachers and lack of required physical infrastructure the geography teaching-learning process becomes a boring activity of the classroom and generally not getting attention from the side of the learners. The Kothari Commission (1964-66) emphasized the professional training of teachers for the qualitative improvement of education but very few concrete steps have been taken till date in this regard (NFG-Teacher Education, NCF-2005). NCERT has been taking great initiative towards imparting in-service education programmes for the teachers in all subject areas in general and geography in particular through face to face mode and also through distance education mode with the help of EDUSAT. In this backdrop, it is essential that geography teachers need to have sound understanding to deal with GIS with a fundamental skill of computer. The present research work, therefore, intends to study In-service geography teachers' perceptions, knowledge and skills of GIS in the light of curriculum of geography at senior secondary stage being offered in the schools of Directorate of Education, Government of National Territory of Delhi.

Objectives of the Study

1. To study the perceptions of geography teachers towards GIS
2. To study geography teachers' understanding and skills to incorporate GIS in their teaching learning process

Methodology

The study has used the mixed method approach. The responses obtained through questionnaire were scored while the responses gathered through

interview schedule were analyzed qualitatively keeping in mind the objectives of the study.

Population and Sample

The population of the study consists of all the geography teachers teaching geography at senior secondary stage in the schools of Directorate of Education in Delhi. A purposive sampling technique was used to collect the relevant data from geography teachers. Therefore, the sample of the study comprised 20 PGTs teaching at senior secondary stage in the schools of Directorate of Education situated in South-East zone of Delhi.

Tools

The investigator used interview schedule and questionnaire to collect the relevant data. Interview schedule was aimed to ascertain the perceptions of geography teachers' towards GIS while questionnaire was employed to study the level of understanding and skills of geography teachers' to incorporate GIS in their teaching- learning process.

Result and Discussion

Perceptions of Geography Teachers towards GIS

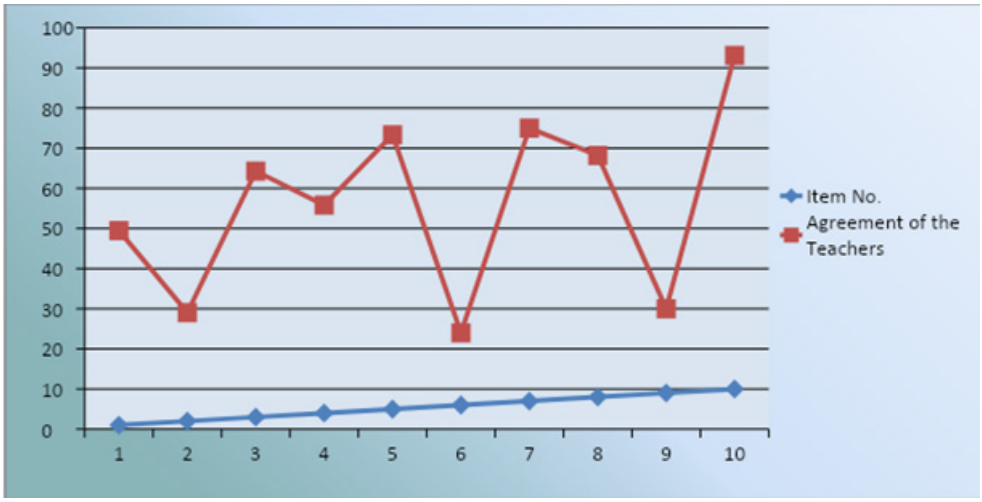
In order to get to know about how to assess the skills of geography teachers to incorporate GIS in their teaching. It was observed that 85 per cent respondents did not have sound understanding of how to use GIS software but they knew something about the concept of GIS as it was an important component of practical geography in class XII. Majority of the teachers responded that although their school have computers still, they did not have GIS software. 30 per cent teachers expressed their views that even if school provide GIS software but we will not be in position to develop a GIS course activity. As we did not learn GIS with the help of computer during our college days due to shortage of system or at that time computers were not easily available. Department and any other Government organization did not organize any training program on GIS, although they had attended some seminars and workshops on geography as conducted by NCERT and SCERT. All teachers expressed their views that GIS should be incorporated and implemented properly in the classroom as it is important component of the geography curriculum in this globalized world. They said that it should be the responsibility of the government to provide in-service training programmes from time to time for geography teachers to learn develop and enhance their geo-literacy with the integration of computer in general and GIS in particular. Three-fourth respondents revealed that due to their own lack of understanding their students would not be able to use GIS successfully in their assignments and projects. However, 70 per cent of respondents stated that they wanted to go for GIS training and more than 85 per cent of them expressed that they were keen to attend any training program based on GIS by the government. From the discussion it can be concluded that all the teachers were interested to get trained in GIS, so that they could be able to incorporate GIS in their teaching learning process with proper command.

Table-1: The geography teachers' understanding and skills for the incorporation of GIS in their teaching

Sr. No.	Statement	Agreement of the Teachers
1.	GIS is a very important tool/method for integrating pedagogy-technological interface	49.47
2.	NCF-2005 emphasizes use of GIS in teaching geography at senior secondary stage	29.03
3.	Do you adopt GIS as a teaching method more in your class as given in NCF-2005?	64.28
4.	Do you have sound understanding about how to incorporate GIS into your teaching/	55.81
5.	Do you incorporate technology (GIS) while teaching/ dealing with diverse concepts of geography in the classroom?	73.33
6.	Do you have enough time to learn and teach various concepts of geography with the help of GIS?	24
7.	The limited facilities provided by the school prevent you for using GIS sufficiently in your class	75
8.	Do you face any problem dealing with the data, images and maps to develop activities in your class related to GIS?	68.18
9.	Do you think that without GIS geography is incomplete in this globalized world?	30
10.	Time to time in-service training programs are organized on GIS for the geography teachers to enhance their learning and also up to date with latest technology	93.10

In the light of above result as depicted in table no. 1it can be safely said that the current application of GIS as a pedagogic tool in geography classroom could not be effectively adopted by the teachers due to their own lack of understanding and skills. Due to this they faced several challenges like how to incorporate GIS with their pedagogy and their motivation may dwindle because of inadequate command over it. All the respondents perceived that GIS is an ideal pedagogic tool for the teachers who wanted to use more student-centric approach in which students play pivotal and active role in the learning process. Instead of these challenges, it should be the responsibility of the teachers to provide space to the students to think critically and rationally but due to lack of understanding of GIS skills they just focussed to complete the syllabus or GIS by using non technophobic approach.

Figure-1: Percentage of the geography teachers' understanding and skills to incorporate GIS in their teaching has been shown graphically



Items of the table have been further analyzed separately keeping in mind the objectives of the study in the following manner: -

Item No.1 'GIS is an important tool/ method for integrating pedagogy-technological interface'

In order to find out the importance and utility of GIS as a pedagogic tool/method for integrating pedagogy-technological interface. 49.47 per cent of the teachers' extent their agreement, 42.10 per cent of the teachers were confused while 18.42 per cent of the teachers disagreed with the statement that GIS is an important tool/method for integrating pedagogy-technological interface. This finding matches with the findings of Green (2001b) "A GIS is a beneficial tool for integrated education because it focuses on geography while pulling together other relevant subjects".

Item No. 2 'NCF-2005 emphasizes use of GIS in teaching geography at senior secondary stage'

Regarding this item 38.70 per cent of the teachers expressed their disagreement and 29.03 per cent of the teachers expressed their agreement while 32.25 per cent of the teachers were confused with the statement. Most of them assumed that NCF-2005 was only provides guidelines about more use of technology which is not used without proper infrastructure and necessary resources.

Item No. 3 'Do you adopt GIS as a teaching method more in your class as given in NCF-2005'?

As far of this item is concerned 64.28 per cent of the teachers show their agreement and stated that for dealing with diverse range of issues, they had tried their best to explain the concept in a simple and lucid way by using geographic information with and without computer. 19.04 per cent of the teachers were confused while remaining teachers were disagreed with this statement.

Item No. 4 'Do you have sound understanding about how to incorporate GIS into your teaching'.

Regarding this item more than one half (55.81 per cent) of the teachers agreed with the statement and another 32.55 per cent teachers were confused. While remaining 11.62 per cent of teachers

expressed their disagreement with the statement indicating that they were unable to incorporate GIS in their teaching due to lack of computer skills and understanding.

Item No. 5 'Do you incorporate technology (GIS) while teaching/dealing with diverse concepts of geography in the classroom'?

As far of this item is concerned almost three fourth (73.33 per cent) of the teachers expressed their agreement with the statement, which might be effective to incorporate GIS while teaching/dealing with diverse concepts of geography in the classroom. While 13.13 per cent of the teachers had shown their disagreement and equal number of teachers were also confused in this regard.

Item No.6 'Do you have enough time to learn and teach various concepts of geography with the help of GIS'?

Regarding this item 68 per cent of the teachers expressed their disagreement with the statement and also expressed their desperation for not providing enough time and facilities by the school authorities to learn and teach various concepts of geography with the help of GIS. This indicates that these teachers were eager to learn but unfortunately not get an opportunity due to lack of time and facilities and other pressure on the part of school. About one fourth (24 per cent) of the teachers agreed while remaining (8 per cent) teachers confused with the statement.

Item No. 7 'The limited facilities provided by the school prevent you for using GIS sufficiently in your classes'.

As far of this item is concerned three fourth of the teachers expressed their agreement with the statement. This indicates that limited facilities were the reason not to incorporate GIS sufficiently in their classes. 16.6 per cent of the teachers had been confused while remaining teachers disagreed with the statement.

Item No. 8 'Do you face any problem dealing with data, images and maps to develop activities in your class related to GIS'?

68.18 per cent of the teachers expressed their agreement with the statement. This reveals that they faced problem in dealing with data, images and maps to develop activities in their classes related to GIS. 18.18 per cent of the teachers were confused while remaining (13.63 per cent) of the teachers shown their disagreement with the statement.

Item No. 9 'Do you think that without GIS geography is incomplete in this globalized world'?

As far of this item is concerned 43.33 per cent and 30 per cent of the teachers shown their disagreement and agreement with the statement respectively while remaining slightly more than one fourth percentage (26.66 per cent) of the teachers were confused in this regard.

Item No. 10 'Time to time in-service training programs are organized in GIS for the geography teachers to enhance their learning and also up to date with latest technology'.

As far as this item is concerned majority (93.10 per cent) of the teachers expressed their agreement with the statement. This indicates that majority of these teachers were interested to attain in-service training programs on GIS to enhance their own learning about it. 6.89 per cent of the teachers were confused while there was no single teacher who did not want to attain training program on GIS.

Conclusion

Teachers recognize the importance and benefits of GIS as a pedagogic tool to deal with the diverse range of phenomenon

with the help of system i.e., computer. But they face several challenges like how to incorporate GIS with their pedagogy and their motivation may dwindle. Due to lack of understanding of GIS most of the teachers wanted more time to learn and incorporate GIS as a pedagogic tool in their classroom. In most of the schools' teachers do not have sufficient time to learn latest software packages and become proficient user of GIS. It is software based system which requires active learning beyond whatever they had learnt in order to gain proper command and proficiency as per the need of the digital world. GIS use technology extensively in various sectors which use spatial data including planning, urbanization, engineering, environmental protection, transportation, forestry, agriculture, remote sensing and at all levels of education. As far the education is concerned the adaptation and implementation of GIS as a pedagogic tool into geography classroom was even slower as compared to other sectors. The reason behind this may be limited facilities provided by the school prevent teachers for not to use GIS sufficiently in the class and they also have lack of functional skills of computer and good command over GIS. Because of lack of understanding these teachers were not be able to create images and maps by using raster and vector data properly. Limited time, curriculum problems, teachers' problem, issues of physical conditions and its access both hardware and software, lack of GIS training and exposures are some of the major factors. Because of these factors GIS technology is very slowly integrated into the senior secondary curriculum by the geography teachers. The speedy integration of GIS in geography curriculum needs to be re-thought and redesigned by curriculum planners, policy makers and teacher educators by adopting and offering latest technology along with the recent software packages of GIS. More recent books, modules and time to time arrangement of the training on GIS need to be made available to the teachers in their school by the appropriate authorities so that it could become easy for the teachers to integrate GIS in their classes effectively.

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Research Article

Study of the Significance of Integrating Technology for Inquiry (NTeQ) Model in Undergraduate Teacher Education Programme

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Abstract

Technology infusion in formal classroom teaching-learning supports the students in conceptual learning, retention and enrichment. Integrating Technology for Inquiry (NTeQ) model is a computer-based sequential learning innovation that integrates technology to promote inquiry-oriented, problem-solving or project-based learning. Present descriptive survey research was conducted to gauge the curricular implications of the NTeQ model and explore the attitude and learning experience of prospective teachers of undergraduate teacher education programs of teacher education institutions of GGSIP University, Delhi. Data analysis showed that in institutions, mere theoretical discussion on the NTeQ model and lack of interactive sessions in computer laboratories restricted the prospective teachers from retrieving the conceptual framework of the NTeQ model in the examination. This also led prospective teachers to develop a neutral attitude towards the NTeQ model as a learning tool. The teacher educators expressed the dire need for professional development programmes for themselves to explore the NTeQ model as a learning tool in formal classroom teaching-learning scenarios. The adequate technical infrastructure of teacher education institutions, simulation-based teaching practice through the NTeQ approach and incorporation of practical activities on the NTeQ model in the curriculum may promote the learning implications of the NTeQ model in classrooms. The study had educational implications for concerned stakeholders.

Keywords: NTeQ model, Computer literacy, Learning implications, Pedagogical tool

Introduction

The exponential advancements in the use of the internet and technology in formal education have led to the emergence of Integrating Technology for Inquiry (NTeQ) model lesson design as an innovative pedagogical tool for academic instruction in classrooms (Morrison & Lowther, 2003). The NTeQ model is an infusion of higher-order thinking in technology (Flake, 2017). Higher-order thinking is referred to as any activity that requires the students to process information in some meaningful ways (Morrison & Lowther, 2005) and includes critical thinking, problem-solving, creative thinking, Bloom's taxonomy and metacognition. The NTeQ model is goal-oriented, interactive and student-centred; it focuses on the meaningful performance of the students and reliable and valid measurement of outcomes through the self-correcting team efforts of the students (Branch & Merrill, 2012). NTeQ model is an inquiry-based ten-step lesson design process for integrating technology into the curriculum to promote problem-solving among the students, hence leading to project-based learning (Lowther & Morrison, 2003).

As an instructional design, the NTeQ model is constructivist in origin as the student is empowered to explore like a researcher, whereas the teacher acts as a facilitator, designer and organiser of learning activities (Morrison et al., 1999). After learning through NTeQ model-based instructions, a student's competence to act and respond to queries, problem-solving, and discuss ideas and outcomes are enhanced (Lowther & Morrison, 1998). The NTeQ model promotes collaborative help learning among students (Ikepeze, 2006). It has been observed that the NTeQ model could not be so popularised among educators. The plausible reason for the unfamiliarity of the NTeQ model for educators may be this role reversal between student and teacher that appears somewhat non-conventional (Flake, 2016).

Operationally, the NTeQ model works in the following ten phases (Lowther & Morrison, 1998):

i. Specify Objectives: The first concern for the teacher using the NTeQ model is to explore what learning objectives will the students achieve after completing the given lesson? This phase focuses on developing specific learning objective(s) for the content.

ii. Computer Functions: In this phase, the teacher matches the developed specific learning objectives to computer functions and activities.

iii. Specifying a Problem: This phase involves the specification of the problem by the teacher.

iv. Data Manipulation: The teacher briefly describes each manipulation activity to explain how to use data. In this phase, there is a focus on research and analysis that involve planning for data collection.

v. Results Presentation: This phase concerns the presentation of results by the students.

vi. Activities During Computer Use: What will the students do while using the computer? This is answered by this phase, where a listing of the activities planned for working while working on the computer is done. The concern of paramount importance is that there must be a correlation between these activities and the specified learning objectives.

vii. Activities Before Computer Use: In this phase, the activities are planned before using the computer. It lists the activities which the students will perform while working on the computers.

viii. Activities After the Computer Use: This phase is a reflection on learning. There is a planning of activities to record, analyse and interpret the information generated by using the computer.

ix. Supporting Activities: This phase is the planning of supporting activities that enable the students to achieve the specified learning objectives. The supporting activities may be reading, reviewing, and associated enrichment activities.

x. Assessment: This phase is the development of assessment strategies.

The computer-based activities are the core activities of the NTeQ model (Williams & Anekwe, 2017), where the computer serves as a learning device. The NTeQ model, as a pedagogical tool, requires a certain degree of technological competence on the part of students (Mishra & Koehler, 2006). The student-centeredness in learning through computers in the NTeQ model develops a spirit of ownership among the students to use technology with zeal and enthusiasm, and thus, it leads to a higher level of inquiry on their part (Morrison & Lowther, 2010). There are a

few assumptions while using the NTeQ model in the classroom (Van Eck, 2009), which can be summarized in table 1:

Table-1: NTeQ model and its assumptions

S.N.	Aspect	Assumption
1.	Teacher	(i) Teacher has functional computer literacy. (ii) Teacher is proficient enough in integrating the technology into the curriculum; (iii) Teacher can motivate the students to use technology in effective ways.
2.	Student	(i) Student can use the technology; (ii) Through exploration, the student may gain competence in using the technology.
3.	Technology	(i) Technology supports problem-solving.
4.	Lesson	(i) Lesson is student-centred; (ii) Lesson offers authentic problem-solving; (iii) Lesson can integrate technology with itself.
5.	Learning environment	(i) Learning environment focuses on activities.

Review of Related Literature

Technology integration with school teaching supports the teachers in attaining learning outcomes (Clark, 1998). The attitude of pre-service and in-service school teachers has an influence on technology integration in their teaching (Fu, 2013). Lack of administrative and financial support at institutional levels restricts teachers from using technology in classrooms (Suleman et al., 2011). The NTeQ model supports the teachers in developing extended problem-solving skills among the students and project-based learning using real-world resources, through student collaboration, that support in arriving at solutions or creating final products (Penuel, 2006). In the NTeQ model, the computer, as a learning tool, can be employed to motivate students' critical thinking in exploring the academic content (Lucey & Grant, 2010). The NTeQ model offers teachers a learning approach to integrate easily adaptable technology in the instructions (Lucey & Shifflet, 2013). Teachers using inquiry-based pedagogical approaches had a preferential tendency to use technology in classroom teaching-learning as compared to the teachers adhering to conventional lecture methods (Mayor, 2014). To explore the gains of the NTeQ model, the student has to be tech-savvy as well as a netizen, and on the other hand, the teacher has to be a digital native (Williams & Anekwe, 2017). As an instructional tool, the NTeQ model is empirically supported with respect to efficacy, heuristics and templates for its implementation in classrooms (Van Eck, 2009). The review of related literature shows that most of the studies pertaining to the NTeQ model have been conducted at higher education level, and it is an under-researched knowledge domain in school education. The NTeQ model and its educational implications in Indian school classrooms are yet to be explored.

Research Questions

The review of related literature supported the investigator to frame the following research questions for this study:

i. How does the NTeQ model, as a learning tool, facilitate prospective teachers in acquiring knowledge?

ii. How does the NTeQ model support teacher educators in inculcating pedagogical skills among prospective teachers?

Research Objectives

To explore the research questions framed for this study, the following research objectives were developed by the investigator:

i. To study the curricular implications of the NTeQ model in the undergraduate teacher education program of GGSIP University, Delhi.

ii. To study the attitude of prospective teachers of the undergraduate teacher education programs of GGSIP University, Delhi, towards the NTeQ model as a learning tool.

iii. To gauge the learning experience of prospective teachers of the undergraduate teacher education program of GGSIP University, Delhi, pertaining to the NTeQ model.

iv. To explore the perception of teacher educators of the undergraduate teacher education program of GGSIP University, Delhi, for the learning implications of the NTeQ model.

Delimitation of the Study

In Delhi, its five universities that offer undergraduate teacher education programs are Guru Gobind Singh Indraprastha (GGSIP) University, Delhi; University of Delhi, Delhi; Indira Gandhi National Open University, New Delhi; Jamia Millia Islamia, New Delhi and Lal Bahadur Shastri Vidyapeeth, New Delhi. Only the undergraduate teacher education program curriculum of GGSIP University offers the course content for the NTeQ model. So, as a delimitation of this study, data was collected from GGSIP University, Delhi only.

Research Design

To explore the research objectives framed for this study, it was essential to gauge the present status of teaching-learning pertaining to the NTeQ model being practised in undergraduate teacher education programs so the descriptive survey research design was used for data collection.

Sample

The undergraduate teacher education programme is offered by 24 teacher education institutions affiliated with GGSIP University, Delhi. Out of these, six (6) institutions were randomly selected for data collection. 440 prospective teachers (B.Ed. students) and 42 teacher educators from these six institutions were randomly selected as the final sample of the study.

Tools

i. To explore the curricular implications of the NTeQ model in the undergraduate teacher education program of GGSIP University, Delhi, content analysis was employed as a research tool.

ii. A 5-point Likert Scale was developed by the investigator to study the attitude of prospective teachers of the undergraduate teacher education program of GGSIP University, Delhi, towards the NTeQ model as a learning tool. The content validity of the attitudinal scale was established after discussion with

subject and research experts. The reliability of the attitudinal scale was established through the Cron-Batch Alpha test, and it was found to be 0.80. The initial draft of this tool had 23 Likert items, and the final draft of the same had 20 Likert items.

iii. Focussed Group Discussion (FGD) was conducted to explore the learning experience of prospective teachers of the undergraduate teacher education program of GGSIP University, Delhi, pertaining to the NTeQ model.

iv. A Structured interview was conducted to gauge the perception of teacher educators of the undergraduate teacher education program of GGSIP University Delhi for the learning implications of the NTeQ model. The initial draft of the interview schedule had nine items, but after discussion with subject and research experts its content validity was established and two items were discarded. So, the final draft of the interview schedule had 7 items.

Procedure

The 5-point Likert Scale was administered to 440 prospective teachers, and focus group discussion was held with 71 prospective teachers of 6 teacher education institutions. The interview was conducted to collect data from 42 teacher educators, teaching core theory course (critical understanding of ICT = 1 teacher educator) and pedagogy courses (mathematics, integrated science, physics, chemistry, biology, business studies, and social science = 6 teacher educators, integrated science was being taught by any one of the teacher educators of physics, chemistry or biology).

Results & Discussion

i. To explore the curricular implications of the NTeQ model in the undergraduate teacher education program of GGSIP University, Delhi the content analysis was employed as a research tool. The concept of the NTeQ model is offered in one core course (critical understanding of ICT) in the first semester and seven pedagogy courses (mathematics, integrated science, physics, chemistry, biology, business studies, and social science) in the second semester. There are 18 pedagogy papers out of which seven pedagogy papers have the NTeQ model as course content. Table 2 shows those core and pedagogy papers and the concerned course content with respect to the NTeQ model.

Table-2: NTeQ model-based course content of undergraduate teacher education programme

S.N.	Course	Course content of NTeQ model
1.	Critical Understanding of ICT	Unit: ICT for Teaching-Learning: Possibilities and Concerns *NTeQ Model
2.	Pedagogy of Mathematics	Unit: Professional Development of Mathematics Teachers *Technology Integration: Planning with the integrating Technology for inquiry (NTeQ) model for Mathematics at secondary school level

3.	Pedagogy of Social Science	Unit: Professional Development a Social Science Teacher *Preparing the Teacher for Technology Integration: Planning with integrating Technology for inquiry (NTeQ) in Social Science at secondary school level
4.	Pedagogy of Business Study	Unit: Professional Development of a Business Studies Teacher *Technology Integration: Planning with the integrating Technology for inquiry (NTeQ) model for Business Studies at secondary school level
5.	Pedagogy of Integrated Science	Unit: Professional Development of an Integrated Science Teacher *Preparing the Teacher for Technology Integration: Planning with integrating Technology for inquiry (NTeQ) in Science at secondary school level.
6.	Pedagogy of Physics	Unit: Professional Development of a Physics Teacher *Preparing the Physics Teacher for Technology Integration: Planning with integrating Technology for inquiry (NTeQ) in science at secondary school level
7.	Pedagogy of Chemistry	Unit: Professional Development of a Chemistry Teacher *Preparing the Teacher for Technology Integration: Planning with integrating Technology for inquiry (NTeQ) in Science at secondary school level.
8.	Pedagogy of Biology	Unit: Professional Development of a Biology Teacher Preparing the Biology Teachers for Technology Integration: Planning with integrating Technology for inquiry (NTeQ) in science at secondary school level

The course content for the NTeQ model is just introductory and theoretical in nature with the no practical implications for prospective teachers. The courses are restricted to only the planning aspect of the NTeQ model. The course content could be strengthened through practising NTeQ model-based lesson plans in the internship programme.

ii. Table 3 shows the attitude of prospective teachers of the undergraduate teacher education program of GGSIP University, Delhi, towards the NTeQ model.

Table-3: Attitude of prospective teachers of the undergraduate teacher education program of GGSIP University, Delhi towards NTeQ model as a learning tool

	Attitude			
	Positive	**Neutral**	**Negative**	**Total**
No. of prospective teachers	44 (10%)	339 (77.04%)	57 (12.96%)	440

It can be observed from table 3 that one-tenth (10 per cent) of the total sample of prospective teachers had a positive attitude; more than one-tenth (12.96 per cent) of the total sample of prospective teachers had negative attitude while more than three fourth (77.04 per cent) of the total sample of prospective teachers had neutral attitude.

To confirm the data shown in table 3 that whether this attitudinal tendency of the majority of prospective teachers for the NTeQ model was a chance factor, the chi-square test was employed by the investigator. Table 4 shows the chi-square test for the attitude of prospective teachers of the undergraduate teacher education program of GGSIP University, Delhi, towards the NTeQ model.

Table-4: Chi-square test for the attitudinal scores attitude of prospective teachers of undergraduate teacher education program of GGSIP University, Delhi towards NTeQ model

	Positive Attitude	Neutral Attitude	Negative Attitude
f_o	44	339	57
f_e	146.6	146.6	146.6
$(f_o - f_e)$	-102.6	192.4	-89.6
$(f_o - f_e)^2$	10,526.76	37017.76	8028.16
$\frac{(f_o - f_e)^2}{f_e}$	71.81	252.51	54.77

Total chi-squares (χ^2) value = 71.81 + 252.51 + 54.77 = 379.09

Degree of freedom (f) = 3 -1 =2

The obtained chi-square (χ^2) value 379.09 for 2 degrees of freedom is significant at 0.01 level of significance so, it can be concluded that the neutral attitude of the majority of prospective teachers for NTeQ model was a not a chance factor. The plausible reason for the majority of the total sample of prospective teachers having a neutral attitude towards the NTeQ model as a learning tool, might be just theoretical deliberation in the classroom. As teaching the NTeQ model, besides focus on theory component, requires rigorous exposure to the activity phase also and if the latter is not practiced then the prospective teachers might not develop a liking for this innovative approach that is the NTeQ model.

iii. To explore the learning experience of prospective teachers pertaining to the NTeQ model, the Focussed Group Discussion (FGD) was centred on the teaching methodology adopted by teacher educators, interactive sessions in the computer laboratory and assignments/project work. The prospective teachers unanimously responded that all pedagogy teacher educators were focussing on the mere theoretical discussion on the NTeQ model to complete the syllabus. For the end-semester examination, prospective teachers prepare themselves to answer questions through online literature, as in the library, the available textbooks are heavily loaded with technical terms and definitions. In the computer laboratory, the latest and upgraded software are needed to practice the NTeQ model as a learning

tool. Completing assignments or project work on the NTeQ model in a computer laboratory is time-consuming. Teachers' competence in using computers for the NTeQ model needs more professional input. The probable reasons for this finding may be that the curriculum emphasises on mere teaching and discussion of NTeQ model.

iv. To gauge the perception of teacher educators of undergraduate teacher education program for the learning implications of NTeQ model, the structured interview was conducted. Out of 42 teacher educators of 6 institutions, more than three-fourth (76.2 per cent) teacher educators agreed that in the classroom, their teaching is confined up to theoretical discussion about NTeQ model. In integrated science, physics, chemistry or biology, the curriculum is spiral in nature and the prospective teachers may work with NTeQ model with increased degree of complexities of the content. Similarly, the concentric nature of social science curriculum may also facilitate the prospective teachers to learn, enrich and retain the concepts through NTeQ approach. All of the teacher educators expressed that they need to attend professional development programmes like workshops where they may themselves practice NTeQ model as learning and instructional tools. They also opined that in school internship programme, practice- teaching through NTeQ model-based lesson plans is difficult as it requires an updated computer laboratory with sufficient computer machines and uninterrupted internet in schools. Moreover, the course content of school subjects is not so much flexible to allow students to contribute through the NTeQ model and hence restricts its learning implications. The plausible reason for this finding might be the lack of technical infrastructure in schools and higher education systems. The professional development programmes of teacher educators need to be interactive and activity-based rather than mere information and discussion-oriented.

Educational Implications for Stake-holders

1. **Curriculum planners:** The undergraduate teacher education curriculum needs to be upgraded by incorporating of practical activities on the NTeQ model for end-semester examination. The practical activities must specify the learning outcomes of associated computer laboratory work for the NTeQ model.
2. **Teacher educators:** Through simulation, the teacher educators may facilitate the prospective teachers to practice the NTeQ approach and present at least two to three lesson plans in the allotted two pedagogic subjects. The teacher educators need to attend workshops on learning innovative technology tools like the NTeQ model with a professional commitment to practice with the students in a computer laboratory. They may themselves research the NTeQ model and its applications in classrooms as it may better acquaint them with its conceptual framework.
3. **Prospective teachers:** The prospective teachers should not cram the conceptual framework of the NTeQ model only for examination purposes, but they should practice the NTeQ model as a learning tool in the computer laboratory. Peer tutoring may support prospective

teachers in exploring the NTeQ model as a pedagogical approach in classrooms.

Conclusion

The NTeQ model effectively brings in cohesion to the concerned elements of instruction, namely the learners, teachers, technology, content and learning environment. Theoretical discussion on the NTeQ model in classrooms, lack of technical infrastructure in teacher education institutions and average computer competence of teacher educators do not motivate the prospective teachers to practice the NTeQ model as a learning tool. Insufficient computers and slow speed internet obstruct the usage of the NTeQ model in classroom teaching-learning. The prospective teachers should use the NTeQ model with respect to some technologically viable content, at least as assignment work, in their pedagogy subjects. Besides stressing the theoretical understandings pertaining to the NTeQ model, the curriculum planners need to focus on emphasizing its uses and practice in bachelor-level teacher education internship programmes.

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Research Article

Reflection of Pre-Service Teachers on usage of Information and Communication Technology during the School Internship of Bachelor of Education Programme

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Abstract

This paper analyses the knowledge and practice of Information and Communication Technology (ICT) of pre-service teachers and explores their experience of using ICT during their school internship in a 2-year Bachelor of Education (B.Ed.) programme. A descriptive survey design was employed. The sample consisted of 107 pre-service teachers from the Regional Institute of Education, Bhubaneswar, sampled through the convenience sampling technique. The achievement test, observation schedule, and focus group discussion were used to collect the data. An independent sample t-test and percentage analysis was applied to analyse the data. Findings of the study revealed that both male and female pre-service teachers were found to have uniform ICT knowledge as well as practice. In other words, the results of this study showed gender equality in terms of ICT knowledge and practice. Pre-service teachers benefitted significantly from ICT use during their school internship. The paper concludes with educational implications. The outcomes of the study will be useful in the implementation of ICT for quality training for pre-service teachers as well as in-service teachers of the country.

Keywords: Teacher Education, Pre-Service Teachers, ICT, School Internship, Gender

Introduction

An internship is essential in the Bachelor of Education (B.Ed.) programme as it links theoretical knowledge with practical applications (Gupta, 2020). An internship gives pre-service teachers real-world teaching experience, allowing them to apply pedagogical strategies appropriately. These experiences provide invaluable insights into the dynamic and multifaceted nature of education for aspiring teachers. This hands-on experience helps pre-service teachers better understanding of classroom dynamics, school students' needs, and effective instructional methods. Furthermore, it prepares them to adapt to various learning environments. The direct interaction of pre-service teachers with school students helps to enhance effective communication, classroom management, and the ability to tailor teaching-learning approaches. Interns learn how to navigate the challenges and rewards of teaching while developing resilience and problem-solving skills. The school internship period serves as a period of reflection for B.Ed. students, encouraging them to evaluate and refine their teaching philosophy. Interns can identify their strengths and weaknesses related to various teaching methodologies in different educational settings (NCTE, 2014 & 2017).

According to the National Policy on Education (1986), an internship model for teacher training may be adopted, as it is firmly based on the primary value of actual field experience in a realistic situation and on developing teaching skills through practice over time. According to the Yashpal Committee Report on Learning without

Burden (1993), these programmes should emphasise enabling trainees to develop the ability for self-learning and independent thinking. Further, the National Education Policy (2020) states that "the inclusion of research and internships in the undergraduate curriculum, faculty career management systems that give due weight to research, and the governance and regulatory changes that encourage an environment of research and innovation—these aspects are extremely critical for developing a research mindset in the country (p. 46)". At the same time, the pandemic has forced us to enter the digital realm. Allo (2020) reported that students had a positive attitude towards online learning during the coronavirus pandemic, considering it helpful and valuable during the crisis created by the pandemic. Furthermore, Huang et al. (2020) identified seven essential aspects that form the foundation of online education and play an important role in optimising learning during the pandemic situation. Sun et al. (2020) found that students believe teachers should know how to continue their lectures in the online environment rather than simply transferring the information that was previously taught traditionally and that they should provide an adequate number of projects and assignments. Furthermore, e-learning is very important in the e-learning process to personalise and adapt courses to their needs (Babu & Sridevi, 2018). Online learning saves time and money (Sadeghi, 2019).

Today, information and communication technology (ICT) has a major impact on our society. The use of ICT as a teaching tool has grown so necessary for teachers that many regard it as an extraordinary teaching sidekick capable of shaping teaching and learning in the digital age (Akaadom & Gorni, 2023). According to the United Nations Division for the Advancement of Women (2005), gender equality is one of the important concerns regarding the use of ICT in various fields across the world. The use of ICT must be appropriate for addressing the difficulties and reducing the inequalities and injustices that shape impoverished people (Donnell & Sweetman, 2018). The utilisation of ICT to achieve gender equality in education and employment may start a never-ending process of positive reinforcing impact feedback between gender equality in employment and economic growth, leading to even more progress in both (Mishra & Kiran, 2015). The status of Indian women in terms of access, utilisation, and consequences of ICT technologies has been reported, where a large gender digital divide is evident in women's lower level of access and usage of ICT compared to men due to socioeconomic factors related to structure, psychological nature, and political impediments (Singh et al. 2019).

Rationale

Teachers require ICT skills and knowledge in this age of information explosion. Teachers who can grasp the use of ICT will reap enormous benefits and, of course, deepen their interest in technology issues. School internships are an opportunity for the younger generation of pre-service teacher educators to acquire knowledge and competency through rigorous practice of their knowledge and skills (Sumintono et al. 2012). When compared to male secondary school teachers, female secondary school teachers had less ICT knowledge, skills, and applications (Mustafa, 2014). The researchers reported very minor disparities in ICT literacy between males and females in middle adolescence (Gnambs, 2021). Recently, Shah and Krishnan (2023) reported that over the years, there have been correlations between ICT, gender inequality, and wealth inequality. From the above rationale, it

may be noticed that less research has been undertaken to study the influence of gender on the ICT knowledge and practice of pre-service teachers of B.Ed. programme. Thus, the existing research gap motivated the researchers to conduct the research to determine the knowledge and practice of ICT of pre-service teachers during their school internship in a 2-year Bachelor of Education **(**B.Ed.) programme. Further, an attempt is made to study the influence of gender on the knowledge and practice of ICT by the participants. Pre-service teachers are provided ICT knowledge and practice during the pre-service teacher education programme which can be applied during their school internship. For this study, the following objectives and hypotheses were formulated:

Objectives

i. To compare mean score of ICT knowledge of male and female pre-service teachers

ii. To compare mean score of ICT practice of male and female pre-service teachers

iii. To study the overall experience of pre-service teachers using ICT during their school internship

iv. To find out the pre-service teachers' challenges in implementing the syllabus during their school internship

Hypotheses

i. There is no significant difference in mean score of ICT knowledge of male and female pre-service teachers

ii. There is no significant difference in mean score of ICT practice of male and female pre-service teachers

Methods

Design: Descriptive survey research was employed in this study.

Population and Sample: All pre-service teachers of the Regional Institute of Education, Bhubaneswar, a constituent unit of NCERT, were selected as population. The sample for this study comprised 107 pre-service teachers (male = 33 and female = 74) of third semester of 2-year B.Ed. programme selected through convenience sampling technique.

Tools and techniques used for capturing the data: Following tools and techniques developed by the researchers were used for collecting the data.

i. **An achievement test:** Comprised of 50 multiple-choice items with one mark for each correct response and zero for each wrong response. Its reliability coefficient of 0.85 was computed by the split-half method.

ii. **Observation schedule:** After establishing the categories and codes, an observation schedule was developed. The structured rubric was scored based on the level at which the sample was performed.

iii. **Focus Group Discussion (FGD):** In this case, thematic analysis was used. The steps were transcribing and analysing the FGD data to uncover themes, patterns, and insights. To interpret the information gathered, employ qualitative analytic tools. Coding, categorising, and summarising the data.

iv. **Interview and feedback from the Cooperating Teachers and Institute Supervisor:** These were used for data legitimation and cross-validating what came from the other sources.

Procedure of data collection: Pre-service teachers of the third semester

of the 2-year B.Ed. programme of RIE Bhubaneswar during the session 2021-2023 completed a school internship programme for 16 weeks during the third semester at different Jawahar Navodaya Vidyalayas under the jurisdiction of Regional Institute of Education, Bhubaneswar. For assessing the ICT knowledge of pre-service teachers, an achievement test comprising of 50 multiple-choice items, each with one mark for correct response and zero mark for wrong or no response, with a reliability of 0.85, was administered to the participants before going to the internship programme. An observation schedule was applied to them to assess their ICT practice in the classroom during the internship. Focus Group Discussion (FGD) was used for collecting information about their experience acquired during the school internship after returning from the internship. Institute Supervisors and Cooperating School Teachers were also interviewed to triangulate the information. By engaging in a face-to-face conversation, researchers established a rapport with interviewees, creating a comfortable and open environment conducive to sharing personal experiences and insights. The researcher deeply realized the same as the interviews of the visiting faculties (supervisor-teacher from Regional Institute of Education, Bhubaneswar) conducted many issues that did not open starkly on the surface and lay hidden cropped up along with the other challenges the students faced and the learning outcomes being established.

Techniques used for data analysis: Assumptions underlying the normality were tested and data were seemed to be normality distributed. For analysing the data, an independent sample t-test and percentage analysis was applied through SPSS and Excel, respectively.

Results

(i) Gender-wise comparison of mean scores of ICT knowledge of pre-service teachers

The first objective was to compare the mean scores of ICT knowledge of male and female pre-service teachers. The data were analysed with the help of an independent sample t-test, and the results are given in Table 1.

Table-1: Gender-wise Mean (M) , SD, N and t –value of pre-service teachers in ICT knowledge

Gender	M	SD	N	t-value	Remark
Male	28.67	9.12	33	1.2	Not Significant
Female	30.93	8.48	74		

From Table 1, it can be seen that the t-value is 1.2, which is not significant. It indicates that there is no significant difference in mean scores of ICT knowledge between male and female pre-service teachers. Thus, the null hypothesis**,** that there is no significant difference in mean scores of ICT knowledge between male and female pre-service teachers, is not rejected. Therefore, it may be said that ICT knowledge of pre-service teachers were found to be gender independent.

(ii) Gender-wise comparison of mean scores of ICT practice of pre-service teachers

The second objective was to compare the mean scores of ICT practice of male and female pre-service teachers. The data were analysed with the help of an independent sample t-test, and the results are given in Table 2.

Table-2: Gender-wise Mean (M) , SD, N and t –value of pre-service teachers in ICT practice

Gender	M	SD	N	t-value	Remark
Male	34.91	2.47	33	1.48	Not Significant
Female	34.24	1.99	74		

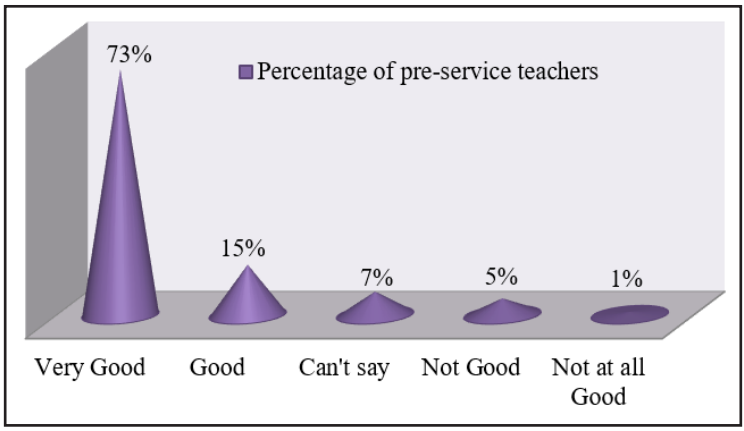
From Table 2, it can be seen that the t-value is 1.48, which is not significant. It implies that there is no significant difference in the mean scores of ICT practice between male and female pre-service teachers. Thus, the null hypothesis**,** that **t**here is no significant difference in mean scores of ICT practice between male and female pre-service teachers, is not rejected. Therefore, it may be said that both male and female pre-service teachers were found to have uniform ICT practice.

(iii) Overall experience of pre-service teachers using ICT during their school internship

The overall experience of pre-service teachers has been reflected in two parts:

Part I: Responses of pre-service teachers using ICT during their school internship has been given in Figure 1.

Figure-1: Responses of pre-service teachers for practising ICT during their school internship

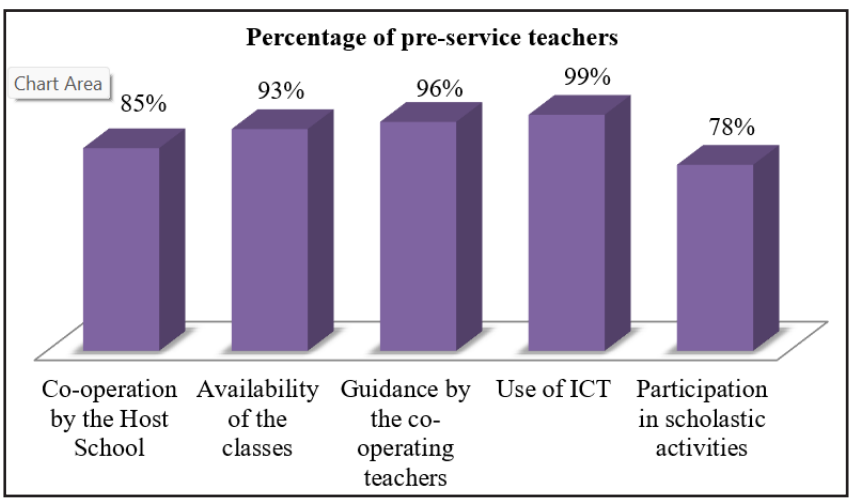


From Figure 1, it is evident that the majority of respondents, 73 per cent, had a very positive internship experience. This suggests that a significant proportion of pre-service teachers found the internship to be not only satisfactory but also noteworthy. This category's high percentage indicates that participants have a generally positive attitude. A sizable but smaller proportion (15 per cent) of respondents rated their internship experience as "good." While not as high as the "Very Good" category, many pre-service teachers had a positive overall experience during their internship. Almost 7 per cent of respondents selected the option "can't say." This could indicate that this group of pre-service teachers is experiencing uncertainty or mixed emotions. It could be due to various factors, such as a lack of a clear-cut positive or negative experience

or a neutral perception of their internship. A smaller proportion of respondents (5 per cent) had a less favourable experience, classifying it as "not good". While this is a small sample, it does highlight a subset of pre-service teachers who encountered difficulties or concerns during their internship that influenced their perception. A small proportion of 1 per cent rated their internship experience as "not at all good". This suggests that a very small percentage of pre-service teachers had an overwhelmingly negative impression of their internship, implying that the experience fell far short of some expectations. Hence, from the above discussion, it can be said that most of the pre-service teachers had acquired positive experience from school internship.

Part II: The experience of the pre-service teachers regarding various aspects has been presented in Figure 2.

Figure-2: The experience of the pre-service teachers regarding various aspects



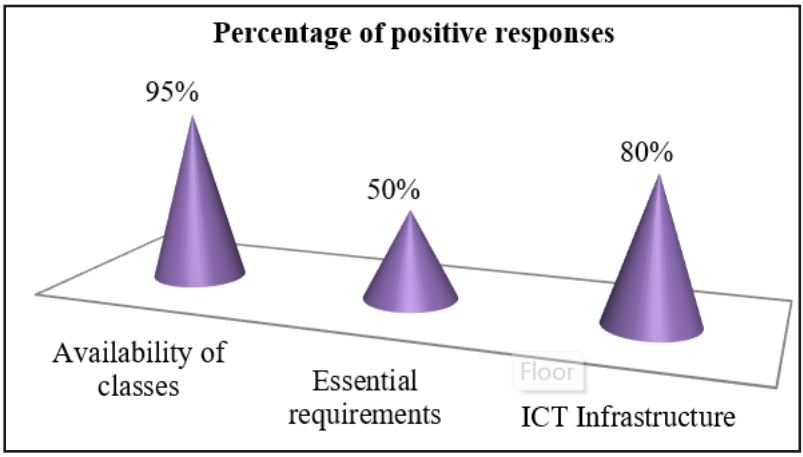
From Figure 2, it can be seen that 85 per cent of pre-service teachers reported that the host school cooperated during internship. This indicates that the vast majority received support, collaboration, and a welcoming environment from the school where they completed their internship. A notable high percentage, 93 per cent, expressed satisfaction with availability of classes for transaction of lesson. This indicates that the majority of students found the class schedule and accessibility to be beneficial to their internship experience. A 96 per cent positive response indicates that the cooperating teachers provided significant guidance during the internship. This high level of supervision and mentoring is critical for pre-service teachers' professional development. A remarkable 99 per cent indicates that pre-service teachers accessed and used ICT during their internship. This reflects a modern, technology-enhanced approach to teaching and learning. The majority,

78 per cent, reported positive experiences participating in scholastic activities during internship. This suggests that a sizable proportion of pre-service teachers had the opportunity to participate in other curricular activities at school, enhancing their overall educational experience. As a result, it can be summarised that most pre-service teachers had a positive internship experience.

(iv) Challenges of implementing the syllabus by Pre-service teachers during school internship

The parameter-wise percentage of positive responses collected from pre-service teachers has been displayed in Figure 3.

Figure-3: Parameter-wise percentage of positive responses collected from pre-service teacher



From Figure 3, it can be observed that the exceptionally high percentage (95 per cent) indicates a strong consensus among pre-service teachers that classes were readily available during their internship. This suggests that the scheduling and organisation of classes were well-structured and accessible, facilitating a conducive learning environment. The positive response reflects a vital aspect of a successful internship, where pre-service teachers can actively engage in classroom activities and gain practical teaching experience. Furthermore, the 50 per cent rating for essential requirements suggests a mixed perception among pre-service teachers regarding fulfilling necessary elements during their internship. This could imply an equal division of respondents who feel that basic requirements were adequately met and those who think otherwise. Further investigation is needed to identify specific elements categorised as "essential requirements" and understand the factors contributing to the perceived satisfaction or dissatisfaction. The 80 per cent rating for ICT infrastructure indicates a relatively positive perception among pre-service teachers regarding the availability and usability of ICT during their school internship. This suggests that a significant majority had access to technological tools and resources that can contribute to

effective teaching practices. The positive response underscores the importance of integrating technology into education, aligning with contemporary teaching methods.

Discussions

Findings of the present study revealed that male and female pre-service teachers were found to have the same ICT knowledge. Their knowledge of ICT was noticed to be independent of gender. ICT practice seemed to be similar in the case of male and female pre-service teachers as evident from the study. These findings are consistent with the previous studies (Alkhasawneh & Alanazy, 2015; Koohang, 1986 and Unegbu et al., 2019). Findings from the study indicated that pre-service teachers acquired positive and enriching professional development experiences during the internship. Further, it was also found that the use of ICT knowledge and practice contributed to improve their teaching skills and competencies, which are consistent with the earlier studies (Bhat & Bashir, 2018; Sharma, 2022). The high percentages across various aspects, from host school cooperation to ICT use and guidance by cooperating teachers, indicate a generally positive and enriching professional development experience during the internship.

Delimitations

This study was delimited to students of B.Ed. Programme of Regional Institute of Education, Bhubaneswar, Odisha, a constituent unit of NCERT. Students in the third semester of B.Ed. (Session: 2021-2023). School internships were conducted at Jawahar Navodaya Vidyalayas under the jurisdiction of the Regional Institute of Education, Bhubaneswar. Only two levels of gender, namely male and female, were considered in the present study.

Educational implications

Findings of this research demonstrated that for developing effective teachers, ICT knowledge and practices are of significant importance in terms of planning, monitoring, assessment, and evaluation of various activities undertaken during the school internship. Effective practices of ICT may be implemented for improving the learning environment in schools as well as in teacher education institutions for teaching and learning abstract concepts of various subjects through animation, simulation and other innovative strategies. Practices of ICT might be used in organising different curricular and other curricular activities efficiently and keeping their records for the future. Further, knowledge and practices of ICT may be applied for survey research in the field of teacher education as well as for the accountability of all institutions. Moreover, the skills of ICT might be implemented for providing research and innovations on various dimensions of teacher education.

Conclusion

The outcomes of the study revealed that both male and female pre-service teachers were found to be independent of gender in terms of ICT knowledge and practice during their school internship. In other words, the *findings of this study revealed gender equality in terms of ICT knowledge and practices,* which is one of the most important concerns in the world. The school internship facilitates pre-service teachers performing their best in ICT usage. As a result, the internship enables students and teaching staff to monitor student-teachers and track emerging technologies and their live applications. Internship experiences help in evaluating the teacher's ability, promote socialisation within the profession, stimulate the development

of teaching-learning concepts, provide a safe field for experimentation, allow insight into new perspectives, and increase motivation to continue learning and reflecting. The results of this study therefore recommend that internship programmes are essential for preparing teachers with the skills and competencies of the modern world. Thus, effective knowledge and practices of ICT might be implemented in monitoring and coordinating various teacher education programmes regarding its development at the national and international levels.

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Research Article

Role of ICT in Improving Quality of Education: Perception of Head Teachers of Secondary Schools of Kamrup (Metro) District, Assam

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Abstract

Digital dominance has been making significant differences in human life since the 1990s. We are now deeply influenced by this digital habitat in the 21st century, be it education or any other field of life. The use of ICT in teaching and learning has been highly recommended and greatly implemented in our education systems in the recent past. The present study has been conducted to gauge the perception of head teachers of secondary schools on the role of ICT in improving the quality of education. The descriptive survey approach has been used to conduct the study. A sample of 50 head teachers, selected randomly, was chosen from the provincialised secondary schools of Kamrup (Metro) district of Assam. Opinionnaire prepared on a 5-point Likert-type Scale, and an open-ended questionnaire were used as tools. Frequency and percentage were used as statistical techniques to analyse quantitative data, and content analysis was done to analyse the qualitative data. The study revealed that ICT helps in enhancing the teaching-learning experiences, makes the teaching-learning process interesting, promotes self-learning, promotes collaborative exercises amongst teachers, promotes innovations, develops the skill of critical thinking, provides exposure to vocational skills, promotes active learning, etc among head teachers, teachers and students. However, some challenges were also perceived, such as lack of adequate infrastructural facilities, lack of sufficient numbers of properly trained teachers, etc.

Keywords: Information and communication technology, quality, perception, head teachers

Introduction

A properly decoded and arranged data can be considered as information and the exchange of information through different ways as communication. The success of the teaching-learning process, to a great extent, depends on proper communication between the sender and the receiver of the information. Due to advancements in the field of Information and Communication Technology (ICT) in the present era, the sharing of information has become rapid due to its accessibility on our fingertips. ICT combines both the information technology and the communications technology. During Covid pandemic the online mode of teaching-learning was adopted by most of the teachers due to its suitability in different ways. Quality in education is related to a high degree of personnel interaction of a teacher with learners. In the modern age of technology, ICT has proven to be an integral part of the teaching-

learning process. ICT contains radio, television, mobile phones, computers, internet, satellite, etc (Choudhary, 2020). All the tools which are used for the better processing of information and communication are included in ICT. The representation of information in a rich way can change the perception and understanding of the context of the teachers and learners, and ICT can also provide support for innovations in education. ICT provides a platform for teachers to professional development as per the demand of the time. ICT can also improve the quality of education in various ways (Gupta, 2018). ICT earmarks innovative dimensions of the human mind, contributes to producing a new global culture and opens up a wide range of perspectives in their use in improving the quality of education. In improving the quality of education, ICT plays a significant role as it promotes the active participation of both teachers and learners in the teaching-learning process (Sekhar, 2016). Tremendous changes are being witnessed to take place in the field of education with the introduction and, later, the wide use of technology in education, mobile phones, digital libraries, e-Books, internet, etc. Enhancing critical thinking and smart decision-making ability in the educational profession seems to be augmented by the wide field of ICT at present (Sharma, 2019). The smartness of a teacher is reflected in the smart use of ICT in the process of education. Due to the ability to integrate multiple media into simple educational applications and the flexibility of use of ICT at present, it is proving to be more powerful than the technologies used before. New and fundamentally different options in education have been opened as a result of the adoption of ICT in education (Sharma, 2021). Integration of technology in teaching-learning provides an enhanced learning environment for the students and also provides scope for the teachers to improve their teaching by playing the role of facilitator of learning, knowledge manager, designer of curriculum, trainer and so on and so forth. The teaching profession at present is shifting towards being more student-centred and creating a more interactive learning environment (Malhotra, 2014).

ICT initiatives in the schools of Assam

To achieve the vision of the digital India campaign, the Government of Assam also recognised the importance of educating teachers in the use of ICT as well as the students in a holistic manner. Some of the significant ICT initiatives in the schools of Assam are Computer-Aided Learning in Elementary Schools, Information and Communication Technology in Schools, Rajiv Gandhi Computer Literacy Programme with the purpose of providing computer education to students of Government schools free of cost, introduction to Integrated Approach to Technology in Education to improve teaching-learning process using technology, ICT Integrated Subject Teacher Forum to create digital learning resources and network, implementation of smart classroom in Govt./Prov. Secondary/ Hr. Secondary Schools across Assam to transform teaching and learning in more attractive and meaningful way with the help of ICT, implementation of DIKSHA (Digital Infrastructure for Knowledge Sharing), Assam for creating and exchanging e-resources to bring qualitative changes in teaching-learning process, implementation of the selected energized textbook (QR code incorporated) at elementary, secondary and higher secondary level to help students and teachers to access digital content by scanning the QR code, Swayam Prabha DTH and Door Darshan Program to streamline all the academic efforts of the state and bridge the academic gap of students in the line of academic calendar 2020, PM e-Vidya One Class One Channel, etc.

Besides these, during the COVID-19 pandemic, to continue with the process of teaching-learning, different online initiatives were taken up. Some of such initiatives were imparting lessons in different subjects for students of Classes IX and X, engaging subject experts through 'Bidyarthee Anusthan' of All India Radio, Guwahati, Silchar, Kokrajhar etc, followed by interactive sessions between the subject experts and the students, extending support to different TV channels in imparting the live classes in different subjects, taking up online classes in different subjects, giving assignments to the students in any convenient way to make the assignments available to the maximum number of students, developing e-learning app for the benefit of the students so that teachers can upload their videos in different subjects, introducing YouTube channel etc.

Review of related literature

Nchunge, Sakwa and Mwangi (2012) in their study revealed that the pace of adopting ICT in public and private secondary schools was slow and the change in the perception is delayed due to insufficient technical and psychological preparedness and insufficient policy guidelines. The study recommends more investment to improve and also to equip the schools with facilities related to training on ICT for teachers and students.

Mumcu, Usluei (2013) conducted a study to develop a scale to determine the perceptions of teachers related to levels of ICT implementation based on levels of technology implementation framework, and the study suggested defining the integration of ICT into teaching-learning process by the teachers in five levels including organisation of activities to develop the basic ICT skills of students, preparing lesson plans, developing higher order thinking skills of students, communication among teachers, students and experts by means of networks beyond the four walls of a classroom, use of ICT resources and application by the students in solving problems of the real world, etc.

Charles and Issifu (2015) in their study found that the usage of ICT by students to support their learning was low, and they used ICT to contact peers through collaborative and inquiry-based learning and also revealed that the perception of students' use of ICT was positive and the value, expectancy of success and the cost perceived by the students were high. Differences were also found between male and female students on perceived value and cost related to ICT usage.

Gebremedhin, Fenta (2015) in their study found that due to a shortage of resources majority of the teachers were not able to use hardware in teaching-learning process but the teachers were found to have strong positive perception to use ICT in the teaching-learning process. The study also revealed that the encouragement of the use of ICT increases the perception of teachers in the integration of ICT in the teaching-learning process. Lack of technical knowledge on the part of the teachers and shortage of resources were pointed out as barriers by the respondents in the implementation of technology as revealed by the study.

Verma, Khaliq and Kumar (2016) in their study mention that teaching of computer science and the absence of curriculum for computer science at the primary level are some of the challenges related to ICT implementation in education. The study concludes that in solving some complex problems related to the real world, scientific principles of computer science can be applied. The students should be motivated to use computer science as a tool in solving problems in their disciplines which will contribute in improving the quality of education and research, according to the study.

Satveer (2017) in his study, expressed that the shortage of infrastructural facilities to enable the use of ICT in school education is a serious matter of concern in rural areas and resistance to implementing the technological change by a section of the teaching community, shortage of power supply, shortage of faculty member to teach computer, faculty members with lack of computer knowledge, lack of staff for maintenance and support for the equipments, etc. are some of the challenges in implementing ICT in rural areas.

Suniya, Lhungdim (2017) in their study found the students to have a positive attitude towards ICT. A significant difference in attitude was also found in the study between the students of government and private secondary schools. No significant difference was found in the attitude of students on ICT with respect to gender and race as revealed by the study. The study suggested making students more aware of the benefits of ICT integration in education.

Gupta (2018) reveals that ICT-based projects significantly influence the framing of objectives, preparing and processing different lesson plans, selecting and presenting contents and evaluating and selecting methods of teaching. Unfavourable attitudes developed among teachers and students towards ICT programmes due to the lack of infrastructural and training facilities as revealed by the study. The study suggests flexibility in the framework of syllabus and curriculum to have maximum use of ICT, arrangement of proper training and support facilities to use ICT in education. The study concludes that the process of education is significantly affected by ICT-based projects.

Chakraborty, Dhara & Santa (2018) found in their study that the most notable factor having an impact on the effectiveness of ICT is the cost of ICT. In instructing, ICT can support a few plans of action or procedure identified with educating and learning through the transmission of data and assistance of information and ICT also changes the job of the educators in some cases.

Sharma (2019) in the study conducted on the use of ICT in enhancing teaching-learning process in professional courses mentions that the exposure provided by the ICT in particular has compelled the institutions of professional education to enhance the ability of critical thinking and decision making smartly. The study found that in enhancing the teaching-learning process in the professional course ICT is playing a significant role as it helps in introducing innovative ways of teaching, learning and training and the use of ICT also helps the learners in placement in local as well as international market; as use of ICT helps in producing skilled and competent professional manpower.

Choudhary (2020) expressed in the study that ICT plays a significant role in social development; as it improves the teaching-learning process by providing an atmosphere of learning in which the transmission of knowledge is faster and in some cases simpler also and for the advancement of education ICT is considered as an efficient method as it provides different facilities through online mode in learning, evaluating, reading books, paying fees, appearing in examination, etc.

Sharma (2021) in the study on challenges and barriers in integrating ICT in Indian schools and the role of a teacher mentions that lack of proper infrastructural facilities, lack of sufficient funds, lack of trained teachers, mental blocks in some students and teachers in using ICT who consider it as a difficult task are some of the challenges in implementing ICT integrated education.

The review of the related studies helped the researcher in framing the objectives and research questions, developing

the design of the research, developing the research tools and also selecting techniques for analysing the data.

Objectives of the study

1. To study the perception of head teachers about the facilitative and creative role played by ICT in the efficacy of teachers' and learners' roles in learning; and
2. To study the challenges faced by the head teachers of secondary schools in implementing ICT in the teaching-learning process to improve the quality of education.

Research questions

1. What is the perception of head teachers about the facilitative and creative role played by ICT in the efficacy of teachers and learners' role in learning?
2. What are the challenges faced by the head teachers of secondary schools in implementing ICT in the teaching-learning process?

Methodology of the study

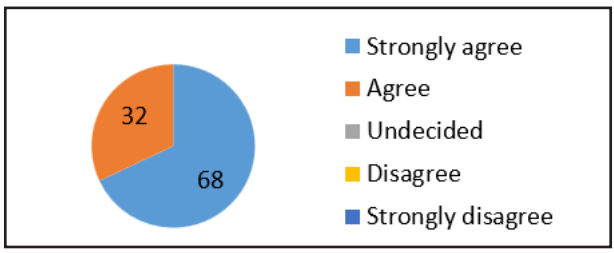
The descriptive survey method was used in the present study. A sample of 50 head teachers was selected randomly for the study from the provincialised secondary schools of Kamrup (Metro) district of Assam. Both primary and secondary data related to the study were used in the study. Opinionnaire and open-ended questionnaires were used as tools to collect data. The opinionnaire was prepared on a 5-point Likert-type scale with five categories of responses ranging from strongly agree (S.A.), agree (A.), undecided (Un.), disagree (D.A.) to strongly disagree (S.D.). To determine the reliability of the oppinionnaire, the test-retest method was used. The reliability coefficient was found to be 0.73. According to the comments and suggestions received from the experts in the related field, the content validity of the tools was determined. Both qualitative and quantitative data analysis techniques were used in the study. Frequency and percentage were used as statistical techniques to analyse and interpret quantitative data. To present the data in a graphic way a Pie diagram was used.

Results and discussion

Table-1: ICT enhances the teaching-learning experiences (Statement 1)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	34	16	0	0	0	50
Percentage	68	32	0	0	0	100

Graph-1: ICT enhances the teaching-learning experiences (Statement 1)

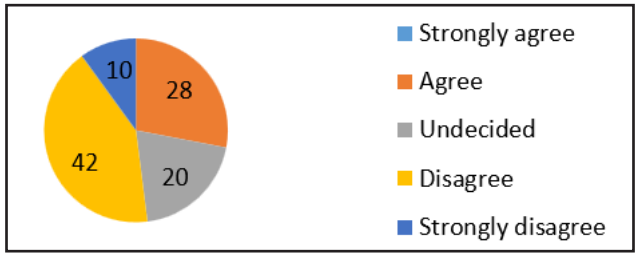


On average, ICT enhances the teaching-learning experiences as 68 per cent of respondents strongly agreed and 32 per cent of them agreed as shown in Table-1 and in the Pie diagram (Graph-1). This indicates that according to most of the respondents the use of ICT helps in enhancing the teaching-learning experiences.

Table-2: The school has adequate access to ICT tools (Statement 2)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	0	14	10	21	5	50
Percentage	0	28	20	42	10	100

Graph-2: The school has adequate access to ICT tools (Statement 2)

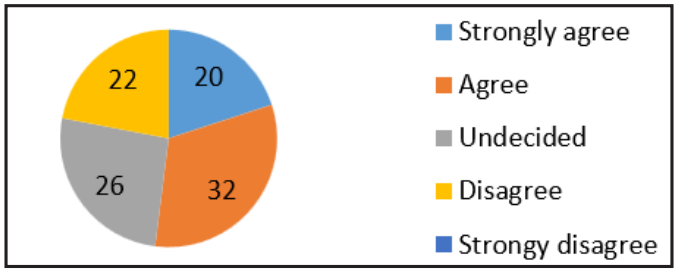


The data shown in Table-2 and Graph-2 indicate, according to 28 per cent of the respondents, the schools have adequate ICT tools, whereas according to 52 per cent of the respondents, the schools lack adequate ICT tools.

Table-3: Teachers are well versed in classroom transaction using ICT (Statement 3)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	10	16	13	11	0	50
Percentage	20	32	26	22	0	100

Graph-3: Teachers are well versed in classroom transaction using ICT (Statement 3)

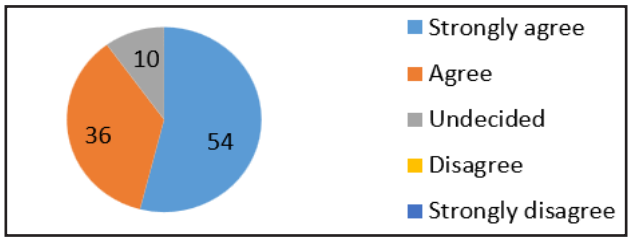


The data in Table-3 and Graph-3 depict that nearly half of the teachers are well-versed in using ICT.

Table-4: Students find classroom delivery through ICT interesting (Statement 4)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	27	18	5	0	0	50
Percentage	54	36	10	0	0	100

Graph-4: Students find classroom delivery through ICT interesting (Statement 4)

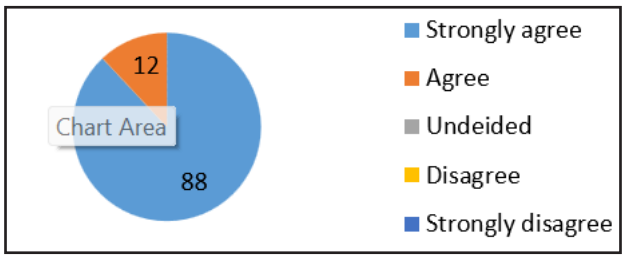


54 per cent of the respondents strongly agreed and 36 per cent of the respondents agreed that the students find classroom delivery through ICT interesting.

Table-5: ICT makes the process of communication more effective (Statement 5)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	44	6	0	0	0	50
Percentage	88	12	0	0	0	100

Graph-5: ICT makes the process of communication more effective (Statement 5)

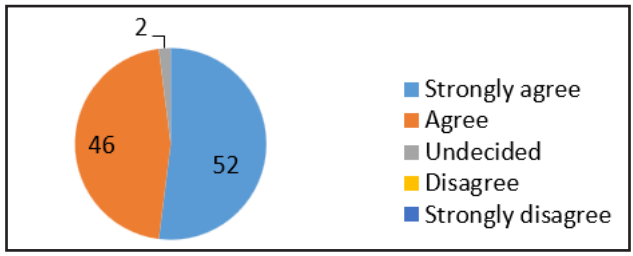


All the respondents (88 per cent strongly agreed and 12 per cent agreed) agreed that ICT makes the process of communication more effective, which are very vivid in Table-5 and Graph-5 respectively.

Table-6: ICT promotes self-learning (Statement 6)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	26	23	1	0	0	50
Percentage	52	46	2	0	0	100

Graph-6: ICT promotes self-learning (Statement 6)

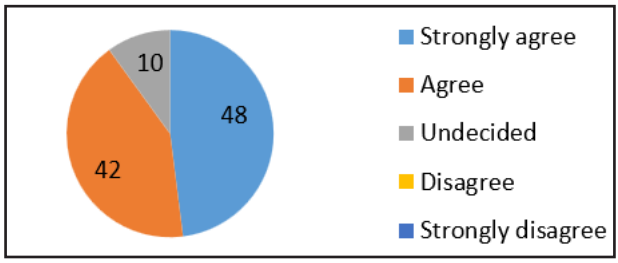


Almost all the respondents (52 per cent agreed strongly and 46 per cent agreed) agreed that the use of ICT promotes self-learning among teachers and students, which is reflected in Table-6 and Graph-6.

Table-7: ICT promotes collaborative exercise amongst teachers (Statement 7)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	24	21	5	0	0	50
Percentage	48	42	10	0	0	100

Graph-7: ICT promotes collaborative exercise amongst teachers (Statement 7)

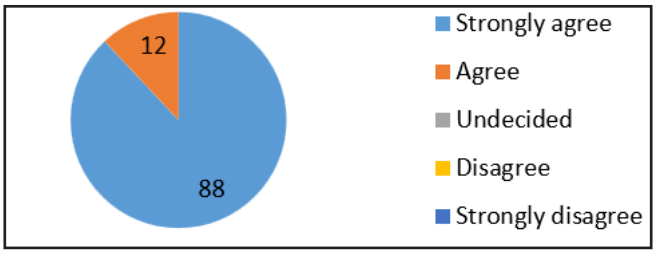


On the statement 'ICT promotes collaborative exercise among teachers', the majority of the respondents (48 per cent strongly agreed and 42 per cent agreed) agreed to it.

Table-8: ICT promotes innovations amongst teachers (Statement 8)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	44	6	0	0	0	50
Percentage	88	12	0	0	0	100

Graph-8: ICT promotes innovations amongst teachers (Statement 8)

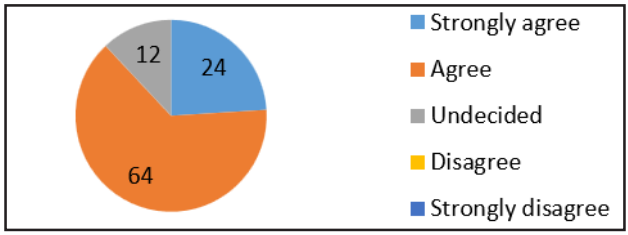


Almost all the respondents agreed that ICT promotes innovation among teachers, as is evident from theTable-8 and Graph-8 respectively.

Table-9 : ICT tools are effective in sharing teaching-learning materials (Statement 9)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	12	32	6	0	0	50
Percentage	24	64	12	0	0	100

Graph-9: ICT tools are effective in sharing teaching-learning materials (Statement 9)



From the Table-9 and the Graph-9, it is evident that ICT tools are effective in sharing teaching-learning materials.

Table-10: Pool of multimedia content enhances the uniformity of classroom interaction in teaching-learning (Statement 10)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	15	24	11	0	0	50
Percentage	30	48	22	0	0	100

Graph-10: Pool of multimedia content enhances the uniformity of classroom interaction in teaching-learning ((Statement 10)

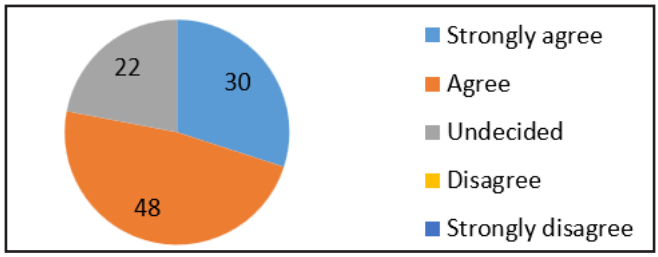
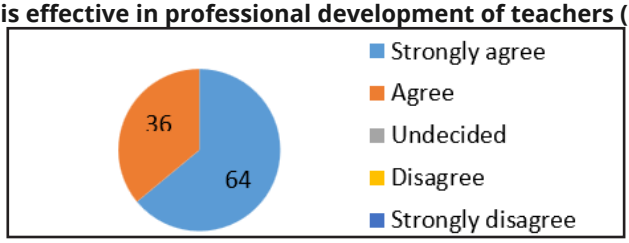


Table-10 and the Graph-10 that the pool of multimedia content enhances the uniformity of classroom interaction in teaching-learning to a great extent (78 per cent of respondents).

Table-11: ICT is effective in professional development of teachers (Statement 11)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	32	18	0	0	0	50
Percentage	64	36	0	0	0	100

Graph-11: ICT is effective in professional development of teachers (Statement 11)

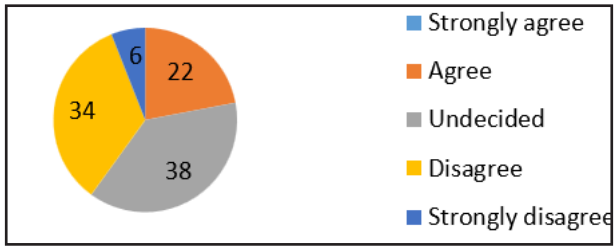


From the Table-11 and the Graph-11 it is clear that according to the head teachers, ICT is effective in the professional development of the teachers.

Table-12: There is sufficient provision of providing training to the teachers on the use of ICT in education (Statement 12)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	0	11	19	17	3	50
Percentage	0	22	38	34	6	100

Graph-12: There is sufficient provision of providing training to the teachers on the use of ICT in education (Statement 12)

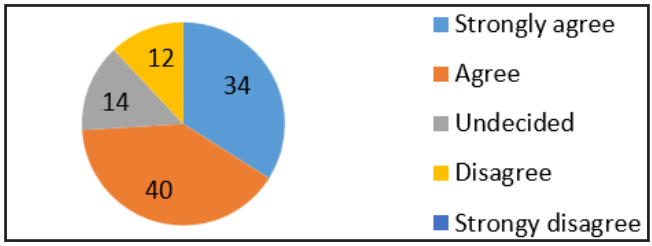


From the Table-12 and the Graph-12 it is evident that sufficient provision of providing training to the teachers on the use of ICT in education is lacking according to 40 per cent of the respondents.

Table-13: ICT develops the skills leading to critical thinking (Statement 13)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	17	20	7	6	0	50
Percentage	34	40	14	12	0	100

Graph-13: ICT develops the skills leading to critical thinking (Statement 13)

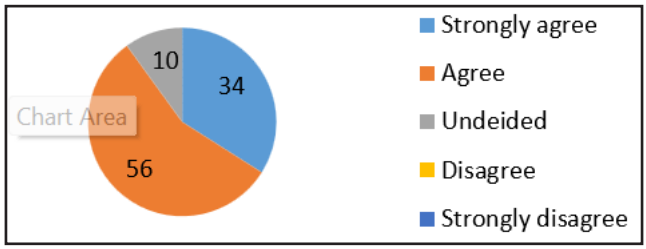


ICT develops the skills leading to critical thinking. A good number of respondents (40 per cent agreed and 34 per cent strongly agreed) agreed to it, as indicated in the Table-13 and Graph-13 respectively.

Table-14: Use of ICT improves students' motivation (Statement 14)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	17	28	5	0	0	50
Percentage	34	56	10	0	0	100

Graph-14: Use of ICT improves students' motivation (Statement 14)

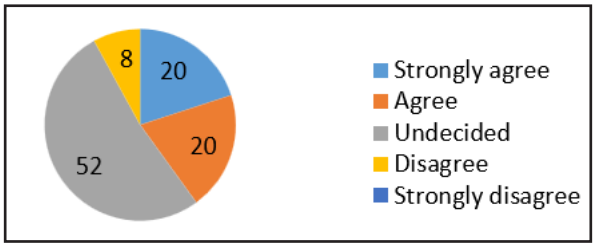


The Majority of the respondents (56 per cent agreed and 34 per cent strongly agreed) confirm that use of ICT improves students' motivation, as is reflected on the Table -14 and the Graph-14, respectively.

Table-15: ICT promotes collaborative learning amongst students (Statement 15)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	10	10	26	4	0	50
Percentage	20	20	52	8	0	100

Graph-15: ICT promotes collaborative learning amongst students (Statement 15)

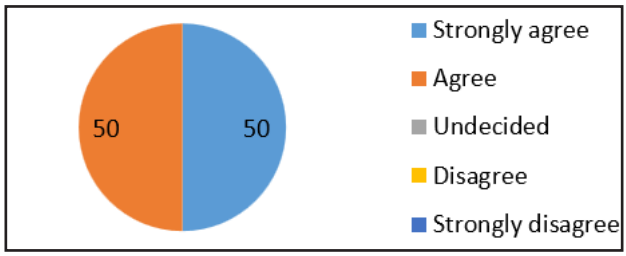


52 per cent of the respondents were found to be undecided, 8 per cent of respondents disagreed and 40 per cent respondents agreed on whether ICT promotes collaborative learning among students as is clear from the Table-15 and the Graph -15 respectively.

Table-16: ICT promotes innovations amongst students (Statement 16)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	25	25	0	0	0	50
Percentage	50	50	0	0	0	100

Graph-16: ICT promotes innovations amongst students (Statement 16)

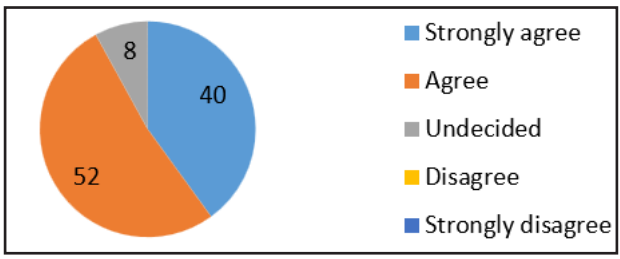


Adoption of ICT in the teaching-learning process contributes to promoting innovations among students. All the respondents (50 per cent strongly agreed and 50 per cent agreed) answered positively that ICT promotes innovations among students, which is clear from Table-16 and Graph-16, respectively.

Table-17: ICT promotes creativity amongst the students (Statement 17)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	20	26	4	0	0	50
Percentage	40	52	8	0	0	100

Graph-17: ICT promotes creativity amongst the students (Statement 17)

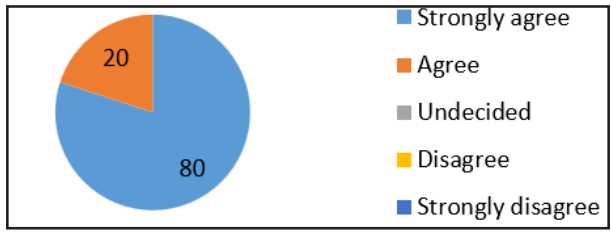


Regarding the statement 'ICT promotes creativity amongst the students', the majority of the respondents (52 per cent agreed and 40 per cent strongly agreed) are in favor of it. It is evident from Table-17 and Graph-17 respectively.

Table-18: ICT promotes active learning environment in the classroom (Statement 18)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	40	10	0	0	0	50
Percentage	80	20	0	0	0	100

Graph-18: ICT promotes active learning environment in the classroom (Statement 18)

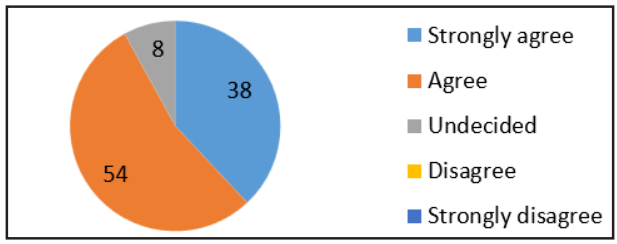


The learning environment in the classroom should be active and supportive. Almost all the respondents (80 per cent strongly agreed and 20 per cent agreed) confirmed that ICT promotes an active learning environment in the class. The data on this statement are presented in Table-18 and Graph-18, respectively.

Table-19: ICT enables students to focus better on learning (Statement 19)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	19	27	4	0	0	50
Percentage	38	54	8	0	0	100

Graph-19: ICT enables students to focus better on learning (Statement 19)

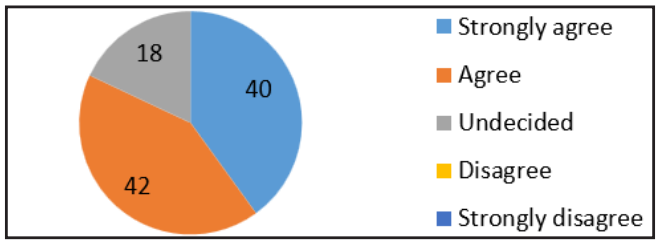


Regarding the statement 'ICT enables students to focus better on learning', the majority of respondents (38 per cent strongly agreed and 54 per cent agreed) confirmed it. The data is presented in Table-19 and Graph-19, respectively.

Table-20: ICT provides exposure to vocational skills (Statement 20)

Responses	S.A.	A.	Un.	D.A.	S.D.	Total (N=50)
Frequency	20	21	9	0	0	50
Percentage	40	42	18	0	0	100

Graph-20: ICT provides exposure to vocational skills (Statement 20)



The development of vocational skills is one of the significant aims of education. ICT, through different means, provides exposure to vocational skills. A majority of the respondents (40 per cent strongly agreed and 42 per cent agreed) confirmed this in the study. The data is presented in Table-20 and Graph-20, respectively.

Challenges faced by the head teachers of secondary schools in implementing ICT in the teaching-learning process

The majority of the respondents expressed that ICT plays a significant role in improving the quality of education. Use of ICT makes the teaching-learning process more effective. ICT motivates the learners. However, regarding the challenges faced by the head teachers of secondary schools in implementing ICT, some issues cropped up clearly. The lack of infrastructural facilities as per requirement emerged as a major challenge, which has also been highlighted by some other studies (Malhotra, 2014, Sharma, H.K. 2021). Some of the other challenges mentioned by head teachers are: lack of sufficient number of smart classrooms, network issues, lack of sufficient number of ICT tools etc., in implementing ICT-integrated education in schools.

The parents/guardians play a significant role in the holistic development of the child. According to the majority of the respondents, the income of the family, parent's level of education, number of children in the family, priority in the family, neighbourhood and beliefs related to ICT education affect a lot of the integration of ICT in education. If the income of the family is not sufficient enough to provide some kind of learning facilities like learning by using smartphones or internet facilities then their children may not be able to go with the system as per expectations. Also, the number of children in the family and getting priority in the family should be considered as some of the challenges - opined by the majority of the respondents. According to 80 per cent of the respondents, the level of education of the parents/ guardians also has an effect on learning process of the child in using ICT tools as sometimes parents may not be able to know in what way the child is using the facilities. Most of the respondents shared that some parents use to discuss the habit of using smartphones with their kids most of the times of the day, but to fulfil what kind of purposes they are using is also a matter of concern, which is difficult to know for some parents. Lack of sufficient number of trained teachers and qualified hardware technicians are also challenges in implementing ICT integrated education as opined by majority of the respondents (Sharma, 2021).

Regarding the utilization of online learning facilities by the students, most of the respondents expressed that proper utilization of online learning facilities by the students can be expected under the guidance of teachers, parents or any other person in the family who is familiar with the system otherwise it is difficult to know in what way the students are using the digital devices in the teaching-learning process.

Major findings

1. ICT helps in enhancing the teaching-learning experiences
2. ICT makes the teaching-learning process interesting
3. ICT promotes self-learning
4. ICT promotes collaborative exercises among teachers
5. ICT promotes innovations
6. ICT develops the skill of critical thinking
7. ICT provides exposure to vocational skills

8. ICT promotes active learning among head teachers, teachers and students.
9. ICT provides exposure to vocational skills
10. ICT is effective in the professional development of teachers
11. Lack of adequate infrastructural facilities, lack of a sufficient number of properly trained teachers are some of the challenges in the integration of ICT in education.
12. Income of the family, parents' level of education, number of children in the family, priority in family, neighboruhood and beliefs related to ICT education affect a lot in the integration of ICT in education.

Conclusion

Improving quality in education by using ICT in the teaching-learning process and also creating awareness among the stakeholders is the need of the hour to have digitalized India with the implementation of ICT-integrated education in schools. The perception of the head teachers of the school has a great role in improving the quality of the school. In this study, it is found that most of the head teachers of secondary schools are of the opinion that ICT enhances the teaching-learning experiences, makes the teaching-learning process interesting, promotes self-learning, promotes innovations, develops the skill of critical thinking, provides exposure to vocational skills, promotes active learning, etc. Due to a lack of properly trained teachers, lack of adequate infrastructural facilities, lack of awareness amongst some of the teachers on proper utilization of facilities related to ICT, and lack of proper skill of guiding and monitoring the children on the use of smartphones by the parents are some of the major challenges in improving quality of education by integrating ICT in education. As evident from the findings of the study it may be suggested that hands-on training followed by regular orientation programs on ICT for teachers is required to keep pace with changing technology in the teaching-learning process, creating grid-connected solar power generation facilities in schools to meet the need of required power supply, creating awareness amongst teachers on the effectiveness of ICT in teaching-learning process, guidance and counselling services to parents on use of ICT tools especially smartphones by their children effectively should also be organized to improve the quality of education by integrating ICT in the teaching-learning process.

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Research Article

Evaluating Effectiveness of ICT Tools in School Internship Programme

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Abstract

School Internship Programme (SIP) is essential part of B.Ed. Programme. It provides opportunity to Teacher Internee (TI) to practice in real classroom at schools. New technology and Information Communication Technology (ICT) has very crucial role to enhance the learning ability of students at schools. It is high time to analyze our traditional pedagogical aspects at school level to make it more effective for all students. Advancement in technologies has also produced a digital divide in our society. We have to think about this situation so as to make it easily available for all students. The investigator has tried to reflect the views of student teachers about effectiveness of ICT Tools during their teaching practice in schools. The data was collected from the student teachers of Semester IV after completing their School Internship Programme.

Keywords: SIP, MTE, MST, TI, ICT

Introduction

The profound shifts undergone in the field of education due to ICT require a pedagogical shift. Traditional teaching and learning paradigms have been shaken by the impact of ICT on educational practices. One of the greatest challenges which we need to overcome on our way to the 21st century is to enable teachers and students to achieve competency and mastery in the use of technology. The challenge is to use ICT in teaching-learning, and if this is to happen, then the change has to begin from the roots of education, i.e., the teacher education system. Teacher education institutions must provide leadership for pre and in-service teachers and model new pedagogies and tools for teaching learning. Teacher educators should expose pre-service teachers to regular and pervasive modelling of ICT. Unless and until teacher educators model effective use of ICT in their own classes, it will not be possible to prepare a new generation of teachers who effectively use ICT in their teaching.

The main aim of the School Internship Programe is the development of a broad repertoire of Perspectives, Professional Capacities, Teacher dispositions, Sensibilities and skills among the Teacher Interns (TI) To Cater to the Diverse Needs of Learners in Schools through a Prolonged Engagement of Teacher Interns with School as a Regular Teacher and participation in all the school activities.

In order to achieve the main aim of SIP, the following goals should be accomplished by Teacher Intern:

- Develop competence and professional identity as a reflective teacher.
- Inculcate and demonstrate the necessary skills in different roles to excel as a professional teacher.
- Develop skills and competencies for working diversities in school and

community; hence, learn to operate successfully and develop an inclusive society.

- Demonstrate ability to reach and liaison through collaboration with the school community and off-school campus community, interdisciplinary colleagues/experts and Teacher Education Institutions.

ICT has very important and significant role in achieving above mentioned goals of SIP. During classroom interactions interventions of new technologies have affected different domains of teaching-learning process.

Need of the Study

The internship provides opportunities to interns for individual as well as professional development through various activities of the school internship programme. Different committees have also recommended including an Internship in B.Ed. programme.

The Acharya Rammurti Committee (1990) recommended that internships should be included in teacher training programme because it provides actual field experience in realistic situations. The Yaspal Committee (1993) has also laid emphasis on internships because they enable trainees to acquire the ability for self-learning and independent thinking.

During the Internship a TI perform all activities like a teacher of the practicing school. She/he takes part in all academic and administrative work performed by a school teacher. While teaching in the classroom various pedagogical practices are used. In the modern era of ICT, there are various tools and techniques available to enhance the teaching-learning experience during classroom interaction. A teacher should be competent to use such tools and techniques to boost her/ his teaching experience.

The intent of this study is to find out the impact of ICT tools in the School Internship Program.

Review of the Literature

1. Pant, Pooja(2019), in her study entitled "A study of the impact of the use of ICT in Pedagogical Practices by Mathematics Student Teachers on problem-solving and critical thinking abilities of elementary school students" finds that the use of technology by mathematics teachers can greatly aid the process of mathematical exploration and wiser use of such aids can help to engage the students. ICT can be a great aid for this purpose.
2. Dhara, Hans (2018) conducted a "Study of ICT-related stress knowledge and attitude of tertiary level teachers and barriers in using ICT in teaching-learning process" find that the ICT barrier that tertiary teachers face on the awareness dimension is a lack of knowledge for introduction of ICT in the pedagogy where 58 per cent teacher agreed, lack of awareness of technical skills to use ICT in teaching 58.3 per cent unavailability of technology content in the curriculum 53.1 per cent Resistance towards the intervention of technology 52.8 per centged gets 49.9 per cent .
3. Kurian, Simmy (2018) has conducted a "Study on the impact of Information and Communication Technology on schools of education in Kerala from the Teacher's perspective". The finding of the study tells that there can be infinite use of computers and new age technology, but if teachers themselves are not able to bring it into the classroom and make it work, then it fails.
4. Basha, F Shaikanwar (2017) conducted a study on "Integration

and Utilisation of Information and Communication Technologies in School at Vellore District". This study reveals that all the higher secondary school teachers who are involved in the survey as a sample of the entire population were of the unanimous opinion of agreeing to the integration and utilization of ICT and felt the need to utilize those technologies at higher secondary schools.

5. Altaf Shaikh Saheen (2012) conducted a "Study of the effectiveness of Information and Communication Technology model of curriculum transition for teacher educators". In this study, he finds that there is a shift in the field of education due to a pedagogical shift using ICT.

Operational Definitions

SIP: School Internship Programme. It comprises a total of 18 weeks spread over Semesters I, II &III.

MTE: Mentor Teacher Educator who provides guidance during the entire School Internship Programme.

MST: Mentor School Teacher. A school teacher is assigned the responsibility of mentoring.

TI: Teacher Intern or Pupil Teacher

ICT: Information and Communication Technology

Objectives of the Study

1. To study the effectiveness of ICT Tools in lesson planning and strategy making.
2. To study the effect of ICT Tools on Cognitive, Affective and Psychomotor domains of learning.
3. To evaluate how ICT Tools help to explore a particular concept in different ways.
4. To evaluate the impact of ICT Tools on the teaching-learning process and effective communication.
5. To assess the issue of the availability of ICT Tools for students.

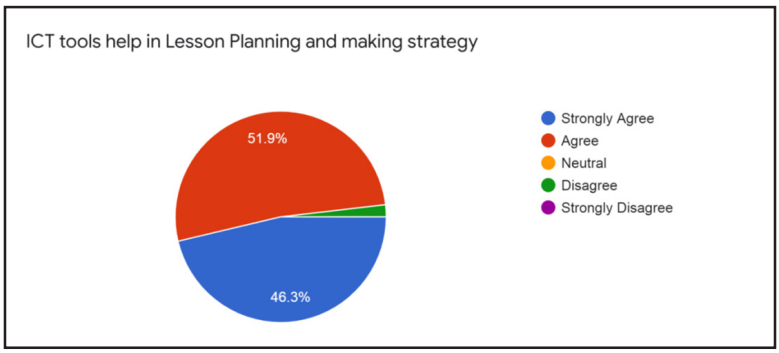
Methodology: This study was based on Descriptive Survey Method to get the opinion of Teacher Interns about the effectiveness of various ICT Tools during the School Internship Programme.

Sample: For this study, a purposive sampling technique was used. All B.Ed. Teacher Interns were involved actively in collecting the required data.

Tools: The self-prepared questionnaire was used for this study. The questionnaire was shared through Google Forms, and data was collected successfully.

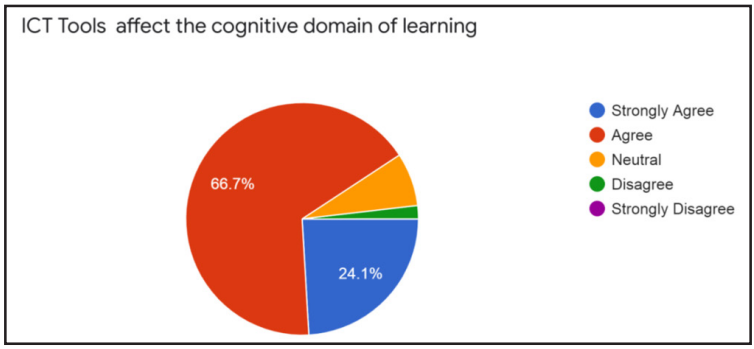
Analysis of the Data:

Graph-1: ICT tools in Lesson Planning and Making Strategy



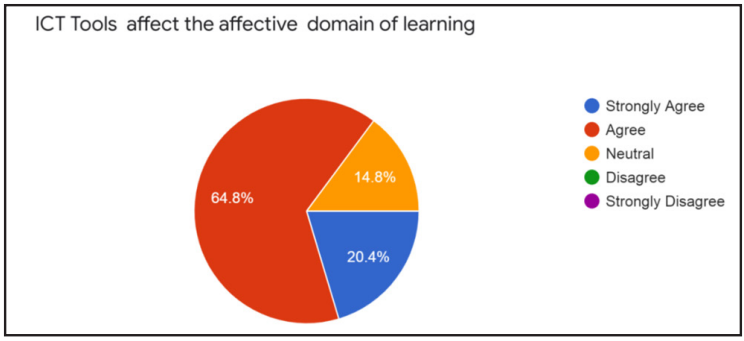
This pie chart shows that 46.3 per cent strongly agree while 51.9 per cent agree and 1 per cent disagree that ICT Tools are helpful in planning and making strategy. This shows that most of the student teachers are in favor of using ICT tools during their practice teaching.

Graph-2: ICT Tools affect Cognitive Domain of Learning



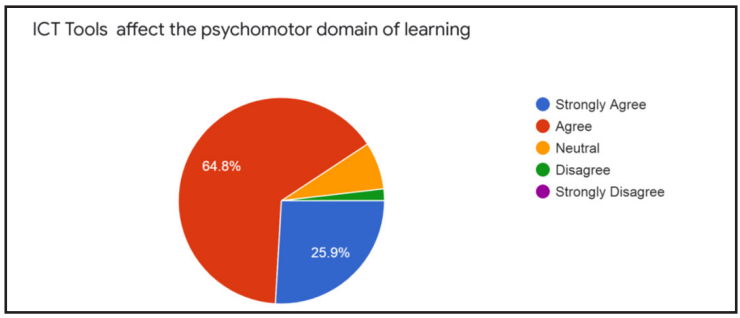
This result shows that 66.7 per cent agree, 24.1 per cent strongly agree, 1.19 per cent disagree and 7.4 per cent are neutral that the cognitive domain of learning is affected through the use of ICT Tools. This shows that the use of ICT Tools enhances the cognitive level of learning.

Graph-3: ICT Tools affect Affective Domain of Learning



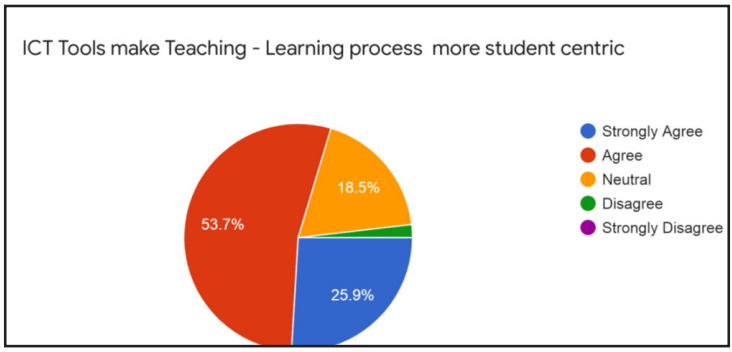
This pie chart shows that 64.8 per cent agree, 20.4 per cent strongly agree and 14.8 per cent are neutral about the effect of ICT Tools on the Affective domain of learning. The result tells that some TIs are not sure about the effect of ICT Tools on the cognitive domain of learning.

Graph-4: ICT Tools affect Psychomotor Domain of Learning



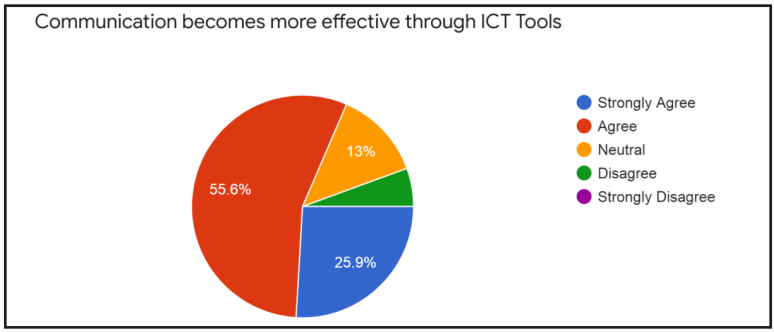
The above pie chart shows that 25.9 per cent are strongly agree , 64.8 per cent are agree , 1.19 per cent are disagree and 7.4 per cent are neutral that psychomotor domain of learning is affected through the use of ICT Tools in practice teaching. This result shows that most of the TIs are in favour that psychomotor domain is affected by the use of Various ICT Tools in practice teaching.

Graph-5: ICT Tools make Teaching-Learning process more students centric



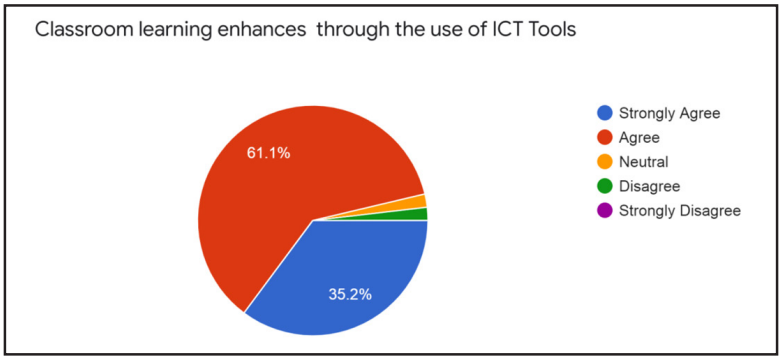
This pie chart shows that 25.9 per cent strongly agree, 53.7 per cent agree, 18.5 per cent are neutral and 1.19 per cent disagree about the opinion that ICT tools make more student-centric teaching-learning. This result shows that students' involvement is enhanced through the use of ICT Tools.

Graph-6: Communication becomes more effective through ICT Tools



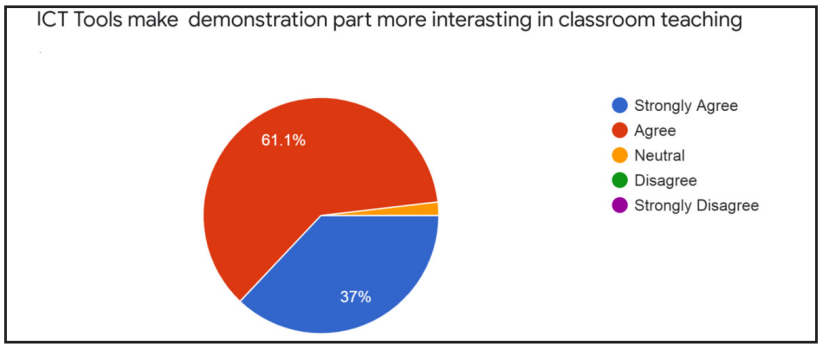
This pie chart shows tha 55.6 per cent agree, 25.9 per cent strongly agree, 13 per cent neutral and 5.6 per cent disagree about the view that communication becomes more effective through ICT Tools.

Graph-7: Classroom learning enhances through the use of ICT Tools



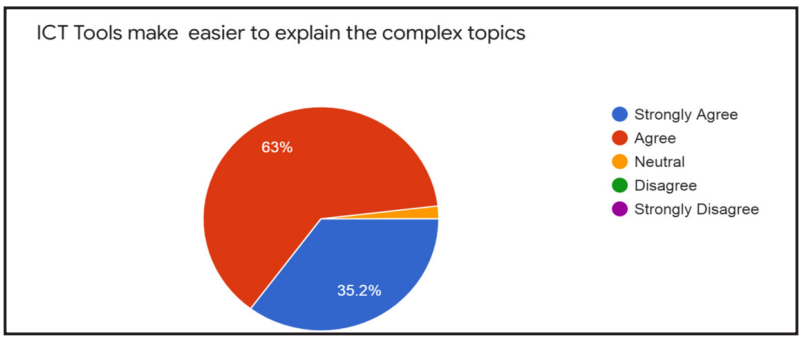
The above pie chart shows that 61.1 per cent agree, 35.2 per cent strongly agree, 1.9 per cent neutral, and 1.8 per cent disagree that classroom learning is enhanced through the use of ICT Tools.

Graph-8: ICT Tools make demonstration part more interesting in classroom teaching



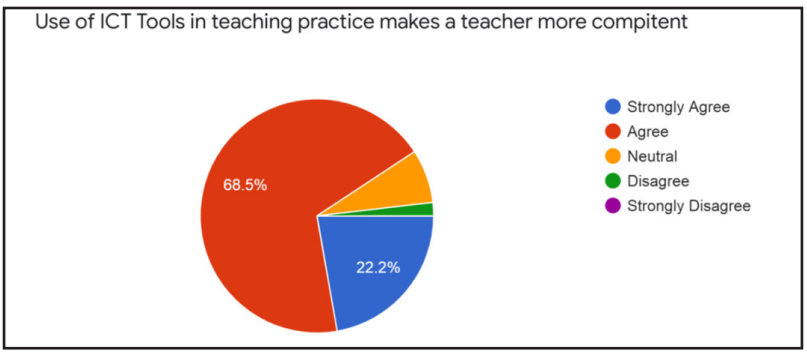
This pie chart shows that 61.1 per cent agree, 37 per cent strongly agree, and 1.19 per cent neutral about the view that ICT Tools make the demonstration part more interesting in classroom teaching.

Graph-9: ICT Tools make easier to explain the complex topics



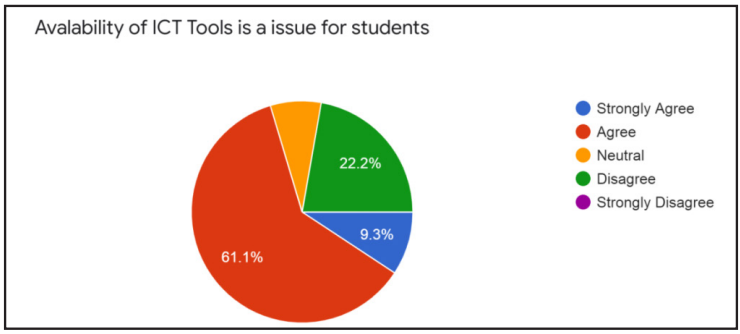
This pie chart shows that 63 per cent agree, 35.2 per cent strongly agree and 1.19 per cent neutral that ICT Tools make it easier to explain complex topics.

Graph-10: Use of ICT Tools in teaching practice makes a teacher more competent



This pie chart shows that 68.5 per cent agree, 22.2 per cent strongly agree. 7.4 per cent are neutral and 1.19 per cent disagree that the use of ICT Tools in teaching practice makes a teacher more competent.

Graph-11: Availability of ICT Tools is an issue for students



This pie chart shows that 61.1 per cent agree, 22.2 per cent disagree, 9.3 per cent strongly agree, and 7.4 per cent are neutral that the availability of ICT Tools is an issue for students.

Conclusion

The findings of this study show that ICT Tools are helpful in various ways during the School Internship Programme. It helps in planning and making proper strategies during classroom teaching practice. ICT Tools positively affect Cognitive, Affective and Psychomotor domains of learning. Various ICT Tools make complex topics simple and interesting for students. It enhances the student's ability to explore complex topics in different ways. Student involvement increases through the use of ICT Tools in the classroom teaching-learning process. There are various tools available that enhance students' communication abilities. It is evident that students learn in a better way when a topic is explained through demonstration. ICT Tools help them in this process. When TI explains a complex topic in a simple and interesting way, it boosts her confidence level. This study also reveals that the availability of ICT Tools for all is a challenging issue, but this challenge can be overcome in a phase-wise manner. The digital Teaching-Learning process should be strengthened to make our future generation of Teachers competent enough to face all kinds of challenges smoothly.

Suggestions

This study was focused on the effectiveness of ICT Tools in School Internship Program. Further, such studies may be carried out at different levels, such as pre-primary level, higher secondary level, and higher education level. Comparative studies may also be done for male-female groups in rural and urban areas.

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Research Article

Effect of Gamification on Teaching-Learning Process: A Descriptive Study

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Abstract

Nowadays, education is going through a moment of methodological transformation. One of the active methodologies with excellent projection within the educational field is gamification. However, there is still a lack of awareness among educators about the acceptable implementation of the technique of gamification. This study analysed the effect of the gamification approach in teaching and learning, which covers students' benefits, especially understanding level, engagement level, motivating factor, the significance of gamification as an assessment tool and also the barriers to using gamification. The research design was descriptive research with a sample of 509 from two developing and academically advancing countries, India and Malaysia, which includes teachers, research scholars, and students. Data is being collected with a questionnaire. The study findings reveal that gamification can be a useful tool for teaching and learning and can increase learner's motivation and turn learning into an enjoyable process. We also find that gamified learning interventions have a positive impact on student learning. These findings will be of practical interest to teaching and learning practitioners working in a range of educational contexts; and at all levels of education; who wish to increase student engagement and enhance learning. The study also finds that gamification still has some barriers to implementation and acceptance all around, especially among age groups above 50.

Introduction

Nowadays, education is going through a moment of methodological transformation. The infusion of technology and education has seen its rise in practice, especially with the ease of access to technology-based equipments such as computers, laptops, tablets and even smartphones [1]. This has enabled the successful application of education technology among students. Also, with the constantly changing landscape of education and the needs of the current generation of students, educational technology has to be adapted and improvised to cater to them diligently. One such improvisation in education is the use of games in learning [2]. Games in learning or game-based learning have been touted as a method that not only engages students but also motivates them. The application of gamification to the teaching-learning process across different fields of knowledge constitutes an emerging practice applied across all levels of education, from primary school up to university. Gamification of education is a strategy for increasing engagement by incorporating game elements into an educational environment. The goal is to generate levels of involvement equal to what games can usually produce.

The main goals of gamification are to enhance certain abilities, introduce objectives that give learning a purpose, engage students, optimise learning, support behavior change, and socialise. The three breakdowns of games include digital games-based learning, serious games and gamification. Digital game-based learning is a form of learning incorporating games in the digital form [3]. It involves the use of games as the main medium of learning. Meanwhile, serious games involve the game's mechanics in learning something. It is deemed devoid of elements of fun as it plays with a serious purpose [4]. It is usually used in fields such as medicine and aviation [5]. The gamification approach is the use of game elements in a non-gaming context. This method has been used in other fields, such as corporate and marketing, and has recently seeped into education. With all these methods, in the present research we chose the gamification approach as it has a better application in a teaching environment [6]. The flexibility provided by gamification will not only help educators in creating gamification-based learning but also allow the students to get easily acquainted with the system. Gamification applies elements associated with video games (game mechanics and game dynamics) in non-game applications. It aims to increase people's engagement and promote certain behaviours [7]

Based on the literature review findings, it can be assumed that although there is research that has seen the effects of gamification on students learning, the inconclusive findings on the contribution and effects of gamification on teaching-learning and its impacts are to be further looked into.

Theoretical Background

i. Gamification and learning

Games typically allow players to restart or play again, making mistakes recoverable. This freedom to fail allows students to experiment without fear and increases student engagement [8] Gamification must not be mistaken for programmed learning or computer-based learning, even though some of the interpretations suggest the latter, only underlining the compatibility of the theory with the new technologies [9]. The essence of gamification does not lie in technology; but in the diverse learning environment and the system of decisions and rewards, all aimed at increasing motivation and reaching higher levels of engagement in the learning process [10]. Massive amounts of feedback, tasks too complex for any one individual to solve alone, and environments that change in response to learners' actions are availed through well-designed educational games. In literature and in practice, several attempts to introduce gamification into blended learning and e-learning can be found.

ii. Gamification and Teaching

The gamification theory in teaching is that learners learn best when they are also having fun. Not only this, they also learn best when they have goals, targets and achievements to reach for, of course in a way the learner still perceives as fun. Because of the addictive features of video games that intrigue children (and adults) and get them hooked, it's only natural that we see similar engagement results when these game-based elements are applied to learning materials. Gamification in teaching involves using game-based elements such as point scoring, peer competition, teamwork, and score tables to drive engagement, help students assimilate new information and test their knowledge. It can apply to school-based subjects but is also used widely in self-teaching apps and courses, showing that the effects of gamification do not stop when we are adults.

Objectives

This research intends to see the underlying benefits of gamification in learning. To observe the change in the understanding and engagement level of students in the teaching-learning process through gamification. To identify the advantages of using gamification as a motivation factor and enjoyment tool. To understand the ease of use of gamification tools and usage of it as an assessment tool. The study also looks into the predominant barriers to using gamification.

Data and Methods

The study focused on India and Malaysia as its selected sample areas. The choice of these countries is founded upon their status as developing and academically advancing nations. A random sampling method was employed, resulting in 309 samples drawn from India and an additional 200 from Malaysia. The respondents encompass diverse categories, including faculties, research scholars, and students. The rationale behind selecting India and Malaysia stems from their transition from traditional to advanced education systems while undergoing phases of technological advancement. These factors motivated the study's focus on these countries, aiming to explore the impact of gamification within their evolving educational landscapes. This research seeks to analyse how gamification influences the teaching-learning process amidst the educational transformation in both nations.

The Questionnaire is developed based on the objectives, and the reliability of questions is tested using Cronbach's alpha. Data are collected from each respondent separately and are analysed using various statistical tools like MANOVA, t test, ANOVA, and Factor analysis. The tables given below show the categorisation of respondents and reliability test results.

Table-1: Category of Respondents

Respondent Category	Count
Faculty	264
Others	10
Research Scholar	38
Student	197
Grand Total	509

Figure-1: Respondents

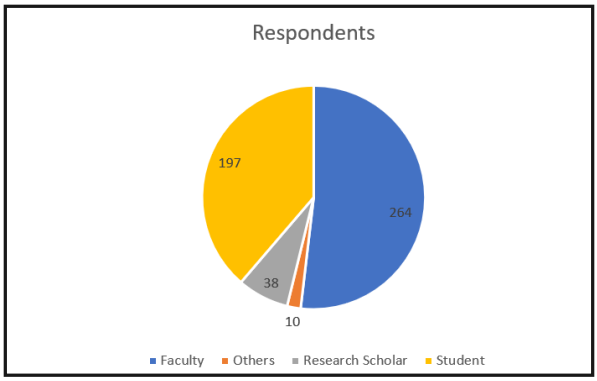

Table-2: Cronbach's Alpha Reliability Coefficient

Constructs	Cronbach's Alpha	N of Items
Understanding	0.9	5
Engagement	0.884	5
Enjoyment	0.898	5
Motivation	0.903	5
Easiness	0.881	5
Assessment	0.896	5
Barriers	0.919	5

Result and Discussion

The following tables will illustrate the descriptive statistics of the research variables.

Table-3: Gender wise classification in the usage of gamification as a teaching – learning tool

T- Test

VARIABLE	GENDER	N	MEAN	Std. Error Mean	t	Sig. (2-tailed)
Understanding Level	Female	314	4.3701	0.03379	-1.961	0.05
	Male	212	4.4783	0.04478		
Engagement	Female	314	4.3439	0.03346	-1.835	0.067
	Male	212	4.4453	0.04538		
Enjoyment	Female	314	4.3382	0.0381	-2.611	0.009
	Male	212	4.4896	0.04236		
Motivation	Female	314	4.3446	0.03569	-1.743	0.082
	Male	212	4.4453	0.04639		
Easiness	Female	314	4.1911	0.03704	-2.869	0.004
	Male	212	4.3623	0.04759		
Assessment	Female	314	4.2363	0.03797	-2.58	0.01
	Male	211	4.3905	0.04607		
Barriers	Female	314	3.9987	0.04677	-2.73	0.007
	Male	211	4.2019	0.05831		

Table 3 depicts that there is a chance for a difference in the gender-wise response since the P value is in the border for the MANOVA test, So Post hoc analysis is done using an independent sample t test to check out, whether there is any difference in attitude towards gamification in teaching-learning process. The result depicts that the gender-based difference is especially large for the variables Easiness of use, Barriers to use and enjoyment level. From the result, it is well clear that males have shown more interest in gamification and are of the opinion that gamification has a great impact on the teaching-learning process.

Table-4: Category-wise classification in the usage of gamification as a teaching–learning tool

Multivariate Analysis

Effect		Value	F	Hypothesis df	Error df	Sig.
Category	Pillai's Trace	0.028	0.705	21	1551	0.831

Table-5: ANOVA

Variables	Category	N	Mean	Std. Error	F	Sig.
Understanding Level	Student	202	4.3653	0.0438	0.838	0.473
	Research Scholar	42	4.5095	0.07535		
	Faculty	272	4.4338	0.03876		
	Others	10	4.44	0.2125		
Engagement	Student	202	4.3396	0.04288	0.577	0.631
	Research Scholar	42	4.419	0.08343		
	Faculty	272	4.4118	0.03911		
	Others	10	4.42	0.19425		
Enjoyment	Student	202	4.3129	0.04704	2.212	0.086
	Research Scholar	42	4.5429	0.07839		
	Faculty	272	4.4397	0.04002		
	Others	10	4.44	0.2247		
Motivation	Student	202	4.3376	0.04199	1.253	0.29
	Research Scholar	42	4.5429	0.08736		
	Faculty	272	4.3985	0.04229		
	Others	10	4.32	0.22549		

Easiness	Student	202	4.2327	0.04803	0.553	0.646
	Research Scholar	42	4.3762	0.08519		
	Faculty	272	4.2647	0.0418		
	Others	10	4.2	0.21499		
Assessment	Student	202	4.2406	0.04771	1.066	0.363
	Research Scholar	41	4.4098	0.08609		
	Faculty	272	4.3199	0.04191		
	Others	10	4.42	0.18962		
Barriers	Student	202	4.0416	0.06063	0.275	0.844
	Research Scholar	41	4.1268	0.12489		
	Faculty	272	4.1044	0.05015		
	Others	10	4.02	0.33393		

Table 5.3 depicted that there is no chance for difference in the category-wise response since the P value is 0.831 for the MANOVA test, Post hoc analysis is done using the ANOVA test to check out; whether there is any significant difference in attitude towards gamification in teaching-learning process based on their category. The result depicts that category-wise, there is no difference in the attitude towards gamification

Table-6: Age-wise in the usage of gamification as a teaching–learning tool.

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
Age	Pillai's Trace	0.075	1.409	28	2068	0.076

Table-7: ANOVA

Variable	Age Category	N	Mean	Std. Error	F	Sig
UnderstandingLevel	< 20	44	4.4364	0.11436	1.657	0.159
	20-25	162	4.3494	0.04648		
	25-35	146	4.3973	0.05047		
	35-50	133	4.4391	0.0575		
	50+	41	4.6195	0.06907		

Engagement	< 20	44	4.35	0.12167		
	20-25	162	4.3309	0.0427		
	25-35	146	4.3945	0.05102	1.636	0.164
	35-50	133	4.3835	0.05866		
	50+	41	4.6049	0.07761		
Enjoyment	< 20	44	4.3773	0.12746		
	20-25	162	4.2914	0.04957		
	25-35	146	4.4493	0.04635	1.821	0.123
	35-50	133	4.4481	0.06308		
	50+	41	4.5122	0.08753		
Motivation	< 20	44	4.4136	0.10927		
	20-25	162	4.3025	0.04601		
	25-35	146	4.4027	0.04986	1.83	0.122
	35-50	133	4.391	0.06777		
	50+	41	4.6	0.07225		
Easiness	< 20	44	4.3273	0.10824		
	20-25	162	4.1889	0.05304		
	25-35	146	4.3329	0.04802	1.553	0.186
	35-50	133	4.206	0.06723		
	50+	41	4.3854	0.09009		
Assessment	< 20	44	4.2636	0.11933		
	20-25	162	4.2173	0.05101		
	25-35	145	4.3531	0.04726	1.764	0.135
	35-50	133	4.2872	0.06819		
	50+	41	4.4976	0.08727		
Barriers	< 20	44	4.1727	0.13757		
	20-25	162	3.9963	0.06757		
	25-35	145	4.0014	0.06844	2.691	0.03
	35-50	133	4.1338	0.07394		
	50+	41	4.4195	0.09443		

Table 7 depicts that there is a chance for a difference in the age-wise response since the P value is in the border 0.076 for the MANOVA test, Post hoc analysis is done using the ANOVA test to check out; whether there is any significant

difference in attitude towards gamification in teaching-learning process based on their age. The result depicts that age wise there is difference in the attitude towards gamification especially on the variable barriers. Age group above 50 finds barriers in using gamification tools.

Figure-2: Understanding level of gamification

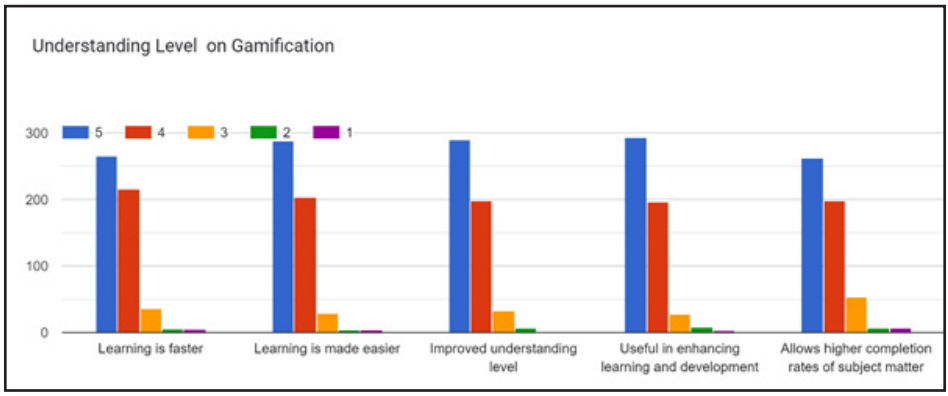

Figure 2 shows that the majority of respondents (61 per cent) have strongly agreed that gamification has helped them to improve their understanding level. It helped them to make their learning fast and easier and also allowed for higher completion of subject matter.

Figure-3: Engagement level of gamification

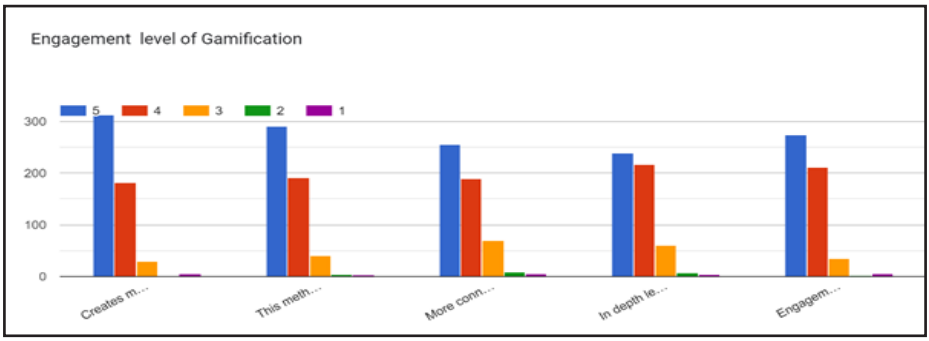

Figure 3 shows that the majority of respondents strongly agreed that gamification has helped them to improve their engagement level in teaching–learning process. This methodology of teaching-learning increases thinking capacity, more connection to the faculty and in-depth learning of the topic.

Figure-4: Motivation factor of gamification

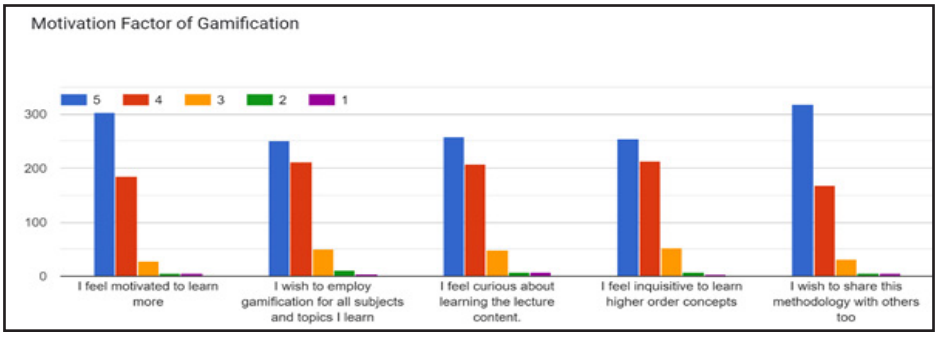

Figure 4 shows that the majority of respondents strongly agreed that gamification has helped them to motivate better learning. It helped them to feel curious about learning the lecture content and feel inquisitive to learn higher order concepts; they also wish to share this methodology with others.

Figure-5: Ease of use of gamification in teaching-learning

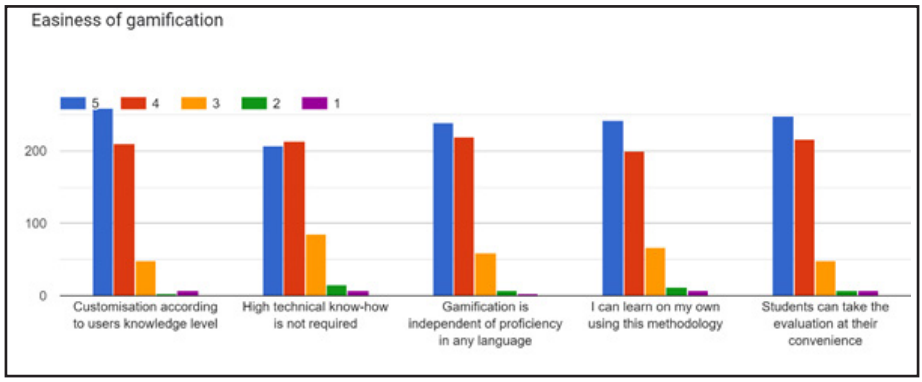

Figure 5 shows that the majority of respondents have agreed that gamification is easy to use. This methodology of teaching-learning can be Customised according to users' knowledge level, high proficiency is not required to use it. Respondents also agreed that they can learn on their own using this methodology.

Figure-6: Barriers in using gamification

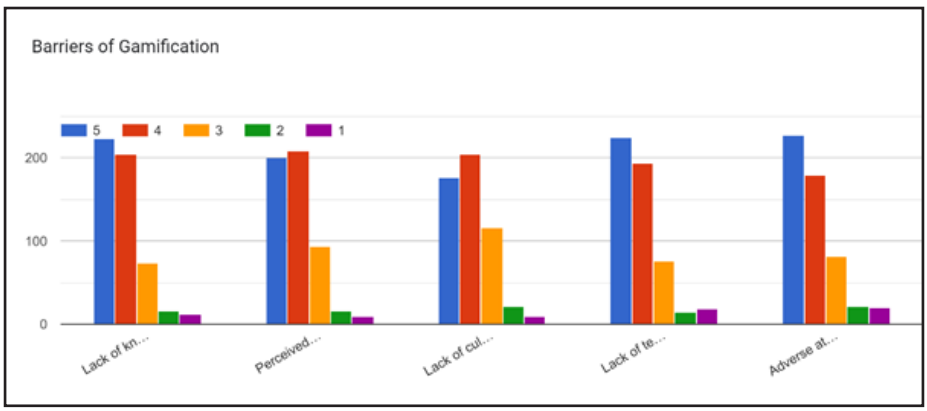

Figure 6 shows that respondents are of the opinion that there are still certain barriers to using gamification as an effective tool in teaching–learning process like a perceived cost for accessing gamified learning content, lack of cultural appetite, scepticism from learners, lack of technical facilities like stable internet connection, uninterrupted power supply, adverse attitude to change into new teaching pedagogy and lack of knowledge of how to implement it.

Table-8: Factor Analysis of different variables

Total variance explained

Component	Total	% of Variance	Cumulative %
1.	17.515	48.652	48.652
2.	2.867	7.964	56.615
3.	1.644	4.565	61.181
4.	1.143	3.174	64.355
5.	1.088	3.022	67.377

	1	2	3	4	5
Improved understanding level	0.729				
Engagement achieved through this methodology leads to achieving the subject's learning outcomes	0.725		0.356		
Useful in enhancing learning and development	0.71				
Allows higher completion rates of subject matter	0.678	0.313	0.36		
In depth learning of the topic	0.677	0.301	0.325		
More connection to the faculty and class is felt	0.672				
Learning is made easier	0.641				0.417
This methodology of teaching-learning increases thinking capacity	0.631				
Learning is faster	0.54	0.304			0.44
Manipulation and Malpractices can be avoided completely		0.737			
Personal bias of the evaluator is completely avoided		0.726			
Evaluation is error free and less time-consuming		0.708			
Gamification is independent of proficiency in any language		0.705			
Results are uniform and independent of where it is administered.		0.69			
High technical know-how is not required		0.688			

Students can take the evaluation at their convenience	0.405	0.613			
I can learn on my own using this methodology	0.347	0.597	0.378		
Speed of Response is measured		0.543			0.507
Customisation according to users' knowledge level		0.524	0.372		0.316
I am immersed when learning is through gamification	0.309		0.712		
I feel curious about learning the lecture content.	0.339		0.698		
I feel inquisitive to learn higher order concepts	0.348	0.379	0.65		
I have a heightened attention span due to the enjoyment I get from gamification	0.37	0.364	0.646		
I wish to share this methodology with 4 too	0.41	0.323	0.624		
I wish to employ gamification for all subjects and topics I learn	0.34	0.315	0.603		
I feel happy when learning through gamification	0.365	0.31	0.6		0.331
I forgot the time when learning through gamification			0.531		0.328
I feel motivated to learn more	0.324	0.326	0.501		0.397
Lack of cultural appetite, or scepticism from learners				0.859	
Perceived cost for accessing gamified learning content				0.843	
Lack of knowledge of how to implement it				0.839	
Lack of technical facilities like stable internet connection, uninterrupted power supply etc.				0.839	
Adverse attitude to change into new teaching pedagogy				0.805	
Learning through gamification makes me feel good.			0.515		0.606
Creates more engaging experiences in learning	0.49				0.588

Figure-7: Factors that make gamification an effective teaching – learning tool

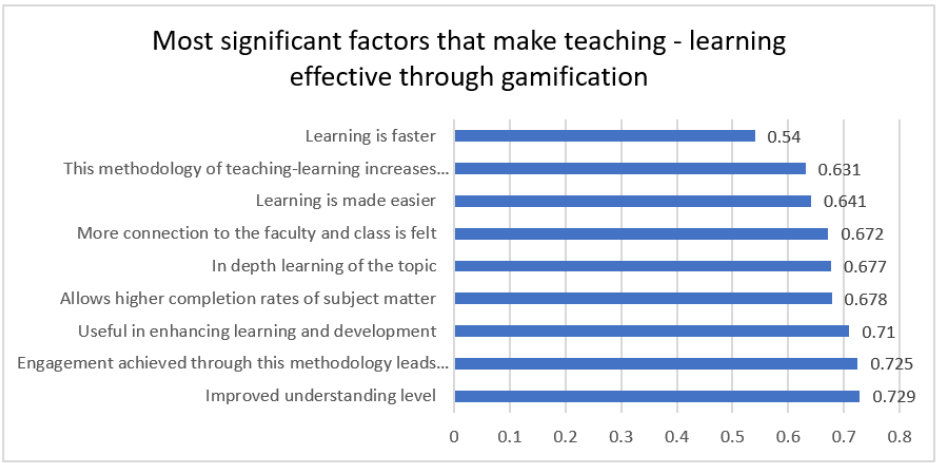

Table 7 shows the result of factor analysis. Results show that the first nine factors are very important in showing the impact of gamification in the teaching-learning process, as it contributes 48.652 per cent of the variance. Based on the analysis of this research, gamification is reliable and beneficial for teaching and learning mainly of nine factors: Improved understanding level, Engagement achieved through this methodology leads to achieving the subject's learning outcomes, Useful in enhancing learning and development, Allows higher completion rates of subject matter, In-depth learning of the topic, More connection to the faculty and class is felt, Learning is made easier, This methodology of teaching-learning increases thinking capacity and also Learning is faster.

Conclusion

Based on the analysis of survey results, it has been established that gamification holds potential as an effective teaching tool for educating adolescents with diverse needs. It serves to not only enhance the learning experience for students across various academic levels but also make it more engaging and entertaining and improve the motivation level of students. Furthermore, educators benefit from higher completion rates of subject material, fostering a stronger sense of connection among students, faculty, and the class community. Despite its evident efficacy in the realm of teaching and learning, gamification does encounter specific barriers to successful implementation and acceptance like perceived cost for accessing gamified learning content, lack of cultural appetite, or scepticism from learners, lack of technical facilities like stable internet connection, uninterrupted power supply, adverse attitude to change into new teaching pedagogy and lack of knowledge of how to implement it. Notably, certain challenges hinder its utilization as a learning tool. Among these obstacles, it has been observed that females, particularly those aged above 50, encounter difficulties when incorporating gamification into the teaching-learning process. This challenge might stem from a lower level of familiarity and exposure to technology among older females.

Consequently, the study underscores the presence of hurdles hindering the adoption of gamification tools. Given that gamification represents the emerging forefront of the teaching-learning paradigm, there is a universal call for nations to transition towards

this innovative approach. To facilitate such a transition, it is imperative to provide comprehensive training to both educators and students. This training should be particularly tailored to address the needs of older female learners, equipping them with an understanding of the intricacies, techniques, and strategies underpinning gamification. By integrating these insights into the teaching-learning mechanism, the objective is to facilitate a simplified, engaging, and captivating learning process. This approach acknowledges gamification's potential to reshape the educational landscape and urges educational systems worldwide to embrace this transformative shift.

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Research Article

Generating Lexical Estimates in Academic Writing in English Using Technology: An Exploratory Study of Adult Indian Learners

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Abstract

In this paper, we demonstrate how teachers can use a digital tool like Lexical Tutor to generate estimates or assessments of adult learners' productive lexical knowledge in academic writing in English as a Second Language (ESL). The digital tool-generated lexical estimates are complemented by teacher feedback to illustrate the inductive method of language learning. In the first step, lexical estimates are created from a few samples of academic writing of adult ESL learners using Lexical Tutor. In the second step, it is employed to identify frequently used collocations in learners' writing samples and then to create an illustrative bank of concordances based on available corpora. This sample of concordances can later be used to give feedback on usage rules of occurrences of lexical items within a variety of syntactic contexts. The feedback, it is hoped, would improve the content and coherence in academic writing by adding lexical richness and variety to the writing. Furthermore, the use of technology would help learners notice lexical features and improve the quality of writing in a self-regulated manner. This would also serve as an example of the inductive method of language learning.

Keywords: *academic writing, lexical estimates, Lexical Tutor, data-driven learning, vocabulary size, lexical density, lexical diversity*

Technology And L2 Writing Assessment

The National Education Policy (2020) endorses the utilization and integration of technology to enhance several aspects of education like learning, assessment, planning and administration. This endorsement is preceded by developments in educational technologies that have impacted every aspect of the language classroom, ranging from teaching and assessment to feedback to promote self-directed learning across the globe. Specifically designed language-based tools have also brought about an insurgence of corpora research and Natural Language Processing (NLP), the results of which have been used to advance ESL/EFL learning in the instructional context (Tribble, 1990; McCarthy & Carter, 1995). The ontogenesis of corpora and NLP research has resulted in the development of software and web tools, which have in turn helped in creating auto-generated lexical estimates of texts uploaded to these portals. This has opened opportunities for technology-assisted language assessment. In this paper, in a novel attempt we explore how auto-generated lexical estimates from a relevant web tool called Lexical Tutor (in short Lextutor) developed

by Cobb in 2004 can be accessed by language teachers and used to give feedback and scaffold academic writing skills of adult learners.

The focus of this paper will be the application of Lextutor to give feedback to academic writing in English using lexical concordances. We shall demonstrate how teachers can give feedback and direct learners' attention to improve their vocabulary use in academic writing using corpus-based concordance illustrations selected from web sources and generated using Lextutor (Cobb & Morris, 2004).

The current insurgence of corpora research has resulted in Data-Driven Learning (DDL) as large databases of English texts provide contextual material to understand how words and phrases occur in the sentential contexts and how they are used in real-life, social, and academic communication. DDL helps in promoting an inductive method of language learning because, through a relevant corpus of concordances, learners can get illustrations of the appropriate use of lexical items and deduce relevant morpho-syntactic rules and patterns from such web-based large linguistic corpora. Thereafter, they can engage in self-correction and attend consciously to the development of their ESL proficiency (McCarthy & Carter, 1995; Todd, 2001). This method supports the inductive approach to language learning which demands from learners a conscious effort to identify patterns in language samples by paying attention and then consciously deriving rules from these patterns (Shaffer, 1989). Concordance software helps in isolating recurrent patterns extracted from authentic language samples. Concordances "make the invisible visible" (Tribble, 1990). Research has shown that a statistically significant transfer of word knowledge to academic writing tasks can be achieved using concordance programs (Kaur & Hegelheimer, 2005). They provide samples of target language items to aid in consciousness-raising (Hadley, 2002) and provide feedback for written errors (Gaskell & Cobb, 2004).

Technology-based feedback on learner language

In human evaluation, lexical estimates are perception-based. So, teachers often assess written responses based on estimates they think are good and aligned with the requirements of specific academic tasks. However, this perceptual estimate is limiting in nature, as it is not possible or practical for a teacher to provide fine-grained in-depth analysis like text length, frequency and range of word types, families and tokens. They would also need to align learners' usage to standardized proficiency levels of the Common European Framework of References (CEFR 2001, 2020), which is not an easy task without being trained on how to apply the framework in teaching and assessment of different levels of language abilities. So technological innovations like Text Inspector (Bax, 2017) or Lextutor (Cobb, 2004) can be employed to get detailed lexical estimates and align them to standardized levels like that of CEFR levels. Teachers can then provide instances of learning through examples they generate in a data-driven mode, like identifying concordances of academic words to improve lexical usage.

The use of technology such as DDL to provide feedback during formative assessments of writing has received mixed reactions from teachers and researchers (Boulton, 2017). Usually, ESL classrooms that provide feedback using technological tools use it in combination with teacher feedback. A recent case study on Online Formative Assessments and Feedback Practices of ESL Teachers in three countries, it was

found that all three participants from each country used Google Forms to provide automated feedback. This was supplemented with recorded audio and videos as feedback from the teacher participants (Mahapatra, 2021). Though recent research shows some useful techniques in generating and using automated feedback, there is still a lack of consensus on the independent use of technology to provide feedback on written documents. It is because the usefulness of technological tools, the long-term impact on learners, and the impact of feedback provided using these tools on the development of learners' writing skills are yet to be empirically verified. This paper, in a novel attempt demonstrates how technological tools can be used to generate lexical estimates and used by teachers to give meaningful feedback on learners' lexical knowledge and help them improve the quality of their writing by attending to lexical richness and lexical substitutions and alongside this minimize phrasal repetitions. However, this is an exploratory study and the results would have to be later validated by further research of larger population and the impact of such feedback on long-term academic language use.

For teacher-mediated feedback to be efficient, three conditions need to be fulfilled: one, it is important that learners too are engaged in the feedback; two, it is provided in a non-threatening environment, and three, it is time efficient. Carless and Winstone, in 2020, first proposed this kind of a tripartite feedback framework. The three dimensions of feedback in this framework are -- *the design dimension* (the teacher designs the assessment, helps learners in making evaluative judgments, and uses technology for learners' feedback uptake), *the relational dimension* (a non-threatening relationship exists between the teacher and the student), and *the pragmatic dimension* (the degree of authenticity and practicality of the feedback in terms of time and human resources). Technology can be used at each stage. As stated above, the goal of this paper is to demonstrate a systematic use of technology to create estimates of lexis used in different types of academic writing required in higher education and complement it with teacher-mediated feedback to increase lexical variety and corresponding syntactic patterns in writing.

Academic Language and Writing Assessment

What makes some articles academic and some others not so academic - is it the lexis or the content? The answer would be that both the vocabulary used and the subject matter being discussed in the articles lend an academic nature to it. The lexis used in these articles, however, plays an important role in setting the tone of the author and the scope of the paper. Writing an academic article requires the author to use Cognitive Academic Language Proficiency (CALP) (Cummins, 2017) and the appropriate usage of words from the academic word list (AWL) (Coxhead, 2000). The degree of use of CALP and frequency of use of AWL words determines a person's academic success. How would one possibly determine whether the learner has acquired sufficient CALP? A person with advanced academic language proficiency would have an extensive vocabulary, as well as use academic words. To help estimate the academic range of lexis used, Averil Coxhead (2000) created the Academic Word List (AWL) consisting of 10 sub-lists, excluding the first 2000 most common words or the General Service List word list. In this paper, we will provide estimates of learner knowledge based on the percentage of tokens of AWL words they use in their writing samples.

Research has shed light on the positive correlation between vocabulary measures and lexical proficiency of learners' writing. The correlation serves as a useful indicator of their academic writing and language development (Maamuujav, 2021). Lexical features present in academic writing thus become paramount in determining the quality of writing. The situation calls for a discussion on what constitutes vocabulary knowledge, how it impacts writing proficiency and how can vary across different task types. Let us now look at a few vocabulary measures commonly used in research that will also be used in this paper to build lexical estimates through Lextutor.

Vocabulary Measures to Build Lexical Estimates

Production-based vocabulary knowledge can be measured with respect to its size, lexical diversity, and lexical density.

1. Vocabulary size: It is defined as the number of words a person knows, either passively or actively. It is measured in relation to the frequency of standard word lists. Two major lists frequently used by researchers are AWL and the British National Corpus (BNC). The frequency of words used from such lists helps in assessing the vocabulary knowledge of ESL/EFL learners (Cobb, 2004); the presence of less frequent BNC words (K3 levels and above) indicates higher levels of lexical sophistication.

2. However, the problem with estimating vocabulary size based on production is that only 16 per cent of the receptive vocabulary is known productively at the 5,000-frequency level and 35 per cent at the 2,000 level (Laufer, 2005 as cited in Schmitt, 2014). Moreover, studies suggest that only one-half to three-quarters of receptive vocabulary is known productively (Fan, 2000). Therefore, written samples do not give a comprehensive view of the size of a participant's entire vocabulary; rather, it is only an estimation of his/her productive vocabulary. Nevertheless, estimating production vocabulary is crucial to giving feedback for the development of content and coherence in writing.

3. Lexical diversity: It is the variety of vocabulary used in a text, measured as the ratio of the total number of new words over the total number of words in a text or the Type-Token Ratio (TTR). However, this measure is vulnerable to the text length because when tokens are less in number the TTR can be high, and conversely, in longer texts the types may be repeated and TTR may be low. The TTR value can be reliable if the range of total words used is comparable across texts written by a group of learners and is of a minimum text length of 150 words and above (Cummins, 2017).

4. Lexical density: It is the ratio of the number of lexical words (content, noun, adverb, and adjective) over the total number of words (Ure, 1971). This measure indicates linguistic complexity because it shows how informationally dense a text is. It is, therefore, assumed that the quality of writing is directly proportional to its lexical density.

The present paper uses Lextutor as a digital tool to help teachers estimate lexical knowledge and design data-driven feedback on lexis use in academic writing samples of adult ESL learners based on the following two research questions:

RQ 1. How can Lextutor be used to buildl exical estimates from learners' academic writing samples across different text types?

RQ 2. How can lexical estimates be used to prepare data driven feedback on lexis use in academic writing?

The Study

Four ESL learners (female 3; male 1) within the age group of 25 to 30 years enrolled in the first year of a doctoral program in English Language Education (ELE) at a university in Hyderabad, India, participated in the study. They had 15 years of exposure to English as a medium of instruction during the time of data collection, and they participated in the study voluntarily.

The participants had completed a course in academic writing as part of their doctoral program. They were requested to submit four types of academic writing from the submissions they had made during the course:

I. a research proposal based on their doctoral study;

II. a report of a small-scale study;

III. a critical review of concepts; and

IV. an argumentative paper to establish a claim.

All the texts dealt with concepts and research claims in English Language Education (ELE). Note that each task type has a slightly different scope in terms of its communicative purpose, though all of them fall under the broader category of analytical and research writing. So, they are quite homogenous in terms of their structural presentation and include language of argumentation. Earlier research that studied the complex relationship between task types and their influence on writing performance, has shown that differences in task types impact aspects like fluency, accuracy, and complexity (Pourdhana et al., 2013). Similarly, in ESL research, where reading for summary recall is examined through different task types, the text types make different demands on working memory, attention, content knowledge, and linguistic competence (Patil, 2022). This leads us to examine whether task types influence lexical estimates in academic writing to better understand this link and use it to fine-tune feedback.

Note that for the purposes of the study, only four learners' writing samples were considered. So, in all, we considered sixteen writing samples (four from each participant) because we intended to provide in-depth analysis and feedback on lexis use across the four text types and see the extent to which this feedback made sense to the participants and whether they were willing to revise their writing samples based on the feedback they received. So, for purposes of this small-scale exploratory study, the sample selection was considered adequate and sufficient.

Method of data analysis:

*To analyze the lexical quality of the texts, Lextutor with the program Vocabulary Profiler (VP) was used (*https://www.lextutor.ca/vp/eng*/). It identified -*

- macro measures of fluency (text length), lexical diversity (TTR), and lexical density (ratio of content words over text length); and
- micro measure of vocabulary size based on percentage frequency of BNC from K1, K2 (most frequently used 2000 words) versus K3 and above levels and words from the AWL list.

This software was used because it is accessible and easy to use. Furthermore, it is a useful tool in understanding lexis use and the academic performance of ESL learners (Cobb & Morris, 2004).

Another program called VP Concordances (https://www.lextutor.ca/conc/sent/) was used to identify frequently used collocations in the learner texts. This was used by the teacher-researcher to design a feedback plan and raise awareness of the role of collocations in building content and coherence.

Findings & Discussion

In this section, we present the findings on the lexical analysis of the texts and explain the pedagogical implications of the findings.

To answer the first research question, we present the descriptives of lexical knowledge across four text types in Table 1:

Table-1: Descriptive of lexical estimates of four types of academic writing

Estimates	Research Proposal		Small Scale Study		Critical Review		Argumentative Paper	
	M	SD	M	SD	M	SD	M	SD
Text length (fluency)	1172.25	696.75	1149	446.69	1102	414.29	1478.75	621.11
TTR	0.38	0.09	0.35	0.04	0.38	0.03	0.37	0.07
Lexical Density	0.60	0.02	0.61	0.02	0.60	0.01	0.60	0.04
AWL %	9.93	6.66	10.58	1.52	13.2	1.90	12.13	2.06
BNC K1 %	69.1	2.20	68.30	4.12	68.2	3.59	68.38	5.43
BNC K2 %	12.28	0.69	15.27	2.42	11.4	2.78	13.28	2.56
BNC K3 & above %	14.23	6.42	8.63	5.73	19.63	6.41	12.78	1.36

The average range of text length from each task is within 1100 to 1500 words, indicating that the participants have been able to compose analytical texts with a fair amount of fluency. We are able to use TTR as a lexical diversity measure in a reliable manner because all the texts are comparable and have 1000-plus token lengths. It is observed that the TTR of the texts is comparable, ranging from 0.35 to 0.38. Further, we found that the average lexical density of each task type is 0.60 to 0.61, which implies that content word use is at 60 per cent of the text length across all four text types.

At a micro level of analysis of vocabulary size, we considered the use of low-frequency words (from K3 level and above) from BNC and AWL words. Though the use of K1 and K2 level words (or 2000 most frequently occurring words) comprise 82 per cent of the content, the learners have also been able to use low-frequency words from K3 and above at 16 per cent to 20 per cent. It indicates that their lexical knowledge is well spread across different word frequencies, and they can be placed at C1 level of proficiency (CEFR, 2020, p. 110). Furthermore, academic words range from 10 per cent to 13 per cent, which is a rather good performance and supports their C1 level of performance. The reason for the high use of AWL words could be because all the tasks demand that research work

is reported in a formal standardized manner, which these participants have been able to achieve.

Impact of text types on lexical knowledge of participants

Note that as the text length and TTR of all four participants do not show much variation across tasks, this indicates that task type does not seem to have any distinct impact on fluency, lexical diversity, and density in the writing knowledge of the participants. This contradicts the earlier research findings on the relationship between task types and fluency from Pourdhana et.al, 2013. A reason for this could be the high degree of relatedness of the text types used – they all belong to research writing, and analytical and argumentation skills had to be used to compose these texts. Another reason for getting stable lexical estimates in the group could be because all four participants are advanced users of the language and have quite high academic writing skills required to complete the four tasks. Furthermore, their knowledge of topics chosen to respond to each task type may have had a strong impact on the content and homogeneity in the range of lexis used. However, this might not be true if larger and more heterogeneous groups are taken into consideration with more diverse text types, as suggested by Zhang (2022).

Feedback on writing using Lextutor inputs

To answer the second research question, a feedback plan was prepared as part of the formative assessment of writing. Previous research has reported that learners believe that editing would be more efficient if teachers indicated 'where' the editing should take place (McGarrell, 2015). Therefore, preparing a feedback plan was deemed to be effective for the participants. First, an academic word list generated by using the Phrase Profiler feature in Lextutor was accessed (https://www.lextutor.ca/vp/collocs/). Then a few frequently used collocations of some of those academic words were identified from each text type of the four participants. A few representative examples are presented in Tables 2a-d to illustrate the choice of collocation on which feedback was prepared. For each lexical item (in bold), the preceding and following syntactic items are underlined to show the context of the use of the collocation or its concordance. In the column on 'comments, ' the usage of each lexical item with variations in syntactic form(s) and meaning are listed.

Table-2: Frequent collocations in Research Proposals

Frequent Collocations	Context of use	Comments
collect data **(V+ N.uncount)** **BNC levels** **collect : K1** **data: K3**	the parental questionnaire will collect data in four main areas [PrP_F_P2019_RP] The study uses information from various statistics, feedbacks and questionnaires to collect data. [ChS_F_P2019_RP]	NP, +LOC (PP) only NP

Table-3: Frequent collocations in Small-Scale Study

Frequent Collocations	Context of use	Comments
follow instructions (V+ N.pl) BNC levels follow: K1 instructions: K2	Most of them can follow instructions in at least three languages. [ChS_F_P2019_SSS] - Reading research in the present times is interactive and goal driven, for ex – when you follow the instructions to install and start an app. [DeS_F_P2019_SSS]	generic use specific use

Table-4: Frequent collocations in Critical Reviews

Frequent Collocations	Context of use	Comments
socioeconomic status **(adj+N)** **BNC levels** **socio-economic: K11** **Status: K3**	Multimodal composition recognizes that the use of multiple modes in the classroom by the learner is always influenced by the learners' culture, history, and socioeconomic status. [MNN_M_P2019_CR] In a multilingual ESL context like India, English may not necessarily be present in the home literacy environment which is related to the socioeconomic status of the family. [PrP_F_P2019_CR]	generic use specific Use
visual image **(adj+N)** **BNC Levels** **visual: K3** **image: K2** **imagery: K2**	Kress and Van Leeuwen's (2001) research indicates digital technology enables second language learners to extract meaning from visual images, audio, and video without the constraints of language. [PrP_F_P2019_CR] Studies of mental representations have included the visual imagery of mental models of representation. [DeS_F_P2019_CR]	generic use specific use, morphological change

Table-5: Frequent collocations in Argumentative Paper

Frequent Collocations	Context of use	Comments
individual difference **(adj + N)** **BNC level** **individual: K2** **difference: K1**	In a multi-lingual, multi-cultural context the diversity of our social experiences produces immense individual differences in terms of our shared experiences and exposure to different practices. [DeS_F_P2019_AP] The stories should not be too complex for the learners to work with on their own and one must consider the needs and abilities of the learners, and also the individual differences while choosing stories. [PrP_F_P2019_AP]	generic Use plural NP specific use plural NP

In Tables 3-5, we find that the learners have been able to use the corresponding lexical items in two contexts, one for *generic use* and another for *specific use* with the definite article 'the'. We concur that owing to a higher level of writing proficiency and adequate content knowledge, the participants were able to distinguish the use between the two syntactic contexts and use them appropriately in their writing. This is an example of learners' lexical depth or various uses of the same root. Conceptually lexical depth is close to lexical density as it shows how dense a text is.

For preparing a feedback plan, this selection was a necessary step as the teacher would be able to draw learner's attention to what they have been able to achieve in their writing. It would serve as a positive indicator of learner performance to show them instances of lexical depth (as seen in Tables 2b-d) and motivate them to prepare well in future. Furthermore, this kind of selection could be taught to the learners to make them notice such information independently and follow a similar style of writing in future. Thus, this is a good example of data-driven learning as it makes the learners self-reliant.

Lastly, incorrect use of lexical items with concordances was also identified. It is through illustrations that feedback can be planned as an inductive approach to language learning. In Table 6 we present an example of incorrect use of the lexical item 'previous research':

Table-6

previous research **(adj+N.uncount)**: BNC level: previous: K2 research: K2	The hypothesis underpinning this study was based on previous researches (*) about the influence of CLIL teaching technique in acquiring language and content comprehensively. [ChS_F_P2019_RP]
explanation	'research' as a noun is uncountable. 'researches' can be used only as a verb with first person singular use: He researches the source for his paper. The teacher regularly researches for the lesson. https://grammarhow.com/researches/

As a second step to provide feedback, we can try to bring learners' attention to the appropriate use of the lexical item in an inductive manner. To this effect, a concordance list was prepared from an internet-based corpus with the use of the lexical item 'research' as a noun and as an adjective, as listed below:

The current research utilised strong research methods as it was observational. (N+V)

Research shows needle exchanges work against the spread of disease. (N+V)

Research chimps are trained to open their mouths for medical exams. (adjN+v)

MBF also supports health, conservation and marine research efforts. (adjN)

A concordance list for the term 'research' as a noun was also created using Lextutor (https://www.lextutor.ca/cgi-bin/conc/write/):

Table-7: Concordance list of the term 'research'

1.	the BBC's vision of our journalism is also based on	RESEARCH	about what our audience wants.
2.	such as VHAI are working to overcome these problems through	RESEARCH	and by strengthening channels of information.
3.	the development of Namibia's own cultural heritage through	RESEARCH	and comprehensive coverage of our people's artistic....
4.	Research and development give an indication of group	RESEARCH	and development activities, if any.

Through such illustrations, we hope learner attention would be drawn to appropriate use of lexical items through use of concordance corpus-based examples. From such examples, learners can extract the rules of appropriate usage and revise their text, as well as learn to use it appropriately in the future.

However, a word of caution for teachers: sometimes the software can generate the wrong output, as was found with the concordance list of 'research' as a noun with a plural form.

Table-8: Concordance list of wrong output with the term 'researches'

1 .	to reconsider.... Will you allow me to display your pre-war	RESEARCHES	and your drawings and your photographs? I was loo
2 .	diverse nature of the IT theses being covered by students'	RESEARCHES	meant that very small numbers of students were fr
3 .	seventeenth and eighteenth centuries, drawing largely on the	RESEARCHES	of a range of Soviet scholars, but particularly t

So, the syntactic rule that can be extracted from all the examples of concordances of the lexical item 'research' listed above is as follows:

- 'Research' as an adjective and noun can only be used in its singular form.
- if it is used as a verb, then the tense morphology will allow the use of present and past tense morphemes accordingly.
- so, the use of research as a third-person singular verb usage should not be confused with plural usage of the lexical item as a noun, which is not allowed in the language as research as a concept is uncountable.

From the incorrect concordance example above, we can draw teachers' attention to the importance of their discretion and intervention in the use of technology to provide DDL because the auto-generated output may result in listing examples of wrong usage. Thus, technology-driven feedback has to be motivated and complemented by teacher feedback.

Conclusion

The lexical estimates generated by Lextutor and presented above must be correctly interpreted by the writing

teacher to understand the level of writing knowledge of her learners, specifically their production vocabulary. This would help in evaluating the learners and placing them on a particular band of performance (CEFR, 2020) and checking the amount of heterogeneity in group performance. Furthermore, by gaining access to this kind of analysis from the Lextutor, teachers can encourage learners to increase their TTR instead of merely increasing text length (Cobb, 2004). Alongside this, the teacher can advise learners to use a higher range of academic words and phrases to increase the lexical quality or diversity in their writing. Furthermore, concordance analysis and illustrations can be designed to make learners pay attention to the use of lexical items in different syntactic contexts and improve content and coherence in writing. Future research can showcase the viability of using Lexical Tutor as a feedback and assessment tool in a long-term setting. The study provides a tangible illustration of the recommendations of NEP (2020) to use technology in the realm of teaching and assessment with a specific focus on lexical development. The paper also provides a sustainable and equitable model for assessment and self-assessment, which can be taken forward by future researchers.

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Research Article

Evolving Trends in Computer Availability in Indian Schools and Households: A State-Level Comparative Study

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Abstract

The education system across the world has undergone major transformations in the technological domain of knowledge. As a result, computer education, in its own way, has managed to make a permanent place for itself in our daily life and education sector. Yet, our schools, mainly government schools, are not well-equipped in terms of infrastructure facilities. The present study focuses its analysis on access and use of computers and internet facilities in schools and households of India using various data sources such as District Information System on Education (DISE) 2014-15, 2021-22 and 71st and 75th rounds of National Sample Survey (NSS) data. This study tries to capture the spatial pattern of the use of computers in schools and households across the country. As per DISE 2014-15, only 26.4 per cent of schools in India had computers, which increased to 47.51 per cent in 2021-22. Out of this, about two-fifths of them were found non-functional. The possession of any type of computer and internet connection by households in India has also been found to be very low. In rural India, only 6 per cent of households had any type of computer, and 16 per cent had internet connections, as per 71st round of NSS data. The conditions in urban areas are better than those in rural areas. Variations were found at the level of gender and location, i.e. rural-urban. The proportion of urban males (aged 14 years and above) with the ability to use computers for various purposes is more than three times of their rural counterparts. In rural areas, the proportion of females are almost half of that of males for different types of abilities to use computers. Apart from this, regional variations have also been observed regarding the ability to use computers for various purposes.

Keywords: Use of Computers, Internet, Elementary school, Household, Spatial pattern of use of ICT.

Introduction

The use of computers and the internet is growing day by day at high speed. Almost all businesses, companies, and schools use computers for various official operations. The IT sector at the global and national levels has generated massive employment in the past and continues the trend of providing jobs. With online shopping, social media and cloud computing flourishing more than ever before, there is great demand for IT professionals in e-commerce and business. The majority of the employment is in the organized sector. Southern states, including Maharashtra account for 73 per cent of all jobs in computers and its related activities (NSS, 2009-10). The internet industry in India is likely to double to reach US$ 250 billion by 2020, growing to 7.5 per

cent of gross domestic product (GDP). The number of internet users in India is expected to reach 730 million by 2020, supported by the fast adoption of digital technology, according to a report by the National Association of Software and Services Companies (NASSCOM, 2012).

National Policy on Information and Communication Technology (ICT) in School Education (2012), Department of Education and Literacy, MHRD, Govt. of India had a mission to devise, catalyse and sustain ICT and ICT-enable activities and processes in order to improve access, quality and efficiency in the school system. Its goal is to create an environment to develop a community knowledgeable about ICT.

Objectives

- With the growing industry of computers and its related activities, are Indian schools, particularly elementary schools and households equipped with computers adequately?
- Is the common population able to operate computers comfortably with ease?

Database

The secondary databases used for the study are: District Information System on Education (DISE), 2014-15 and 2021-21 and National Sample Survey Report No. 575 (2015). These are the data sources used widely across the country. It also helps in getting the trend in the use of computers and provides a larger perspective with data under various heads, i.e. school-level, household-level, gender and location.

Literature review

Sinha et al. (2020), in their paper, conducted a comparative study among five government schools in urban areas and five rural schools located in the Ranchi district of Jharkhand, India. The objective of their study is to highlight the effectiveness of computer learning among school-going teenagers, with the help of various statistical analyses such as student t-test, fisher-exact test, and chi-square test. They observed differences in attitude, awareness, and effectiveness of computer education among boys and girls ranging from 11 to 17 years of age group. The results of the study showed that most of the students achieved basic computer knowledge at the age of 13 years. However, it was observed that girls achieved basic computer education better than boys, but boys achieved advanced computers much better than girls. This situation dramatically changed as both boys and girls registered low scores on computer studies as they had to assist their parents in the family earnings and work. Moreover, the study depicted that there is a huge gap between governmental recommendations and advertisements on the one hand and the growth of computer education in our country on the other.

A significant difference in interest towards computer education between the teachers of rural and urban areas was stated by Gupta and Patel (2016). A significant difference was also observed between the students of rural and urban areas towards computer education, in which the interest of the students of urban areas was more significant.

The role of computer and information technology in the field of education and how it makes teaching-learning processes enjoyable to readers has been discussed by Dabas, N. (2018). She also made a sharp demarcation between classroom teaching guided by computers in earlier days and today's computer education system. This paper presents that computers and their related techniques have completely

changed our present quality of education and become an indispensable part of our lives. Distance learning, online examination, monitoring, and computer-aided learning are some of the benefits of computers in Education. Nonetheless, computer and information technology not only provide successful learning programs but also increase the retention capacity of students.

Kumar and Kumar (2020), on the basis of their study, say that computers are mostly used by students and teachers in universities, libraries and other academic pursuits, with the majority of respondents being men, indicating gender discrimination, which still needs further improvement. The majority of the male respondents used a computer every day compared to female respondents. The study recommends that the university authority needs to provide a congenial environment for female respondents by providing free hostel facilities on the campus for the optimum use of computers and other ICT facilities. Most of the respondents have a highly positive attitude towards the use of computers. In this context, it is suggested that the concerned university authorities need to provide more computer facilities with Internet connections and ICT-based learning programmes to the students and faculty members so as to enhance their academic activities.

Raja and Naga Subramaniumi (2018) say technology has a positive impact on education and at the same time may also pose negative effects. Teachers and students should take advantage of this in a good light and eliminate the drawbacks which are pulling back many students as well as schools from achieving excellence. It is thus time for every country to introduce a more technologically equipped education sector in the future.

Upadhyay, P. (2016), in his paper, surveys the research work done on the theme: the advent of information and communication technology at the school level in the contemporary period as well as the effectiveness of information and communication technology at the primary level in the Indian context. With the help of many references, he shows that ICT brings benefits to the teaching-learning style and provides rich educational materials for students, teachers, and schools. He revealed that despite the immense importance of ICT in teaching-learning processes, India faces major drawbacks whether in terms of access to ICT facilities or capabilities of teachers, and infrastructural facilities at schools. He reported that even after launching two educational programs such as 'Gyanvani' and 'Gyandarshan' for students from primary to university levels, the adaptation of modern techniques in teaching-learning processes is a big question in India. He used the dataset from 1984-85 to 2007 to assess the quality of learning aided by ICT in various Indian states and thereby concluded that although the government has invested millions of rupees in strengthening computer-aided learning, most of the schools are lagging behind in achieving the target. To ameliorate this adverse situation, he urged modification in teaching skills and responsibilities of schools to enhance the successful implementation of ICT in schools.

Yadavet al., (2016) in their paper documented the challenges and experiences encountered by computer science teachers of the USA in their schools to meet the growing demand for computer science education. Not only in the United States of America, the push for introducing computer science education is a common phenomenon even in the curriculum of primary and secondary classes all across the

world. They selected twenty-four high schools from across the United States of America to understand the challenges faced by computer science teachers in their classrooms. They interviewed 24 teachers with the help of a questionnaire to address the challenges. They arranged the interviews to put it to qualitative analysis software called Dedoose, which generates 58 codes from the raw data. The codes were broadly divided into eight conceptual themes and then categorized into three classes: all-embracing challenges, professional needs, and factors affecting teaching in a computer science classroom. The study suggests that computer science teachers should indulge themselves in community teaching, which develops habits of practice teaching with each other and provides opportunities to reflect on their thinking as well as gain pedagogical perspectives.

The importance of ICT integration to support teaching-learning processes in schools of Malaysia was described by Ghavifekr, S., and Rosdy, W. A. W. (2015). The main aim of their study is to analyze the effectiveness of ICT integration for both teachers and students through teachers' perceptions. Random sampling was done with the help of a survey questionnaire from ten public secondary schools in Kuala Lumpur, Malaysia. Raw data were obtained from 101 teachers and a quantitative method was followed for this research. The data were analyzed using SPSS software for both descriptive and inferential statistics. The results show that professional training programs for teachers played a key role in enhancing quality learning among the students and also helped in strategic planning and educational policymaking for the country.

Methodology

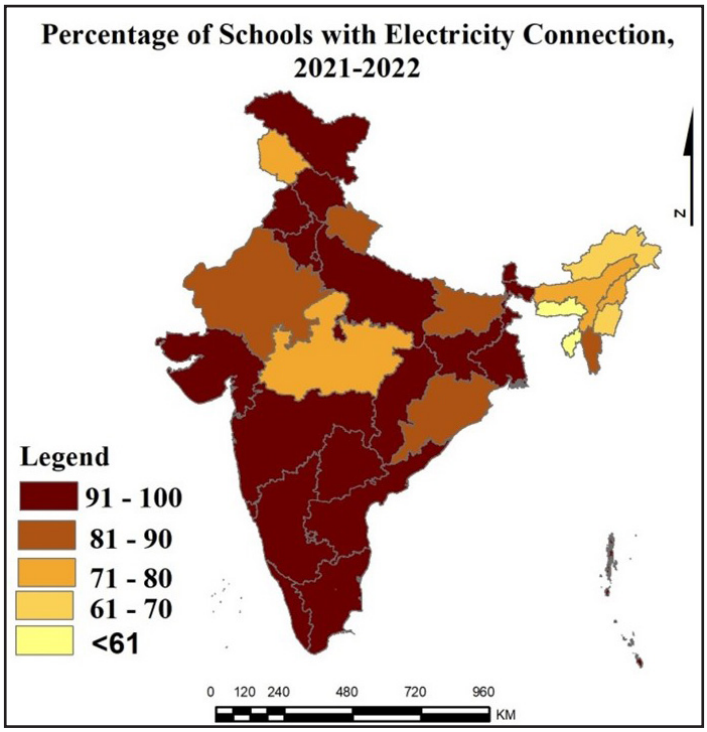
In the present study, both qualitative and quantitative works have been done in this study. This comprehensive study is descriptive in nature, encompassing all the relevant facts and figures based on secondary data sources. Some graphical representations have also been used to represent the data more meaningfully.

Analysis

Electricity in schools in India

The use of ICT has some prerequisites, and the availability of electricity is one of them. So, apart from being an essential part of our day-to-day life, electricity is required as the basic infrastructure for running electrical equipment and, here, computers. But, all the schools in India do not have the provision of electricity. In India, only 60 per cent of schools had electricity in 2014-15. Some states performed poorly, and some states had a percentage more than the national average. Some of the northern states like Jharkhand, Assam, Bihar, Jammu & Kashmir (J&K), Madhya Pradesh (M.P.), Odisha, Uttar Pradesh (U.P.), Rajasthan and West Bengal had figures below the national average. Jharkhand and Assam had figures below 20 per cent. Some states/UTs, like Kerala, Karnataka, Gujarat, Punjab, Chandigarh and Delhi, had more than 90 per cent of schools with electricity connections. The situation improved by 2021-22 (as seen in Fig-1), with the majority of the states and UTs of India having more than 80 per cent of schools having electricity. The national average was found to be 89.34 per cent. The northeastern states and some of the states/UTs like M.P and J&K still had many schools with no electricity connection.

Fig.-1 (Source: UDISE 2021-22)

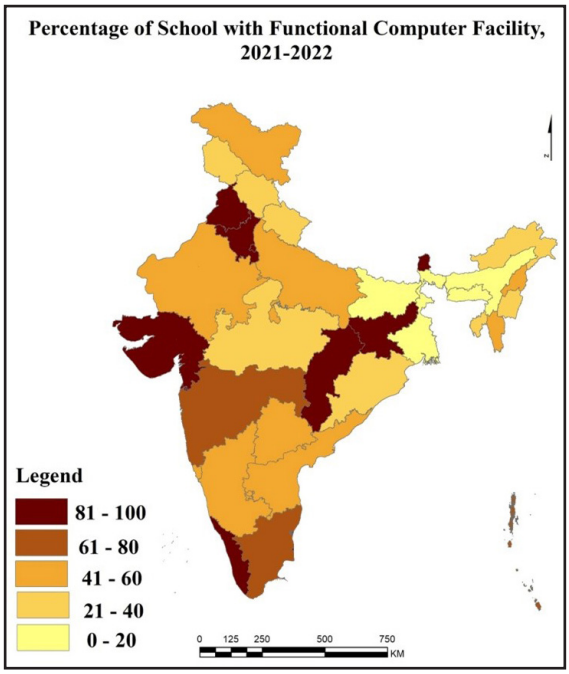


Availability of computers (and functional computers) and Internet in schools

The use of computers has become a part of the curriculum in the school system of India. It not only helps generate the required skills among the students for using computers, but it also helps in incorporating ICT into pedagogy in teaching-learning practices. NEP 2020 also suggests adequate use of computers in teaching-learning at various stages of education (NEP 2020). UDISE+ (Unified District Information System for Education Plus) reports of 2014-15 and 2020-21 show that in India, the percentage of computer facilities available in schools was 25.2 per cent in the year 2014-15, which increased to 41.25 per cent in 2020-21. There were spatial variations, with some of the southern and western states/UTs like Gujarat, Kerala, Tamil Nadu, etc. having higher percentages of computer availability. On the other hand, northern states and northeastern states performed poorly.

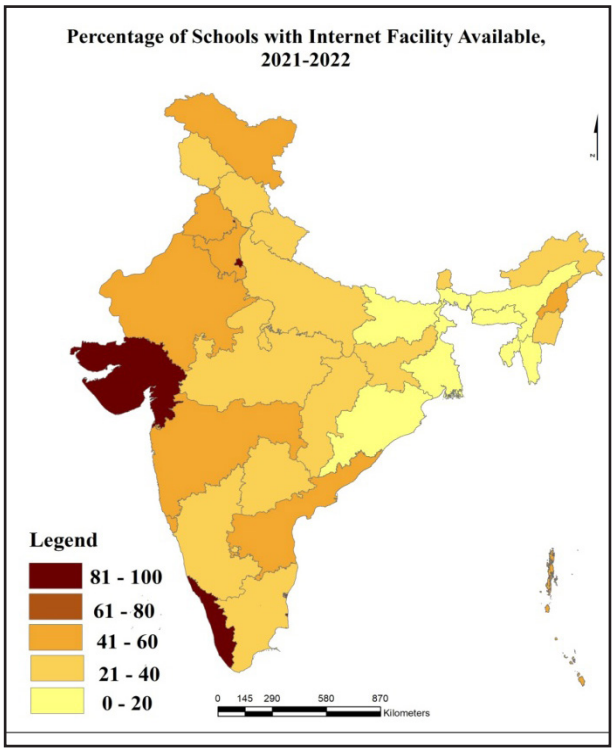
Apart from the availability of electricity and computers, it is also important to have functional computers available for use by learners. UDISE reports of 2014-15 and 2020-21 show that in the majority of the states/UTs, a large percentage of schools did not have functional computers. Some larger states like Chhattisgarh, Jharkhand and Rajasthan were found to have improved their conditions from 2014-15 to 2020-21. The figures for the year 2021-22 (Fig.-2) still show that except Kerala, Punjab, Haryana, Gujarat, Chhattisgarh, Jharkhand and Sikkim that had more than 80 per cent schools with functional computers, the majority of the states/UTs performed poorly in this parameter as against the national average of 95.25 per cent.

Fig.-2 (Source: UDISE 2021-22)



All these figures point out the poor maintenance of computers and their use at school, even if their availability is there as an infrastructure. Even though the schools now have made computers available as an infrastructure, they are not available for use in the teaching-learning process.

Fig.-3 (Source: UDISE 2021-22)



The Availability of the Internet at schools can be considered as another indicator to determine the level of use of ICT in schools. As fig-3 shows, barring Delhi, Rajasthan and Kerala, the majority of the states/UTs of India average to have poor availability of internet facilities in schools. The national average was found to be around 33 per cent, meaning only this high percentage of schools had internet facilities in them. The western and southern states performed better than the eastern and northeastern states. Internet facilities not only ensure easy communication of the school as a unit with other organizations but also good connectivity within the school. It also helps in the use of internet for pedagogical use in teaching-learning.

Availability of Computers at the Household level

Apart from schools, the availability of computers at home for the use of households is also an important variable to determine the use of computers. As the data source (NSSO) shows, about 6.2 per cent of households had computers in their home in rural areas, which decreased to 4.4 per cent (a decline of 2.2 per cent) till the survey year of 2017-18. In the case of urban households, the percentage was 29.2 per cent which also decreased to 23.4 per cent, i.e. by about 5 per cent till the survey year 2017-18.

States like Chattisgarh, Odisha, Bihar, Jharkhand, West Bengal, Madhya Pradesh, Tripura, UP, Assam, Karnataka and Manipur had lower percentages of availability of computers in rural areas than that of the national average. On the other hand, states like Maharashtra, Tamil Nadu, Punjab, Himachal Pradesh, Puducherry, Daman & Diu, A & N Islands, Nagaland, Sikkim, Mizoram, Kerala, Delhi, Chandigarh, Lakshadweep and Goa had a higher percentage in rural areas than the national average.

It must be noted here that the report does not capture the availability of smartphones and other handheld devices.

Availability of Internet facilities at the Household level- Rural

The availability of the internet is related to the use of computers but makes an important aspect while assessing the use of ICT. The national average of internet access in households came to nearly 24 per cent till the survey year 2017-18. The figures were 15 per cent in the case of rural and 42 per cent among urban households. From the previous year, the decline in internet availability was noticed by 1.1 per cent and 6.7 per cent in rural and urban households, respectively.

Table-1: Households with internet facilities for different States of India

Range of categories (%)	Rural	Urban
< 40 Poor	Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Haryana, Jammu & Kashmir, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, West Bengal	Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, Odisha, Tamil Nadu, West Bengal

41-80 Average	Himachal Pradesh, Kerala	Assam, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Kerala, Maharashtra, Punjab, Rajasthan, Telangana, Uttarakhand, Uttar Pradesh
>80 Good	None	None
All India	14.9	42

(Source: NSSO 75th Round 2017-18)

The distribution of states/UTs as per the availability shows that the majority of the states in India had low, i.e. less than 40 per cent, availability of internet facilities in rural areas. Only two states namely, Himachal Pradesh and Kerala, had access to internet facilities in 41-80 per cent of households. However, households in urban areas had better access to internet facilities and northern as well as western states seemed to perform better (average level) as compared to other parts of the country. None of the states had more than 80 per cent of households with access to internet facilities. Details on tools used on computers and the internet are given in the tables given in the appendices.

Conclusion

In the present times, when the world and even the Indian government are working extensively for digital transformation, many schools and households of India are still deprived of basic infrastructural facilities like availability of computers and internet facilities. It is important here to note that the Samagra Shiksha scheme of the Government of India, launched in 2018, ensures the availability and use of ICT-related infrastructure in schools. This scheme is an integrated scheme for school education covering all the stages, i.e. from pre-school to class XII. The scheme treats school education as a continuum and is also in accordance with **the Sustainable Development Goal for Education (SDG-4).** The scheme provides support for the implementation of the Right of Children to Free and Compulsory Education Act, 2009 (RTE). Along with this, it has also been aligned with the recommendations of **National Education Policy (NEP) 2020**. The ICT and Digital Initiatives component of Samagra Shiksha covers all the Government and Aided Schools having classes VI to XII. Under this component, financial assistance is provided for establishing ICT labs and Smart Classrooms in schools. The non-recurring and recurring grants under 'ICT and Digital Initiatives' are available to the States and UTs for proper implementation of this scheme.

Despite such schemes launched by the government, though the availability of computers in schools all across India has increased, the availability of functional computers is another point of concern. There seem to be large variations in the availability of these facilities across the country at various levels. Internet access at school was also found to be below 60 per cent of schools in most parts of the country. Variations were also found at the state and UT levels, where western and southern states seem to perform better than some of the northern and eastern states. Similarly, access to computer and internet facilities at the household level was poor in most parts of the country. As compared to the schools, the performance of households was poorer in the availability of the two ICT-related infrastructures. The schemes (Samagra Shiksha and schemes prior to this) launched by the government to ensure ICT facilities at schools can be the reason behind this.

The IT and ITE sector has generated massive employment in the past and continues to provide jobs. However, the percentage of properly functional computers, even at schools in some of the states of the country, is as low as 40 per cent. There is a big gap between rural and urban households having computers and their knowledge of operation. Such situations pose a question mark on the efforts made at the level of formulation policy and program and at the stage of implementation. Infrastructures related to computer education in schools need an enhancement in the present, times for which the availability of basic infrastructures related to that is a prerequisite. Basic knowledge of computers of common people also needs to be enhanced- at the household level.

These pose a few questions: Having such variations in the availability of computer-related infrastructures at the school and household level, how does India aim to bring digital revolution and transformation in society? What sort of impact have campaigns like Digital India made on the availability of infrastructure related to computer education? Whether the availability of computers in households should also take into consideration the availability of handheld devices like smartphones and tablets? The present study, therefore, generates these questions, which can be further analysed.

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Appendices

Table-1: Persons aged 14 and above having knowledge of Word, Search and Email (Rural & Urban)

States/UTs	Rural			Urban			Total		
	Word	Search	Email	Word	Search	Email	Word	Search	Email
Andhra Pradesh	7.3	6.7	6.3	25.6	24.7	23.5	13.2	12.5	11.8
Arunachal Pradesh	11.8	10.8	9.5	28.4	25.1	23.2	14.5	13.2	11.8
Assam	6.1	5.6	4.6	28.6	27.3	26	9.1	8.4	7.4
Bihar	3.3	3.5	3.3	19.1	19.3	17.3	5.1	5.3	4.9
Chattisgarh	2.5	2.2	1.8	17.8	17.2	15.5	5.5	5.1	4.5
Delhi	27.3	28.2	26.8	39.8	40.1	39.3	39.4	39.7	38.9
Goa	34.5	28.9	26	40	34.8	32.5	37.7	32.4	29.9
Gujarat	10.3	8.6	7.9	29.2	26.1	24.3	18	15.8	14.6
Haryana	12.1	11.1	8.7	33.4	31.3	29	19.2	17.8	15.4
Himachal Pradesh	18.3	17.3	15.9	39.6	38.4	37.9	20.6	19.6	18.3
Jammu & Kashmir	8	8.6	6.5	23.6	24.6	21.7	11.3	12	9.7
Jharkhand	4	3.8	3.4	21.8	21.8	20.4	7.9	7.8	7.1
Karnataka	9.1	7.7	6.8	31.4	29.4	28	17.8	16.1	15
Kerala	29	25.3	22.7	37.9	34.2	32.5	33	29.3	27.2
Madhya Pradesh	41	4.1	3.6	23.5	24.1	21.7	9.5	9.7	8.6
Maharashtra	11.4	10.9	10.3	34.6	35.1	33.1	21.7	21.6	20.4
Manipur	4.6	6.6	4.7	8.6	12.9	9.6	5.9	8.6	6.3
Meghalaya	11.9	9.2	5.2	41.3	37.4	33.1	17.2	14.3	10.3
Mizoram	21.4	14.6	11.1	35.9	28.6	24.1	28.2	21.2	17.2
Nagaland	39.8	34.6	37	48.3	44.7	43.7	41.8	37	38.6
Odisha	4.5	4.3	4.2	21.4	21.2	19.6	7.5	7.3	6.9
Punjab	14.4	12.7	11.2	32.7	31.3	29.2	21.2	19.6	17.9
Rajasthan	8.3	8.1	7.1	24.7	24	21.1	12.8	12.5	11
Sikkim	19	19.1	19	45.4	47.1	46.3	24.2	24.7	24.4
Tamil Nadu	14.7	12.9	12	29.1	27.1	25.7	21.9	20	18.8
Telangana	8.7	8.7	8.5	28.8	27.6	27	16.3	15.9	15.5
Tripura	2.4	2.3	2.1	13.4	10.8	10.3	4.9	4.3	4
Uttar Pradesh	5	5.2	4.1	21.7	21.6	20.1	9	9.1	7.9
Uttarakhand	10	10.6	10	33.9	33.9	33.2	15.6	16.1	15.5
West Bengal	5.8	4.7	3.9	21.7	19.7	18	10.9	9.6	8.5
A & N Islands	14.6	12.1	11.3	27.9	22.6	19.2	19.6	16.1	14.3
Chandigarh	30.5	28.9	27.1	48.6	43.8	42.4	47.9	43.3	41.8

D & N Haveli	5.6	5	5	42.8	41.2	41.2	24.1	23	23
Daman & Diu	26.8	32.1	17.3	30.2	30.5	27.7	29.6	30.8	25.7
Lakshadweep	32	32.5	26.3	39.5	36.5	36.3	37.9	35.7	34.2
Puducherry	32.8	34.5	31.4	33.3	33.1	31.4	33.1	33.5	31.4
India	7.8	7.3	6.5	28.1	27.1	25.4	14.2	13.5	12.4

Source: NSS Report No. 575, 2016

Table-2: Persons aged 14 and above having knowledge of Word, Search and Email (Male & Female)

States/UTs	Male			Female		
	Word	Search	Email	Word	Search	Email
Andhra Pradesh	18.1	17.5	16.6	8.3	7.5	7
Arunachal Pradesh	18	16.2	14.5	10.6	9.8	8.6
Assam	11.3	10.4	9.6	6.6	6.2	5
Bihar	7.2	7.5	6.9	2.9	3	2.7
Chhattisgarh	7.4	7.2	6.3	3.6	2.9	2.7
Delhi	43.7	44.8	43.7	34	33.2	32.9
Goa	44	39.7	35.9	31.5	25.3	24
Gujarat	23.1	21.1	19.7	12.7	10.2	9.3
Haryana	23.1	22.5	20.1	15	12.8	10.5
Himachal Pradesh	25.5	24.4	23.2	15.8	15	13.6
Jammu & Kashmir	14.5	15.4	12.8	7.9	8.2	6.3
Jharkhand	11	10.9	9.9	4.7	4.4	4.1
Karnataka	22	20.6	19.4	13.7	11.7	10.7
Kerala	36.5	34.6	32.7	30	24.8	22.4
Madhya Pradesh	12.6	13	11.6	6.2	6.1	5.5
Maharashtra	26	26.7	25.1	17.1	16.4	15.5
Manipur	8.2	11.2	8.6	3.4	6	3.9
Meghalaya	18.1	15.9	11.4	16.4	12.8	9.3
Mizoram	30.7	23.4	19	25.8	19	15.4
Nagaland	48.4	45	44.1	35.4	29.2	33.3
Odisha	10	9.9	9.5	5	4.6	4.2
Punjab	25.4	24.1	22	16.5	14.5	13.2

Rajasthan	18.2	18	15.9	7.4	69	6
Sikkim	25.5	26.3	25.9	22.7	22.8	22.8
Tamil Nadu	25.9	24.5	23.4	18	15.7	14.5
Telangana	22.1	21.8	21.3	10.6	10	9.8
Tripura	6.6	5.9	5.6	3.3	2.6	2.4
Uttar Pradesh	11.7	12.1	10.4	6.1	5.8	5.2
Uttarakhand	21	21.7	20.7	9.9	10.1	9.9
West Bengal	13.7	12.4	11	8	6.7	5.9
A & N Islands	19.3	17.7	15.1	19.9	14.5	13.4
Chandigarh	51.2	48.2	46.4	43.6	36.8	35.8
D & N Haveli	28.2	27.8	27.8	19	16.8	16.8
Daman & Diu	30.5	32	27.7	27.9	28.7	22.1
Lakshadweep	47.2	44.6	43.8	27.8	25.9	23.7
Puducherry	39.1	40.7	37.6	27.3	26.6	25.4
India	17.7	17.3	16	10.6	9.5	8.7

Source: NSS Report No. 575, 2016

Research Article

Research Tales of Numbers: Enhancing Numeracy Skills through Digital Storytelling

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Abstract

The National Education Policy (NEP) 2020 emphasises the importance of foundational numeracy as a key component of early childhood education. The policy recognises that developing strong foundational numeracy skills is essential for building a strong foundation in mathematics and other disciplines and for preparing children for success in the 21st century. To achieve the goal of foundational numeracy we need that pedagogy, which is helpful in developing foundational skills among the learners in grade third. This paper focuses on such pedagogy which is helpful in teaching mathematics, i.e., digital storytelling. For this study, the methodology was a quasi-experimental design, which was conducted over 240 students in grade 3. The results of the control and experimental groups showed a significant difference at 0.5 level when the achievement of the two groups was compared. The results show that digital storytelling is effective in comparison to teaching mathematics in traditional ways.

Keywords: Digital Storytelling, Mathematics Competence, Foundational Numeracy

Introduction

Mathematics is a subject that often intimidates and confuses many students. It is abstract, complex, and, at times, difficult to grasp. However, with the advancement of technology, digital storytelling has emerged as an effective tool to enhance students' understanding of mathematical concepts. Digital storytelling refers to the use of multimedia tools, such as videos, animations, and images, to tell a story or convey information. It allows students to visualize and experience abstract mathematical concepts in a more concrete and engaging way, which leads to a better understanding and retention of the subject matter.

Competence-based learning (CBL) is an educational approach that focuses on developing students' skills and abilities through practical and hands-on experiences. It emphasizes the application of knowledge and the acquisition of competencies that are relevant to real-life situations. In this context, digital storytelling can play a crucial role in facilitating CBL by providing students with a dynamic and interactive learning experience. By using digital storytelling, educators can create a more immersive and personalized learning environment that encourages students to engage with mathematical concepts in a meaningful way.

Moreover, digital storytelling has been shown to be effective in promoting student engagement and motivation, which are critical factors in enhancing learning outcomes.

Fundamental Numeracy

The National Education Policy (NEP) 2020 emphasizes the importance of developing fundamental numeracy skills among students. The NEP 2020 recognizes the importance of fundamental numeracy skills for students and proposes a range of strategies to ensure that all students have the opportunity to develop these skills. By focusing on experiential and activity-based learning, integration of numeracy across different subjects, and the use of technology, the NEP 2020 aims to provide students with the tools and skills they need to succeed in the 21st century.

The NEP 2020 proposes the integration of numeracy across different subjects, including language, social sciences, and sciences. This approach can help students develop a deeper understanding of the relevance and application of mathematical concepts in different contexts. The NEP 2020 recognizes the potential of technology in education and proposes the use of technology to enhance the teaching and learning of numeracy skills. This can include the use of educational apps, games, and other digital tools that provide students with engaging and interactive ways to practice and develop their numeracy skills.

Digital Story

A digital story is a type of storytelling that combines various multimedia elements, such as images, video, audio, and text, to create a narrative. Digital Storytelling Association (2002) elaborates on digital storytelling as "the modern expression of the ancient art of storytelling using digital media to create media-rich stories to tell, to share, and to preserve. Digital stories derive their power through weaving images, music, narrative, and voice together, thereby giving deep dimension and vivid colour to characters, situations, and insights." It is a form of digital media that allows individuals or groups to share personal stories, experiences, and perspectives in a creative and engaging way. Digital stories can be used to communicate ideas, promote awareness, entertain, or educate audiences. They can be created using a wide range of digital tools and software, such as video editing software, animation software, and online platforms that offer templates for creating digital stories.

Digital stories can be shared on social media, websites, or other digital platforms, allowing them to reach a wider audience and potentially make a greater impact. They offer a unique way to tell stories and share experiences that can be more engaging and immersive than traditional forms of storytelling.

Digital Storytelling in Mathematics at Primary Stages

Digital storytelling can play a significant role in the development of mathematical competencies by creating engaging and interactive learning experiences that promote understanding, problem-solving, and critical thinking. Here are a few ways in which digital storytelling can support the development of mathematical competencies:

1. **Visual representation:** Digital storytelling allows for the use of images, animations, and videos to create visual representations of mathematical concepts. This can help learners to understand abstract concepts, visualize problems and solutions, and make connections between different mathematical concepts.
2. **Interactivity:** Digital storytelling can make learning more interactive by incorporating quizzes, games, and other activities that allow learners to apply their mathematical

knowledge and skills in a fun and engaging way. This can help to develop problem-solving skills and critical thinking.

3. **Personalization:** Digital storytelling can be personalized to the needs and interests of individual learners by incorporating real-world examples and scenarios that are relevant to their lives. This can help to increase engagement and motivation and promote deeper learning.
4. **Collaboration:** Digital storytelling can promote collaboration and communication among learners by allowing them to share their work, give and receive feedback, and work together on projects. This can help to develop communication and teamwork skills, as well as support social and emotional learning.

Digital Storytelling, thus, can be a powerful tool in the development of mathematical competencies by creating engaging and interactive learning experiences that promote understanding, problem-solving, and critical thinking.

Significance of storytelling in the teaching

Digital storytelling can be helpful in developing fundamental numeracy by providing an engaging and interactive way for students to learn and practice basic mathematical concepts. Here are some ways in which digital storytelling can help develop fundamental numeracy:

- **Making Mathematics Engaging:** Digital storytelling can make mathematics more engaging by incorporating visual elements, audio, and interactive elements that capture the attention and interest of students.
- **Contextualizing Mathematical Concepts:** Digital storytelling can contextualize mathematical concepts by presenting them in real-world situations, helping students understand how math is used in everyday life.
- **Developing Number Sense:** Digital storytelling can help students develop number sense by presenting numerical information in a variety of formats, such as graphs, charts, and tables, and allowing them to interact with the information.
- **Promoting Problem-Solving:** Digital storytelling can promote problem-solving skills by requiring students to solve math problems as part of the storytelling process or by presenting them with math-related challenges that they need to overcome to complete the story.
- **Enhancing Communication Skills:** Digital storytelling can enhance communication skills by requiring students to effectively communicate mathematical concepts in a clear and concise manner as part of the storytelling process.

Digital storytelling can be an effective tool for developing fundamental numeracy by making math more engaging, contextualized, and interactive and by promoting problem-solving and communication skills.

Literature Review

Digital storytelling in mathematics is an emerging area of research that aims to enhance students' engagement and learning outcomes by using digital tools to create and share stories related to mathematical concepts. Some recent research in this field includes "Digital Storytelling: A Meaningful Technology-integrated Approach for Engaged Student Learning " by Alaa Sadik (2008),

which found that digital storytelling can improve students' engagement and achievement in mathematics, particularly for students with lower prior achievement. According to Robin and Pierson (2005), the act of creating meaningful stories has improved the experience for both students and teachers. Digital storytelling has grabbed both students' and teachers' imaginations. According to Robin (2005), educators can utilise digital storytelling in a variety of ways to assist students' learning by encouraging them to organise and express their thoughts and knowledge in a unique and meaningful manner. "Digital Storytelling as a new meaningful teaching/learning strategy for mathematics and geometry. " By Corrado P. et. al. (2013), which explored the use of digital storytelling to promote students' understanding of geometric transformations found that students were more engaged and had a better conceptual understanding of the topic. "Digital storytelling to support mathematics learning in the Early Years" by Ulutas, I. et al. (2022). which investigated the use of digital storytelling to support young children's mathematical learning and found that it was effective in promoting their interest in mathematics and improving their mathematical skills. These studies suggest that digital storytelling can be an effective tool for enhancing students' engagement and understanding of mathematical concepts. Digital storytelling in mathematics is an emerging field of research in India, with a growing number of studies exploring its potential to enhance students' engagement and learning outcomes. Some recent research in this field includes: " The Effectiveness of Digital Storytelling in the lCassrooms: a comprehensive study" by Smeda et al. (2014), The results of this study indicate that digital storytelling is a potent tool for fusing instructional messages with educational activities to make learning environments more fascinating and engaging. It is an effective strategy for developing a constructivist learning environment based on cutting-edge teaching and learning ideas. As a result, this strategy could improve student engagement and give students better educational results. "Enhancing Teaching-Learning of Mathematics among Grade II Children Using Storytelling Strategy" Singh and Gandhi (2020), which investigated Storytelling proved to be an appropriate strategy for this involvement Storytelling helped the intern-teacher in solving the problem of low participation in the mathematics classroom. Bohara, P.S (2023), in his study "Incorporating Digital Storytelling in Secondary Mathematics for Engaged Learning; A Collaborative Action Research Study", which was conducted on secondary school students, found out that using digital storytelling in their pedagogy enhances the engagement of the learners in three aspects emotional, behavioural, and cognitive that the story, besides providing a meaningful context to the children, helped to break the teacher-student barrier. Digital storytelling and multimodal design were unfamiliar concepts to the group of preservice teachers, who saw them as novel approaches. They saw digital storytelling as a method and strategy for promoting "Student voice" and participatory knowledge creation.

These studies suggest that digital storytelling has the potential to be an effective tool for enhancing mathematics education in India, and further research is needed to explore its potential in different educational settings and contexts.

Rationale of the Study

Our educational system is struggling with a number of ways to measure the advancement of technology in education to its standard level. We are in the age of digitalization, so our students are able to gather information from a

variety of sources. So that they are able to assess it, analyse it and collaborate with others.

Integrating ICT in education has opened a number of doors for the teachers as well as for the learners. At primary stages ICT has evolved around child-centred pedagogies. Teaching through using ICT has made learning more interesting and innovative. By using ICT tools, teachers are able to develop mathematics competence among the learners. Teachers' determination to succeed is the result of their mastery of mathematics subject, pedagogy, and technological integration, as well as their awareness of research findings.

Digital storytelling is one of the ways of teaching mathematics, which is helpful for teaching mathematics concepts till the primary stages. Through digital storytelling, the learners learn pre-number concepts, mathematics operations, shapes and measurements quickly. The researcher identified very few studies relating to the use of digital storytelling as a competence-based methodology in mathematics. There is a need for more explanation about this field. The Present study sought to determine how digital storytelling affects mathematics competence among primary-stage learners.

Title of the study:

Tales of Numbers: Enhancing Numeracy Skills through Digital Storytelling

Objectives of the Study

1. To find out the impact of digital stories telling in teaching on the student's achievement in mathematics
2. To compare the achievement of experimental groups and control groups in mathematics.

Hypothesis of the Study

1. There exists no significant impact of digital storytelling on the student's achievement in mathematics.
2. There exists no significant difference between digital storytelling and traditional teaching methods on students' achievement in mathematics

Operational Definition

Digital storytelling: It is a modern and multimedia-based form of storytelling that combines traditional storytelling techniques with various digital media elements. involving the creation and presentation of narratives using digital tools and technologies such as text, images, audio, video, animations, and interactive elements**.**

Mathematical competence: This refers to a learner's ability to understand, use, and apply mathematical concepts and skills effectively in various real-world contexts

Methodology

Description of digital storytelling

This is a case study of primary schools of Jamia Millia Islamia New Delhi. This was based on the basic mathematics learning in grade three students for this experiment some stories were developed, which were narrated to students. These stories were presented to control groups and experimental groups as well. To the experimental group, the same story was shown digitally using videos or showing slides. These stories were based on mathematics operations (addition, subtraction, multiplication and division) of two/three digits.

Some Ideas for Digital Stories in Mathematics for Primary Students:

Counting Adventures: A digital story

that takes students on a journey of counting adventures, where they count different objects such as animals, fruits, and shapes. The story can incorporate interactive elements that allow students to count along with the story and practice their counting skills.

Time-Telling Tales: A digital story that teaches students how they can tell time. The story can feature characters who have different activities throughout the day, and students can help them tell time by adjusting their hands on a clock.

Geometry Quest: A digital story that explores geometric shapes and their properties. The story can feature a character who is on a quest to find different shapes in their environment, such as circles, squares, and triangles.

Measurement Mayhem: A digital story that introduces students to the concept of measurement. The story can feature a character who needs to measure different objects to complete a task, such as baking a cake or building a treehouse.

Problem-Solving Stories: Digital stories that present students with math-related problems to solve, such as figuring out how many apples are left after some have been eaten or how to divide up a set of objects among a group of people. The stories can incorporate interactive elements that allow students to work through the problems and find solutions

Sample

The study was piloted on a sample of 240 students studying Jamia Schools. These students were divided into two groups; one group was kept as a control group, and the other group was treated as an experimental group.

Tool used: Various Tools chosen and used by the investigators are given below:

- Mathematics Achievement Test developed by Researcher
- Digital story adapted from various sources

Execution of the Experiment & Data Collection

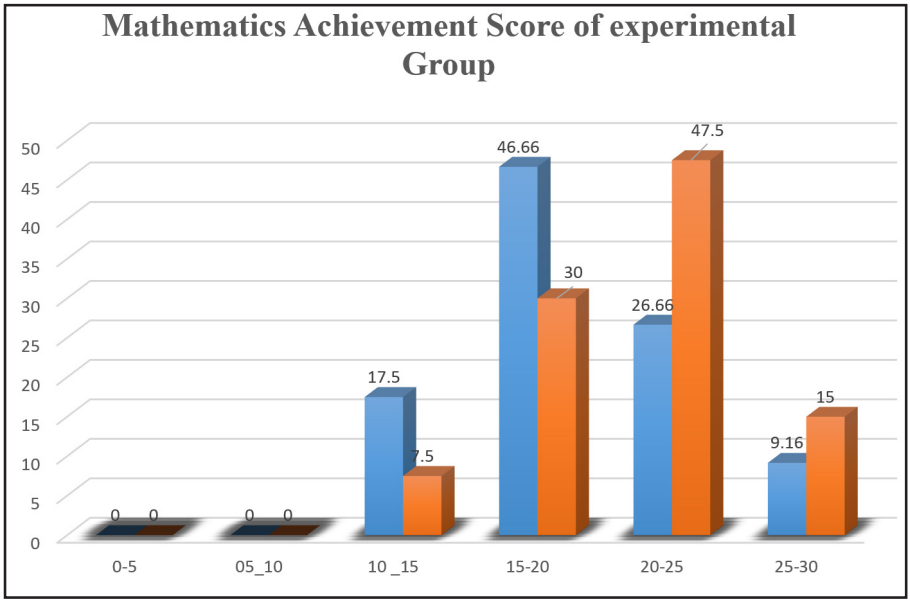
Execution of the experiment and data collection for this study took three weeks. Before the experiment, a pre-test was administered to check the previous concepts of students related to basic mathematics operations (addition, subtraction, multiplication and division) and also to know the use of mathematics in their daily life. Achievement tests were prepared to keep the mathematics competence needed at grade 3. The experiment was conducted by the investigator himself and some D.El.Ed. trainee doing their teaching practices.

Table-1: Mathematics Achievement Score of Control and Experimental Group

Class interval Pre-test		Mathematics achievement of control group		Mathematics achievement of experimental group	
		Post-test	Pre-test	Post-test	
1.	0-5	0	0	0	0
2.	5-10	1	0	0	0
3.	10-15	35	21	26	9
4.	15-20	53	55	56	36
5.	20-25	19	29	27	57
6.	25-30	12	15	11	18

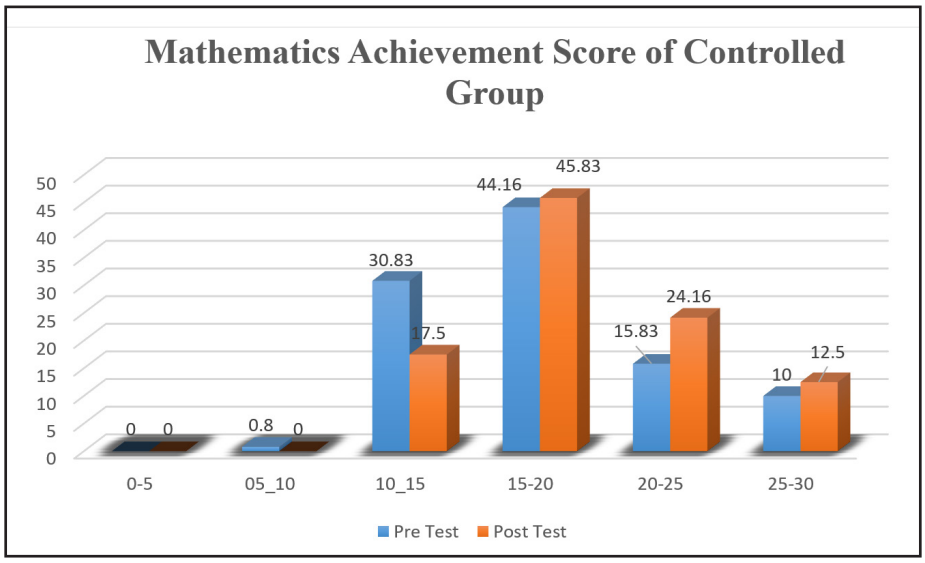
On the basis of the test score(Pre and Post) of controlled and experimental groups, we can say digital storytelling is useful. These results predict that if teachers use digital storytelling in their classrooms, then it is more effective than other traditional ways of storytelling.

Figure-1: Mathematics Achievement Score of Controlled Group



Achievement scores of the controlled group show that when teachers taught traditional ways or by storytelling verbally then the achievement of the students did not rise significantly. But some changes were seen in group 20-25 and other groups remained almost the same.

Figure 2: Mathematics Achievement Score of experimental Group



By the graph, when we compare students' scores of pre and post-tests then we observe decrease in groups 10-15 and 15-20, and the scores rise

in groups 20-25 and 25-30. Most of the students who were in groups 15-20 shifted to the group. The maximum distribution, i.e. 47.5 per cent was observed in group 20-25.

Table-2: t-Value of Pre- Mathematics scores of controlled and experimental groups

	M	N	Std. Deviation	Std. Error Mean	t-value
CONTROL	18.57	120	4.883	.446	.991 Insignificant at (0.5 and 0.1)
EXPERIMENTAL	18.28	120	4.777	.436	

Comparing Mean, Standard Deviation

The two groups (control group and experimental group) selected for the experiment and control are approximately equivalent. The mean of achievement tests of the control group and experiment group are nearly same.

Table-3: t-Value of Post- Mathematics scores of controlled and experimental groups

	M	N	Std. Deviation	Std. Error Mean	t-value
CONTROL	18.67	120	4.882	.445	3.252* Significant at (0.5 and 0.1)
EXPERIMENTAL	21.29	120	4.399	.401	

Comparing Mean, Standard Deviation

Table-4: Comparing Means of Experimental and Control Group

Summary of ANCOVA				
	Sum of Squares	df	Mean Square	F-ratio
Between Groups	1725.256	21	82.155	13.941
Within Groups	577.536	98	5.893	

Students of the experiment group showed significant improvement in post-score (after treatment) the t-value calculated comparing two groups was 3.252, which is significant at 0.5. This shows the difference between the means of control and the experimental group. and ANCOVA is a statistical technique used to compare means of two or more groups while controlling for the influence of one or more continuous covariates. This is a test statistic that measures the ratio of the variability between groups to the variability within groups. It's used to determine if there are significant differences between the group means. The F-statistic is 13.941, which is significant at 0.05. This result shows that the experimental group achieved higher scores than the control group. Thus, H01 rejected the idea that teaching mathematics by using

digital storytelling is more effective than teaching by traditional ways or telling stories orally at grade 3. In this method, the audio-visual senses of students Participate in learning and so they see and listen to the situation so the learning is effective. These results are supported by McLaren, Adams, Mayer, and Forlizzi (2017), who found a favourable correlation between ICT use and math achievement. ICT improved kids' learning, critical thinking, and math proficiency, according to the study's findings Istenic Starčič, A., Cotic, M., Solomonides, I., & Volk, M. (2016). Albano, G., & Pierri, A. (2017) "perceived digital storytelling as a strategy meant for empowering the student's voice and active construction of knowledge". Thus, we can say digital storytelling in mathematics in primary classes is an effective way of teaching mathematics and developing competence, which is required in the 21st century.

Conclusion

Early numeracy skills are crucial for learning because this not only provides the groundwork for future academic success but also for a person's quality of life, well-being, and economic prosperity. Children who have strong numeracy skills are better able to learn, explore, reason, and create, as well as participate in society on a social, cultural, and economic level. So, the goal of teaching children fundamental numeracy is to help them develop into independent, enthusiastic readers and writers who can move from "learning to read" to "reading to learn" and from "learning to write" to "writing for academic achievement and pleasure." Youngsters show an awareness of numbers and mathematical concepts, establish connections between ideas, and gradually apply what they have learned. This is only possible as per the demand of the 21st century, i.e., using technology and the interest of the learners together.

In this study, digital storytelling was found to be significantly different from traditional storytelling in a t-test; it suggests that the two methods of storytelling are not equivalent in terms of their impact or effectiveness. So, meeting the demand for digital storytelling should be used as a methodology to achieve the target of foundational numeracy.

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Research Article

The Impact of Digital Gaming Experience on the Self-Concept of Students of Delhi NCR

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Abstract

Children start to comprehend the universe at birth and eventually come to realize their own existence. They gradually establish their self-concept as they engage with their environment and start to identify who they are. Technological advancements have led to a rapid increase in the popularity of playing games on digital devices that offer a virtual space for users to interact through virtual avatars. Digital games have now largely taken the place of traditional toys in children's lives. The gaming metaverse is gaining popularity as it is revolutionizing the cyberspace of gaming into an interactive and interesting 3D platform by providing immersive environments. This quantitative study aims to comprehend how students' gaming experiences while engaging in virtual gaming platforms affect their self-concept, employing Robson's Self-Concept Scale (1989) and the Gaming Experience Questionnaire (IJsselsteijn et al., 2013). The sample comprises students from Delhi NCR. The statistical tools used are mean, standard deviation, t-test, and Pearson's correlation. The study elicits that female participants not only harbor a more positive self-concept but also demonstrate an enhanced involvement in gaming activities compared to their male counterparts. Similarly, age group distinctions manifest in self-concept and gaming experiences. The findings also illustrate that positive gaming encounters correlate with elevated self-concept, accentuating the intricate interplay between digital gaming experiences and self-concept formation.

Keywords gaming experience, metaverse, digital games, self-concept

Introduction

The employment of new and existing instruments in education is a blistering topic among academics and institutes of learning. A game is a form of play in which players adhere to set rules. The use of games to help teaching and learning is known as educational gaming. The learning experience for students can be improved and additional skills, such as following rules, adapting, problem-solving, interaction, critical thinking, creativity, teamwork, and good sportsmanship can be taught by using games as a supplement to traditional teaching methods. Learning shouldn't be boring and shouldn't only be rote memory exercises where pupils memorise information or study for tests. To raise student achievement, teachers can benefit from the vitality and creative thinking that technology-enhanced learning offers (Houghton et al., 2013).

In educational institutions, schools, and homes, a wide variety of educational games are being used. The primary

goal of using games in the classroom is to help students develop their critical thinking abilities while teaching a particular subject by encouraging them to think creatively while adhering to the rules. In recent years, digital games have proliferated in children's and adolescents' lives. Children learn informal digital literacy skills through play, and their unstructured encounters with technology may be changing how they learn and generate knowledge. These games also foster the type of learning that is distinctive to the culture of the information society, and this learning is expected to have long-term effects. Games can be used to teach a certain subject, but they can also have an impact on the learners. The purpose of introducing a gaming element in the classroom is to raise student motivation and engagement, improve visual skills, enhance peer interaction and collaboration, and give students the opportunity to apply game principles to real-world situations (Zirawaga et al.,2017).

Games like chess can promote reasoning, logic, and other qualities that are desired in education, but they are not characterised as educational games because they do not deliver content or communicate curriculum material (Yue & Zin, 2009). We refer to games as educational games if they contain curricular content or other instructional resources (Michel, 2016).

Children start to comprehend the universe at birth and eventually come to realize their own existence. They gradually establish their self-concept as they engage with their environment and start to identify who they are. Playing games on a computer or other digital device has become a daily need of children due to rapid technological innovation. Various electronic devices are used for playing games, the most used is a smartphone. Children are increasingly handling electronic devices at younger ages. Digital games, which have largely taken the place of traditional toys in children's life, are replacing more traditional toys on a regular basis.

The pace at which the world is moving today was unprecedented in the past. Children's play has evolved significantly over the past several decades because of the entry of electronic and video games into their world of pretend play. Digital natives, also known as net citizens (netizens), are members of the generation that was born in the twenty-first century. They internalise and interpret technology in daily life as if there were no such thing as living without it. In addition to growing up with computers and other technological advancements, the G-generation also experienced the rise of digital gaming. Digital gaming is a focus for the G generation (Zicherman & Linder, 2010). Children from the G generation spend a lot of time playing digital games, which helps them develop as players because the G generation is one of the biggest gamers (McGonigal, 2011). Electronic games' availability on smart phones and electronic touch screen tablets during the past ten years has made this transformation even more noticeable. Additionally, most of these games are available for free or a minimal fee for download. These days, kids can enjoy playing these games (of many genres, including action, adventure, sport, and strategy, etc.) anytime, anywhere.

The latest and the most trending innovation in the gaming environment is of the metaverse gaming world. The growth of cutting-edge technology like blockchain, real-time rendering technologies, digital twins, artificial intelligence, and 6G communications has aided in the spread of the metaverse (Zhong et al.,2017). The concept of the metaverse, a stereoscopic virtual universe that exists side by side with the real world, was

first introduced in the science fiction named Snow Crash (Joshua, 2017). The metaverse is viewed as a fresh wave of technological innovation that offers a digital environment for avatar-based communication. The players can enter the gaming world in the form of their virtual avatars and change characteristics of avatars, collect money, defeat opponents, interact with them and do activities as they desire through this mode of gaming structure. The current study collected data from the participants who engaged themselves in such kind of an immersive gaming environment.

The impact of electronic games (video games or computer touch screen tablet games) on player behaviour have been studied, with varying degrees of success. On one hand, certain studies have recorded negative impacts like increased aggression and several medical and psychosocial repercussions, while on the other hand, favourable effects like enhanced hand-eye coordination, reduced reaction times, and raised self-esteem have also been observed (Griffiths, 2002). Electronic games that are considered passive entertainment have no relationship to children's happiness or good self-concept, but those that are considered active entertainment have connections to happiness and positive self-concept in children (Holder, Coleman & Sehn, 2009).

Self-concept is the way a person views himself or herself as a physical, social, spiritual, or moral being (Gecas, 1982). Self-concept and self-esteem are two different but related concepts that are frequently used interchangeably. Self-concept is best exemplified by a profile of self-perceptions across domains and refers to a student's perceptions of competency or sufficiency in academic and nonacademic (such as social, behavioural, and athletic) domains. A student's entire assessment of who they are, including feelings of contentment and happiness in general, is called self-esteem (Harter, 1999). By putting self-concept-enhancing techniques into place, schools are more likely to encourage kids' good self-esteem (Manning, 2007). People's experiences with online gaming have an impact on their self-concept. If people experience joy and happiness, especially when playing adventure and action games, they typically have a positive self-concept (Przybylski, Weinstein, Murayama, Lynch, & Ryan, 2012). To increase learners' self-confidence, games are essential. Games are beneficial as teaching aids because they enliven typically dry and tedious teaching strategies (Boyle, 2011). Studies also show that by allowing the child to become more technologically adept and self-directed, educational computer programmes have a positive impact on learning and sense of self-worth (Wartella & Jennings, 2000). Overall, playing electronic games proficiently and mastering those yields better results than trying to complete them or advance from one level to another (Ryan, Rigby, & Przybylski, 2006). It is clear from Durkina and Barberb's (2002) study with university students that playing computer games helps students develop positive self-concept, particularly about skills related to computer technology. Students who played computer games scored better on self-concept reports than those who did not play. Additionally, those who engage with others via computers and social media typically have a positive self-concept (Sponcil & Gitimu, 2013).

Compared to kids who don't play electronic games, those who play them exhibit a better predisposition toward academic success (Yee, 2006). This is a significant finding because achievement and self-concept are strongly and favourably correlated (Marsh & Craven,

2006). As a result, it is advised to enhance students' self-concept as a non-cognitive intervention to increase academic achievement (Parker, Marsh, Ciarrochi, Marshall, & Abduljabbar, 2014). People who enjoy playing video games have a higher sense of self-concept and are more motivated (Przybylski et al., 2012). Self-efficacy is linked to self-concept because those who have higher self-esteem are typically better at problem-solving and critical thinking (Kim & Choi, 2014). Studies have revealed a link between physical play and a physical self-concept (Babic et al., 2014). For kids to learn something or benefit from the games they play, interaction with others (Kory & Breazeal, 2014), particularly parent-child interaction (Radesky, Schumacher & Zuckerman, 2015), as well as interactive feedback from their parents, teachers, or siblings is necessary (Yannier, Koedinger & Hudson, 2015).

The World Health Organization (WHO) media brief 2022 states that children who have crossed or are about to cross puberty can be divided into two general categories: older adolescents and young adults, who fall within the age ranges of 15 to 19 and 20 to 24 years, respectively. This is the time when the personality of an individual starts developing, and they start forming their self-concept. This self-concept is a key component of their personality because it determines their chances of success in the future. Given the extreme popularity of video games among older adolescents and young adults, it is imperative to investigate the benefits of playing online games during these developmental stages (C. Adachi & Willoughby, 2015).

Numerous studies have been under taken regarding the effect of playing games on students' self-concepts, however it is quite uncommon to find studies that specifically delineate into the impact of immersive gaming experiences in a virtual world on students' self-concepts. Gaming experience refers to what the players encounter as a result of engaging with a game. Common metrics used to analyze these experiences include flow, immersion, competence, challenge, tension, and negative/positive affect (Bernhaupt, IJsselsteijn, Mueller, Tscheligi & Wixon, 2008).

Overall, researchers agree that games have some influence on how people behave. However, there is a dearth of research on the direct impact of metaverse gaming experiences on students' self-concept. Also, the association among older adolescents and young adults on the self-concept has not been studied in-depth over a long period of time, so it represents an interesting new field of research. For this reason, the objective of this study was to examine the impact of gaming experiences on students' self-concept.

In light of the aforementioned context, the researcher has investigated how gaming experiences are affecting older adolescents and younger students' self-concept. The current study has been guided by the following three research questions.

Research Questions

1. Does gaming experience affect the self-concept of students?
2. Whether students of different age groups and gender exhibit different self-concept when exposed to gaming experiences?
3. Does there exist any relationship between the self-concept and gaming experience of students?

To answer the above three research questions, the following three objectives have been achieved.

Objectives

1. To study the impact of gender and age on the self-concept of students.

2. To study the impact of gender and age on the gaming experience of students.
3. To examine the relationship between the self-concept and gaming experience of students.

The following hypothesis are developed and put to the test with the intention of achieving the objectives.

Hypothesis

H_{01}: Gender does not have significant impact on the self-concept of students

H_{02}: Age does not have any significant impact on the self-concept of students

H_{03}: Gender does not have significant impact on the gaming experience of students

H_{04}: Age does not have any significant impact on the gaming experience of students

H_{05}: There exists no significant relationship between self-concept and gaming experience of students

Methodology

The study was carried out by the researcher using the descriptive survey method. The population of the study comprised of older adolescent (15 to 19 years) and young adult (20 to 24 years) students of NCR of India.

Utilizing a random sampling technique, the sample for the study was selected. 65 students, 27 males and 38 females who are enrolled in English-medium schools across both public and private high schools and colleges made up the study's final sample. The study was conducted on 29 older adolescents and 36 young adults.

Tools Used

To assess the gaming experience, the Game Experience Questionnaire (GEQ) (IJsselsteijn et al., 2013), a self-report measure that aims to comprehensively and reliably characterize the multifaceted experience of playing digital games was used. The self-concept of students considered in the present study was examined using the Self-Concept Questionnaire (SCQ) designed and standardized by Robson (1989).

Game Experience Questionnaire (GEQ)

The GEQ is popular and widely used in previous studies with different game genres. In Parts 1 and 2, the players' emotions and thoughts are examined while they are immersed in playing the game; in Part 3, the post-game module, the players' feelings are evaluated after they have finished the game. A modular framework is used in the development of the Game Experience Questionnaire, and it consists of:

1. Core Questionnaire (GEQ): This module examines seven facets of gamers' experiences, including Immersion, Flow, Competence, Positive and Negative Affect, Tension, and Challenge.
2. Social Presence Module (SPGQ): This module explores players' interactions with co-players, both real and virtual, examining psychological and behavioral engagement.
3. Post-Game Questionnaire (PGQ): This module investigates players' experiences after a gaming session, encompassing positive and negative aspects, tiredness, and the transition back to reality.

The three modules should be given out in the sequence listed above, just after the gaming session has ended. Component scores are calculated using the average value of its items.

Self-Concept Questionnaire (SCQ)

The research investigation made use of the Robson-designed and standardized Self-Concept Questionnaire (SCQ) developed in 1989 by Robson. This scale

measures one's perception of oneself (Robson, 1989). This scale, comprising thirty items such as "I am in charge of my life" and "I feel emotionally mature," measures one's self-perception. Each item is rated on an eight-point scale, ranging from total agreement (0) to total dissent (7). The scale has demonstrated reliability (Cronbach's alpha of .89) and clinical validity (i.e., clinical validity of .70) (Ata Ghaderi, 2005). Higher scores indicate a positive self-image and strong self-esteem, while lower scores suggest rejection and a negative self-image.

Collection of Data

With the help of Google Forms, the data was gathered from the respondents. They were informed beforehand about the study, and information was voluntarily provided by them. By interacting using Google Forms, the researcher disseminated two questionnaires: the Self-Concept Questionnaire and the Gaming Experience Questionnaire.

Statistical Measures

The software system SPSS 16.0 was used to examine the data. To examine the gathered information, a descriptive statistical analysis was performed on the scores for Self-Concept and Gaming Experience. The statistical tools used were mean, standard deviation, t-test, and Pearson's correlation. The total scores of both the variables under consideration were found to have estimated Skewness and Kurtosis values that ranged from -1.96 to +1.96 (Joreskog, 2001), which tested the assumption of a normal distribution. The information was therefore seen as being normally dispersed. Table 1 provides the descriptive data for Self-Concept and Gaming Experience. The parametric statistical test for Correlation Analysis was used to determine the association between Self-Concept, Gaming Experience Core Module, Gaming Experience Social Presence Module, and Gaming Experience Post Game Module after confirming that the assumptions of normality had been met.

Analysis and Discussion

The t-test value for each hypothesis analysis has been computed at a significance level of 5 per cent to assess the statistical significance.

Table1 depicts the descriptive statistics for the levels of self-concept and gaming experience.

The sample under study belonging to different gender and age groups exhibit a difference in their self-concept. The gaming experience does not have a significant difference on either of the demographic variables, i.e., gender and age.

Table-1: Descriptive Statistics for Self-Concept and Gaming Experience

Variable	Min	Max	Range	Size	Mean	S.D.	Variance	Skewness	Kurtosis
Self-Concept	65	191	126	65	121.523	31.108	967.722	0.4099	-0.4053
Gaming Experience	57	221	164	65	134.892	36.873	1359.628	0.3684	-0.2467

Following is a discussion of the study's findings according to each hypothesis.

H_{01}: Gender does not have significant impact on the self-concept of students

Based on the results of the self-concept, all male and female students were identified, and the data collected through questionnaires is tabulated, which yielded the following result:

Table-2: Mean scores and standard deviation of self-concept with respect to gender

GENDER	NUMBER OF STUDENTS	AVERAGE (MEAN)	STANDARD DEVIATION
MALE	27	107.6667	29.0887
FEMALE	38	131.3684	28.9766

An analysis of the Table 2 indicates that out of the entire sample of 65 students, there are 27 male students and 38 female students. The results show that females have an average score of 131.3684 (SD = 28.9766) which is higher than that of males who have an average score of 107.6667 (SD = 29.0887). Males differ significantly from the females when a comparison is made amongst them on the variable of self-concept wherein females standout by a difference in average of 23.7018. The computed t test value is 3.24 with 63 as the degree of freedom. The tabulated value at the same level is 2 which is less than the computed value. This shows that there is a significant difference in values and the null hypothesis stands rejected.

H_{02}: Age does not have any significant impact on the self-concept of students

Based on the results of the self-concept, the students belonging to the category of older adolescent (15-19 years) and young adult (20-24 years) students were identified and their data tabulated, which yielded the following result:

Table-3: Mean scores and standard deviation of self-concept with respect to age

AGE	NUMBER OF STUDENTS	AVERAGE (MEAN)	STANDARD DEVIATION
Older Adolescents (15-19 yrs.)	29	104.3793	25.1288
Young Adults (20-24 yrs.)	36	135.3333	28.7173

An analysis of the Table 3 indicates that out of the entire sample of 65 students, there are 29 older adolescent and 36 young adult students. The results show that older adolescents have an average score of 104.3793 (SD = 25.1288) which is lower than that of young adults who have an average score of 135.3333 (SD = 28.7173). Young adults differ significantly from the older adolescents when a comparison is made amongst them on the variable of self-concept wherein young adults are better than older adolescents by an average difference of 30.9540. The computed t test value is 4.56 with 63 as the degree of freedom. The tabulated value at the same level is 2 which is less than the computed value. This shows that there is a significant difference in values and the null hypothesis stands rejected.

H_{03}: Gender does not have significant impact on the gaming experience of students

To test the above hypothesis, the gaming experience data of male and female students was collected using questionnaire consisting of three modules. The results are tabulated below:

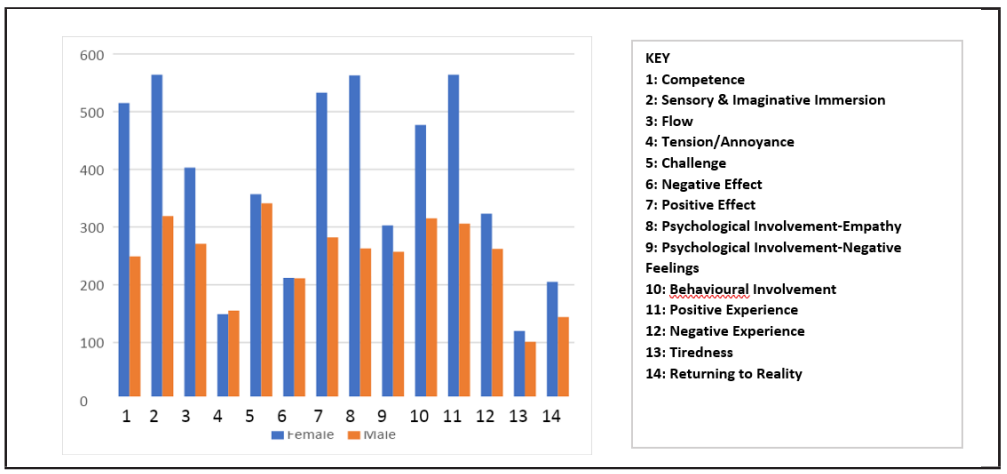
Table-4: Mean scores and standard deviation of gaming experience (gaming module wise) with respect to gender

GAMING EXPERIENCE	GENDER	NUMBER	AVERAGE (MEAN)	STANDARD DEVIATION
PART-I CORE MODULE	MALE	27	67.7037	13.1816
	FEMALE	38	71.921	19.7119
PART-II SOCIAL PRESENCE MODULE	MALE	27	30.9259	11.4654
	FEMALE	38	35.3421	14.1407
PART-III POST GAME MODULE	MALE	27	30.1111	6.0468
	FEMALE	38	31.8947	12.5822
TOTAL	MALE	27	128.8148	26.7439
	FEMALE	38	139.2105	42.4628

The results in Table 4 show that male students have a total average score of 128.8148 (SD = 26.7439) which is lower than that of female students who have a total average score of 139.2105 (SD = 42.4628). Female students differ from the male students by an average difference of 10.3957 when a comparison is made amongst them on the variable of gaming experience. A mean comparison test (t-test) was conducted to determine whether the gender variable influenced the gaming experience. The computed t test value is 1.1224 with 63 as the degree of freedom. The tabulated value at the same level is 2 which is more than the computed value. This shows that there is no significant difference in values and thus the null hypothesis is accepted.

The bar graph below shows the item analysis of gaming experience of males and females. As discussed above the gaming experience questionnaire consists of three modules. The first seven key components are a part of the core module. The next three components are a part of the social presence module and the last four are a part of the post gaming module.

Figure-1: Gender-wise comparison of the gaming experience of each item



The graph shows that, except from the tension/annoyance and negative effect components, results with females are generally better than those with males. This demonstrates that while men are more tenacious and irritable than women, playing games can help them relax more. Several studies have been conducted to elicit the hidden components as to why the stress level among males is relatively higher among males in comparison to females. After the players have stopped playing the game, majority of them suffer from the negative experiences of gaming.

H_{04}: Age does not have any significant impact on the gaming experience of students

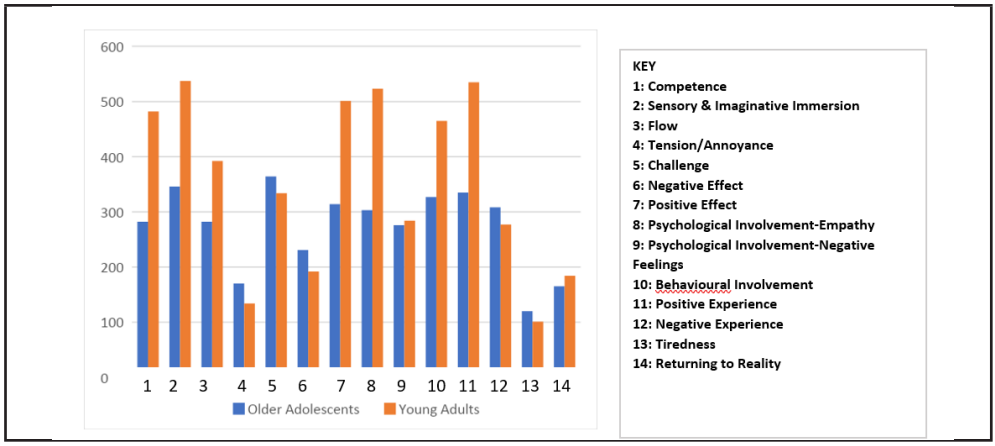
The above hypothesis is tested by categorizing the students into two categories. The students in the age group of 15-19 years and 20-24 years, the older adolescents, and the young adults respectively. The results are tabulated below:

Table-5: Mean scores and standard deviation of gaming experience (gaming module wise) with respect to age

GAMING EXPERIENCE	AGE	NUMBER	AVERAGE (MEAN)	STANDARD DEVIATION
PART-I CORE MODULE	15-19	29	68.5862	14.5835
	20-24	36	71.4444	19.3383
PART-II SOCIAL PRESENCE MODULE	15-19	29	31.2414	14.6206
	20-24	36	35.3333	11.7959
PART-III POST GAME MODULE	15-19	29	32	9.9319
	20-24	36	30.4722	10.7690
TOTAL	15-19	29	131.9655	34.3610
	20-24	36	137.25	39.1001

The results in Table 5 indicate that older adolescents have a total average score of 131.9655 (SD = 34.3610) which is slightly lower than that of young adults who have a total average score of 137.25 (SD = 39.1001). Older adolescent students differ from the young adult students by an average difference of 5.2845 when a comparison is made amongst them on the variable of gaming experience. A mean comparison test (t-test) was conducted to determine whether the gender variable influenced the gaming experience. The computed t test value is 1.1224 with 63 as the degree of freedom. The tabulated value at the same level is 2 which is more than the computed value. This shows that there is no significant difference in values and thus the null hypothesis is accepted. The item analysis of male and female gamers is displayed in the graph below.

Figure-2: Age wise comparison of gaming experience of each item



The graph shows that the young adults outshine the older adolescents in majority of the components of gaming experience questionnaire barring a few. The older adolescents show higher scores with item components tension/ annoyance, challenge, and negative effect of the core game module as well as the two components of the post-game module (negative experience and tiredness). Both the core and post-game modules frequently result in negative effect or experience, which causes players to either feel bored or exhausted, think about other things, or feel regret and wish they had done something more beneficial other than gaming immersion. The items that make up the components showing the variations in the gaming experiences of older adolescents and young adults can be used to elicit these player thoughts.

H_{05}: There exists no significant relation between self-concept and gaming experience of students

Table 6 depicts the findings from the Pearson correlation coefficient technique to determine the existence of relationship between gaming experience core module, gaming experience social presence module, gaming experience post game module and self-concept.

Table-6: Correlation Matrix between gaming experience and self-concept of students

	Gaming Experience CORE Module	Gaming Experience SOCIAL PRESENCE Module	Gaming Experience POST GAME Module	SELF-CONCEPT
Gaming Experience CORE Module	1			
Gaming Experience SOCIAL PRESENCE Module	0.7637	1		
Gaming Experience POST GAME Module	0.6995	0.6695	1	
SELF-CONCEPT	0.1063	0.0452	-0.0704	1

It is evident that there is a strong positive correlation between gaming experience core module and gaming experience social presence module (r = 0.7637). A moderate positive correlation is found between gaming experience core module and gaming experience post game module (r = 0.6995). Whereas there is a very weak positive correlation between gaming experience core module and self-concept (r = 0.1063). A moderate positive correlation between gaming experience social presence module and gaming experience post game module (r = 0.6695). The social presence module of gaming experience and self-concept have a weak positive correlation (r = 0.0452). On the other hand, there is a weak negative correlation between gaming experience post game module and self-concept (r = -0.0704). These figures of correlation depict that all the relationships show a positive correlation except the gaming experience post game module and self-concept. This shows that there is a significant difference in values and thus the null hypothesis is rejected. The results reveal that a good gaming experience leads to a high self-concept amongst students, the only exception being with the gaming experience post game module wherein the gaming post game experience is good when the self-concept of students is low which indicates that students whose self-concept is low is indulging in playing more games to boost up their self-confidence. The students with low self-concept are finding these game experiences extremely useful.

Analysis and Interpretation of Results

The results extracted from Tables 2-6 reveal noteworthy patterns across various dimensions under investigation. Firstly, the mean self-concept of females surpasses that of males, indicating a gender-based discrepancy in self-perception. This disparity is bolstered by a statistically significant difference in the self-concept of male and female students. Our results are consistent with other studies (Cross & Madson,1997; Maddux & Brewer, 2005). The data also illustrates that older adolescents exhibit a higher mean self-concept than their young adult counterparts, and this contrast between the two age groups is statistically significant. Transitioning to gaming experiences, the absence of statistically significant differences in gaming experience, both between genders and across age groups, aligns with Bunz et al.'s observations (Bunz et al., 2020). While investigations, such as those conducted by Apriani et al. (2022), Hou (2018), and Khan et al. (2017), have reached the consensus that female students exhibit variations in both perception and gaming performance. These results emphasize that further research is imperative to elucidate the reasons behind the observed divergence, necessitating a more in-depth exploration of methodological nuances, contextual variations, and the evolving nature of educational practices to enhance the understanding of gender disparities in digital gaming experiences. This collective insight contributes significantly to advancing our comprehension of the intricate relationships between self-concept, gaming experiences, and demographic variables within the studied population.

Conclusion

The findings of this study demonstrated the relationship between metaverse gaming experience and self-concept. The study's findings show that students who have positive gaming experiences tend to have higher self-concepts leading to a positive self-image and high self-esteem, in contrast to the post-game module, which shows positive gaming experiences even when students have low self-concepts bolstering a negative

self-image. This suggests that students with lower self-concept might turn to gaming to enhance their mood or gain a sense of accomplishment within the virtual world. Even though their self-concept may not improve significantly after the gaming experience, as indicated by the weak negative correlation, the positive aspects of gaming may still serve as a source of enjoyment or temporary confidence for these individuals. This insight could be valuable for understanding the role of gaming in the lives of students with varying levels of self-concept. The findings of this study are consistent with those of Przybylski et al. (2012), who discovered that individuals who played video games exhibited better self-concept. Our results corroborate with those of McPhee et al. (2013) and Bahatheg (2013), who discovered that playing video games improved one's self-concept. Electronic and tablet games are neither essentially good nor negative; rather, the effects they have depend on how they are played (Eichenbaum et al., 2014). It is suggested to conduct more research studies with a larger sample size on the impact of gaming experiences on children's development. These studies should include children of various ages, economic and social backgrounds, and intellectual abilities, as well as games from various genres. This is especially important now that kids all over the world use gaming devices extensively. The act of gaming stirs up powerful emotions. However, little is known about the gameplay circumstances that cause a variety of emotions to arise. More research can be done to determine which game scenarios cause unpleasant feelings.

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Research Article

A Tale of Two Cities: Exploring Factors Affecting Online Learning Equity

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Abstract

The Covid pandemic has caused a significant shift in the education sector, pushing for rapid integration of technology in education worldwide. This has resulted in a move from traditional classroom learning to online and blended modes of learning, which is likely to continue. Though access to technology is crucial for driving innovation and equity in education, regional disparities have been widely pervasive, affecting overall educational governance at national, regional, and local levels. This paper delves into the problem of equity in online learning in Delhi and Varanasi, with a total of 2,563 responses and data analysis based on regression charts identifying key trends and patterns affecting equity in learning. Our findings show that students enrolled in private schools had better access to online education in both cities. The study also revealed the significance of cultural inclusivity in online learning. The diversity of students' cultural backgrounds affects the process and outcomes of online learning. The findings from this research can serve as valuable guidance to enhance pedagogical designs that adapt better to online learning practices for school students during the COVID-19 pandemic or any future unexpected crises. We provide recommendations for policymakers and educators to promote inclusivity in online education.

Keywords – learning equity, online education, Delhi, Varanasi, COVID-19, digital divide, educational policy, cultural inclusivity.

Introduction

Online Learning in School Education: Emergence and Equity Challenges

In recent years, online learning has burgeoned as a central component of primary education worldwide, primarily facilitated by its ability to grant unrestricted access to educational content and instructions, irrespective of time and geographical limitations (Ali et al., 2020). 'Online learning', deciphered as the usage of technology in education evolved and led to the creation of new challenges and opportunities during Covid-19 (Kidd and Murray, 2020). It encompasses remote learning, distance learning as well as e-learning (Singh and Thurman, 2019; Shahzad et al., 2021). Well-built online learning programmes can impart qualitative, affordable, flexible and equitable access to education (Castro and Tumibay, 2021; Dhawan, 2020).

Technology has fundamentally altered the landscape of learning by facilitating interactive and immersive experiences that foster both engagement and effective outcomes. However, attaining global equity in online learning is a complex endeavour, with empirical studies underscoring a gamut of factors influencing its efficacy. A primary concern is students' satisfaction, perceived effectiveness, and preferences regarding online learning platforms, which have been found to be intricately tied to familial, school, and individual factors, hence necessitating these factors' integration in strategies to augment the online learning experience for primary school students (Zheng et al., 2022).

ICT literacy emerges as another significant factor, notably in regions grappling with limited technological access, posing barriers to the holistic development of students' digital skills. Teachers' proficiency in computer usage and the tangible accessibility to technological tools are critical aspects to be addressed (Alshmrany & Wilkinson, 2017; Mogwe & Balotlegi, 2020). Professional development programs aimed at bolstering teachers' computer literacy and strategic partnerships to augment ICT infrastructure in schools could serve as potential countermeasures.

Cultural responsiveness is vital to ensuring inclusivity, negating the possible dominance of Western educational paradigms, and embracing the diversity of students' cultural backgrounds globally (Smith & Ayers, 2006). In parallel, understanding and addressing the determinants influencing parental choices and intentions towards online learning is pivotal. Some of the most frequently used technologies during COVID 19 for online learning were Zoom, private learning management systems (Turnbull et al., 2021), social media (Kara et al., 2020; Bordoloi et al., 2021) etc. Concerns have also been raised about the compromised quality of online learning as compared to traditional classroom teaching (Palvia et al., 2018; Korkmaz and Toraman, 2020) due to lack of academic rigour, passiveness and disengagement (Coman et al., 2020; Ferri et al., 2022; Duki'c and Krzic, 2022).

Most importantly, the digital divide due to lack of device or internet access, especially in the Global South (Ghazi-Saidi et al., 2020; Ndzinisa and Dlamini, 2022), as well as gender disparity in access to online education (Shahzad et al., 2021) has been found to be pervasive. Despite the challenges, the transition to online learning during Covid led to nouvelle learning opportunities, experimentation, and an overall boost to digital infrastructure worldwide (Almarzooq et al., 2020; Greenhaw et al., 2022) The pandemic also provided the opportunity globally to experiment with rapid innovations and trials with technology to facilitate access to remote

learning (UNESCO, 2020; UNICEF, 2020). However, different research findings before 2020 had reflected only moderate learning gains through digital learning techniques; and may be considered as a supplement rather than substitution to imparting education and learning (Allen et al., 2004; US DoE, 2010; EEF., 2019). In the context of developing countries, Muralidharan et al. (2019) find that well-designed learning programmes utilizing technology as a learning aid bring favourable outcomes.

The rapid shift to online learning has highlighted equity challenges, particularly in regions with diverse socio-economic backgrounds such as Delhi and Varanasi. This study aims to explore these challenges further, focusing on the impact of factors such as technological access, digital literacy, and cultural inclusivity on learning equity during the COVID-19 pandemic.

Regional insight – Delhi and Varanasi

In Delhi, one of India's largest metropolitan cities with a significant young population (Census of India, 2011), the literacy rate among students is a remarkable 86.2%, far exceeding the national average of 25 per cent (Economic Survey of Delhi, 2020). This reflects the city's robust education system and its successful integration of technology into educational practices, especially critical during the COVID-19 pandemic (Hindu, 2021; Dayal 2023).

Contrastingly, Varanasi, an ancient city and a significant cultural center, faces distinct educational challenges. With a population of over 3.6 million, Varanasi grapples with limited internet access and a noticeable disparity in digital literacy, issues that are particularly acute in its surrounding rural areas (ISP News, n.d.). The economic impact of the pandemic has further exacerbated these challenges, hindering the accessibility of digital devices necessary for online education (Singh 2020).

This juxtaposition of Delhi's progressive educational environment against Varanasi's struggle with technological integration underlines the digital divide in India. Despite national efforts like the PM e-Vidya and Diksha programs aimed at enhancing digital literacy (Department of School Education & Literacy, n.d.), the pandemic has laid bare the necessity for more targeted support and resources, especially in areas like Varanasi where barriers to online learning remain significant (Bailey, 2020).

In the next sections, we present the methods and results of our study which aims to uncover the key factors impacting online learning equity in Delhi and Varanasi. Our analysis seeks to contribute valuable insights to the discourse on online learning and offer evidence-based recommendations for enhancing equity and inclusivity in online education.

Methodology

Research funded by Anglia Ruskin University's 'Global Challenges Research Fund' in collaboration with, Banaras Hindu University (BHU), Jamila Millia Islamia University1 (JMI) and the National Institute of Educational Planning and Administration (NIEPA) looked at gendered impacts on access to education and technology during COVID-19 in India. The study rooted itself in the horizon of inequalities within the supply of education, which has been further widened following the pandemic due to a sudden need to transition towards face-to-face to online learning. The present study undertakes quantitative research design to study the inequity in access to education and technology between and within two populous cities e.g., in Delhi and Varanasi, which come under different categories. As of 2023, Delhi is an X-Class, which comes under tier 1, whereas Varanasi is a Y-Class which comes under a tier 2 city 2. Both cities present

unique characteristics, contributing to a comprehensive understanding of the challenges and opportunities for online learning equity.

Sample

The data in the present study was collected from 2,554 students from both Delhi and Varanasi. A random sampling approach was used to select the schools under study. This was done using the UDISE data, from where a total of 105 schools were filtered for Varanasi and 45 for Delhi. The final appointment of schools from both regions was made by the principals' confirmation. Within these schools, a convenient sampling method was appointed for the data from students who studied in classes 6-12th.

The demarcation of data includes 1389 student respondents from Delhi who studied in ten schools in Delhi from both the Southeast and Southwest regions within the capital. From Varanasi, 1165 student respondents participated from six schools in the region. The students in the present study belonged to both government, government-aided and private schools, which were co-educational and senior secondary by nature. Most of the students in the present study belonged to schools in urban locations while only a few belonged to schools in a rural region. With respect to gender, 1510 were males while 1022 were female students in the study. Region-wise data of the students on school type, location type and gender can be further seen in Table 1.

Table-1: Demographic Profile of the Respondents

Demographic Category	Sub-Category	City	n	%
School Type	Government Schools	Delhi	338	13.2
		Varanasi	678	26.5
	Government Aided Schools	Delhi	618	24.1
		Varanasi	65	2.5
	Private Schools	Delhi	430	16.8
		Varanasi	416	16.3
	Missing Data	Delhi	9	0.4
		Varanasi	6	0.2
Location Type	Urban	Delhi	1290	50.4
		Varanasi	1165	45.5
	Semi-Urban	Delhi	28	1.1
		Varanasi	0	0
	Rural	Delhi	50	2.0
		Varanasi	0	0
	Missing	Delhi	27	1.1
		Varanasi	0	0

Gender	Male	Delhi	824	32.5
		Varanasi	686	27.1
	Female	Delhi	558	22.0
		Varanasi	464	18.3
	Others	Delhi	2	0.1
		Varanasi	0	0.0

Data Collection and Tool Development

A structured survey was conducted on students to gather insights into their experiences, perceptions, and challenges related to online learning. The survey questionnaire was designed to capture the inequity in access to education and technology, with respect to online classes on six parameters such as access to online classes, access to digital infrastructure for online learning, student's digital preparedness, access to the conducive learning environment at home, institutional support, stress and well-being and academic self-efficacy. These items were tapped analytically through a self-composed scale, which incorporated 20 items which were answered by the students along with the questions on demographic features. The reliability of the scale conceptualized in the study has a Cronbach Alpha value of 0.91, which makes it a reliable and valid measure.

Data Analysis

The collected data were subjected to a rigorous analysis. Since the data from the survey aimed to explore the factors affecting learning equities, regression analysis was performed as a multivariate method of analysis to locate the primary interplay of the variables undertaken. According to Ter Braak & Looman (1995), regression as a statistical method can be effectively used in investigating the relationship between variables a functional measure to identify the interplay of variables in a causal way, which successfully predicts the responses without great error. Regression Analysis for the present study was performed on Jamovi Software (Version 2.3), which used the R core team package for its statistical computing. This approach enabled the identification of key trends and patterns, as well as the emergence of critical factors affecting online learning equity. Comparative analysis between the regions were analysed similarly.

Findings and Discussion

Delhi (n=1389)

Results from the regression analysis of data from Delhi obtained that school type was a single factor contributor to the overall variability in students' access to online learning and education with a significant p-value of less than 0.001. It varied the score to upto 17.4 per cent (Table 2), where students from private schools were found to have better access to online learning and education (Table 3).

Table-2 : Regression Model Fit Measures

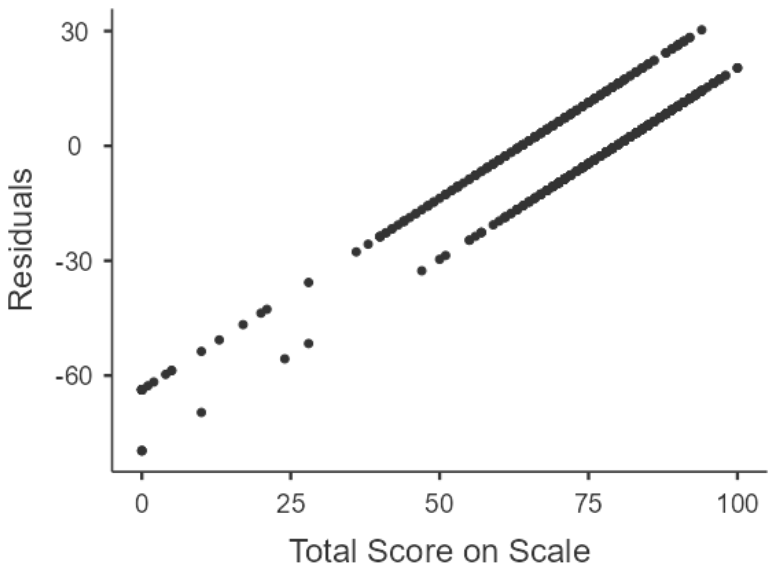
Model	R	R^2	Adjusted R^2
1	0.419	0.175	0.174

Table-3:Model Coefficients on the Total Score on Scale of "Online Learning Equity"

Predictor	Estimate	SE	t	p
Intercept	63.7	1.05	60.6	< .001
School Type:				
Private – Public	15.9	1.32	12.0	< .001

Represents reference level

Figure-1: Residual Plot of the Regression Model



Note. Figure 1 shows that there is a positive relationship between school type and learning equity of the students, such that students from private schools have better access to online learning and education.

Varanasi (n=1165)

Regression analysis on the data from UP found that 7.1 per cent variation in learning access was found (Table 4) for two predictor variables, such as school type and gender. It can be seen from Table 5 that with respect to school type, students who belonged to private schools had greater learning equity than those from government schools. In terms of gender, female students were found to have better access to online learning, education, and technology as compared to male students.

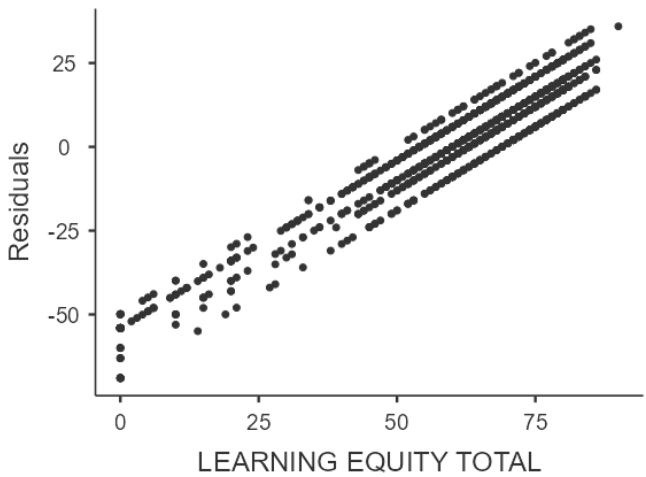
Table-4:Regression Model Fit Measures

Model	R	R^2	Adjusted R^2
1	0.271	0.0736	0.0712

Table-5:Model Coefficients on the Total Score on Scale-"Online Learning Equity"

Predictor	Estimate	SE	t	p
Intercept	54.06	0.931	58.04	< .001
School Type:				
Govt. Aided – Govt.	-4.14	2.698	-1.53	0.125
Private-Govt.	8.99	1.257	7.15	< .001
GENDER:				
Female-Male	5.93	1.234	4.80	< .001

Figure-2: Residual Plot of the Regression Model



Note. The figure shows a strong relationship between school type, gender and learning equity, such that female students and those belonging to private schools had greater learning equity.

Compiled Data from Delhi and Varanasi

Results from the regression analysis of the complete data represented up to 18 per centvariation (Table 6 see below) in the results with respect to the school type, annual income and region type on access to online learning. It can be seen from Table 7 that in terms of school type, students from private schools had more access to education and technology for online classes as compared to those studying in government schools. It was also obtained from the analysis that students whose families belonged to upper-income groups had greater access to online education and learning. The results found a stark contrast between those whose monthly income was less than five thousand Indian rupees and those earning up to eighty thousand and above monthly. With respect to the region type, students from Delhi were found to have greater learning equity than students from Varanasi. The results were significant on a 0.001 level of significance.

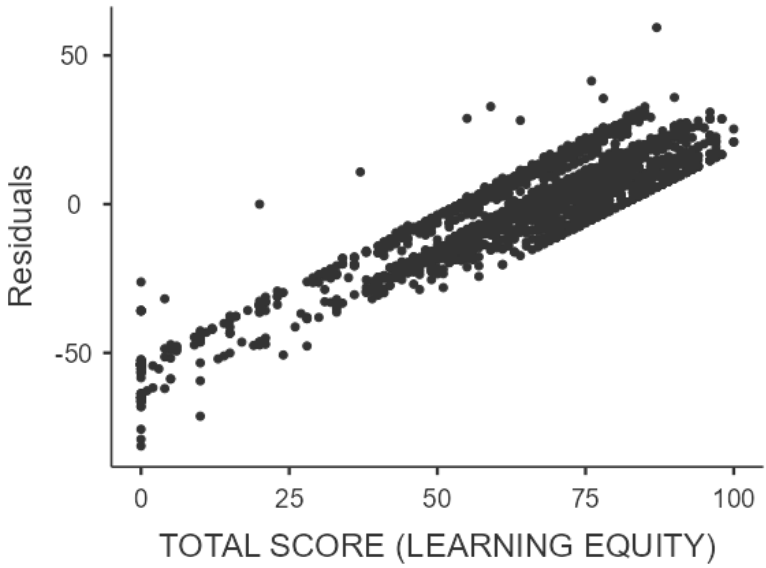
Table-6:Regression Model Fit Measures

Model	R	R^2	Adjusted R^2
1	0.429	0.184	0.180

Table-7: Model Coefficients on the Total Score on Scale-"Online Learning Equity"

Predictor	Estimate	SE	t	p
Intercept [a]	63.380	1.410	44.955	< .001
SCHOOL TYPE:				
Govt Aided-Govt.	-1.497	1.551	-0.965	0.335
Private – Govt	9.698	0.988	9.812	< .001
MONTHLY INCOME:				
(5K-10K) – Below 5K	0.499	1.377	0.362	0.717
(10-20K) – Below 5K	2.856	1.462	1.954	0.051
(20-40K) – Below 5K	3.321	1.583	2.098	0.036
(40-60K) – Below 5K	4.948	1.704	2.905	0.004
(60-80K) – Below 5K	6.177	1.897	3.257	0.001
Above 80K – Below 5K	8.389	1.732	4.844	< .001
REGION TYPE:				
Varanasi- Delhi	-10.276	0.835	-12.310	<.001

Figure-3: Residual Plot of the Regression Model



Note. Figure 3 shows a strong relationship between the school type, monthly income, region type and learning equity, such that students from the private schools and greater monthly household income and those from Delhi schools had greater learning equity.

Table-8: Summary of Factors Affecting the Online Learning Equity

Data Type	Factor Affecting	Predictors for Better Online Learning Equity
Delhi	School Type	Students studying in private schools had greater online learning equity.
Varanasi	School Type	Students studying in private schools had greater online learning equity.
	Gender	Female students had more online learning equity than male students.
Total Data Compiled	School Type	Students studying in private schools had greater online learning equity.
	Monthly Income	Students with monthly income greater than five thousand a month had better online learning equity
	Region Type	Students from Delhi were found to have greater learning equity than students from Varanasi.

Conclusion

The impact of the COVID-19 pandemic on education has been especially severe in India, and the pandemic has exposed existing fault lines in the education system and exacerbated greater learning inequalities. The government responses in these two cities have been different in Varanasi and Delhi and this has generated a larger divergence in learning equity. The analysis based on regression charts in the two regions unravels varied convergent and divergent patterns regarding technological access, digital literacy, cultural factors, and parental attitudes. Due to the continuous efforts by the Delhi government in the sector, the literacy rate of the students has increased to 86.2%, which is more than the average 25 literacy rate of Indian Students. One of the prominent reasons for this growth can be attributed to the continuous efforts made by the Delhi Government Authorities who invested a sum total of 25.3%, which is a quarter of its budget into education (Economic Survey of Delhi, 2020). Similar initiatives were missing in Varanasi.

Students in Delhi also had greater online learning equity compared to students in Varanasi, with Delhi being a national capital and an X-Class city, implying better educational and technological infrastructure and capacity-building initiatives. Similarly, students who were enrolled in private schools had better access to online education in both cities. The study also revealed the significance of cultural inclusivity in online learning. The diversity of students' cultural backgrounds affects the process and outcomes of online learning. For instance, in Varanasi, students from private schools and higher-income families experience greater educational equity compared to their peers.

The study recommends enhancing teachers' computer proficiency and providing them with technological

tools to overcome barriers to digital skill development in regions with limited technological access. Professional development programs and partnerships to improve ICT infrastructure in schools are also essential to address this issue including greater fiscal allocation towards school education, external financial & social audits of fund utilisation in government departments schools, and building robust digital infrastructure in government & government-aided schools.

Overall, the study reveals that limited access to technology impedes digital skill development, making ICT literacy a crucial factor. Indeed, policymakers should work with schools, students, parents, public and private partners, and civil society to create policies and allocate funding for affordable and user-friendly technological innovations that ensure inclusivity and accessibility to technology and digital infrastructure.

Therefore, crafting an equitable online learning ecosystem necessitates a multifaceted approach that encapsulates students' satisfaction and perceived effectiveness, heightened ICT literacy, cultural inclusivity, and an understanding of parental choices and intentions. By amalgamating insights and strategies in these areas, policymakers and educators can champion the creation of a more inclusive and equitable online learning realm for students.

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Research Article

Exploring the Factors of Smartphone Addiction: An Exploratory Factor Analysis

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Abstract

Overuse of smartphones (smartphone addiction) has become a nuisance in student life. Therefore, this study had an objective to explore the factors of smartphone addiction among undergraduate (UG) students. The descriptive research method was adopted with a quantitative approach. 591 UG Students were selected randomly from different colleges of the University of Delhi. Under the descriptive statistics, the index of skewness and kurtosis and its standard errors were computed to test the normality of the data set. As an inferential statistic, "Exploratory Factor Analysis" (EFA) was applied to explore the factors of smartphone addiction. Further, "Kaiser-Meyer-Olkin Measure of Sampling Adequacy", (KMO) was applied to test Sampling Adequacy. In addition to it, "Bartlett's Test of Sphericity", was applied to test intercorrelations among variables. Multicollinearity was verified by determinant. The varimax rotation method was applied to rotate the factor matrix under orthogonal rotation. The analysis of the data set provides evidence as a result that smartphone addiction has six factors namely 'Time', 'Interference', 'Psychological Worry and Concern', 'Dependency', 'Craving', and 'Technology use and Privacy' This study explains the total 35.397 per cent of the total variance. 'Time' as a factor had the highest explained variance i.e. 16.895 per cent among all six factors whereas the factor namely 'Technology Use and Privacy' explained 2.766 per cent of the total variance which was the lowest among all the factors.

Keywords: Smartphone Addiction, Compulsive Behavior, and Factor Loading.

Introduction

The 21st century is the age of technology and science. Those countries that are doing well in the fields of Technology, communication, and electronics are generally labeled as advanced countries. This advent of technology had provided a ground for a 'today's essential commodity, i.e., smartphone' which was invented and designed by IBM in 1993. Those smartphones were sold by BellSouth (Hosch, 2023). Since then, smartphones has been playing a significant role in connecting people across the globe. The significance comes from the superb features that provide various interactive services through wireless facility, access to the internet, Wi-Fi, web browsing for real time communication. The portability enhanced the smoothness of computing, along with that touchscreen, typing keyboard, voice typing, gaming, embedded memory, digital camera made smartphones Pandora Box of real time usage as well as 'a must for' synchronous and asynchronous transmission which attracts the mass across the world. This is the reason that smartphone users are multiplying rapidly across the world. The ownership of smartphones in the population is highest in Germany at 82.4 per cent. A large portion of the population in Japan i.e. 78.4 per cent also use smartphones,

followed by Italy 77.5 per cent, US 73.7 per cent, Russia 73.2 per cent whereas the ownership of smartphones in India is 45.7 per cent (Horwath, 2023). However, there is a prediction of exponential increase in the number of smartphone users in India. One billion Indians will have a smartphone by 2026 as reported by (Business Standard, 2023).

The smartphone is a kind of device that has a double-edged sword. The exponential increase in number of smartphone users might not show a clear picture of usage as per time and need. Intelligent use may be put to the advantage whereas overuse and misuse may put the users in miseries. Moreover, there is a great debate on the abuse and addiction of smartphones and its influence on health and interpersonal skills of youths, not only globally but in India to be particular. Here in this research, the researcher talked about two types of addiction, Physical and Behavioural. In physical addiction, the use of substances is involved for instance the consumption of drugs or alcohol whereas behavioral addiction refers to compulsive use or dependency to get pleasure or enjoyment e.g. smartphone addiction. Nowadays, smartphone addiction is a great concern due to its constant overuse as 52.8 per cent of even medical students were found addicted to smartphones as investigated by (Liu et al., 2022). Generally, an addicted person feels that very important things are missing if they don't have a mobile with them. Having a smartphone has become a very important part of life like food, home, and clothes. It has also been observed that youths keep scrolling through their smartphone even if they do not have reason to scroll through it. Youths also keep busy on their smartphone if they encounter a tense situation or avoid someone. The youths become so dependent on their smartphone that creates the situation of nomophobia (Fear/tension without being smartphone) which builds the foundation for health risks and interpersonal problems.

Theoretical Framework

Psychology Associated with Smartphone: A Connection with Skinner's Theory of Respondent Response and Operant Response

Skinner was very much interested in introducing reinforcement as an independent variable to measure its effect on behavior. In this context, He introduces the types of reinforcement schedule which includes ratio schedule and time schedule to verify how these schedules affect the behavior like how frequently learning occurs, rate of response and how the particular behavior persists over period of the time in absence of reinforcement. Ratio schedule means the portion of current responses whereas time schedule refers to passage of time (Lefrancois, 2000). Although Skinner did many experiments to know the influence of reward and punishment on behavior. His famous experiment was on pigeons. He closed the one pigeon into the lever box in which food came out as a reward if a lever of the box was pressed. There was nothing that excited and created curiosity in this experiment. Simply press the lever and get the food if you are hungry. But generally, people get habituated about rewards when it is not known to them how much reward they will get and when. Pigeon knew well that they would get food by pressing the lever so the pigeon pressed the lever only in that situation in which he was hungry. On pressing the lever, if sometimes Pigeon gets the food and sometimes Pigeon doesn't get the food then the Pigeon will stick to the lever box and keep pushing the lever continuously. (Skinner 1938, as cited in Singh, 2006).

Similarly, in the case of gambling, the designer of the gambling machine also created gambling addiction by developing the design of the gambling machine in which gamblers gamble until they have money. Similarly, mobile companies applied this psychology to smartphones and designed the attractive features of smartphones. You must be thinking about the similarity among Skinner's experiment, gambling machine, and smartphone. Let's make it clear through different examples.

Similarity: Skinner's experiment, gambling machine, and smartphone

Hitting the lever in the hope of getting food by Pigeon or Pressing the button of the slot machine by the Gamblers in Casino (Gambling device) or Scrolling the screen of a mobile phone anywhere or checking the timeline of Facebook. There is one common thing in all the above examples that people want to know what is about to come in the form of reels or text messages or videos (rewards like Skinner's experiment). He/she starts to think about what would be the next reels/message (reward) or how many likes/comments have come on my social media posts (reward). It is like an attractive net in which the humans are stuck and pulled deep down in the ocean of entertainment. A person who is so absorbed in entertainment is unable to control the urge of using his/her smartphone.

Smartphone Addiction- Consequences for Eye Vision and Brain

The excessive use of smartphones has negative consequences on the eyes because (39.7 per cent) of students had dryness and pain in the eyes whereas (66 per cent) of students reported ocular problems due to prolonged use of the smartphone as investigated by (Issa et al., 2021). In addition to it, Nayak et al. (2021) found that even after one hour of smartphone reading, the problem of tiredness, sore eyes, and discomfort increases. They further, reported that binocular problem like blurred vision was also noticed. Concerning the smartphone consequences to the brain, it is evident that the excessive use of smartphones is harmful to the brain (Seo, 2017), a neuroradiologist, did research on "Smartphone addiction creates an imbalance in the brain" and found that "smartphone and internet addiction increases the level of neurotransmitter called GABA in one region of the brain which slows down brain's signal". Similar consequences like a foggy mind, headache, and even decreased vision have also been investigated by (Sharma, 2021), a Neurological Scientist & Head, of the Department of Neurology, AIIMS. She also reported the significant change observed in "frequencies of brain wave patterns". Furthermore, similar findings have also been reported by a group of researchers that "excessive use of mobile phone may be a serious problem. It might cause neurological damage which are not observable immediately but in the long term, it may decrease the brain's reserve capacity that might be a great cause of neurological diseases" as examined by (Salford et al., 2003).

Smartphone Addiction- Friendship, Social Isolation, Psychological Well-Being, and Road Accidents

Although smartphones provide the opportunity to make friends in the virtual world through various social media platforms. However, it is very harmful for social well-being in real-life as it is evident that loneliness was found to be high correlated with smartphone addiction as investigated by (Singh and Kumari, 2021). Similar findings have also been endorsed by (Yilmaz et al., 2022). Further, due to being a University student, the separation begins not only from family but also from local and school friends. Smartphone addiction additionally multiplies in raising the magnitude of loneliness. This social loneliness might cause

impact on negative social behavior such as communication, understanding emotions and facial expressions of others, and social interaction. Hence, not only quantity but also the quality of the real relationship starts to deteriorate slowly and unknowingly due to a lack of face-to-face interaction. Moreover, smartphone addiction also discourages students from participating in physical activity. Hence, under such circumstances, the possibility of obesity cannot be ignored. In addition to it, smartphone addiction is not only harmful for psychological well-being but has other health risk factors because it is established that smartphone addiction is significantly correlated with sleep deprivation which implies that higher smartphone addiction has higher sleep deprivation (Kokkaparambil and James, 2023). A similar finding has also been reported by (Rathakrishnan et al., 2021) that those students who were smartphone addicted, had poorer sleep quality while quality sleeping is not for just rest; rather it is essential for good psychological well-being and physical health otherwise sleep deprivation may have very adverse consequences in form of "irritation, depression, anxiety, fatigue in the daytime, poor respiratory system, the problem of cardiovascular, week immunity and digestive system, weight gain, poor balance, and concentration" as medically reviewed by (Johnson et al., 2023).

Further, statistics also reveal that mobile phones are a great cause of road accidents in the country, a report titled "Road Accident in India 2021", reveals that there were 6753 accidents in 2020 which resulted in 2917 fatalities. Similarly, 2982 fatalities in 2021 as reported by (Ministry of Road Transport and Highways, 2021). Hence, the above statistics are sufficient to understand how the mobile phone is dangerous and life-threatening concerning road accidents. Therefore, it is necessary for us to explore those factors which make UG students addicted.

The research at the international level shows discrepancies in their findings. In the case of gender, a contradiction is noticed, both male and female respondents were the same in their smartphone addiction as investigated by (Keshky et al., 2023; Samaha and Hawi, 2016; Wu and Chou, 2023) but a study in Tunisia revealed that male university students were at high risk of smartphone addiction in comparison to female students (Turki et al., 2023). Similarly, on the factor of academic performance, Samaha and Hawi (2016) found that high smartphone addiction leads to poor academic performance. In contrast, Bennett (2020) does not find any relation between smartphone usage and academic performance. As far as dependency and anxiety are concerned, a study done in South Korea and Lebanon showed higher scores on the smartphone dependency test which was identified as the probable cause of anxiety (Lee et al., 2016; Samaha & Hawi, 2016). In contrast, a group of researchers reported a negative correlation between smartphone use and anxiety (Stankovic et al., 2021; Cumino et al., 2017). Similar findings (on smartphone dependency) were also reported by (Bagcı & Peksen, 2018; Zamri et al., 2023). In addition to it, those females addicted to smartphones showed high levels of loneliness and were likely to feel lonelier (Zamri et al., 2023). Likewise, Kim et al. (2015) did a study and found that depressed people rely more on mobile phones to alleviate their negative feelings. Further, concerning sleep quality and smartphones, Parlak et al. (2023) reported a significant correlation between smartphone addiction and poor sleep quality. Apart from it, on the factor of family income, Gökçearslan et al. (2018) presented that family income had no significant effect on smartphone addiction. In contrast to the above

findings, Parlak et al. (2023) found that smartphone addiction increases with an increase in family income. Apart from these contradictory researches, there are researches which focused on factors of smartphone addiction. As per Liu et al. (2022) perceived stress, study pressure, and isolation are some of the factors responsible for smartphone addiction. Similarly, a study done by Meena et al. (2021) showed loneliness had a strong correlation to smartphone addiction but shyness and social anxiety were moderately correlated, whereas, external locus of control were weakly correlated to smartphone addiction. On the other hand, Kim (2021) presented the different factors that adolescents with low economic status, high academic stress, or low perception of parental support, or those who have been victims of bullying, are more likely to be addicted to smartphones. Further, factors reported by Munasinghe (2016) are also not consistent with other researches as he confirmed that common reasons for using a smartphone by students are Usefulness, Loneliness, Gender, and Family income level.It is probably difficult to generalize international research studies in Indian settings.

International researches are probably difficult to generalize in Indian settings. The first reason is being contradictory findings. Second, Changes in geographical area\location show different factors related to smartphone addiction, which limits the external validity of the research. It may be due to various reasons like cultural, socio-economic, political, historical, and environmental factors. Moreover, the local context widely influences the research outcomes. Hence, it is essential to include the Indian context to explore factors of smartphone addiction that may enhance the relevance.

At the national level, research findings are also contradictory. Some research findings support that gender influences smartphone addiction while others contradict it. Chatterjee and Kar (2021) found that male students showed high smartphone addiction in comparison to female students but Oswal et al. (2020) found no association between smartphone addictions with gender. On the factor of academic performance, Chaudhary and Tripathy (2018) showed a negative correlation between smartphone addiction and academic performance whereas Oswal et al. (2020) found no association of smartphone addiction with academic performance. Concerning sleep quality and insomnia, various studies confirmed that smartphone addiction leads to impaired sleep quality (Chatterjee and Kar, 2021; Ghogare et al., 2021; Govarthini, 2023). In contrast, Snekha (2023) indicated that there was no significant relationship between Smartphone addiction and quality of sleep. Further, in view of income, Kundapur et al., (2020) present evidence that smartphone addiction is more prevalent in the family with higher economic status whereas Pooja et al. (2022) found no significant relation between family income and smartphone addiction. Likewise, a study done by Pradeep et al.(2022) confirmed that gender, number of peers, and social quality of life were associated with increased risk of cell phone addiction and Age, empathy, communication skills but physical quality of life were associated with reduced risk of cell phone addiction. Similarly, Handa and Ahuja (2020) reported that the fear of missing out is one factor responsible. However, Malik and Devi (2018) reported various other factors such as cheap internet facilities, behavioral addiction, dependency, communication, a symbol of status, and personal use, etc. as factors responsible for smartphone addiction. Therefore, there is great variation in findings at national level. Hence, this contradiction should be

studied carefully and thoughtfully to understand the cause of the underlying difference. All these variations in research findings culminated in an idea to carry out research to understand the most important factor of smartphone addiction which contributes maximum (explained variance).

Significance of the Study

Although the smartphone has numerous advantages, but it has also emerged as a source of many problems not only for social, personal, and academic, but also for health and psychological wellbeing. Many researches have been conducted related to smartphone addiction based on various issues and demographic variables such as gender (Keshky et al., 2023; Samaha and Hawi,2016, Wu and Chou,2023), education level (Samaha and Hawi, 2016; Bennett, 2020), family income (Gokcearslan et al., 2018), caste (Tenhunen, 2018), age (Gromik, & Litz, 2021), and habitat (Sowndarya & Pattar, 2018) that explains which group has the higher addiction and the lower addiction towards the smartphone but a very important issue has been ignored i.g. identification of highly contributing factors to smartphone addiction. Therefore, in order to minimize the adverse effects of smartphone addiction, it is necessary to determine those factors that are largely accountable for making UG students addicted to smartphones. When it is known which factor has contributed and how much (explained variance) in smartphone addiction then appropriate efforts can be made to reduce the adverse effects of a particular highly contributed factor. Such kind of evidence will not only be helpful to the parents but also the teachers and the psychologist to make UG students smartphone addiction free. Therefore, this study is a need of hour to detect those factors which are highly responsible for making UG students addicted.

Statement of the problem

Exploring the Factors of Smartphone Addiction: An Exploratory Factor Analysis

Objective

To explore the factors of smartphone addiction among undergraduate students.

Research question

What are the factors which are accountable for smartphone addiction among undergraduate students?

Functional Definition of Terms Used

Smartphone Addiction-

Smartphone addiction is a problematic behavioral pattern of students that involves excessive and compulsive use of smartphone, over dependency and inability to control its overuse.

Undergraduate Students-

Undergraduate students refer to those students who enrolled themselves in different undergraduate programs.

Research Methodology

Research method

Based on the nature of the research problem and its objective, the descriptive research method was applied with the quantitative approach.

The population of the study

Those undergraduate students, who registered themselves under any undergraduate program at different colleges of the University of Delhi, constitute the population of this study.

Sample and Sampling Technique

Initially, 650 undergraduate students were selected randomly from different

colleges of the University of Delhi. However, 59 students were excluded from this research because of the non-completion of the scale. Thus, this research comprises 591 UG students as sample.

Data collection

Construction of Smartphone Addiction Scale- A Description

Concerning the collection of scientific data, based on the Likert scale method, a five-point Smartphone addiction scale was constructed to measure smartphone addiction of UG students with the help of experts, personal experiences, and literature. Initially, 64 questions were constructed. For the purpose of validation of the scale, it was also sent to the experts with a request to assess the scale on the criteria of 10 point rating scale and whether every item of the scale can examine the smartphone addiction for which this scale has been constructed. The average rating for each item was computed and only those items were retained in the final version of the scale which were rated an average of 7 or above by the experts. Hence, 9 questions were dropped from the scale due to low ratings. A pilot study was also done to rectify the administrative problems of the scale. The administration of scale was done on a small group of students. Minimum 55 and maximum 275 scores were possible on this scale. z-score norms were also developed to interpret the raw data meaningfully.

Statistical Analysis

To analyze the raw data, various measures of descriptive and inferential statistics were applied. The assessment of the normality of the data was done through descriptive statistics. Therefore, the index of skewness and kurtosis along with its standard errors were computed. The assumptions of exploratory factor analysis were examined by three statistical tests like "Kaiser-Meyer-Olkin Test of Sphericity" which authenticates the sampling adequacy whereas intercorrelations among variables was confirmed by Bartlett's Test of Sphericity". Further, in order to verify the multicollinearity of the data, an index of determinant was calculated. After being satisfied from the cutoff criteria of all three tests, exploratory factor analysis was applied.

Testing of Normality of the Data Set

Table-1: Showing skewness, Kurtosis, and its Standard Errors.

Descriptive Statistics

	N	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Total	591	178.3875	25.86255	668.872	.194	.101	-.003	.201
Valid N (listwise)	591							

It is evident from Table 1, that the data has a positive skewness. The coefficient of skewness is (0.194) which is not too much larger than the standard error (0.101) of skewness. In addition to it, the coefficient of the skewness is very close to the normal value of the skewness i.e. (0). Further, If the index of skewness is divided by the standard error of the skewness, it (skewness= +1.92) falls between +1.96 to -1.96. Similarly, the computed value of the kurtosis is (-.003) which is too close to the normal value of the (.263). Furthermore, the value of kurtosis (-.003) is also divided by its standard error (0.201), it falls (Kurtosis = 0.01) between +1.96 to -1.96. Although, there is a very slight deviation in the

index of skewness and kurtosis of the data set, but it is very negligible. Hence, the data are normally distributed in the distribution and follow the assumption of normality.

Table-2: Showing the value of the determinant

Sl	Computed Value of Determinant	Normal Value of Determinant
1.	1.07	.00001

It is evident from Table 2, that the index of the determinant is 1.07 which is higher than the normal index of the determinant i.e. (.00001) which signifies that the data set is absolutely free from the problem of the multicollinearity and fit to apply to the exploratory factor analysis.

Table-3: Showing the value of the "Kaiser-Meyer-Olkin test" to determine the sampling adequacy and the value of "Bartlett's Test of Sphericity test" to determine the interrelations among the variables

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.880
Bartlett's Test of Sphericity	Approx. Chi-Square	7847.528
	df	1485
	Sig.	.000

In order to determine the sampling adequacy, the measure of the sampling adequacy was applied. For this purpose, "Kaiser-Meyer-Olkin test" (KMO) was adopted. It is revealed from Table 3, that the determined value of the KMO test is 0.880 which is greater than the normal cut-off criteria (0.05) of the KMO test which implies that the data set has sampling adequacy to run the exploratory factor analysis.

Similarly, in order to secure the inter-correlations among the variables, "Bartlett's Test of Sphericity ", was applied. It shows from Table 3, that the calculated value of "Bartlett's Test of Sphericity ", is 7847.528 which is significantly high at 0.0001 level of significance. Therefore, the Null hypothesis that "all variables are not interrelated", is rejected. Therefore, due to the rejection of the above-mentioned null hypothesis, the alternative hypothesis that "all variables are interrelated", is accepted. Hence, the above analysis infers that the data set have inter-correlation and is suitable to run the factor analysis.

Process of Factor extraction

In order to extract the factors, principal component analysis was used. Further, concerning the rotation of the factor matrix, the varimax rotation method was used under the orthogonal factor rotation. As far as "Coefficient Display Format" is concerned in SPSS, the coefficient below (.40) was suppressed. The details of extracted factors are given below in Table 4

Table-4: Total Variance Explained

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.292	16.895	16.895	9.292	16.895	16.895	4.688	8.524	8.524
2	2.809	5.108	22.003	2.809	5.108	22.003	4.412	8.022	16.546
3	2.478	4.506	26.509	2.478	4.506	26.509	2.902	5.277	21.822
4	1.811	3.292	29.801	1.811	3.292	29.801	2.724	4.953	26.776
5	1.556	2.830	32.631	1.556	2.830	32.631	2.520	4.581	31.357
6	1.522	2.766	35.397	1.522	2.766	35.397	2.222	4.040	35.397
Extraction Method: Principal Component Analysis.									

It is evident from Table 4, that only six factors have greater than one eigenvalue which provides evidence that this research has only six factors of smartphone addiction which emerged from 55 variables. Further, altogether these six factors cumulatively share and explain 35.397 per cent of the total variance. Factor one has the highest eigenvalue i.e. 9.292, and followed by factor two-2.809, factor three-2.478, factor four-1.811, factor five-1.556, factor six-1.522. The details of the labeling of the above six factors have been explained below in Table 5.

Table-5: Showing the Rotated Component Matrix and Factor Loading of Components of Smartphone Addiction

Rotated Component Matrix						
Factor 1:Time	Factor Loadings/Component					
	1	2	3	4	5	6
The prolonged use of Smartphones has made me more lazy.	.675					
My working capacity is compromised due to excessive time spent on my smartphone.	.670					
I try to minimize the time spent on my smartphone but I am unable to do so.	.633					
I am well aware of the adverse effects of excessive use of Smartphone still I overuse it.	.564					
I want to spend little time on my Smartphone but get so involved that I spend more time than expected.	.554					

I get distracted by smartphone Apps while I am studying.	.523					
Due to prolonged use of Smartphone I feel strain in my eyes.	.492					
I want to do physical activity but it gets compromised due to my excessive engagement on my Smartphone.	.477					
Before start studying, I like to pass some time on my smartphone.	.441				.416	
I think that the duration of smartphone usage is increasing rapidly.	.417					
Factor 2:Interference						
I am using my Smartphone and scrolling through social media even in my dreams.		.654				
I love to spend my time on my Smartphone rather than spending time with my family members.		.529				
I desire to have multiple Smartphones.		.499				
Due to excessive use of smartphone through headphones and buds, I have begun to face difficulty in the frequency of listening in a normal manner.		.495				
I get too much involved with my smartphone that I even forget about the humans around me.		.490				
Sometimes I am so engaged with my Smartphone that I turn a deaf ear and do not respond to my family members.		.476				
Due to excessive use of Smartphone, my study time is being compromised and it leads to late submissions of assignments.	.459	.469				
Due to too much use of Smartphone I get headaches and dizziness.	.405	.457				
My concentration begins to lose if I do not look at my Smartphone for some time.		.448				
I get angry/ irritated when someone interrupts me while scrolling my smartphone.		.444				
I wish to use my Smartphone during lectures in the classroom.		.442				

Factor 3:Psychological Worry and Concerns						
I don't want my Smartphone should be seen or guarded by parents.			.647			
I feel uncomfortable when someone is scrolling or using my phone.			.626			
I get defensive when someone ask me what I am doing on my Smartphone			.569			
I do not want that my parents should know my Smartphone password.			.494			
I feel annoyed when my phone does not work properly.			.400			
Factor 4:Dependency						
I feel very anxious as if a very important thing is missing when I don't have my Smartphone with me.				.545		
I cannot compromise to have a smart-phone.				.497		
I feel it is impossible to keep away or give up Smartphone.				.494		
I want my smartphone with me even if there is no need.				.473		
I always want to have a Smartphone with the latest technology.				.429		
I feel Smartphones have become an essential part of our lives just like food, home, and clothes.				.411		
I feel very anxious and tense if the bat-tery of my smartphone is low or dead.				.409		
Factor5:Craving						
I prefer using my Smartphone while waiting for someone (College/ railway station/ bus stand).					.601	
I like to use my Smartphone even while eating.					.495	
I like to have smartphone beside me while sleeping					.431	
In the vacant period, I use a Smartphone to fill the gap between two classes at college.					.414	

Factor 6:Technology Use and Privacy						
I like to book tickets through my Smartphone.						.641
I prefer to make payments through my Smartphone.						.568
I keep my smartphone updated and virus-free.						.471
I keep my Smartphone password very complex so that one should not be able to anticipate.						.467
I like to do online shopping through my Smartphone.						.461
I always keep my Smartphone protected by a password.						.401
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]						
a. Rotation converged in 14 iterations.						

Factor 1: Time

It is evident from Table 5, that ten variables are loaded significantly in factor one. The close observation of all these attributes indicates that all attributes are represented by 'time'. Therefore, this factor is labeled as time that explains 16.895 per cent of total variance which is the best and maximum amount of explained variance among all six factors. Further, it is also exhibited from the rotated factor matrix that variables like the prolonged use of Smartphone has made me more lazy, and has the highest factor loading (.675). Similarly, my working capacity is compromised due to excessive time spent on my smartphone (.670), which has the second highest factor loading. Likewise, 'try to minimize the time spent on my Smartphone but I am unable to do so. (.633), has the third highest factor loading. At the fourth level, attributes such as being well aware of the adverse effects of excessive use of smartphones still I overuse it, loaded in this factor with factor loading (.564). Further, ' I want to spend little time on my Smartphone but spend more time than expected (.554), which has the fifth top factor loading in the factor matrix. In addition to it, variables like 'distracted by Smartphone Apps during study time' also loaded with the factor loading of (.523), and followed by 'due to prolonged use of Smartphone I feel strain in my eyes (.492), physical activity gets compromised due to excessive engagement on Smartphone (.477), 'before start studying, I like to pass some time on Smartphone' (.441) loaded in the above factor with good degree of factor loading. At last, variable like 'the duration of Smartphone usage is increasing rapidly' (.417), loaded in the 'time' factor with the lowest factor loading. This factor not only consists of a very good number of attributes but also explains the maximum portion of total variance to understand the phenomenon of smartphone addiction. The scale of the factor loading for the 'time' component is between .675 and.417. The index of eigenvalue for this factor is 9.292 which is greater than the eigenvalue of the rest of all five factors.

Factor 2: Interference

With reference to Table 5, it is evident that eleven variables are loaded significantly in factor two. The analysis of all the variables provides evidence that all attributes are represented by the 'interference'. Therefore, this factor is named as 'interference' which retains 5.108 per cent of the total explained variance. The interference factor has the second maximum explanation power of smartphone addiction. The variance is distributed in the eleven-factor loading such as "I am using my Smartphone and scrolling through social media even in my dreams" (.654), which has the uppermost factor loading whereas 'love to spend time on smartphone rather than with my family members' (.529), has second top factor loading. Similarly, the 'desire to have multiple smartphone' (.499), has the third highest loading. Furthermore, 'Due to excessive use of Smartphone, face difficulty in the frequency of listening in a normal manner' (.495), and have fourth highest loading. In addition to it, an attribute like 'I get too much involved with my smartphone that I even forget about the humans around me', is loaded in the above factor with factor loading of (.490). Surprisingly, sometimes I am so engaged with my smartphone that I turn deaf ears and do not respond to my family members (.476), which has the sixth highest factor loading for the 'interference' factor. At the seventh level, 'due to excessive use of Smartphone, my study time is being compromised and it leads to the late summation of assignments', is loaded with factor loading of (.469). Apart from it, a variable such as 'Due to too much use of Smartphone I get headaches and dizziness', has the eighth highest factor loading (.457). Correspondingly, 'My concentration begins to lose if I don't look at my smartphone for some time (.448), has the ninth highest factor loading, and followed by getting angry/ irritated when someone interrupts me while scrolling my smartphone (.444). Lastly, an attribute like 'I wish to use my smartphone during lectures in the classroom, has the lowest factor loading for this factor. (.442). The range of factor loading confines between .654 and .442. Further, concerning the eigenvalue of this factor, it is 2.809.

Factor 3: Psychological Worry and Concern

Concerning Table 5, the factor matrix demonstrates that five variables are loaded in the factory matrix. The closed observations of these attributes signify that all variables express worry and concerns. It is the reason that this factor is named as 'Psychological Worry and Concern' which contributes 4.506 per cent of the total explained variance. Further, the explained variance is distributed into the five factor loadings such as attributes like 'don't want my smartphone should be seen or guarded by parents, which possesses the maximum amount factor loading (.647) in the above factor. Further, 'feel uncomfortable when someone is scrolling or using my smartphone', has the second highest factor loading (.626). Likewise, at the third level, 'get defensive when someone asks me what I am doing on my smartphone, loaded with factor loading of (.569) in the rotated factor matrix, and followed by 'don't want my parents should know my smartphone password (.494). At last, 'I feel annoyed when my Smartphone phone does not work properly' has loaded with the smallest factor loading of (.400) in this particular factor. As far as the concern of the distribution of factor loading in the above factor, it is between 0.647 and 0.400. It is also evident from Table 5, that the index of eigenvalue of this factor is 2.478 which is larger than factor four, five, and six.

Factor 4: Dependency

Further, with reference to Table 5, it can be observed that seven variables are loaded significantly on the fourth factor which is related to important things missing, not compromising to have a smartphone, impossible to keep it away, want a smartphone even there is no need, desired to have the latest technology, smartphone as an essential part of life, and feel anxious in case battery dead. All these attributes represent the dependency of students on the smartphone. Therefore, this fourth factor is named as 'dependency'. The factor 'dependency' shares 3.292 per cent of the total explained variance which is distributed into the seven different factor loadings like 'feel very anxious as if a very important thing is missing when I don't have a smartphone with me, has loaded with toppest factor loading (.545). Similarly, 'cannot compromise to have a smartphone, has the second highest factor loading (.497) in the factor matrix. Likewise, in third place, variable like 'feel it is impossible to keep away or give up smartphone', loaded with factor loading of (.494). In addition to it, I want my smartphone with me even if there is no need, has the fourth-highest loading (.473). Furthermore, 'want to have a smartphone with the latest technology, is at sixth rank and is loaded with factor loading of (.429), and followed by 'feel Smartphone have become an essential part of our lives just like food, home, and clothes (.411). Lastly, I feel very anxious and tense if the battery of the Smartphone is low or dead, and has the lowest factor loading (.409). The range of between the highest and lowest factor loading for this factor is between .545 and .409. The index of eigenvalue for the above factor is 1.811 which is greater than factors five and six.

Factor 5: Craving

Further, table 5, demonstrates that four variables are grouped together which are highly correlated like using a smartphone while waiting, even eating, sleeping, and to fill the gap between two classes at college. All these attributes show the desire or passion of students towards the smartphone. Therefore, this factor is named as 'craving' which shares 2.830 per cent of the total variance explained that is distributed into four-factor loadings like "prefer using my smartphone while waiting for someone (college/ railway station/ bus stand), has uppermost factor loading (.601) in this factor while I like to use my smartphone even while eating, has second greater factor loading (.495), Further, at the third level "I like have smartphone beside me while sleeping", has third highest factor loading (.431). Similarly, at last "In the vacant period, I use my smartphone to fill the gap between two classes at college", which has the lowest factor loading (.414). The spectrum of factor loading is between .601 and 0.414. Regarding eigenvalue, the factor craving has 2.830 as the eigenvalue.

Factor 6: Technology Use and Privacy

From the analysis of the aforementioned Table 5, it is evident that six correlated attributes form a group that comprises variables like ticket booking, doing payments, online shopping, protection by password and keeping password complex, carefulness about updation, and making smartphone virus-free. All these attributes are well described by the technology use and privacy. Therefore, this factor is labeled as 'Technology use and privacy' which explains 2.766 per cent of the total variance. This variance is shared by six-factor loading such as "like to book

tickets through my smartphone, which has the highest factor loading (.641) whereas "prefer to make payments through my smartphone", which has the second highest factor loading (.566). Similarly, " keep my smartphone updated and Virus free", and has the third highest factor loading (.471). In addition to it, variable like I keep my smartphone password very complex so that one should not be able to anticipate, has the fourth highest factor loading (.467) in the factor matrix, followed by I like to do online shopping through my smartphone (.461) and I always keep my smartphone protected by a password (.401). The range of factor loading for this factor is between .641 and .401. As far as the eigenvalue is concerned, it is 1.522.

Findings of the study

Based on analysis of the data the following results were drawn.

- The index of determinant, "Kaiser-Meyer-Olkin Measure of Sampling Adequacy", and "Bartlett's Test of Sphericity " was suitable as all these parameters were found fit to run the exploratory factor analysis.
- Smartphone addiction has six factors namely 'Time', 'Interference', 'Psychological Worry and Concern', 'Dependency', 'Craving', and 'Technology use and Privacy'.
- This study has 35.397 per cent of explained variance of smartphone addiction whereas it has 64.603 per cent of unexplained variance which is not known.
- Out of the explained variance of this study, 'time' as a factor shares 16.895 per cent of the total variance which is the maximum variance among all six factors of smartphone addiction. Hence, Time as a factor is the dominant factor in the Smartphone addiction of students.
- The second factor i.e. 'Interference', had 5.108 per cent of the total explained variance which was the second dominant factor for Smartphone addiction, followed by 'Psychological Worry and Concern' 4.506 per cent, Dependency 3.292 per cent, and Craving 2.830 per cent.
- Components like 'Technology use and Privacy' explained 2.766 per cent of the total variance which had the least explained variance among all six factors.
- The highest factor loading of .675 was found in factor one i.e. 'time' whereas, in contrast to it, the lowest factor loading of .400 was noticed in factor three i.e. 'Psychological Worry and Concern.

Discussion

This study was conducted with the prime objective of exploring the factors of smartphone addiction. The findings have provided great insight regarding smartphone addiction among undergraduate students. The data analysis suggests that there are six factors that are accountable for smartphone addiction i.e. 'Time', 'Interference', 'Psychological Worry and Concern', 'Dependency', 'Craving', and 'Technology use and Privacy'. There might be numerous potential reasons for such findings. It is evident from the research that in the situation of depression humans rely upon the mobile to alleviate their negative feelings as reported by (Kim et al., 2015). Further, perceived stress, study pressure, and isolation are also big reasons for smartphone addiction as investigated by (Liu et al., 2022). In addition to it, when a student starts to think too much about their academics and future career it builds additional apprehensions and worries. Therefore, students may start to use smartphone as entertainment devices which lead to spend more time

to smartphone to release worriedness, apprehensions, and pressure. It may make them slowly and unknowingly addicted. Research also supports that high academic stress is the leading reason for being smartphone addicted as examined by (Kim, 2021). Apart from it, extreme dependency on smartphones is also a significant reason for smartphone addiction as investigated by (Lee et al., 2016; Bagci & Peksen, 2018; Zamri et al., 2023). Apart from it, social media applications such as WhatsApp, and Facebook Instagram have addictive features, which propels human's endless desire to check social media messages, reels, and other forms of entertainment. Further, the findings contradict the claim of Fidan (2016) who investigated that mobile addiction has seven factors - relapse, silence, mood modification, mobile internet tendency, tolerance, conflict, and withdrawal, whereas in contrast to the findings of Fidan (2016), this research has the six factors of smartphone addiction. Similarly, although the findings are also inconsistent with the findings of Fernandez (2017) as he reported the different factors of smartphone addiction like tolerance, withdrawal, disruption, disregard, loss of control, and preoccupation but this research has a slight resemblance with his findings because the number of factors are same in both the researches i.e. six. However, the meaning and context of the factors are different. The basic reason for the inconsistency with the findings of Fernandez (2017) is that the smartphone addiction scale was in Spanish and French language whereas in this research the smartphone addiction scale was developed in the English language which might be the potential cause of differences in the findings. Further, no research was found that corroborates with the findings of this research.

Based on the findings of this research, there are great implications to organizing the guidance and counseling program for undergraduate students because the University of Delhi has students from multilingual and multicultural backgrounds where the most of the students come from every corner of the country and reside as either paying guest or hostlers which keep away from the observation of the parents and other family members. As a result, this freedom provides a lot of scope to spend uncontrolled time on smartphones which increases the possibility of smartphone addiction. Hence, on the pattern of the above argument, the data of this research builds evidence that 'time' as a factor has explained the highest variance which implies that time is the highest contributing factor in smartphone addiction. Further, an unexpected factor loading was also noticed that "The prolonged use of the smartphone has made me more lazy", which is highest across all factor loadings which indicates that more time spent on smartphone is not only dangerous to compromise academic performance but also for overall personality development because it is already established through research that smartphone addiction lead to poor academic performance of the students as reported by (Samaha and Hawi, 2016). Similar findings have also been endorsed by (Khan et al., 2019; Rathakrishnan et al., 2021). It is recommended that in the future, another side of the time factor needs to be exploreed "how much time do students spend on their academics using the smartphone as a device?" Moreover, it is also suggested that research may be done to explore the remaining unexplained variance of smartphone addiction.

Conclusion

Concerning the associated research question of this research i.e. what are the factors which are accountable

for smartphone addiction among undergraduate students? The analysis of the primary data provides certain conclusions that smartphone addiction has six factors i.e. 'Time', 'Interference', 'Psychological Worry and Concern', 'Dependency', 'Craving', and 'Technology use and Privacy'. It is observed that Time as a factor has a huge impact on Smartphone addiction which consists of ten variables. Similarly, eleven variables are observed by the Interference factor which has the second highest impact on smartphone addiction. Likewise, five variables are observed under the Psychological Worry and Concern factor which has the third best influence on smartphone addiction. In addition to it, factor four like 'Dependency' possessed seven variables. Further, four other variables are also observed by the Craving factor. At last, six variables are retained by the factor 'Technology use and Privacy' which has the lowest impact on smartphone addiction. Concerning the highest factor loading, variable such as the prolonged use of my smartphone has made lazier, and loaded on time factor.

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Research Article

Public Debate on NCERT History Textbooks: Analysing Tweets on Mughals

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Abstract

In April 2023, NCERT brought out rationalised textbooks, which generated heated debate on social media. The present study examined this recent public debate on Twitter (now X) over the supposed removal of Mughal history from NCERT history textbooks by analysing tweets for nearly a month. The study sought to find out how X was used to share information and opinions. The findings show that X posts have both a direct and immediate effect on the perception of public opinion and that a better understanding of how different viewpoints shape the debate on X is highly important. The findings also bring forth a possibility to identify potentially misleading information on the platform. How all this puts greater responsibility on organisations like NCERT in bringing textual material or in anticipating responses to changes/modifications made in its textbooks or its future textbooks and in responding to them effectively are other aspects highlighted in the paper.

Keywords: History debates, textbook controversy, Twitter, X, rationalisation, Mughals

Introduction

The Cambridge Dictionary defines 'debate' as 'a serious discussion of a subject in which many people take part' (Cambridge University Press, n.d.). Among all disciplines, the history curriculum, syllabus and textbooks invite the most controversies. This is because history deals with issues of nationality, culture, and identity. In the past, these debates took place in books, media, and academia, but they now also take place online and on social media. Social media has brought a phenomenal shift in public debate and in also influencing people. This makes social media important for researchers to provide insight into how it engages the public in controversies. It can also inform policymakers because while social media can be used to encourage democratic participation, it can also be used to spread misinformation. We can provide insight into how information is exchanged, how people connect on social media and the outcomes of those efforts by looking at platforms like Twitter. In July 2023, Twitter was rebranded as X. Therefore, except in a few places, where context demanded, X has been used throughout the paper instead of Twitter.

History Textbooks and Public Debate

In India, the National Council of Educational Research and Training (NCERT) has been entrusted with designing the national curriculum frameworks and syllabuses for all school stages and preparation of model textbooks. These textbooks are adopted and adapted by different states. However, many states prepare their own textbooks. However, several

state boards consider the NCERT syllabuses as guidelines for developing their syllabuses and textbooks.

The NCERT textbooks in history have been at the forefront of public discourse since the first textbooks were brought out in the 60s. However, there have been debates over some state textbooks. This kind of public debate, though, is not limited to India. The world over, curricula, syllabi and textbooks in history have been in discussion over the interpretation of certain facts, events, personalities, the presence or absence of some historical facts, overemphasis on certain things, errors, outdated information etc. Botero (2009) states that, because of their public nature, history and social science textbooks are always open to debate as "many people feel they have the right to give their opinion about them regarding the information that is present or absent, the interpretations they make of historical facts or processes"(p.471-472). Danino (2016) says that no nation can escape historical controversies because history defines our identity. He also draws attention to the irony of Indian history, which, on the one hand, has often been despised by school children but, on the other hand, is very much alive in public space through numerous debates, often kept alive by the media, which brings daily reports of claims and counter-claims about historical distortions, 'controversial' topics and scholars, writing, and rewriting of history textbooks and so forth (Danino, 2016).

There have been efforts to look at some of these debates. Banerjee (2007), in 'West Bengal History Textbooks and the Indian Textbook Controversy says that school history curricula and textbooks have always reflected power politics, where the ruling party exercised influence over the entire exercise of teaching school history. The paper 'Conflicts in Indian History Textbooks: Between Avoidance and Abundance', highlights the Indian textbook controversy between 1998 and 2004 and elaborates on how history textbooks during this period interpreted certain events as conflicts and included or omitted these (Guichard, 2009). 'Politics and the Writing of Textbook' highlights that history textbooks developed after independence exhibited a particular ideology (Danino, 2015).In 'Textbook Controversies and the Demand for a Past: Public Lives of Indian History', author of the Chapter 'Clothing: A Social History' in the Class IX NCERT history textbook mentions one such controversy, which created a huge uproar (Nair, 2016). History is an interpretative subject. Botero (2009) says that "textbooks have so many different facets that they can be analysed from various angles and perspectives" (p.467). Sometimes textbooks are criticised because they are politicised because they include certain contents and eliminate others because they include distortions or half-truths (Botero, 2009). Sometimes, controversies erupt over not mentioning the source or reference of a claim or historical fact (Bharath and Bertram 2008).In 'Understanding Public Discourse on History Textbooks in India' Ojha (2022) considers the lack of multiple viewpoints and perspectives in history textbooks as one of the reasons for controversies.

Besides these, no attempt has been made to date to analyse a public debate over textbook content in history on social media. This study seeks to expand our understanding of the way the public responds to such debates by analysing tweets regarding recent rationalised content on Mughals. Studying social media is a valuable way to analyse the public as a whole. Examining communication on X provides us with a mirror to examine the ways people share information, especially in regard to controversies over history textbooks.

Rationalisation of History Textbooks and Recent Public Debate: Context And Chronology

During the Pandemic - COVID-19, students struggled to complete their education through online and other methods. Many children were unable to make much progress. The NCERT responded to these needs by undertaking several initiatives, like online sessions on *Swayam Prabha*, Alternative Academic Calendar, etc. Studies reveal that learning gaps have developed (Kuhfeld et al.2020; The Center for Research on Education Outcomes, 2020). In such a situation, if students were given the same textbooks without any change, it might have been detrimental to their further education. Concerns related to curriculum load were already raised by the Parliament Standing Committee (Rajya Sabha, 2021) and other stakeholders. In this context, NCERT rationalised textbooks to facilitate a speedy recovery. A general understanding of the term 'rationalization' means 'making a change in something to make it more efficient' (Oxford University Press, n.d.).

The criteria used for rationalisation by experts and teachers were: a. overlapping of similar content in other subjects of the same class. b. similar content in the lower or higher class in the same subject. c. high difficulty level d. easily accessible content that does not require much intervention from the teachers and can be learned through self-learning or peer learning. e. content not relevant in the present context or outdated (NCERT, 2022).

Using these criteria, some chapters/ topics were dropped, some were merged, and some parts/sentences were modified. In the case of history, experts ensured that the chronological framework of textbooks and important concepts were not disturbed. This exercise took place in 2020-2021. The details were made public in 2022-23. However, rationalised textbooks came out on the market in 2023. No sooner than the textbooks came, the rationalised content drew the attention of social media, especially the portrayal of the Mughals in history textbooks. It became one of the most debated topics in recent Indian history public debates. This debate began on April 2, 2023 with news on X informing the Uttar Pradesh (U.P.) government's decision to drop the Mughals from its history textbooks. Soon, it started trending on X with hashtags #Mughals #historytextbooks #NCERT #Mughalhistory etc. Supporters and critics began sharing information and opinions on this. Social media was crucial at the start of this discussion, as well as how it was maintained, and ultimately it became a mainstream media topic.

History Textbooks: Before and After Rationalization

Presently, Indian history is taught at the Upper Primary and Higher Secondary stages. The syllabus for Secondary and Higher Secondary Levels says that "Lessons have been introduced to chronologically ordered histories of India in classes VI to VIII. These histories will not be repeated within the same format in classes XI and XII. Instead, the focus would be on certain select themes, which will be examined in some depth" (NCERT, 2005, p.93). At the Higher Secondary stage, a thematic approach has been adopted while maintaining a broad chronological framework. The table (1) on the history textbook for class VII, *Our Pasts-II*, shows the broad changes following rationalisation. This textbook now has eight chapters, of which the Mughals are discussed in three chapters- one, four and ten (NCERT, 2022).

Table-1: Chapters in the history textbook for class VII, Our Pasts II

S.No.	Our Pasts II (Before Rationalization)	Our Pasts II (After Rationalization)
1.	Tracing Changes Through A Thousand Years	Introduction: Tracing Changes Through A Thousand Years
2.	New Kings And Kingdoms	Kings And Kingdoms
3.	The Delhi Sultans	Delhi: 12th to 15th Century
4.	The Mughal Empire	The Mughals: 16th to 17th Century
5.	Rulers And Buildings	Rationalized
6.	Towns, Traders And Craftspersons	Rationalized
7.	Tribes, Nomads And Settled Communities	Tribes, Nomads And Settled Communities
8.	Devotional Paths To The Divine	Devotional Paths To The Divine
9.	The Making Of Regional Cultures	The Making Of Regional Cultures
10.	Eighteenth-Century Political Formations	Eighteenth-Century Political Formations

The class XII history textbook Themes in Indian History is available in 3 parts (NCERT, 2022). The table (2) shows the broad placement of themes in 3 parts:

Table-2: Themes (Retained and rationalised) in the history textbook for class XII, Themes in Indian History, Part I, II & III

S.No.	Themes in Indian History, Part I	Themes in Indian History, Part II	Themes in Indian History, Part III
1.	BRICKS, BEADS AND BONES The HarappanCivilisation	THROUGH THE EYES OF TRAVELLERS Perceptions of Society (*c*. tenth to seventeenth century	COLONIALISM AND THE COUNTRYSIDE Exploring Official Archives
2.	KINGS, FARMERS AND TOWNS Early States and Economies (*c*.600 BCE-600 CE)	BHAKTI-SUFI TRADITIONS 140 Changes in Religious Beliefs and Devotional Texts (*c*. eighth to eighteenth century)	REBELS AND THE RAJ 1857 Revolt and Its Representations

3.	KINSHIP, CASTE AND CLASS Early Societies (*c.* 600 BCE-600 CE)	An IMPERIAL CAPITAL: VIJAYANAGARA (*c.* fourteenth to sixteenth century)	COLONIAL CITIES Urbanisation, Planning and Architecture **(Rationalized)**
4.	THINKERS, BELIEFS AND BUILDINGS Cultural Developments (*c.* 600 BCE-600 CE)	PEASANTS, ZAMINDARS AND THE STATE Agrarian Society and the Mughal Empire (*c.* sixteenth-seventeenth centuries)	MAHATMA GANDHI AND THE NATIONALIST MOVEMENT Civil Disobedience and Beyond
5.		KINGS AND CHRONICLES The Mughal Courts (*c.* sixteenth-seventeenth centuries) **(Rationalized)**	UNDERSTANDING PARTITION Politics, Memories, Experiences **(Rationalized)**
6.			FRAMING THE CONSTITUTION The Beginning of a New Era

Originally, Part I of the textbook had 4, Part II had 5 and Part III had 6 themes. However, this arrangement and selection of themes didn't go unchallenged. An analysis of letters received in NCERT from 2005-2020 shows many stakeholders accusing NCERT of omitting important themes and periods of Indian history like the entire Vedic and Post Vedic period (2000-1500 BCE), 600- 1000 CE and the period of the growth of nationalist consciousness (1858-1915) and omitting personalities like Shivaji, MaharanaPratap, Prithviraj Chauhan and others (Ojha, 2022).

Now the rationalised textbooks have 4 themes in each part. The Chief Advisor (2014) of history textbooks stated that the "class XII syllabus is formulated in such a way that each chapter becomes an exploration of one particular kind of source" (p.108). The Syllabus for Secondary and Higher Secondary Levels mentions sources for each theme (NCERT, 2005). It mentions *Ain I Akbari* for theme 8 and *Akbarnama* and *Padshahnama* for theme 9. It's important to note that *Ain I-Akbari* is one of the three books of the chronicle *Akbarnama*, written by Akbar's court historian Abu'lFazl. Thus, both themes 8 and 9 focused on similar sources, i.e. chronicles. The syllabus document (NCERT, 2005) further says, "Each theme in class XII will also introduce the students to one type of source... Through such a study, students would begin to see what different types of sources can reveal and what they cannot tell" (p.93). Unlike other themes in the textbook, theme 9 did not discuss the limitations of the chronicles *Akbarnama* and *Padshahnama* as a source. Themes 8 and 9 discussed the same time period, the c. 16th-17th centuries. Theme 8 discusses society and economy, while theme 9 discusses the political history of the Mughals.

Social Media: Sharing Of Information and Its Impact

Social media platforms serve as significant information gateways and public opinion formation agents. Since its founding in 2006, X has drawn millions of users. On X, users write their thoughts in 280 characters each, called 'tweets'. X has methods of connecting tweets to larger themes, specific people, and groups. Messages can be connected to one another by using a hash symbol called "hashtag" (Murthy, 2011). This links all messages into a searchable list, where individuals can visit the main X page and search for a hashtag to find all tweets containing that tag. On X, users have their own usernames called 'handles', which are used with an 'at' symbol (e.g. @abcd). Any tweet using the said symbol then features on the user's timeline as a 'notification' for further conversation. By "following" other X users, users can build a live feed of tweets. Every time a person posts a new tweet, it is immediately visible in their feed and can be read, "retweeted" or reacted to in a direct tweet. Members thus establish a network of contacts via which they send or receive information.

Gaisbauer (2021) says "Due to its open platform design, user interactions on Twitter might, of all major social media platforms, come closest to what is commonly referred to as 'public debate"(p.1). X is a public forum where users share other people's ideas, publish their own, and collaborate to form public and draw in new followers. He says that prominently featured standpoints on this platform are reinforced in traditional media because journalists often incorporate social media, especially Twitter, as an established news source in their daily routine; journalistic content or events on television are discussed on the platform in parallel and Twitter content is often explicitly used to represent the public opinion (Gaisbauer, 2021).

Several studies tried to study the impact of social media on public opinion. The study Twitter Use in Iranian, Moldovan and G-20 Summit Protests Presents New Challenges for Governments by Ems (2009) found that Twitter was used to "organise protests, get information to media outlets about the protests, or to avoid police in the streets during protest" (para.9). Regarding the usage of Twitter in protests and its effects on protest participants, Grossman (2009) notes that in addition to promoting democratic engagement, Twitter may also be utilised to disseminate false information or to locate and intimidate dissidents. Murthy (2011) contends that individuals might use Twitter to record noteworthy occurrences using photos and videos and to share information. In this context, he talks about the 2008 Mumbai blast, when eyewitness stories posted on Twitter attracted so much traffic that the Indian authorities asked Twitter to cease updating the feed, fearing that terrorists were utilising it for planning. Politics and Twitter Revolution by John H. Parmelee and Shannon L. Bichard (2012) discusses how quickly tweets grow in number and how they connect with their intended audience in local, national, and global political contexts. It examines the reasons behind the rising use of Twitter and how it affects people. The study Opinion Formation on Social Media: An Empirical Approach by Xiong and Liu (2014), investigated how opinions evolve on Twitter. They discovered that the public's view on Twitter frequently fluctuates quickly, then quickly settles into an ordered state, and once the public's opinion has stabilised, change becomes difficult. They found that Twitter users are more prone to try to influence others' ideas than they are to acknowledge changes in their own opinions (Xiong & Liu, 2014). Social Media: Usage and Impact by Hana S. Noor Al-Deen and John Allen Hendricks (Eds.) (2012) is an important book

which examines several social media channels. It addresses various ways in which social media might be used to persuade individuals. SocialMedia and Political Change:Capacity, Constraint and Consequences by P.N. Howard and M.R. Parks (2012) highlight that social media impacts society as a whole. Talking about the role of social media in history, Catherine Fletcher (2020), in History Today, says that "social media favour the quirky, the visual, the gruesome, salacious or conspiratorial. There's a certain tabloid headline quality to it all and, while that can be fun, it has real problems" and cautions historians while using this platform by saying that, "under pressure to promote an exciting piece of research, it can be all too easy for historians – even those with the best of motivations – to buy into social media's more worrying tendencies"(para 3). Thomas Cauvin (2022), author of Public History: A Textbook In Practice, echoes the same concern, "Paradoxically, in proportion to the level of interest in the past, the presence of trained historians in public space is relatively limited. Even worse, the public space is full of ready-to-use statements and opinions about the past that reflect a general lack of historical understanding"(para 2).

Objectives of the Present Study

The study attempts to understand the recent public debate over NCERTs rationalised history textbooks by critically examining X responses and offers insight into the various sides of this discourse. It attempts to bring out the extent to which public opinion could be influenced through such debates, as the image created on the platform not only affects how public opinion on certain issues is perceived by its users, but by society in general. For this, public activity on X for one month i.e. April 2023, was taken into account.

Methodology

The researcher first drew up a list of several topics significant with their public participation on X in April 2023 related to the rationalization of NCERT history textbooks and then selected the topic of the removal of Mughals from history textbooks. This topic was 'trending' on X for some days and had significant public participation. X does not permit the publication of substantial volumes of raw data. The researcher used the software tool TrackMyHashtag to extract tweets based on search terms and dates. Hashtags #Mughals #Mughalhistory #NCERT #ncerthistorytextbooks were used to identify these. The content analysis method was used for critical evaluation of the discussion. A purposive sample of X response for the first three days (3rd, 4th and 5th April) was selected. A total of 1500 tweets were obtained by selecting the latest 500 responses from each given day for study. Each tweet was looked at as a separate unit of analysis. A few tweets have more than one phrase. Some had nothing but single words, hashtags, or hyperlinks. These were taken into consideration because they were all related to the subject.

The researcher developed a list of categories for tweets on the topic. These were general information sharing, referral, opinion sharing, public outreach, and linguistic and visual sharing. General information sharing included information regarding the complete removal of Mughal history from history textbooks. The referral category focused on tweets that referred to outside information like URLs/hyperlinks (of articles), pictures, or videos. Any opinion stated in the tweet was considered to be part of the opinion sharing. Tweets with public outreach were those that targeted followers or media and famous people for attention

(often in the form of requests for retweets). Lastly, linguistic and visual features included things like imagery, jokes, memes and other similar things (Fig.3).

Figure-3: Some memes shared on X using #NCERT over supposed removal of Mughals from history textbooks

The researcher performed a theme unit analysis in addition to a referential unit analysis and developed three themes. These were: expressing anger over the removal of content on Mughals (#Removing Mughal history could limit students' understanding of Indian history, #By removing Mughals, you can't erase history. Where will you hide LalQila and other monuments?, #Removal of Mughal history will bring a glaring gap from the early 16th to the mid 18th century), expressing satisfaction over the removal of content on Mughals, expressing displeasure over erasure (#Mughals should not be deleted but corrected. #Mughal history should be taught in detail to bring out the truth).

Result and Discussion

Using the previously described categories, the researcher examined tweets. First, the researcher looked at the tweets' format, e.g. their originality, contrasting original content with user-retweeted content. The analysis revealed that 61.2 per cent of tweets were retweeted, suggesting that most users prefer to resend other people's messages rather than write their own. This suggests that users repurposed content from other people's posts in their own network of followers because they could relate to it. They rely on other community members to provide them with stuff to share with their followers instead of creating their own messages.

A second category examined was that of targeting. In targeting, a user can choose to send an open message to their followers or a directed tweet to another user using their screen name. 68 per cent of the messages in this category were directed or meant for other users. The researcher looked through the tweets for any references that contained links to websites, images, or videos. There were several referrals in a few tweets. A total of 581 tweets (38.8 per cent) included a referral of some kind. Referrals to videos (13.9 per cent) and URLs or hyperlinks to other websites (24.4 per cent) were the most common types of referrals. It is evident that X was used as a means for information

sharing because general information about the removal of content on the Mughals accounted for 24.5 per cent of all tweets shared. Public outreach was mentioned in 16.2 per cent of all tweets. 10.6 per cent of tweets were directed towards celebrities or members of the mainstream media, pleading with them to take notice. This suggests that X can be employed as a means of attracting attention.

The presence of opinions in each tweet was also examined. The findings showed that opinion sharing was present in one-third (38.2 per cent) of all tweets. When it came to the removal of the Mughals, the majority of X users had negative opinions (22.9 per cent), which were followed by positive opinions (7.3 per cent). The findings imply that the great majority of thoughts about the Mughals that were shared through different hashtags were opposed to their removal. When paired with the theme analysis, this suggests that, at least when it comes to using structured hashtags, people who support the erasure are not nearly as active as those who oppose it.

The tweets' verbal and visual elements, including jokes, sarcasm, and memes, were evaluated. 20 per cent of the tweets had some combination of visual and verbal elements. Slang was the most prevalent language element (11.3 per cent), with humour coming in second (8.9 per cent). These findings suggest that there is a particular lingo that members of the community on X utilise.

The essential frame in the tweet was found with the aid of thematic analysis. The primary goal and content of each tweet were determined by the researcher through careful examination. Viewing the primary idea of each tweet regarding the erasure of the Mughals was made easier by comparing the themes. Anger was the most prevalent theme in the tweets (28.5 per cent). There was a reference to news articles or other tweets with clear opinions expressed in them. This suggests that rather than using X as a means of spreading knowledge, those debating the erasure of the Mughals mainly utilised it as a forum for their opinions. Expressing satisfaction (24 per cent), which would include favourable impressions of the erased, was the second most popular theme. Displeasure (22.1 per cent) was the next most popular theme.

As evidenced by the significant number of stories that emerged in newspapers or portals (Ramakrishnan 2023; Thapar 2023; Roy 2023) following the debate on X and echoing the same critical thoughts, X seems to have an influencing role. According to the study's overall findings, X is largely a tool primarily used for sharing information, along with opinions, to create a unified community and mobilise individuals to see an issue in a particular way.

Limitations

To begin with, the accuracy of the information shared in the tweets cannot be guaranteed. Furthermore, there are no assurances that the people posting are who they claim to be or are carrying out their stated activities. It is impossible to find out if users responded to tweets until you get in touch with them one-on-one. The date range and sample of 500 tweets every day represent another constraint. Subsequent studies ought to examine a more extensive time period and a greater number of tweets. Additionally, tweets that were pertinent to the subject matter might have been accidentally excluded by the hashtag selection. Even if we employ a variety of hashtags, using online social media always carries the danger of missing important information.

Conclusion

As stated earlier, the NCERT prepares model curricula, syllabi and textbooks, which are available for adoption or adaptation by states. In the past few years, the U.P. government has started adopting NCERT textbooks. The public debate on the removal of Mughals from the history textbooks of the state grew so huge that the state education minister had to clarify that they have not made any change in the history textbooks as they follow NCERT textbooks. Whatever change is being reported has been made by NCERT. Suddenly, the debate shifted to NCERT and people in general and the media in particular started questioning NCERT. Director, NCERT, in a number of interviews explained the rationale and context of the rationalization. An article, 'Textbooks for the Times', by NCERT, also appeared in the newspaper *The Indian Express* (Sridhar et al., 2023), which explained the idea behind this exercise and responded to the queries raised recently on the removal of Mughals. It stated that allegations about deleting the Mughal period are completely wrong as "the textbook for class XII *Themes in Indian History, Part-II*, has another theme on the Mughals covering the same empire and time period... based on identical sources of history... The Mughal rule is also covered in the history textbook for class VII, Our Pasts -II, under the themes of 'Introduction: Tracing Changes Through a Thousand Years', 'The Mughals (16th to 17th Century)', and 'The 18th Century Political Formations". The article suggests seeing the content of textbooks from classes VI to XII in totality. However, this clarification didn't stop the debate and a number of articles and editorials, appeared daily in mainstream media and other news portals. This indicates that social media has great power to influence people.

The analysis of the debate on X in reference to rationalised history textbooks shows that the allegations levelled against NCERT of the complete erasure of Mughals from history textbooks are not true. A major section on Mughals is still part of the textbooks. However, users' continuous engagement with the topic and its frequent coverage in the mainstream media by journalists and some historians raises some pertinent questions on the credibility of this social media platform and also on the role of some historians, who echoed the reaction to the X against the complete removal of the Mughals in their articles. In such cases of controversies, the voices of historians are critical in providing an honest assessment based on evidence. Millions of users currently access historical content on social media. Few people explore an issue further by reading books or articles. This is apparent in this debate also, where, from politicians to journalists to common people to celebrities, many people got involved in this discourse, without going into the detail or trying to find out the truth. The rationalised textbooks are available in the public domain for anyone to cross-check and see. The findings show that some historians selectively took up issues and presented their views partially with lots of twists and wrong claims. The study reflects the general understanding of people, too, with regard to the content of history textbooks. Many who lamented the erasure of Mughals mocked NCERT and the government by saying that in the absence of Mughals, mention of personalities like Shivaji and Maharana Pratap would automatically disappear. It shows that people, in general, believe that textbooks cover contemporary history and rulers, whereas the fact is that there has been hardly any mention of these personalities in these textbooks. The finding also tells us about the perception of people in general who consider textbooks as the only source of knowledge and seem to believe that history cannot be understood without

specific segments. The findings raise some questions about the role of NCERT in communicating these changes. The NCERT made public rationalised tables in 2022 but did not provide a specific explanation for those rationalised chapters/sections, and that's why when this debate started, people didn't have ready reference material to look for. Though NCERT immediately clarified and explained by that time, it was too late. This requires bodies like NCERT to publish full information on any effort to choose, revise, or modify curricula, syllabi, or textbooks and offer an opportunity for informed public debate and discussion whenever such a situation arises. It will help in checking the spread of misleading/ false/distorted information. Overall, the findings of the study show that social media, in this case, X, have great power to influence people as it provides instantaneous communication between spatially separate individuals. But as we have seen, it spreads misleading information also. Therefore, whatever is appearing on social media requires careful analysis so that facts can be filtered from perception.

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Review Article

Empowering Women through ICT: A study

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Abstract

ICT is not a brand-new idea. It has existed for some time and has seen some substantial improvements. ICTs quick development in recent decades has boosted women's advancement. Women now have greater prospects for success thanks to ICT. With so many doors for women now open that were before closed, ICT makes anything possible. Offering them a variety of online education platforms eliminates the gender pay gap, lowers prices, improves access and quality of education, and encourages women's entrepreneurship, which in turn offers them financial independence and boosts their political engagement. The current paper examines several research papers and articles on how ICT helps empower women in order to highlight the ways in which ICT has helped women progress.

Keywords: Information and Communication Technology (ICT), Women, Girls, Empowerment

Introduction

Women play a significant and varied role in the development of nations and economies. Half of the world's population is made up of women, and progress and sustainable development depend on their involvement in all spheres of society. According to the U.N. Report from 2019, SDG5 aspires to promote the use of enabling technology, in particular ICTs, to boost women's empowerment. In order to empower women, Information and Communication Technology (ICT) is essential. It gives women more influence in a variety of spheres, including social, psychological, political, technological, and economic (Beena et al., 2012). It takes a multi-layered strategy that covers access, skills, safety, inclusion, and opportunity in order to empower women through ICT. ICT has the potential to be a potent instrument for advancing gender equality and empowering women and girls in the digital age if the right tools, training, and support are given to them. ICT gives women access to e-commerce platforms, online marketplaces, and digital entrepreneurship as a means of economic empowerment. These platforms can be used by women to launch their own businesses, sell goods and services, and gain access to international markets, thereby raising their standard of living and achieving financial independence. Financial services are increasingly more accessible to women, particularly those who live in rural regions, thanks to ICT's new financial services like mobile banking and digital payment systems. Today, women may use their mobile phones to access banking services, save money, and conduct transactions, giving them financial stability and empowerment.

Conceptualization of terms

Empowerment

Empowerment refers to the process of giving or receiving power, authority, and confidence to people or groups—often those who have been marginalized or oppressed. It entails empowering and providing people or communities with the instruments, assets, information, and assistance they require to take charge of their lives, make educated decisions, and accomplish their objectives.

World Bank. (2008). Empowerment is the process of increasing a person's or group's capacity to make decisions and translate those decisions into desired actions and outcomes.

Kabeer, N. (1994). When a person's ability to make wise decisions in life is increased in a situation where it was previously unavailable to them, they are said to be empowered.

Women Empowerment

Giving women the same rights, opportunities, and resources as men and enabling them to fully participate in all facets of life without bias or discrimination based on gender is referred to as "women empowerment." Important social, economic, and political issues are involved in it. It involves numerous initiatives to advance gender equality, remove discrimination, and foster a supportive atmosphere where women can actively engage in all aspects of life. It entails giving women the freedom to assert their rights, make decisions, and take charge of their own lives, which promotes their overall development and well-being.

Information and Communication Technology (ICT)

The broad category of tools and technologies used to process and transfer information electronically is known as Information and Communication Technology (ICT). To acquire, process, store, and exchange information using various kinds of communication, such as computers, cell phones, the Internet, and other electronic devices, this can involve hardware, software, networks, and other digital technologies. Telecommunications, data management, cybersecurity, e-commerce, digital media, and other areas are only a few of the many applications that fall under the umbrella of ICT. It is a fast-developing field that has a significant impact on how we communicate, work, learn, and interact with technology in the linked world of today.

Objective

- To highlight the capabilities of ICT in empowering women.

Methodology

The methodology deployed in this study is mainly descriptive and exploratory in nature. An attempt has been made to highlight the role played by ICT in empowering women based on secondary data by reviewing existing information from various research papers, articles, books, theses, and online resources in the period of 2002-2020. This helped in building a solid foundation of knowledge and understanding of the subject matter. Further, by analyzing existing data, the researchers are able to draw conclusions and make inferences about the relationship between ICT and women's empowerment. The analysis is solely based on the review of related literature.

Importance of Empowering Women

For a society to progress, empowering the women therein is ubiquitous. Their empowerment for societal

Development and Sustainable Development can happen in numerous ways. Warth and Koparanova (2012) explored how empowering women can help the United Nations accomplish its Sustainable Development Goals (SDGs) and provided evidence-based examples from various countries and regions. They also recognized important tactics and initiatives for advancing social advancement and women's empowerment, such as gender equality, health and well-being, education, and economic opportunity. Similarly, Bayeh (2016) asserted that the nation would not accomplish sustainable development if only men were acknowledged to participate in all of these sectors until gender equality is realized and women are given the freedom to play their share in the economic, social, political, and environmental spheres. Having empowered women makes it easier to achieve gender equality. Women should have the same rights, opportunities, and access to resources as males because they make up half of the world's population. Men and women shall have equal rights and opportunities in the political, economic, and social arenas, according to the Indian Constitution Article 14. Also, the prohibition of discrimination against any citizen in accordance with one's caste, race and religion is mentioned in Article 15 (1). Building a more just and inclusive society is dependent on gender equality, which also promotes social justice and fairness. Economic development can benefit immensely from empowered women as well. They can be used to increase productivity, innovation, and economic competitiveness. Women who are empowered can start enterprises, participate actively in the workforce, and contribute to the economy, which is good for families, communities, and countries. Women who are empowered have higher health and well-being, which benefits their families, communities, and themselves. Increased access to healthcare and nutrition, decreased infant mortality rates, and better family planning options are all associated with women's empowerment. According to Article 42, the state must make provisions to guarantee first-rate working conditions and maternity leave. Women who are more empowered are also better equipped to make choices about their own bodies, particularly those concerning their sexual and reproductive health, which leads to better general health outcomes. Women are more likely to be educated when they are empowered. Women who have received an education are thought to make wise decisions about their lives, participate in society, and fight for their rights. The cycle of poverty is also broken by education since educated women are more likely to have better salaries, invest in the education of their families, and give back to their communities. For women to participate more actively in social and political areas, empowerment is also essential. Women who are empowered can take on leadership responsibilities, take part in decision-making, and speak up for women's rights and gender equality at all levels of society. In addition to these, prevalent problems like child marriage and female genital mutilation can only be resolved by empowering women. Therefore, Women require support and encouragement from their families, the government, society, and male coworkers, among other groups. With the correct help from a variety of organizations, they may integrate into the mainstream of the national economy and so contribute to its development (Mishra & Kiran, 2014).

Capabilities of ICT for Empowering Women

By giving women access to technology, opportunities to develop their digital skills, and opportunities to participate in the digital world, ICT empowers them in a variety of ways. ICT empowers women in the following ways:

- **Training in digital literacy and skills:** ICT resources like computers, the Internet, social media, and other digital platforms can be used effectively by women and girls if they have access to training programs that concentrate on developing their digital literacy and abilities. They may be able to communicate, obtain information, and engage in online activities as a result. Mukherjee et al. (2019) examined the relationship between the digital literacy program and its effects (perceived ICT proficiency, pursuing education and employment possibilities, and the role played by the perceived value of the training). The research by Nedungadi et al. (2018) showed how tablet-based learning might empower women. Women acquire life skills, safety awareness, and computer literacy. Febro et al. (2020), in their research revealed that using the e-learning module had a substantial impact on how girls and women developed their talents. This project was a step toward helping marginalized girls and women in Philippine society develop their technical abilities. The usage of ICTs and the e-governance system was taught to the women. These abilities help them achieve a higher social rank (Karan & Mathur, 2010). Women and girls have been able to increase their self-confidence by using digital ICTs and gaining new skills (Cummings & Neil, 2015; Intel, 2013). Women were trained to manage ICT kiosks as part of the E-Seva initiatives in India, and as a result, they benefited from the system's facilitation (Karan & Mathur, 2010).
- **Reducing the gender gap in digital environments and promoting gender equality:** For women and girls to be empowered by ICT, it is essential to ensure that they have equitable access to ICT infrastructure, including internet connectivity and gadgets. This may entail delivering subsidized or free devices, extending affordable internet access to underserved and rural areas, and advocating gender-responsive policies that address obstacles to ICT access for women and girls. The adoption of mobile technologies alone can significantly help to reduce the gender gap by empowering women to feel safer and more connected and by giving them access to information, services, and opportunities that improve their lives, such as health information, financial services, and employment opportunities (GSMA, 2018). ICT is the most recent in a long line of technical revolutions, and it is thought to have a big impact on female empowerment (Ark et al., 2002). As it motivates girls and women to seek technological careers and increases their awareness of entrepreneurship education, ICT can be a significant weapon for gender equality. Women can improve their social, economic, and educational position in this way (Bhimrao et al., 2015).
- **Promoting women's involvement in ICT-related fields:** Women in the Middle East are liberated as a result of women's participation in STEM fields (Islam, 2019). By supporting and promoting their participation in STEM (Science, Technology, Engineering, and Mathematics) courses, which include ICT, women can be encouraged to pursue careers in these fields, which are typically dominated by men. According to a descriptive research method used in an Italian university, there is still a gender disparity between university professors and students who study computer science, computer engineering, and other STEM subjects (Marzolla, 2019). This can be accomplished by implementing programs like mentorships and

scholarships and promoting admirable female role models in the ICT sector. In workshops geared at luring women into STEM fields, tablets and internet technologies like Socrative for online surveys were employed (Morales, 2020). Tools like statistics and figures that try to inform on the achievements of women in the many fields of STEM fall under this category. These sites provide listings of well-known women and their experiences in the STEM fields, including their achievements and disappointments (Islam, 2017; Holgado et al., 2020). The promotion of gender equality and science education has been the focus of a variety of programs and initiatives, including W-STEM, Science for Girls and Boys, and Tec novation Girls. Utilizing all available human resources while integrating gender through ICT gives organizations a crucial competitive edge and fosters innovation, both of which are necessary for sustainable development and economic progress (Dickins, 2017).

- **Encouraging women to start their own businesses in the digital economy:** Women can gain economic empowerment by being encouraged and assisted in launching and expanding their own businesses in the digital economy. The goal of gender equality is to expand women's participation in the digital economy, which will strengthen the nation's capacity and lead to higher economic development and growth (Ranganath et al., 2011). Technology empowers women both financially and holistically in both their professional and personal lives, including in the areas of entertainment, knowledge, and consumer power (Pascall, 2012). Access to networks and information, lower transaction costs, and better market access are three of the major advantages of ICTs for women entrepreneurs. For most women who own modest or home-based enterprises, technologies are strong tools that can be used to encourage female entrepreneurship in the corporate world. Information and communication technology usage (ICTs) and the creative ways in which they have been applied have sparked the creation of new service delivery models and created new opportunities for smallholders (Rani & Joshi, 2012; FAO, 2017). In the larger business community, it increases the visibility of female business owners (Golmohammadi, n.d.). Their economic strength, independence, and freedom all increased (Kivunike et al., 2009; Olatokun, 2009). ICTs are viewed as a crucial tool for fostering socioeconomic development and have the potential to reduce poverty (Gopalakrishna, 2005). Many women have been drawn to technical and management roles because of the Internet, which has opened up excellent employment opportunities for female candidates. As a result, increased female engagement in public life has liberated them from male constraints and elevated their claims of equality (Bhattacharyya & Ghosh, n.d.). ICTs have enormous potential and opportunities to give rural women new career options and give them economic empowerment (Sulaiman & Kalaivani, 2011). The Internet offers a method for women who have found the traditional workplace to be less than ideal for making a fantastic career with little to no overhead (Padmannavar, 2011). Women can choose how to spend their money as well (Antonio & Tuffley, 2014).
- **Addressing women's violence and online abuse:** Access to ICTs may be made easier, which can help stop violence against women and

empower women (Brimacombe & Skuse, 2013; Gill et al., 2010; Weiss & Tarchinskaya, 2015). To empower women and girls using ICT, safe online places must be created for them. This entails addressing online harassment, cyberbullying, and violence against women, as well as putting safety and security precautions in place for them online. The promotion of safe online habits for women and girls can be accomplished through legislative and policy frameworks, awareness campaigns, and capacity-building initiatives.

- **Using ICT to promote gender equality and social change:** Using ICT to advocate for gender equality and social change can enable women and girls to speak out. ICTs are enhancing the global networks of women (Bonder, 2002). It promotes their rights and works to improve local communities. In order to do this, women's voices can be amplified, gender concerns can be brought to light, and legislative reforms that support gender equality and empowerment can be advocated for through social media, online campaigns, and digital platforms. Women can use digital ICTs to petition decision-makers, engage with peers online, exchange information, and foster solidarity (Antonio & Tuffley, 2014). Women share their public opinions on blogs and other digital venues (Gurumurthy, 2012; Chami, 2014). Using digital ICTs, women can start or grow their micro-businesses while avoiding patriarchal societal conventions (Srivastava & Manzar, 2013).
- **Women's political engagement**: ICT can give women access to political information, such as news, statements, laws, and regulations. This makes it possible for individuals to continue learning about political topics and processes, which is essential for effective participation. Even when they have inadequate reading abilities, women's understanding of government programs and processes can be improved via ICT (Karan & Mathur, 2010). Online forums can be utilized for civic engagement, including petition signing, discussion participation, and attendance at virtual town halls. Social media can give women a platform to express their viewpoints, connect with others who share those viewpoints, and form networks with like-minded people or organizations. ICT can also facilitate remote political engagement, such as online voting or virtual meetings, making it more accessible for women who face obstacles like limited mobility or cultural norms. The Andhra Pradesh State Wide Area Network (APSWAN) serves as the state of A.P.'s main network for phone, data, and video communication. Because they now have the ability to write directly to the chief minister, cutting over the layers of hierarchy, women stand to gain much from them. Gyandoot is an intranet project that links 21 rural cybercafés known as Soochanalayas in the Dhar region of Madhya Pradesh, India. These interventions assist women because they now have more knowledge about and control over regional dynamics (Golmohammadi, n.d.). ICT can be a potent driver of women's political empowerment, which advances gender equality (Ramilo et al., 2005).

- **Conclusion**

- Information and communication technology (ICT) can revolutionize society and empower women in a number of ways. Women and girls can take advantage of ICT platforms, which facilitate communication, information acquisition, and online participation, by receiving training

that imparts digital literacy and skills. A key component of advancing gender equality is closing the gender gap in digital spaces and pushing for equitable access to ICT infrastructure. Encouragement of women's engagement in ICT-related sectors, especially in STEM fields, improves female representation while also paving the road for innovation and professional progress. Additionally, encouraging female entrepreneurs in the digital economy can result in economic empowerment and open doors for business growth and financial independence. Safe online environments must be built and maintained by regulations and awareness efforts in order to use ICT to solve issues like violence against women and online harassment. ICT is also a powerful weapon for advancing social change and gender equality by amplifying the voices of women and supporting advocacy initiatives. Finally, ICT helps to increase women's political involvement and empowerment by giving them access to political information and enabling remote political engagement. ICT emerges as a dynamic force in the effort to empower women, close gaps, and advance society thanks to its wide range of possibilities.

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Review Article

Conceptualizing Digital Divide and Identifying Factors of Digital Exclusion in Higher Education through Systematic Literature Review

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Abstract

Our civilization is being transformed by information and communication technology. Over the last two decades, technology has permeated every element of our social and cultural life. The use of internet-enabled devices is fast rising, making online surfing, access to social media and cross-border communication easier. These new technologies are making educational resources more accessible to individuals all across the world. ICTs have long been recognized as an important and critical condition for overcoming social exclusion since they contribute to improved education, governance, and health care, and hence may function as a facilitator for social inclusion. However, the rise of ICTs has not benefitted everyone equally. Digital exclusion occurs when some digital technologies contribute to constraints and exclusion from community engagement. This research attempts to demonstrate how the variables responsible for social exclusion contribute to digital exclusion, which in turn contributes to the extension of socioeconomic supremacy in education. The purpose of this study is to highlight the basic issues surrounding digital exclusion, which is currently in its early phases of research.

Keywords: Digital Divide, Digital & Social Exclusion, and Higher Education.

Introduction

Education is regarded as the foundation of any country, and every citizen has a full (fundamental) right to receive a quality education. It can change the life of an individual by reducing poverty and improving health, gender equality, peace, and stability in their life (World Bank, 2022). When we look at education beyond its traditional confines, we find it at the centre of all our actions. Whatever we do, we know and whatever we know has been learned either by instruction or observation and assimilation. Education is important and cohesive in society, which is why society and knowledge can never be separated. A proper education aids in our empowerment. It is the most powerful tool for social transformation (Justice Watch Foundation, n.a.; Mohan, 2012). Education has the potential to transform society by providing opportunities and experiences that prepare individuals to adapt to the changing needs of society. Education is also seen as a tool for bridging the gap between rich and poor. It is thought to bring equality; more precisely can bring equity to everyone and provide a fair playing field. As a result, every country's first priority has been education. It serves as a tool for achieving equality among the country's citizens (Walker et. all, 2019). As a result, the constitution of India mandates free and compulsory primary education for all. Education is a constantly changing and evolving

process. To remain relevant in today's society, educational methods and formats must evolve alongside it.

We are living in the 21st century, which is known as the 'Digital Era', which is an example of educational evolution and the people who live in it (particularly the educational personnel) are known as 'Digital Natives'. As we know, the method and techniques of education are evolving over time, and the emergence of ICT and e-learning is the most significant change of this era. In the last two decades, technology has infiltrated virtually every aspect of society and our social and cultural lives. We are living in a high-tech worldwide culture, and ICT may be found almost everywhere (Warschauer, 2003). The usage of internet-enabled devices, which facilitate web browsing and give access to social media and cross-border communication, is rapidly increasing (Baranghi & Sheth, 2014). These new technologies enable more people around the world to gain access to educational learning resources.

In the past few decades, ICT has affected the educational environment at all levels to enable learners to achieve the set educational goals. Higher education is comparatively more affected one among these. Higher education of high quality and relevance can provide students with the knowledge, skills, and competencies they need to succeed in life. In India, it is improving over time, and technology is playing a significant role. The government and private sectors of India have taken a number of important steps to promote e-learning in higher education. EDUSAT satellite, National Mission on Education through Information and Communication Technology, National Program on Technology Enhanced Learning, Virtual Labs, E-yantra, E-Shodh Sindhu, E-PG Pathshala, Shiksha.com, and others are among these measures (Kaushal, N., n.a.).

When we see ICT in the higher education context, it is embedded in the form of virtual learning environment (Sims, Vidgen & Powell, 2008). The Massive Open Online Courses (MOOCs) and other video conferencing technologies are used by/in several universities to provide multimodal instruction that transcends time and space (KHALIET l., 2016). ICTs have for long been regarded as a **"**necessary and key condition for overcoming social exclusion (since they contribute towards) improved education, government, and health care, too, and thus can be a multiplying factor for social inclusion**"** (Warschauer, 2003, p. 30). ICTs have not, however, benefited everyone. There is an existence of digital exclusion in the society. It was addressed in the European Union's research and innovation programme named "Platform for ICT for Learning and Inclusion" as an notion. For certain persons, digital technologies result in limits and exclusion from community engagement; this process is known as digital exclusion (European Commission, 2014). There are two terms, 'barriers' and 'divide', which are used to describe digitally excluded persons and it also refers to the same set of variables that cause social exclusion. However, there is a scarcity of facts and expertise when it comes to digital exclusion in education (Khalid, 2014).

Conceptual Discussion

E-learning

With the introduction of the computer and internet in the late 20th century, e-learning tools and delivery methods expanded. The first MAC in the 1980s enabled individuals to have computers in their homes (The Evolution and History of E-Learning, n.a.). According to Dr. Nandita Kaushal "A learning system based on formalized teaching but with

the help of electronic resources is known as E-learning". She also stated that e-learning is facilitated and supported by ICT to enable people to learn from anywhere and anytime. That means learning based out of class with the help of electronic devices, i.e. computers, mobile phones & internet, is known as e-learning (The Economic Times, 2022). It has different meanings in different contexts. Here, the researchers see it in the higher education context; it relates to the internet-based flexible distribution of information and educational programming (Campbell, 2004). It also characterized by active learner-centered pedagogies (Harel, 1991; McDougall & Betts, 1997 in Nicholson, 2007).

Digital Divide

The term 'Digital Divide' is defined as the distinction between those who have access to new information technologies and those who do not have it. Those who have the access known as "haves" and those who do not are known as "have-nots". There is a digital divide, but it is not as simple as haves and not haves. The distinction between high, medium, low, and non-users will always exist (Clark, 2003, p. 663; Sims et al., 2008, p. 431). That is why this term is a debatable or can say disputed concept that nowadays is based on the simple question of owning or not owning. In other words a divide between those who can and cannot afford a computer over time (Liebenberg et al., 2012).

Digital Exclusion

Over the period of time, the definition of digital exclusion has evolved. Earlier, it was limited to only the "user / non-user" distinction. Now a more comprehensive examination of various levels of internet use and skill divisions exists (Carnegie UK Trust, 2016b cited in Sanders, 2020). If we broadly define it, digital exclusion occurs when a segment of the population continues to have unequal access to and capacity to use ICT, which is necessary for full participation in society (Schejter, 2015; Warren, 2007, cited in Sanders, 2020).

Social Exclusion

According to Collins Dictionary, "Social exclusion is the act of making certain groups of people within a society feel isolated and unimportant". Despite the fact that there is no universally agreed-upon definition or benchmark for social exclusion, lack of involvement in society lies at the heart of practically every definition proposed by academics. Overall, social exclusion refers to a situation in which people are unable to fully engage in economic, social, political, or cultural life, as well as the process that leads to and maintains that position (United Nations, 2016, p. 18).In developing countries, social exclusion is widespread, paradoxical, and harsh. When ICT is introduced into the picture, it tends to "exacerbate social exclusion" (Phipps, 2000, in Tambulasi, 2009, p. 120) by recreating "existing social networks of inclusion and exclusion" (David, 2003, p. 236 cited in Tambulasi, 2009, p. 120). In developing nations, "unequal access to ICTs adds a new dimension to the social exclusion debate" (Durieux, 2003, p. 22 cited in Tambulasi, 2009, p. 120). The growing divides between the "haves and have nots"; the "information rich and information poor," and the "knowledge rich/poor" are causes for concern (Phipps, 2000, p. 40-1).

The central argument of this paper is that most developing countries already have high levels of social exclusion due to a variety of factors such as poverty, gender discrimination, low education, rural residence, and government policies and institutions, and in this

sense, ICTs only widen and perpetuate this exclusion by highlighting the socio-economic elitism that already exists in society (Tambulasi, 2009, p. 119).

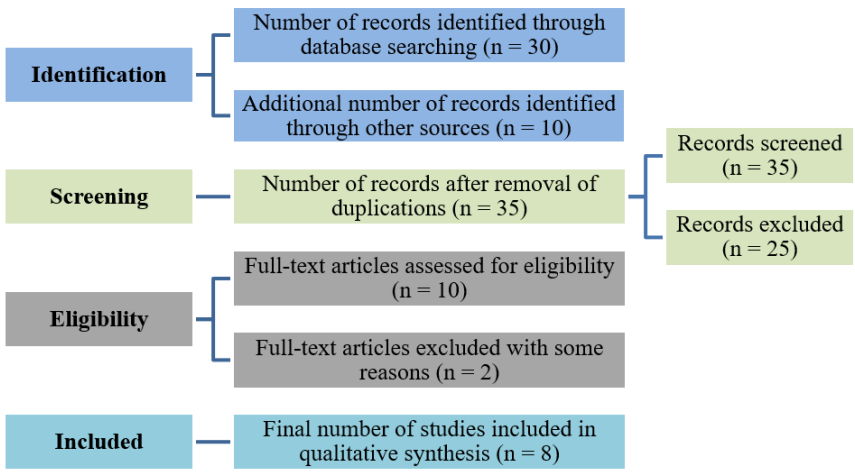
This research aims to identify the factors that lead to digital exclusion and, as a result, social exclusion for particular members of society. The following research question guides this paper's investigation of these issues: What factors play a role in social and digital exclusion in education? How these factors are reinforcing the current social classes? The paper contains two main sections. In the first section, selected articles are categorized and analyzed according to different time periods; this is followed by arguments and conclusions based on analysis in the first section.

Methodology

Digital exclusion is a relatively new idea, dating back only a decade or so. Digital divide, internet access, material access, and other studies relating to this subject are limited. Thorough literature research has been conducted in order to investigate the above-mentioned concerns about digital and social marginalization. A total of thirty related research papers, dissertations, and a thesis were chosen for this study, with 10 research papers and theses being chosen based on their relevance to the goal of this work. These studies were specifically chosen to look at the evolution of arguments about the digital divide and digital exclusion over the last two decades. Second, studies were chosen that would aid the author in a better understanding of the concept in developing countries, with a special emphasis on India.

The papers were chosen using the 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram' (Moher et al., 2009), which consists of four steps: identification, screening, eligibility, and inclusion (See Figure 1). This approach identified three databases: Google Scholar, Research Gate, and Sodhganga. Different combinations of the keywords "higher education", "digital exclusion", "digital divide", "e-learning" and "social exclusion" were used to search both abstracts and complete papers.

Figure-1: PRISMA flow diagram of selected reviews based on identified key words



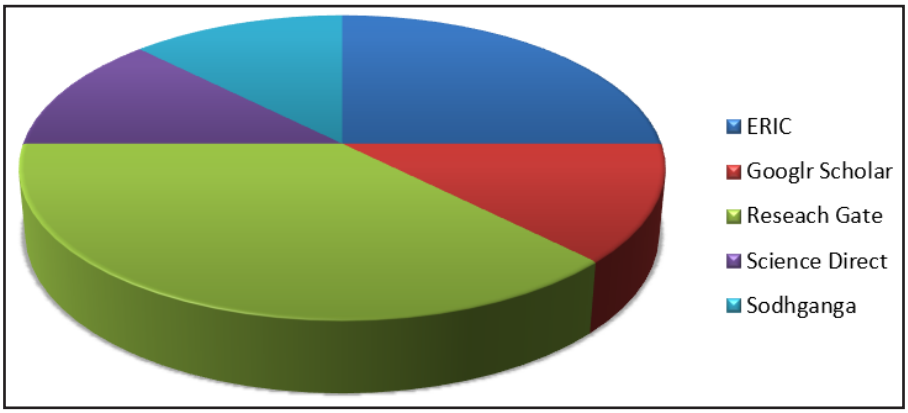
During the search, approximately 100 papers were discovered, including both full-text and abstracts. In this study, 30 papers from the years 2000 to 2017 were chosen. Other sources yielded a total of ten articles. After the duplicate article was removed, 35 articles remained. Ten articles were chosen for screening based on their relevance to the study, such as the presence of more than two keywords, time period, and nation. Articles from both developing, i.e. Indonesia, India, China, South Africa etc. and developed countries, i.e. UK, England, Australia, America, Britain, etc were picked. The Education Resources Information Center (ERIC) and Emerald were also used as other sources to locate the other ten papers. Finally, eight research papers were chosen, one of which is an M.Phil. Thesis. The publications were chosen for analysis based on their relevance to the research.

Qualitative Analysis and Interpretation of the Articles

Overview of the Articles

The articles cover both developing and developed country's experiences & evidence of digital exclusion and the digital divide, which in turn leads to social exclusion and socio-economic elitism in the Higher Education context/education.

Figure-2: Source-wise distribution of research papers selected for the study



The distribution of papers is as follows: two research papers derived from ERIC, one other from Google Scholar, three research papers taken from Research Gate, and one from Science Direct and one M.Phil. The thesis is also included for analysis, which is published on Sodhganga. All the research papers and the thesis are published in different journals as follows: one paper published in Procedia - Social and Behavioral Sciences, one paper published in the South African Journal of Libraries and Information Sciences, one more paper published in Communication of the Association for Information System, one other paper published in British Educational Research Journal, other journal are Information Research: An International Electronic Journal, Telecommunication Policy & Journal of Information, Communication and Ethics in Society. This is a complex and interdisciplinary research subject, as evidenced by the mix of different research fields. Most of the research papers collected primary quantitative data with the support of qualitative data one research paper is a systematic literature review to understand the change in the concept of digital divide and digital exclusion. The list of articles/

papers is given in the appendix section of the paper on the basis of qualitative analysis of the articles.

Systematic Literature Review

The papers chosen span a wide spectrum of experiences and evidence connected to digital exclusion and its link to the growth of new social exclusion in developing and industrialized countries like South Africa, England, India, the UK, Australia, etc.

In a study, Khalid & Pedersen (2016) attempt to identify the fundamental causes that lead to digital exclusion in higher education. They observed the reasons that lead to social exclusion also lead to digital exclusion, and these causes, in turn, result in social exclusion of those who are already marginalized, describing it as a 'Vicious Cycle'. The observed factors are classified into three categories: Digital exclusion which resulted from a lack of hardware devices & internet services, Social exclusion which includes low income, lack of inspiration and commitment, ICT – escaping as the norm, and mental and physical disability, and the third one is Accessibility which includes differences in ICT literacy and information literacy, as well as the divide between rural and urban locations. As per the analysis of their paper, these factors are layered and intertwined. The studies on the digital exclusion, digital divide and hurdles in the adoption of ICT have found similar factors and reasons in higher education, despite similarities these factors perceived differently in different circumstances and social contexts (Khalid & Pedersen, 2016).

In another study, Naidoo and Raju (2012) found that African students at Durban University of Technology in information literacy courses varied in their ICT competencies and owing differences in access and familiarity with computers and the internet. That is why they faced issues in attending that program. This study also revealed that "… inequitable computer access impacts on students' abilities to function effectively in an online environment… students with diverse digital expertise in the same classroom poses a problem to teaching IL, especially when the lesson includes online lessons"(Naidoo and Raju, 2012, p.38). According to them below three factors are the features of digital exclusion: 1. Crisis of funds to provide computer hardware and pay for Internet accessibility; 2. A lack of interaction (including psychopathic inability), self-belief, understanding, and/or motivation (and lack of opportunity to remedy this); and 3. Lack of public internet access due to distance coupled with a lack of transportation or physical mobility.

The same factors are found in the study of Sims et al. (2008), which clearly indicates that the reasons for digital exclusion can be generalized or at the very least classified. They note two significant objections to e-learning as a means of increasing higher education enrollment. The first one is access to technology and the second one is learning's applicability as a means of including a population that has previously been excluded from higher education. They concluded that "without particular measures to overcome the digital divide, current practices in higher education can only reinforce socioeconomic, cultural, ethnic and gender divides in access to higher education". They also argued that lowering time and place barriers is a key part of including nontraditional students in higher education, and if students need to go to campus to use computer facilities, place barriers are not lowered, and time barriers are not lowered if facilities are not open 24/7 (Sims et al. 2005, p.440).

In contrast to the study of Sims et al. (2008) in the study of Gorard et al. (2000), the authors challenge the pre-argument

that time and space obstacles decreased by the use of learning technologies, and the researchers also investigate whether learning technologies and ICT are being utilized to increase the number of "non-traditional students" in higher education. Gorard et al. (2000) defined a "non-traditional student" as a student from a vulnerable group, who is exposed to a biased, elitist class attending higher education in their study. According to them, for pupils who are digitally and socially excluded, the usage of ICT and its benefits (for example, access independent of time and geography) is not that beneficial. Technology may also cause or exacerbate existing inequities to participate in lifelong learning. They also argued that the culture of ICT is often youthful, white, middle-class, and male rather than the working-class, elderly, female, or ethnic minority. This leads to the conclusion that, in the short to medium term, access to the Internet will be divided along socioeconomic, gender, and ethnic lines, with old patterns of exclusion remaining. Low-income groups are unable to use the Internet due to a lack of skills and access to technology, and the cost of equipment and internet connectivity is unlikely to attract poorer populations. Furthermore, as access patterns and the technology necessary for access evolve, individuals who are currently excluded will be forced to play catch-up (Godard et al., 2000).

These findings are corroborated by Clarida (2015) findings, which show that organizational factors, such as course content or virtual learning environment navigation, have a greater influence on digital exclusion than intrinsic characteristics, such as individual technological skills. It demonstrates that the component of digital delivery in the university structure was more likely to induce exclusion than features of diverse students. According to the findings, digital exclusion cannot be anticipated or addressed by categorizing pupils based on gender, age, ethnicity, region, socioeconomic level, or educational background. Age has little bearing on digital exclusion. However, younger and older students saw this exclusion differently; younger students perceived difficulty utilizing unfamiliar technology, but older students perceived it as a great learning experience. The findings of this research also suggested that "there is no typical attribute that is more closely associated with digital exclusion or inclusion of some form or other" (Clarida et al., 2015, p.99).

Smeaton et al. (2017) in their study, explore the online information experiences of individuals who are experiencing socioeconomic disadvantage. The study tries to capture the lived experiences of digitally excluded personnel. They found that from having technological skills to being willing to move into various information realms, there are numerous issues to solve in order to enable socioeconomically disadvantaged folks to make use of online information. In this research paper, four themes emerged from analyzing the experiences of socioeconomic disadvantaged groups, which are: endless information journey, uncontrolled information space, inadequate information space & essential information space.

An M.Phil. thesis done by Swalehin, M. (2010) based in India, discussed about four digital divides which are emerging in this new IT environment. The first is an internal conflict between the technologically enabled rich and poor. The second linguistic cultural divide primarily exists between English and other languages. The third is the disparity in access to information technology between affluent and poor countries. "Finally, there is the emergent intra-national phenomenon of the 'digerati', an affluent elite characterized by skills appropriate to information-

based industries and technologies, by growing affluence and influence unrelated to the traditional sources of elite status, and by obsessive focus, especially among young people, on cutting edge technologies, disregard for convention and authority, and indifference to the values of traditional hierarchies" (Swalehin, M., 2010, p. 177).

Tambulasi, R.I.C. (2009) is the last study that was examined in order to meet the goal of this work. He attempted to determine the extent to which ICTs serve as a tool to perpetuate social exclusion in developing nations and discovered that developing countries are already experiencing social exclusion, and ICTs exacerbate this social marginalisation and exclusion. He argued that "there is apathy in the use of ICT facilities in most developing countries thereby making ICTs fail to perform as an instrument of integration". People, despite the existence of ICT infrastructure, prefer conventional modes of communication and information gathering in the majority of cases. He concluded that due to a lack of suitable ICT networked infrastructure, indifference to the use of ICT, and sustainability issues, ICT infrastructure does not operate as a tool of social integration (Tambulasi, 2009).

Discussion and Suggestion

Researchers found that people who are socially disadvantaged are also digitally excluded regardless of the nation of origin (Brown & Czerniewicz, 2010; Lane, 2009; Warren, 2007). "There is a "vicious cycle" between social exclusion and digital exclusion, social exclusion leads to digital exclusion, which in turn perpetuates and exacerbates that social exclusion" (Warren, 2007, p. 379). One measure of social exclusion is that the most disadvantaged social groups use ICTs the least (Sims et al., 2008). The underlying causes of social exclusion can include "income deprivation, social deprivation including poor education or health, disengagement and marginalization (i.e. withdrawal and rejection), and local services: public and private, infrastructure" (Warren, 2007, p. 378), low income, low motivation, and an accepted norm that ICT is not necessary (Sims et al., 2008). This is true within both developed and developing countries, including South Africa (Brown & Czerniewicz, 2010; Naidoo & Raju, 2012), 'India' (Swalehin, 2010) and the 'USA' (Madigan & Goodfellow, 2005).

There are various perspectives on the digital divide. Political scientists define the digital divide in terms of who rules and who is dominated. Geographers examine the digital divide in terms of both geography and location. The digital divide is viewed as a technological issue by engineers. The digital divide is viewed by economists in terms of income, wealth, and poverty. Sociologists define the digital divide as unequal access based on socioeconomic level, social class, ethnicity and race, caste, and gender. Educators regard this as a difficulty that must be overcome in order to market courses globally through distance education agreements. Feminists claim that internet access is gendered (Swalehin, M., 2010).

E-learning, contrary to popular opinion, allows the inclusion of a bigger audience and mass education, but the reality is quite different. According to the arguments, people are encountering difficulties as a result of e-learning. According to Walker et al., "Inequalities of income are compounded with other inequalities of gender, ethnicity, disability, and geography to form a suffocating web of exclusion… In India, the median number of years of education girls from the poorest families receive is zero, compared to 9.1 years for girls from the richest families" (Walker et al., 2019).

India is a developing country, and

findings show that developing countries are already facing the issue of social exclusion. As per the recommendations of the New Education Policy, 2020, the Indian education system is introducing digital technology at all levels of education. And the condition of India in terms of access to digital technology is very critical. According to a survey by the Telecom Regulatory Authority of India (TRAI), total internet density in India was 49 per cent in 2018. Rural area users accounted for 25 per cent, while urban area accounted for 98 per cent (TRAI, 2018). Here, we see the vast gap in the data between rural and urban populations. One more latest data published by TRAI reflects that the country had over 1,160 million wireless customers in February 2020, which was up from 1,010 million in February 2016. According to the figures, urban customers increased by 74 million, while rural subscribers increased by 86 million (TRAI, 2020). This suggested an increase in basic telecom facilities rather than digital progression.

India has one of the world's largest gender discrepancies too. According to the GSMA's (Global System for Mobile Communication) 2020 Mobile Gender Gap Report, only 21 per cent of women in India utilize mobile internet, compared to 42 per cent of men. According to the survey, in India, 79 per cent of men own a cell phone while only 63 per cent of women do (GSMA, 2020 in BYJU'S, n.a.). Having internet facilities or access does not guarantee that one can use it. In this reference data shows that only 40 per cent of the Indian pupils in the age group of 15 to 29 years had basic digital literacy (NSO report; The Hindu, 2020, 08 Sep.). Without a concerted effort to bridge the digital divide, the socio-economic, cultural, ethnic, and gender divides will only widen (Sims et al., 2005).

After having looked at the above analysis, as a researcher, my measure concern is how we can fill this digital exclusivity gap? I want to give some suggestions which can be used to overcome these issues:

- The Government should focus on the development of network infrastructure in educational institutions, i.e. universities, colleges, etc., in public places with special reference to rural areas.
- Education and training should be given to students to search and find the needed information.
- Appropriate action to ensure the sustainable integration of the socially excluded groups.
- Charitable organizations can work in this field. They can provide recycled computers in minimal amounts or free to low-income households. This can be combined with Wifi too. Because the barrier of time and place is an essential factor in including nontraditional students in higher education. Etc.

Conclusion

Social inequality is a worldwide phenomenon, and it is necessary to comprehend and challenge the digital inequities that exist among students, affluent and poor, rural and urban, and in private and public schools. The widely held notion that digital technology would erase all injustices is based on an unrealistic vision. It is critical to recognize that social and digital inequalities cannot be eliminated only through the Internet. This paper focuses on finding the factors that result in digital exclusion and, in turn, social exclusion of some people of the society. This extensive literature results indicate that there exist digital disparities in society. These discrepancies are created by the same factors that cause socioeconomic inequality, i.e. low income, vulnerability, rural location etc. Some other common

factors are also identified in the present study, i.e. lack of hardware devices, digital literacy, accessibility, motivation, internet access etc. This study also confirms that there is a 'Digital Vicious Cycle' and access to ICTs is not enough or is not the only concern to delineate the Vicious Cycle. In this regard, poverty is prominent, or can say, crucial dimension to any kind/form of exclusion**.** These comprehensive literature review findings are critical for policy purposes; policymakers may utilize the findings to implement suitable interventions to assure the socially excluded groups' long-term integration.

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Appendix

Table-1: List of Papers Selected in Present Systematic Literature Review

S. No.	Researcher Name	Title of the paper/ thesis	Database	Journal
1.	Clarida, B. H.	"Strategies for digital inclusion: Towards a pedagogy for embracing and sustaining students' diversity and engagement with inline learning"	ERIC	Journal of Education
2.	Kathleen Smeaton, Christine S. Bruce, Hilary Hughes & Kate Devis	"The online life of individual experiencing socio economic disadvantage: how do they experience information?"	ERIC	Information Research: An International Electronic Journal
3.	Stephen Gorard, Neil Selwyn & Sara Williams	"Must Try Harder! Problems Facing Technological Solution to Non-participation in Adult Learning"	Google Scholar	British Educational Research Journal

4.	Julian Sims, Philip Powell & Richard Vidgen	'E-learning and the Digital Divide: Perpetuating Cultural and Socio-Economic Elitism in Higher Education'	Research Gate	Communication of the Association for Information System
5.	Md. Saifuddin Khalid & Mette Jun Lykkegaard Pederson	'Digital Exclusion in Higher Education Context: A Systematic Literature Review'	Research Gate	Procedia - Social and Behavioral Sciences
6.	Segarani Naidoo & Jaya Raju	'Impact of the digital divide on information literacy training in higher education context'	Research Gate	South African Journal of Libraries and Information Sciences
7.	Richard I. C. Tambulai	"Pushed to the abyss of exclusion: ICT and social exclusion in developing countries"	Academia/ Science Direct	Journal of Information, Communication and Ethics in Society
8.	Md. Swalehin	'Digital divide: A Sociological Analysis'	Sodhganga	Sodhganga

Review Article

"Friend Request from Education": The need for Social Media Policy for Educational Institutions in India

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Abstract

The ubiquitous presence of Social Media in all fields in the current times cannot be denied. Exploring the possibilities of social media and its innovative use has become a fundamental skill in this era. The field of education, which had always distanced itself from social media, has finally come to accept social media at least as a channel for educational communication, especially during the COVID-19 scenario. This has raised several concerns ranging from privacy issues, cyberbullying, and surveillance to muffling of voices under the guise of discipline in educational institutions in India. This paper recognizes the lack of awareness of rights in digital spaces. The paper points out instances of social media policy framing becoming restrictive. This paper calls attention to the glaring absence of such guidelines and highlights the need for social media policy guidelines for educational institutions in India in order to overcome these concerns. This paper recommends the formulation of guidelines for educational institutions in India by an autonomous panel of experts from multidisciplinary domains.

Keywords: social media policy, social media in education, social media, education policy 2020

Introduction: Social media penetration

The last decade has seen the ubiquitous presence of social media networks which has transformed our daily lives. From information updates regarding an emergency situation to delivering messages, from networking to participating in a community, the shift in the role of social media has been speedy and overwhelming. The remodelling of the meaning of 'wealth' to 'information and knowledge' has accentuated the role of media in everyday life with an unprecedented ascent in the use and power of social media. The students- mostly digital natives are immersed in social media, in particular using it for everything from news and updates to gaining knowledge and supplementing their educational experiences. There have been rising concerns regarding misinformation and safety since then and it is imperative for media literacy to be identified as a fundamental skill in the current times of moving to a knowledge-based society. Most stakeholders, including the policymakers from educational systems, have largely viewed the disadvantages of social media, thereby not being keen to incorporate it as an educational scaffold. It is quite understandable considering the backdrop of instances that have brought out the murky side of social media (Clarance and Perera, BBCNews, 2020). This, in actuality, highlights the gap to be catered to by the educational systems, that of formulating guidelines, undertaking measures to instil awareness about the risks and benefits of usage of social media and tapping the potential of social media for optimising reach and access in education.

There has been a steady increase in the breadth and depth of research efforts on varied aspects of social media for educational purposes. Studies on behavioural aspects, immersivity, perceptions, use cases, and their impact have shown positive and negative results. Studies and practises have recorded Facebook, WhatsApp, Instagram, Twitter being leveraged for educational purposes. Social media is widely used for the purpose of socialisation and informal learning as well as building a community of learning (Deshmukh.A, 2019). Like everything else, social media comes with its own set of disadvantages. Research points out its role in establishing a sense of belonging, support, networking, and means of communication in distress and calamities on one hand (Kryvasheyeu.Y. et al., 2016; Muhammad. I., et al., 2015; Ogie, R.I., et al, 2022) and in the spread of misinformation, defamation, hate speech, cyberbullying on the other(Zachos, G.; Paraskevopoulou.K., 2018). Studies also point out that though students are enmeshed in social media use it extensively and are open to its usage for learning, educators do not support the use of social media in education (Connolly, T.; Boyle, E.; MacArthur, E.; Boyle, J., 2012). This contradiction and the double-edged nature of social media necessitates that education professionals including educators and administrators, draw consensus for formulating a social media policy for educational institutions and their stakeholders.

Concerns about the challenges like social media usage being excused for targeting people, restricting citizen's access to information and media usage, and freedom of expression have been vocalised (UNESCO news, *WSIS Forum,* 2018). On the other hand, these disruptions have also brought to light the fear of accountability, uncontrolled processes, and disruptions that social media brings. Social media is seen and hailed as a free space. Its rise to popularity had two major reasons amongst others, viz not being under censorship and the ease of access. Social media including online petitions, allows people to have a platform for a collective voice of their problems, concerns and discontent (Deshmukh.A., 2017). There have been several instances where people came together for common causes and concerns without being manned or led by any 'leader' as such. Multiple mass movements across the world have been impacted by social media (Smidi.A.,Shahin. S., 2017; Meral K., Meral.Y., 2021) to an extent. At the same time, the very same social media is being used as a tool to manipulate public opinion (Oxford Internet Institute, 2019). It is for this very reason that students, in particular, as young citizens, should be aware of the ways and implications and be cautious of covert and overt manipulations using social media.

Such out-of-control and unaccountable disruptions lead to varied reactions. While some could see this as "freedom", with certain grey areas looming around, on the other hand, Governments and administrators usually react to things out of their control by calling a "ban" on such platforms (Kelly.S., et al, 2017). Such reactions tend to do more harm than good since the call of the hour is to strengthen the usage of social media in order to create a safe and responsible internet space for all. A safer internet-based space, being a collective responsibility, various organisations in countries around the world have their own social media policies in place that describe and lay out desirable behaviour.

There have been instances of disciplinary action taken on posts by people, including sports personalities (Belson. K, The New York Times, 2012) amongst others with some academicians almost

losing their jobs (Ingeno.L, Inside Higher Ed, 2013). Similar incidents in academia have also been reported in India (Nath.S, News18, 2019). It was easier to take disciplinary action in the case of sports personalities since there are a set of guidelines on their conduct that make disciplinary action by the concerned Committees easy and justified. The dearth of such social media policies in Higher Education Institutions is striking, though guidelines about cybersecurity for school sections by NCERT have been in place since 2019.

There is extensive research literature available on various aspects of social media, including the effect on teenagers, privacy concerns as well as the role of social media in political movements (Tufekci, Z.and Wilson,C., 2012). However, literature on social media policy reveals that they cover utilitarian aspects like leveraging for the expansion of business or cautionary in the purview of legalities. Most of the social media policies are framed by the corporates, trying to separate the official and personal use. Surprisingly, there have been rare instances of the analysis of the content of the social media policies framed. It is found that the policies framed by various institutions regarding social media evolve through three stages- mitigation, information, and differentiation (Pomerantz J, Hank C, Sugimoto CR (2015).

It is also worth the attention that social media policies cannot be blanket policies for all users. Rather, they have to be for specific cohorts since their usage, application, and impact vary age-wise (René.C., 2019; Pew Research Centre, 2019) as well as according to the culture of the respective region (Koiranen et al. 2020). The legal age of usage of social media, though averagely considered as 13 years, also varies according to countries (Vincent. J., 2015). There are also instances that we see around us of users falsely reporting the age of a social media account, though this may be due to a lack of awareness. This, therefore, highlights the need to have policies on guidelines of usage as per the specific groups.

India and Social media

India has taken to social media as fish takes to water. It tops the usage chart of social media worldwide. The IT Act 2000 and its amendments look forth to define cybercrimes and electronic transactions. Several cases (PIL- Public Interest Litigations) have successfully sought to strike down certain articles of the above Act that curb the freedom of speech. Though the larger cause of freedom of speech has to be protected at all costs, there are certain grey areas left around that are manipulated by cyber criminals (PYMNTS, 2020). The need for protection of the fundamental rights of individuals and providing for a safe cyberspace is not mutually exclusive. On the contrary, that forms the backbone of the policy on social media.

And yet, when it comes to framing policies for usage of social media, it leaves a lot to ask for and to be met. The Ministry of Electronics and Telecom, Government of India lays down guidelines for social media usage by government institutions (Ministry of Electronics and Information Technology, Govt. of India, 2021), where it hints at the 'institutionalisation' of social media and the types of social media that can be used. It largely remains at a mitigation level and focuses on the outreach and managing interactions and perceptions of the individual citizens with the government. There has been an instance of the Indian government attempting to link the social media handles of students to that of their institutions, which was met by severe criticism citing invasion of personal space and surveillance (Joshi.S., VICE, 2019). The fears of using

personal data and surveillance, amongst others, are well-placed apprehensions. Even for the purpose of regulation of abuse or hate speech, there needs to be a nuanced understanding of the *"Spectrum of various online activities"* as opposed to an oblate concept of acceptable speech (Udupa, 2019). The fine line of 'invasion of private spaces', 'freedom of speech' needs to be defined with the backdrop of Constitutional Rights and the Indian Penal Code (IPC) sections. This necessitates the guidelines to be framed by autonomous bodies with a sound understanding of Laws and the Constitution as well as Education. It is worthwhile to note the steps taken over the years in the legal and policy framework of the country to strengthen the use of safe cyberspace (Sharma.D., et al, 2022). The focal point here is that autonomous bodies would ensure that there will be neutrality and academic integrity and keep commercialisation away.

When left to the organisations, including the educational institutions, the social media policies are at the mitigation stage. Not many educational institutions have social media policies per se, and the ones that mostly suggest responsibilities are listed (Central University of Tamil Nadu, 2019). While institutions are concerned about their reputation over social media, some of them state very clearly the disciplinary action that would be taken if the students speak against the institutions and/or the staff and services provided (Social media policy of some institutions noted here-All India Shri Shivaji Memorial Society, 2020; National Institute of Fashion Technology, 2020). This could be considered a gag policy on the student's freedom of expression as there are chances that their voices could never be heard. Surprisingly, mention of hate speech, cyberbullying, and ways to report cybercrime is largely unspoken, which remains the major cause of concern in the cyber world. Such restrictive, mitigative policies could be a deterrent to a student being harassed to file a complaint.

The lower rate of literacy, little awareness of cyber security, cybercrime, hate speech, and rights related to such incidences in a growing democracy should lead to educational institutions being the torchbearers in the framing of guidelines that inform students and staff about the specific laws, their implications and their protection. Yet, this role by the educational institutions remains largely in taking only awareness programs and not developing a strong policy document which could be due to a number of reasons- administrative and practical.

With the COVID 19 situation, educational transactions have been forced to go online, thereby necessitating the urgent need to frame and development of a social media policy for educational institutions. Social media no longer remains a frill but a scaffold in education due to reach and minimum bandwidth requirements. The pandemic of COVID 19 has seen social media being used as a platform for information dissemination and its usage for academic communication - synchronous, lectures and asynchronous to carry out discussions, send notifications and other academic purposes. This has highlighted a number of gaps which need to be addressed, including the awareness of the age at which using social media is legal and the attitude of the teachers towards the usage of social media in education that ranges from hostility to over-enthusiasm. It has also brought to the forefront the demographic challenges that are unique to the field of education thus underlining the need for overarching policy guidelines for appropriate usage of social media in education.

Thus, there is a need for policy guidelines to be drafted by autonomous bodies in sync with legal expertise and NGOs to

involve multiple perspectives. The social media policies in education have to consider various points, the basics being the age group. The social media policies will have to be framed considering the cultural diversities, literacy rates and socio-cultural-economic aspects. Additionally, the impact on, and of the groups active on social media has to be of prime focus while framing such policy guidelines. The social media policy, while upholding the rights of students and faculty alike, should ensure to provide for a safe cyberspace. Therefore, this paper recommends the formation of a committee comprising experts from autonomous bodies or institutes of excellence such as NCERT, IITs, National Law School related to the domains of Education, Educational Psychology, Technology, and Law. While this paper strongly advocates the autonomy of educational institutions to draft their own policy, it recommends that educational institutions need clear guidelines by such a committee and possibly a system of regulation for the same in order to ensure fairness of usage in terms of providing a voice as well as maintaining professional requirements.

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Review Article

AI-Assisted Learning in Higher Education: Exploring the Pedagogical Potential of ChatGPT

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Abstract

Chat-GPT witnessed exponential growth by attracting 1 million users within five days and over 100 million users in 2 months since its launch in November 2022. ChatGPT responds to user-generated prompts in real time using the provided prompts or questions. The entry of ChatGPT and how it functions by creating a body of text from responses raises concerns about the pedagogical implication on language teaching and learning, ethical issues, and new research avenues for educational specialists to explore. This article examines what ChatGPT can do and its capabilities from recent literature, opportunities that are brought by ChatGPT, such as the creation of sound human-like content, and the limitations, including concerns around bias and the creation of false or misleading information. Further, the pedagogical implication of the ChatGPT is discussed with an analysis of institutional reactions and uptake of the ChatGPT so far. Additionally, the paper suggests what can be done in policy and adoption of the practice of using ChatGPT by emphasizing the need for careful integration into educational practice. By leveraging the capabilities of Chat-GPT and mitigating its limitations, the technology can be a valuable resource for enriching the teaching and learning of language and research.

Keywords: chat-GPT, Generative AI, AI in Education, Higher Education, Innovative Teaching, Pedagogical Tool.

Introduction

The integration of Artificial Intelligence (AI) in education has gained significant attention in recent years. AI technologies offer innovative solutions to enhance teaching and learning experiences, providing personalized and adaptive learning pathways for students (Anjum et al., 2020). Artificial Intelligence (AI) is one of the growing fields of technology that has impacted education by promoting better learning outcomes by improving learning opportunities for students, such as collaborative learning, real-time feedback and an increase in learners' engagement (UNESCO, 2019). Generative AI is AI technology that can generate content from the given dataset that it has been trained to (Gozalo-Brizuela & Garrido-Merchan, 2023); for instance, the generative AI can generate image and convert it to text or text to image or video or text to text. ChatGPT is one of the technological tools under the generative AI that is based on a text-to-text model. (Technical University Munich, 2023) asserted that ChatGPT is

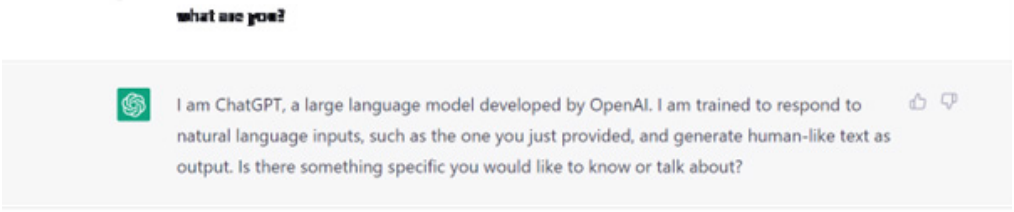
one of the tools that can benefit mostly academic institutions regardless of their curriculum or the types of learners the institution has.

ChatGPT is a tool that use uses natural language processing (NLP) techniques to respond to the responses provided by the users. In simple words, a user inputs the question, a prompt, or a statement into ChatGPT, and ChatGPT will generate the response using NLP from the available data set it has been trained to which currently is up to the year 2021 (Torrey Trust, 2023). Golumbia (2022) defined the ChatGPT as a machine which generates human-English responses from the given prompts. With such capabilities, ChatGPT has gained attention as a potential pedagogical tool in higher education (Schatten, 2022). Its functionalities encompass a wide range of academic tasks, such as generating code languages, social media posts, essays, CVs, and even poems, which can be particularly valuable for both educators and students (Gleason, 2022). Additionally, ChatGPT has been used to assist in content creation, summarization, and error detection in academic papers (Morning Edition, 2022).

ChatGPT is a language model developed by OpenAI, designed to understand and generate human-like text based on the input it receives. It is part of the GPT (Generative Pre-trained Transformer) family of models and has been trained on an extensive dataset to achieve its language processing capabilities OpenAI (2022),. Training process and dataset used The training process of ChatGPT involves exposing it to a vast amount of data from diverse sources, such as books, articles, websites, and other textual content available on the internet. This massive dataset provides ChatGPT with a wide range of language patterns and structures, enabling it to generate contextually appropriate responses.

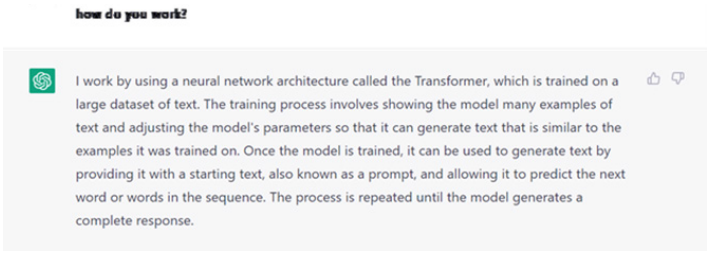
According to OpenAI (2022), ChatGPT was trained using reinforcement learning from human feedback. The initial model was trained using supervised fine-tuning. Later the human AI trainers played a key role in responding both as a user and the ChatGPT in which ChatGPT learned the dialogue format from given data. The following figures, figure 1 and figure 2 display some sample responses provided by ChatGPT.

Figure-1: Screenshot of response from chat-GPT after given prompt of "what are you?" (https://chat.openai.com/chat)



The ChatGPT was provided with the prompt as indicated in figure 1, ChatGPT was questioned "What are you?" ChatGPT responded by providing a clear explanation of what ChatGPT is and a sample example of how it works, further, it provided a dialogue continuation if the answer is not understood or more explanation is needed.

Figure-2: A screenshot of the response from chat-GPT after being given the prompt of "How do you work?" (https://chat.openai.com/chat)



In figure 2, the ChatGPT was questioned "How do you work?" ChatGPT responded by providing a clear explanation of how it works using the dataset it was trained on. It explained the process of reinforcement learning as a repeated process until the model generates the complete response. Further, ChatGPT explained how it works by indicating it works on the dataset given and using the examples that were provided during the training.

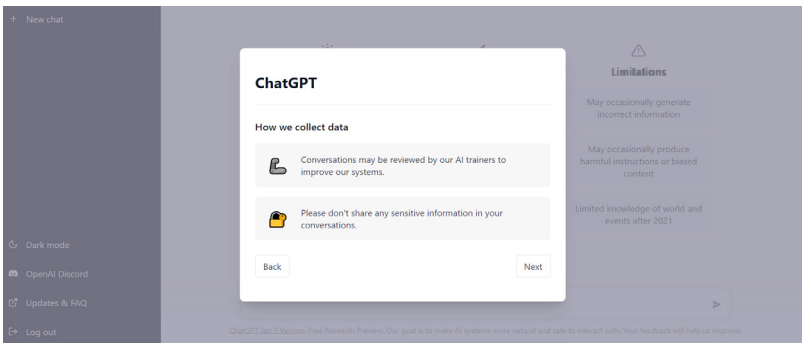
When provided with an input prompt, ChatGPT employs its transformer-based architecture to analyze the context and patterns within the text. It uses this analysis to generate a response that is relevant and contextually appropriate to the given prompt. The model's ability to understand the relationships between words and sentences allows it to create coherent and human-like responses, making it a versatile and useful language generation tool. (Brown et al., 2020).

Methodology

The study involved an innovative literature survey from online sources and tool exploration. Literature sources were obtained from online sources such as open journal repositories, news, public talks and discussions, books and reports published on ChatGPT.

Moreover, a ChatGPT account was opened (one needs an account to be able to use ChatGPT) using an active email address to see how it works. ChatGPT started being used after the confirmation of the mobile number (an active mobile number is needed for confirmation). Then, various responses related to the education setting were entered to see how ChatGPT responds and the alternative answers it could provide.

Figure-3: Homepage view of the ChatGPT tool after the sign-on process indicating instructions to the user on how it collects the data and privacy (https://chat.openai.com/chat)



Discussion

The discussion section delves into the pedagogical implications and practical considerations of integrating ChatGPT in higher education. This section

explores the potential benefits of ChatGPT in simplifying academic tasks by providing human-like responses to tailored prompts (Schatten, 2022; Gleason, 2022). Additionally, it adds to the limitations of ChatGPT, including issues of trustworthiness, dataset limitations, biases, and its inability to comprehend complex human language (Torrey Trust, 2023; Golumbia, 2022; Bogost, 2022). Furthermore, this discussion addresses the evolving landscape of academic integrity and plagiarism concerns in the context of AI-generated content (Hippel, 2023; Hern, 2022). Finally, it explores how institutions can adapt to this AI revolution, outlining policy considerations and recommendations for effective implementation (Mills, 2022; Montclair State University, 2023).

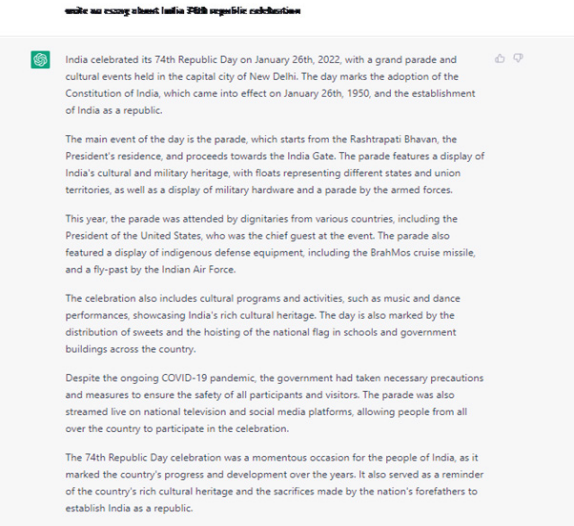
Benefits of ChatGPT as a Pedagogical Tool

ChatGPT provided opportunities to simplify various academic works by providing dedicated responses that sound human-like. According to Schatten (2022), when you input the prompt in ChatGPT, you get a specifically tailored response according to your prompt, and it has a user-friendly interface. Gleason (2022) added that ChatGPT can generate structured content such as code languages, social media posts, and essays, create a CV from given info, create poems following specific poets' styles, design outlines for courses and lesson plans, design content for teaching and quizzes.

Further, Morning Edition (2022) debated how ChatGPT is used to create content as one can paste an entire academic paper, and ChatGPT can work on it or summarize it, ChatGPT can find errors in codes and make corrections. Gravett (2023) added that with ChatGPT, we can get the response to prompts as when we ask the learners to demonstrate what they have learned, and ChatGPT will answer accordingly, the only difference now is the response will be human-like, and no human is directly involved in providing the response.

According to (Herman, 2022), ChatGPT has proved how it can change how people do writing, and its integration into teaching might end writing assignments. The figure below indicates an example of an essay generated by the ChatGPT tool using the prompt to write about India Republic Day, which it did and provided the response.

Figure-4: A screenshot of the response from chat-GPT after being given the prompt to write about India Republic day (https://chat.openai.com/chat)



Limitations and Challenges of ChatGPT

With the affordances ChatGPT is offering by generating content from prompts, it still has some limitations on how it works, such as trustworthiness. ChatGPT is not always trustworthy and cannot provide accurate responses when asked to. Torrey Trust (2023) affirmed that the massive dataset ChatGPT was trained on is up to 2021. Hence, the recent events and information cannot easily be available, and ChatGPT cannot by itself access the internet (Mills, 2022) to search for the available information.

Further, as OpenAI (2022) explained how ChatGPT was trained, some trustworthy issues arise as ChatGPT was trained by humans and to some extent, will respond as trainers trained it to and reinforced. On the same, Golumbia (2022) mentioned that biases such as racial preferences might emerge from the dataset used for training ChatGPT. ChatGPT has been trained on the massive dataset; however, it does not mean that it has all the available data when given a prompt as such Torrey Trust (2023) found out that when missing the data, ChatGPT makes up guesses when they lack data to pull information from instead of indicating it cannot respond to the prompt.

Further, Bogost (2022) claimed that ChatGPT does not truly understand how human language is complex but only provides responses on given input and cannot comprehend the meaning behind the words, which makes it easier for it to make up data, the same was found by Thompson (2023) when ChatGPT provided the wrong response with supporting evidence from Hobbes' work which could easily be spotted by a human. Additionally, Gravett (2023) observed that most of the time ChatGPT will provide incorrect and non-existing citations in its responses. OpenAI (2022) explained this scenario by indicating that at times, ChatGPT will generate plausible-sounding but incorrect or nonsensical answers as it misses data that was not trained on; some answers were wrongly trained depending on what the model knows and do not reflect human knowledge.

Pedagogical Implications of ChatGPT

ChatGPT forces institutions to rethink pedagogical practices and assessments of learners. Integrating AI writers into learning and teaching can be done in higher education. With AI writers such as ChatGPT, Gleason (2022) suggested the change of assessment from assessing the product to focusing on the whole learning and assessing process by integrating AI technologies like ChatGPT into learning and teaching.

Nevertheless, Mills (2022) stressed how institutions can adapt to these new changes by regulating academic policies by giving a way to include AI-created content, such as using the ChatGPT to create a question on a selected topic, which also Technical University Munich (2023) explained could be a strategy tool for learners to use prepare themselves for examinations.

Moreover, Hippel (2023) discussed how universities are grappling with the challenge of incorporating ChatGPT and other generative AI tools into their curriculum. Faculty members need to invest time in improving their digital literacy and understanding the technology's affordances and limitations. This understanding will enable faculty to effectively integrate generative AI, like ChatGPT, into their classes and assess its impact on learning outcomes.

Policy and Adoption Considerations

The ethical implications of using ChatGPT have sparked discussions on what is considered acceptable and what

is not in academia (Morning Edition, 2022). Plagiarism, in particular, is a major concern when it comes to integrating ChatGPT into instructional activities (Hippel, 2023). Hern (2022) indicated that institution admins have concerns over plagiarism caused by ChatGPT and how they can function to detect it. Bowers-Abbott (2023) revealed how plagiarism can occur when ChatGPT provides related content to students with similar prompts, potentially allowing some to go unnoticed while others unwittingly produce similar work.

To address the issue, recent developments by OpenAI include working on a watermarking solution to highlight work produced by ChatGPT and GPTZero, aiding in spotting potential plagiarism (Kim, 2022). However, Peritz (2022) argues that using ChatGPT might not be considered traditional plagiarism, as the student initiates the process by exploring multiple prompts, and no previous work exists for the student to copy. Still, Hippel (2023) raises concerns about ChatGPT's ability to respond to mathematical prompts and complex concepts, as it can provide incorrect answers to some calculations.

In response to these concerns, organizations are creating policies to prohibit the submission of AI-created work as one's own in order to uphold academic integrity (Hern, 2022). For instance, platforms like Stack Overflow, designed for programmers to solve coding problems, have implemented policies limiting users from using code generated by ChatGPT and presenting it as their original work. This ensures a fair academic environment and prevents potential issues related to plagiarism.

In navigating the ethical landscape, institutions are striving to find a balance between leveraging AI technology for educational purposes and maintaining academic honesty (Morning Edition, 2022). Some argue that if responses from ChatGPT can be modified and improved upon by students, this process could be seen as a legitimate way to use generative AI tools. However, this has prompted the need for clear guidelines and codes of conduct to prevent potential misuse of AI-generated content. As institutions move forward, it becomes crucial to establish comprehensive policies and adoption considerations to ensure the responsible and ethical use of ChatGPT and similar AI technologies in the academic setting.

Future Directions and Recommendations

To maximize the benefits of ChatGPT and overcome its limitations, several future directions and recommendations can be explored. In the context of Indian higher education, specific strategies can be adopted to effectively utilize ChatGPT as a pedagogical tool. Firstly, integrate ChatGPT in Language Learning: Given India's linguistic diversity, ChatGPT can play a vital role in language learning. By providing responses in various regional languages, ChatGPT can aid learners in improving their language proficiency and understanding.

Another consideration is how to raise awareness and training for faculty members and students of higher education. Faculty members and students need to be adequately informed and trained on the proper use of ChatGPT. Workshops, training sessions, and educational materials can help users leverage the tool effectively and ethically. Moreover, Indian higher education can develop Policies and Guidelines: Institutions should establish clear policies and guidelines for using generative AI tools, including ChatGPT, to prevent academic misconduct and ensure responsible usage. The government and ministries can work in the provision of fund studies to explore ChatGPT for Personalized Learning: By understanding individual students'

learning preferences and abilities, ChatGPT can be utilized to provide personalized educational content and support, enhancing the overall learning experience. Also, research can be directed into measuring learning outcomes and evaluating the impact of ChatGPT on learning outcomes. This data-driven approach can inform further improvements and enhance the effectiveness of the tool in educational settings.

ChatGPT, as an AI-powered generative tool, offers promising opportunities to simplify academic tasks and enhance pedagogical practices in higher education. Its ability to provide human-like responses to tailored prompts, generate structured content, and aid in various academic processes has been widely acknowledged (Schatten, 2022; Gleason, 2022; Morning Edition, 2022; Gravett, 2023). However, alongside these benefits, several limitations and challenges have been identified. Trustworthiness remains a key concern, as ChatGPT's training data has temporal limitations and potential biases, impacting the accuracy and reliability of its responses (Torrey Trust, 2023; Golumbia, 2022). Additionally, the tool's lack of access to current information and limited understanding of complex human language raises further questions about its usability in certain scenarios (Bogost, 2022; Thompson, 2023).

Conclusion

The education sector is not outside the realm of technological change that is happening in the world, and we need to adopt technological tools to enrich our teaching and learning experiences. With the ChatGPT's capabilities to generate a body of text from given prompts, we can use it in various settings from creating letters to the provision of exemplary essays in our classes. However, with the development of generative AI technologies such as ChatGPT, academic institutions can focus more on how to regulate its usage and adoption, as suggested by Hern and Mills (2022) instead of blocking them. Also, institutions should find a way to equip their faculty with digital literacy skills to be able to work in a changing technology that is dominating the world of work. To effectively harness the benefits of ChatGPT, academic institutions need to foster digital literacy among faculty, develop clear policies, and raise awareness of responsible AI use (Gleason, 2022; Center for Integrated Professional Development, 2022; The New York Times, 2022; Montclair State University, 2023).

ChatGPT and other AI technologies do not exist to replace work that is done by a human. Rather than simplifying it, human intervention is needed to create meaning behind the words generated Bogost (2022) suggested that ChatGPT doesn't understand the meaning. Rather, it works on the dataset as it was reinforced. ChatGPT is a powerful tool. However, human intervention is needed to understand more its full potential capabilities and limitations when used to teach and learn, understand what it can do and what it cannot do and how to integrate it into the school curriculum.

Upon graduation, students will interact with ChatGPT and other AI tools in their work line, and they need to start interacting with them early. Higher education institutions have a chance to adopt the tools and develop innovative assessment practices that can integrate the usage of the tools that students can meet in the workplace as Gravett (2023) advocated to use of ChatGPT to teach digital literacy to learners and explore the capabilities of generative AI in terms of output and efficiency in work settings. While the journey towards integrating AI in higher education may present obstacles, the rewards in terms of improved teaching, learning, and

assessment practices make the effort worthwhile. As we continue to explore the possibilities offered by ChatGPT and similar AI technologies, it is crucial to maintain a balance between embracing innovation and addressing ethical and pedagogical considerations. By doing so, we can ensure a future where AI becomes a valuable tool, enhancing the educational landscape while preserving academic integrity and promoting equitable learning experiences for all.

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Review Article

Hybrid Learning: How Educational Technology is enabling a New Era of Classroom Flexibility

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Abstract

As schools continue to navigate the ongoing COVID-19 pandemic, many have turned to hybrid learning models as a way to balance in-person and remote instruction. Educational technology has played a critical role in enabling this new era of classroom flexibility. This article explores what hybrid learning is, the benefits and challenges of this approach, and how educational technology supports it. The article provides examples of educational technology tools commonly used in hybrid learning, along with best practices for effective implementation. Teacher and student perspectives on hybrid learning are also examined. Finally, the article explores the future of hybrid learning and educational technology and how this approach may continue to evolve in the years to come.

Keywords: Hybrid learning, educational technology, remote learning, online learning, in-person instruction, classroom flexibility, personalized learning, virtual learning, blended learning, technology integration, future of education.

What is Hybrid Learning?

Hybrid learning, often referred to as blended learning, is an educational approach that combines traditional in-person teaching with the utilization of educational technology. This method aims to leverage the strengths of both conventional classroom instruction and digital tools while mitigating their respective drawbacks. By seamlessly integrating online educational resources and digital platforms into the educational environment, hybrid learning offers an unprecedented level of flexibility for both students and educators. As educational technology continues to advance, hybrid learning has gained widespread acceptance across various educational and training settings.

Hybrid learning fosters a dynamic and interactive learning environment, allowing students to access course materials, participate in discussions, and collaborate with peers in both physical and online settings. This educational model involves students attending classes in person as well as remotely through digital technology. This flexibility empowers students to choose between on-site and online attendance based on their personal preferences and circumstances. The implementation of hybrid learning can take on diverse forms, ranging from a fully blended model where students split their time equally between in-person and online learning, to a more adaptable approach that enables students to attend classes on-site or remotely as needed (Gil, Mor, et al.,

2022). Many educational institutions have embraced hybrid learning, especially in response to the challenges posed by the COVID-19 pandemic. It facilitates social distancing and reduces the risk of viral transmission within the classroom (Nørgård, 2021).

Hybrid learning offers numerous advantages, such as enhanced flexibility and convenience for students, as well as the incorporation of educational technology to enrich the learning experience. However, the implementation of a hybrid learning model also presents certain challenges, including ensuring equitable access to technology and maintaining a sense of community and engagement in the classroom (Bülow, 2022). In summary, hybrid learning represents a promising educational approach that can deliver a more personalized and adaptable learning experience for students.

The Benefits of Hybrid Learning

Hybrid learning, which combines elements of online and face-to-face instruction, has garnered attention as an innovative approach poised to reshape higher education (Krishnan, 2023). Research indicates that this approach, while not without its challenges, offers a range of benefits for both students and instructors. It stands to enhance the educational landscape by fostering a more adaptable and engaging learning environment in contrast to traditional in-person classes (Krishnan, 2023). However, it does come with its share of pedagogical and technological hurdles (Krishnan, 2023).

Snart (2010) contends that hybrid learning has the potential to revolutionize education for the 21st century by harnessing emerging technologies and multimedia, thus expanding its horizons. While faculty may define hybrid learning in various ways, Abdelrahman (2016) found that by and large, they support it for its ability to increase accessibility, even though they tend to believe that face-to-face learning provides a higher-quality educational experience (Abdelrahman, 2016).

Hybrid learning appears to be particularly well-suited for computer science students, as Rosbottom (2001) suggests, as they tend to perform better in hybrid and online courses. Furthermore, research by Mossavar-Rahmani (2007) has shown that a hybrid model with at least 50% of learning activities conducted online can have a positive impact on course delivery and student success.

Community colleges grappling with overcrowded in-person classes and the challenges of online courses, have been actively exploring hybrid learning as a viable alternative (Crawford, 2014). Olapiriyakul (2006) provides valuable guidance on the development of hybrid courses and reveals that there is generally no significant difference in student performance between hybrid and online courses, though students typically prefer the hybrid format. Additionally, Sutisna (2020) found that a hybrid model can enhance students' digital literacy.

In summary, while hybrid learning does present its fair share of challenges, research indicates that it can offer distinct advantages over traditional face-to-face and online learning methods. These advantages encompass the creation of an engaging learning environment, improved accessibility, enhanced student success, and greater digital literacy. With careful design and adequate support, hybrid learning holds the potential to bring about transformative changes in higher education (Krishnan, 2023). Recent studies, such as the work by Ramli, Setyawan, et al. (2022), continue to affirm the many benefits of hybrid

learning, further solidifying its position as an advantageous approach in contemporary education.

Hybrid learning, which blends online and in-person elements, offers numerous benefits for students and educators alike. These include flexibility, personalization, increased engagement, improved access, and cost-effectiveness. Overall, hybrid learning presents an opportunity to create a more tailored, engaging, and accessible learning experience while also being a cost-effective option for institutions and students.

Challenges of Implementing Hybrid Learning

Hybrid learning, a pedagogical approach blending both online and face-to-face instruction, holds significant promise in reshaping higher education to align with the evolving needs of contemporary students (Snart, 2010). Nonetheless, its implementation is not without substantial challenges. A recurring theme in the literature is the technical hurdles faced by both students and instructors when navigating the digital landscape of hybrid learning. Krishnan (2023) highlights the struggles lecturers encounter in managing the pedagogical and technological complexities of this approach. Moreover, concerns persist regarding the potential for technology to facilitate academic dishonesty during assessments (Krishnan, 2023). Khatib (2023) concurs, emphasizing the substantial effort required for the effective integration of digital technology into hybrid learning.

Ensuring high-quality interaction and a positive learning experience presents another set of challenges. Damo (2020) underscores the necessity of ample, high-quality interaction between students and lecturers for hybrid learning to yield meaningful results. Masson (2008) argues that hybrid learning must adopt a supportive framework that centres on the learning experience to effectively guide both students and instructors. However, research by Sendra-Pons (2022) suggests a potential downside, with findings indicating that students in hybrid learning settings may exhibit lower academic performance and motivation, possibly attributed to reduced face-to-face interaction and guidance.

Despite these challenges, a growing body of literature highlights the merits of hybrid learning. Snart (2010) contends that hybrid learning has the capacity to make higher education more engaging, flexible, and cost-effective. Empirical assessments by Damo (2020) and Faradita (2022) reveal overwhelmingly positive feedback from students regarding their hybrid learning experiences. Additionally, studies by Krishnan (2023) and Nashir (2021) report that both students and instructors perceive hybrid learning as more effective and engaging compared to fully in-person or fully online instruction.

While the introduction of hybrid learning in higher education presents technological, pedagogical, and experiential challenges, numerous studies suggest that its advantages can outweigh these difficulties. With meticulous planning and robust support systems in place, hybrid learning has the potential to render higher education more accessible, affordable, and relevant to the needs of today's diverse student population. In sum, current research underscores the value of further developing and refining the hybrid learning approach to meet the evolving demands of contemporary higher education.

How Educational Technology Supports Hybrid Learning

Educational technology has assumed a pivotal role in facilitating and enriching hybrid learning, a dynamic educational model encompassing both in-person and online components (Sharma, Sood, et al., 2022). Its contribution to hybrid learning is multifaceted and transformative.

Educational technology serves as the linchpin for seamless communication, collaboration, and resource sharing within the hybrid learning environment. Manciaracina (2021) outlines a comprehensive array of 12 technological communication tools, encompassing video conferencing platforms, online whiteboards, and cloud storage solutions. These tools empower students and instructors to engage effortlessly, whether they are physically present or participating remotely.

The integration of educational technology has enabled the creation of scalable, shareable, and sustainable e-learning modules, as advocated by Bai (2010). These modules offer automated feedback and adapt to individual student needs, fostering knowledge dissemination and cost-efficiency. Moreover, this approach encourages the sharing of pedagogical best practices among faculty members.

Rosita (2020) demonstrates the practical application of educational technology through Google Classroom, a free web service that significantly enhanced hybrid learning in Indonesian high schools. Comprehensive training on Google Classroom equipped teachers with the tools to optimize the quality and quantity of learning materials and assignments, thereby enriching the educational experience.

Snart (2010) envisions a transformative potential for hybrid learning through the incorporation of emerging technologies, culminating in tailored, engaging learning environments that cater to diverse student needs. Similarly, Callaghan (2010) presents a conceptual framework that employs virtual classrooms and mixed reality to instil a sense of togetherness and community among online students.

Linder (2017) propounds the concept of hybrid pedagogy, which exploits technology to create versatile learning environments accommodating varied learning preferences. Hybrid courses often leverage technology-enhanced activities beyond the traditional classroom setting.

Olapiriyakul (2006) offers valuable guidance and a case study on establishing hybrid learning courses at the New Jersey Institute of Technology. The study reveals no significant performance disparity between students in hybrid and distance learning courses, with students expressing a preference for visual and active learning modalities.

Educational technology is instrumental in the success of hybrid learning by providing platforms for communication, collaboration, and resource sharing. Well-designed hybrid courses harnessing technology have the potential to deliver engaging, tailored learning experiences that cater to the diverse needs and preferences of students.

Examples of Educational Technology Tools Used in Hybrid Learning

Learning Management Systems (LMS): LMS platforms such as Canvas and Moodle are used by teachers to create and manage course content, assignments, and assessments. They also enable communication and collaboration between teachers and students.

Video Conferencing Software: Platforms like Zoom and Google Meet are used to facilitate live virtual classes and meetings, where students can interact with their teachers and classmates remotely.

Interactive Whiteboards: Interactive whiteboards, such as SMART Boards, can be used in both in-person and virtual classes to display and manipulate multimedia content, and to facilitate student collaboration.

Screen Sharing Software: Tools like Microsoft Teams and Google Workspace allow students to share their screens with their teachers and classmates during virtual classes, making it easier to demonstrate and explain concepts.

Online Learning Resources: Online learning resources such as Khan Academy and Coursera provide students with access to high-quality educational content that can supplement their in-class learning.

Educational Games and Simulations: Educational games and simulations, such as Minecraft and SimCity, can be used to create engaging and interactive learning experiences that are accessible to students both in-person and online.

Digital Textbooks: Digital textbooks, such as those provided by Pearson and McGraw-Hill, can be accessed both in-class and online, providing students with a more interactive and engaging learning experience.

Mobile Apps: Mobile apps like Duolingo and Quizlet provide students with the ability to learn on the go, making it easier to stay engaged and retain information outside of the classroom.

Online Discussion Forums: Online discussion forums, such as those provided by Edmodo and Schoology, enable students to participate in class discussions and collaborate with their classmates outside of the classroom.

Digital Whiteboards: Digital white boards, such as Google Jamboard and Microsoft Whiteboard, allow teachers and students to collaborate in real-time, whether they are in the same physical classroom or participating remotely.

Best Practices for Effective Hybrid Learning

Hybrid learning, which harmoniously combines online and face-to-face instruction, stands as an innovative model with significant potential for the future of higher education. Numerous studies have highlighted best practices that can guide the design of effective hybrid courses, aiming to enhance the learning experience for students.

One paramount best practice is the judicious use of technology to offer "just-in-time" knowledge and cultivate an immersive learning environment (Desmarais, 2008). Technologies such as learning dashboards, social media, and virtual reality can furnish students with timely information while immersing them in authentic tasks (Dafoulas, 2016; McNaught, 2011).

Aligning course design with learning outcomes and student needs is another pivotal best practice (Westover, 2014; Olapiriyakul, 2006). Successful hybrid courses should be constructed around the development of skills and capabilities rather than merely content delivery. Furthermore, they should be attuned to students' diverse learning styles, acknowledging that many students favour visual and active learning approaches.

Tahir, Van Mierlo, et al. (2022) offer a comprehensive set of best practices for effective hybrid learning. Clear and regular communication is deemed essential, necessitating the establishment of communication protocols and channels between teachers, students, and their families.

Clarity about attendance, assignments, and assessment expectations is crucial.

Sustaining student engagement in hybrid learning environments can be a challenge, but several strategies prove effective. Incorporating interactive elements such as breakout rooms, polls, and discussion boards into lessons can foster engagement. Additionally, creating opportunities for collaborative work and peer feedback enhances the learning experience.

A prerequisite for successful hybrid learning is ensuring that both teachers and students have access to the requisite technology and infrastructure, encompassing devices, software, and reliable internet connectivity. Teachers should also receive training in educational technology tools and platforms while possessing the ability to troubleshoot technical issues as they arise.

Flexibility is a fundamental tenet of hybrid learning, demanding adaptability from both teachers and students. Teachers should be receptive to adjusting their lesson plans based on feedback and observations, while students benefit from having some flexibility and autonomy in how they complete assignments and assessments.

Assessment practices are equally critical in hybrid learning, mandating clear and equitable grading rubrics communicated transparently to students. Formative assessments throughout the learning journey serve to monitor student progress, enabling instructors to tailor their teaching strategies accordingly.

In essence, effective hybrid learning hinges on meticulous planning, transparent communication, and a disposition for adaptation and innovation. By adhering to these best practices, educators can empower their students to thrive in hybrid learning environments, thereby realizing the full potential of this pedagogical approach.

Teacher and Student Perspectives on Hybrid Learning

Research into hybrid learning, an educational approach that melds online and in-person instruction, reveals generally positive perceptions from both educators and students, despite some persisting challenges. Students find hybrid courses appealing due to their flexibility and interactivity. Lin (2008) observed that students highly valued the organization and adaptability inherent in hybrid learning. Similarly, Hall (2015) noted students' appreciation for the array of interactive activities encompassing both online and face-to-face components. However, it is important to acknowledge that certain students encountered difficulties with the online elements, as indicated by Lin (2008) and Jackson (2008).

From the teachers' vantage point, hybrid learning has presented both challenges and rewards. It has necessitated an adaptation of teaching methods and proficiency in utilizing educational technology tools. Yet, it has also granted educators greater flexibility and creativity in their instructional approaches, while extending their reach to students who might have otherwise faced attendance or academic difficulties in a traditional classroom setting (Gaffas, 2023; Gil, Mor, et al., 2022).

For students, the experience of hybrid learning has elicited mixed reactions. While some students relish the flexibility of remote learning, others miss the social interaction and structured environment of a traditional classroom. Furthermore, students who grapple with technology issues or lack reliable internet access may encounter additional hurdles in hybrid learning environments.

It is crucial to emphasize that the effectiveness of hybrid learning hinges on the adept implementation of technology and pedagogy. Teacher training and support mechanisms play a pivotal role in surmounting these challenges and optimizing the potential of hybrid learning. As the COVID-19 pandemic has underscored, hybrid learning has become a prevalent model in education globally. Its enduring significance rests on the capacity to harness technology and pedagogy effectively, tailoring educational approaches to meet the diverse needs of both educators and students.

Future of Hybrid Learning and Educational Technology

The future of education is undeniably intertwined with the evolution of hybrid learning, a dynamic blend of online and in-person instruction. This educational paradigm has garnered substantial attention due to its potential to provide students with increased flexibility, accessibility, and interactivity (Bai, 2010; Manciaracina, 2021). Hybrid learning is particularly appealing as it accommodates diverse learning styles and fosters efficient teacher-student interaction, aligning well with the preferences of today's digital-native students (Chan, 2010; Krishnan, 2023).

Nevertheless, the adoption of hybrid learning is not without its complexities. Snart (2010) envisions its transformative potential through the incorporation of emerging technologies like online gaming and social media. However, the reality is more nuanced, with Krishnan (2023) reporting mixed reviews from both lecturers and students. Lecturers grapple with pedagogical and technological challenges, while students express concerns about the quality of online lectures and assessment methods. Putra (2015) advocates for the integration of multimedia in hybrid learning models to diversify, interact, and enhance communication in the learning process.

Several studies have pinpointed the characteristics of effective hybrid learning. Bai (2010) introduced shareable e-learning modules designed to offer automated feedback and adapt to individual student needs. Khatib (2023) affirmed the efficacy of digital technology when implemented within higher education hybrid learning contexts. Chan (2010) emphasized the importance of hybrid learning catering to diverse learning styles, boosting interaction, and harnessing information and communication technology (ICT) to engage students.

While hybrid learning unquestionably holds the promise to revolutionize higher education by providing flexible, accessible, and interactive learning environments, it also presents formidable challenges that demand meticulous design and implementation. As we look ahead, ongoing technological advancements and evolving educational needs will likely continue to shape the future of hybrid learning and educational technology. Personalized learning platforms, adaptive technologies, artificial intelligence, virtual and augmented reality, and digital citizenship education are anticipated to play pivotal roles in transforming the way we teach and learn (Gil, Mor, et al., 2022).

To prepare students for success in the 21st century, educators will need to remain agile, keeping abreast of new developments in technology and adapting their teaching methodologies accordingly. The fusion of innovative educational technology and pedagogical expertise holds immense potential for reshaping the landscape of education in the years to come.

Conclusion

Hybrid learning has emerged as a promising model for education in the wake of the COVID-19 pandemic. By combining in-person and online instruction, hybrid learning offers greater flexibility, personalization, and accessibility for students. Moreover, educational technology has played a crucial role in enabling and enhancing hybrid learning, from video conferencing and learning management systems to adaptive learning platforms and virtual reality simulations. While hybrid learning presents numerous benefits, it also poses significant challenges, including technological barriers, pedagogical adjustments, and student engagement. Nevertheless, with careful planning, collaboration, and innovation, schools can overcome these challenges and leverage hybrid learning to create more effective and engaging learning environments. As we move forward, the future of hybrid learning and educational technology holds great promise. By embracing new technologies and pedagogies, educators can continue to expand the possibilities of hybrid learning, making education more accessible and effective for all learners.

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Review Article

Modelling Dominant Factors of Technology Acceptance in Education: A Systematic Review Analysis of Indian Studies

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Abstract

The study aims to identify common external factors of the Technology Acceptance Model (TAM) that influence the adoption of digital education in India. The analysis included a systematic review of 20 independent Indian research papers published in leading journals. This work summarizes existing knowledge in the areas of e-learning, m-learning, and learning management systems and their acceptance in education over the last decade. The results show that social influence, self-efficacy, result expectancy, content quality, and facilitating conditions are the most frequently used external factors. The strengths of the causal relationships between these 5 independent variables and the dependent variables of the main constructs of TAMs were developed into the conceptual model.

India, with its diverse learning needs, is immensely benefiting from the latest advances in educational technologies. For effective implementation, it is important to understand how students and teachers in India perceive and use technology. The results of this study can help improve educational outcomes, benefiting not only India but also the global education community. The causal relationship developed serves as a reference for researchers working on educational technology and the further development of TAM.

Keywords: Technology Acceptance Model, Digital Education, Ed-Tech, India

Introduction

In India, there has been a growing emphasis on integrating technology into education to enhance teaching and learning outcomes. EdTech enables education institutions to be more dynamic and modern by using the latest trends in teaching and learning practices.

According to a UNESCO report in April 2020, more than 1.5 billion students globally experienced disruptions in their education due to closure of schools and higher education institutions, and over half of these students faced challenges in accessing education through alternative means, often due to economic and technical limitations. Therefore, as a response to this critical situation, a huge emphasis has been placed on digital education outlay in the Union Budget of India in FY 2022-23. Notably, the allocation for Samagra Shiksha increased from Rs 29,999 crore to Rs 37,383 crore in 2022-23. Similarly, the state allocation to strengthen digital teaching-learning increased from Rs 340 crore to Rs 550 crore. The government has initiated several programs and policies to promote digital literacy among teachers and students. Many educators in India have embraced technology tools to engage students in innovative ways (MOE-GOI, 2020). Digital tools such as interactive smart

boards, projectors, tablets, learning management systems multimedia content, and virtual labs have become integral parts of instructional practices. Open and Distance Learning (ODL) provides flexible and time-saving technology to meet the learning needs of students. (Kambris et al. (2022).

Therefore, it is interesting to investigate the significant external factors that enabled the acceptability of technology in the Indian educational system. The valuable information obtained through systematic literature review would significantly benefit research endeavours. From a business perspective. The technology examined in the review analysis would inform investors about the digital innovations that are bringing changes to the Indian education system.

This systematic review analyzed selected research papers to identify trends in the use of external factors, data analysis, methodology and technologies used. The synthesis of these data through systematic analysis has led to the development of conceptual models that can serve as a baseline for future research on technology acceptance in Indian education. Therefore, the following research questions arise:

1. What are the dominant external factors used in the selected studies?
2. What statistical analysis and research methods were used in the selected studies
3. Identifying significant causal relationships between the most used factors and TAM constructs to develop a conceptual model.

Research Background

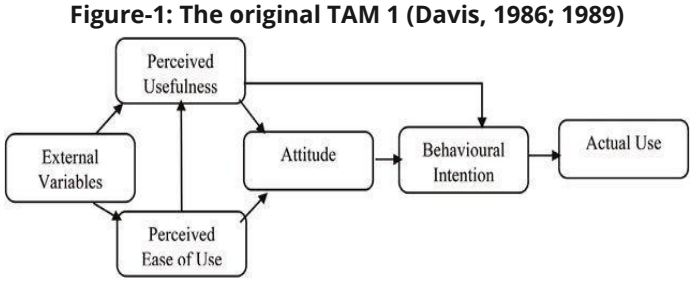
In the age of information technology, understanding technology adoption and acceptance is crucial. Rapid changes in the development and implementation of education technologies are having far-reaching impacts on secondary and higher education institutions in India.

An important part of technology integration is understanding why people use or reject new technologies. The Technology Acceptance Model (TAM) is the main scientific model for understanding technology acceptance.

Technology Acceptance Model

TAM is generally referred to as the most influential and commonly used theory of Information System by Warshaw, Davis, Bagozzi (1989) . This initial model included two theoretical determinants, which are the perceived usefulness (PU) and perceived ease of use (PEOU) which results in Behavioral intention to use technology. In 1996, Venkatesh and Davis, Davis, F. D. et al. (1996), the TAM model was adapted and proposed with the assertion that perceived usefulness and perceived ease of use directly impact an individual's intention to use the system. This initiative spearheaded the expansion of TAM using external variables. The number of TAM-related studies has increased dramatically since the outbreak of the covid-19 pandemic.

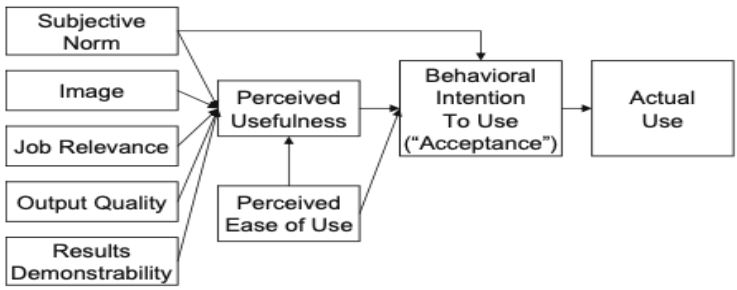
Figure-1: The original TAM 1 (Davis, 1986; 1989)



Modification and Extension of TAM

TAM appears to be able to explain about 40-50 per cent of user adoption. As research progressed, the TAM was modified and expanded to account for new factors that significantly influenced its two main variables, namely PU and PEOU. In 2000, Davis and Venkatesh, F.D. et al. (2000) proposed an extension of the model called TAM2. In this version, the authors explain the perceived benefits considering social influence (subjective norm, voluntariness, and image), and instrumental cognitive process (relevance of work, quality of results and verifiability of results). The researchers have also developed and extended other TAM-based models to better understand technology adoption behaviour.

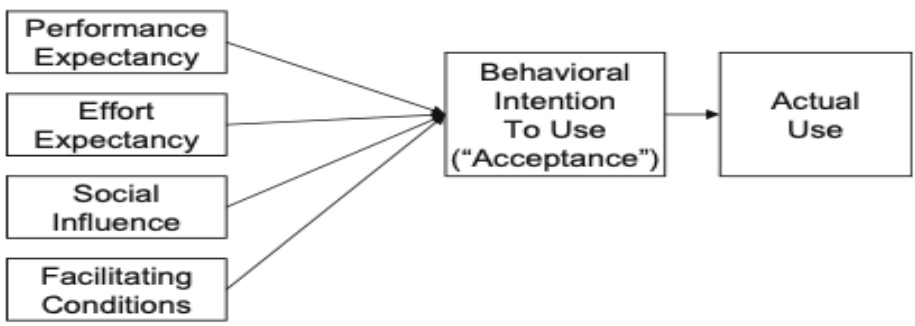
Figure-2: TAM 2 model (Davis and Venkatesh, 2000)



In 2008, Venkatesh and Bala, Bala, H. et al. (2008) released TAM 3 model which included factors such as self-efficacy, computer anxiety, and Computer playfulness, perception of external control, subjective enjoyment, and objective usefulness.

In addition to TAM 1 and TAM 2, researchers have also developed and extended other TAM-based models to better understand technology adoption behaviour. Venkatesh et al. (2003) proposed a unified theory of acceptance and use of technology (UTAUT), providing a more comprehensive framework for explaining technology adoption behavior. Four main concepts have been proposed that directly determine behavioural intentions: performance expectancy, effort expectancy, social influences, and enabling conditions. Additionally, behavioural intentions are predicted to be predictors of actual usage. A well-known information system model for evaluating technological success was developed by DeLone-Mclean, DeLone et al (1992).

Figure-3: Unified Theory of Acceptance and Use of Technology (UTAUT)



Even after more than three decades, TAM and advanced models have been research in the educational context and beyond.

Research Methodology

This study systematically reviewed existing published Indian research articles and identified the dominant external factors influencing the adoption of technology in education. Published research articles were selected based on the following:

Inclusion Criteria:

1. The research should have mainly focused on the Indian education system. This includes research conducted within educational institutions in India or studies that investigated technology acceptance.
2. Research papers should have used TAM or extended TAM models in an empirical study.
3. Research published in the last ten years (from 2013 to 2023).
4. Scientific articles and scientific papers from various journal databases and search engines.

Exclusion Criteria:

1. Studies not related to TAM and its application in education.
2. Non-peer-reviewed sources such as blog posts, news articles and opinions were not included.
3. Research conducted in countries other than India
4. Studies published before 2013 were considered outdated.
5. Studies published in languages other than English were not considered as the journal is produced in English.

These criteria were used to select the studies that were most relevant to the research question and could provide valuable information to formalize the conceptual model.

Data Sources and Search Strategies

The search examined a combination of keywords related to educational technologies (e-learning, m-learning, technology-enhanced learning, digital tools, etc.)) or the TAM theory of Indian education. Articles published in reputable journal databases such as Emerald Publication, Wiley, Amity University Press, Springer, and International Journal of Library, Information, Networks and Knowledge (IJLINK) were inspected as part of search strategy.

The search resulted in 35 documents from various magazines and the Google search engine. A standardized table was created to systematically capture information from each selected study. The selected research articles were analyzed in detail based on the inclusion and exclusion criteria and TAM in the context of Indian education. Based on these criteria, 15 research articles were excluded, and 20 research articles passed all screening and eligibility checks.

The dominant external factors were selected based on the maximum frequency of occurrence in the selected research articles. Once the common external factors were identified, studies were grouped by types of educational technologies and user types. The user types were divided into “teacher”, “student”, and “mixed”.

The systematic review was carried out by analyzing the statistical significance level (p-value), correlation coefficient (r-value) and regression coefficients (β) as well as the strength of relationship between the external variables and the TAM construct. Finally, the study proposed an Indian conceptual model

for technology acceptance in education was proposed.

Analysis of Indian Studies

As mentioned in the Methodology section, twenty Indian educational research documents using TAM and extended TAM models were analyzed to answer the research questions. In the last decade, the Indian government has launched several e-learning projects. Initiatives like SWAYAM and DIKSHA are the dominant online learning platforms in this regard (Singh, M, Adebayo et al. (2021)). Additionally, the advent of coronavirus has acted as a catalyst for increased reliance on online learning in 2020. "The collaboration between the Indian Institute of Technology (IIT) and the Indian Institute of Sciences (IISc) offers online certificate programs through the National Program on Technology Enhanced Learning (NPTEL) platform", Chugh, N et al. (2023). Even competitive exams like Common University Entrance Test (CUET) and Joint Entrance Examination (JEE) are now computer-based assessments. Therefore, it is important to understand the various factors that influence the adoption of online learning and the usage of digital tools in Indian education. The selected research articles are divided into three tables according to the user type, i.e., Teachers, students and mixed (students and teachers).

Each research article was evaluated based on parameters such as theoretical model, sample size, research area (e.g., School or higher education), applied statistical analysis and research approach.

Table-1: Indian Papers on Acceptance of Technology by Teachers

Research (Year)	Domain	Model	Technologies	Sample	Measures	Approach
Sharma.et al. (2020)	Higher	TAM2	Online Tools	235	Multivariate	quantitative
Sangeeta.et al. (2021)	School	UTAUT	Online Tools	643	SEM	quantitative
R Bansal.et al. (2022)	Higher	UTAUT	LMS	480	PLS-SEM	quantitative
Bhatt. Et al. (2020)	Higher	TAM	Zoom Software	125	SmartPLS	quantitative
Kolil. Et al. (2022)	Higher	UTAUT	Virtual Labs	650	SEM	quantitative
Joy. Et al. (2019)	School	TAM	ICT Tools			qualitative

Table-2: Indian Papers on Acceptance of Technology by Students

Research (Year)	Domain	Model	Technologies	Sample	Measures	Approach
Chahal. et al. (2022)	Higher	TAM	e-learning	570	PLS-SEM	quantitative
Kampa. Et al. (2023)	Higher	TRAM	M-learning	665	PLS-SEM	quantitative
Chughs. et al. (2023)	Higher	TAM	e-learning	384	SEM	quantitative

Antontte. et al. (2019)	Higher	TAM	e-learning	205	Smart PLS SEM	quantitative
Thakar, Vaghela (2021)	Higher	TAM	M-learning	112	Multivariate	quantitative
Kaur, Gopal. (2022)	Higher	TAM	e-learning	200	Multivariate	quantitative
Gupta. et al. (2021)	Higher	TAM	e-learning	209	SEM	quantitative
Majumdar, Rai (2021)	Higher	UTAUT	e-learning			qualitative
Dubey, Sahu (2022)	Higher	TAM	TEL	600	Smart PLS SEM	quantitative
Ratna, Mehra (2015)	Higher	TAM	e-learning	116	Multivariate	quantitative
Murari, Rai (2022)	Higher	TAM	e-learning	506	PLS-SEM	quantitative

Table-3: Indian Papers on Acceptance of Technology by Students and Teachers

Research (Year)	Domain	Model	Technologies	Sample	Stat, Analysis	Approach
Mahindravada (2015)	School	TAM	Digital Tools	110	Multivariate	quantitative
Chatterjee. et al. (2020)	School	UTAUT	M-Learning	271	PLS-SEM	quantitative
Duggal (2022)	Higher	UTAUT	E-Learning	331	SEM	quantitative

Results

The results of the analysis are shared below:

Identification of Dominant External Factor

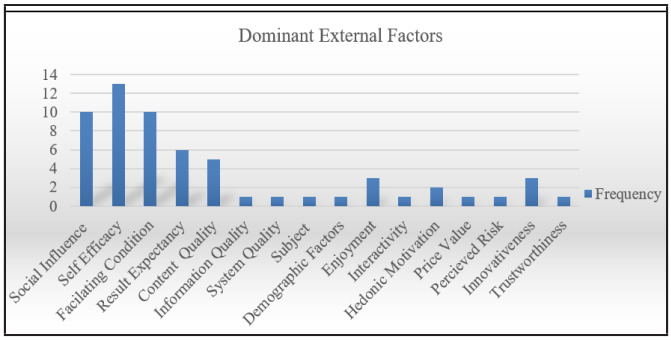
Most of the articles reviewed were extensions of the original TAM. Only one paper has used the original TAM with no external factors Ratna, Mehra (2015). It is worth mentioning that Indian researchers have given different names under sub-classifications but can be broadly classified under commonly used main factors in extended TAM theories. As per our meta-analysis, a total of 39 external factors were identified from 20 Indian research papers. We have grouped them into 16 major factors based on common classification and similarities. The frequency of major external factors has been shared in Table 4 and figure 4.

Table-4. Identification of Dominant External Factor/Construct

S. No	External Factors	Sub-Classification	Indian Studies reference	Frequency
1.	Social Influence	Subjective Norm (SN), Playfulness (PLY)	[15],[16],[17],[20],[23],[26],[27],[30],[31],[33]	10

2.	Self-Efficacy	Computer Experience (CE), Computer Competency (CC), Anxiety (AX), Habits (HB), Optimism (OT), Insecurity (INS), Discomfort (DIS), Learns prior Knowledge (LPK), Learners prior experience (LPE), Learner characteristics (LC), Capability {CAP), Individual Belief (IB), subjective interest (SIN)	[15],[18],[19],[20],[21],[23],[24],[25],[28],[29],[30],[31],[34]	13
3.	Facilitating Condition	Management Support (MS), Training (TR), Environment Concern (EC), Instructor Quality (INQ), Instructor prompt feedback (IPF), Institutional Quality (INQ), Compatibility (COM), Resource availability (RA), institutional branding (INB)	[16],[17],[19],[20],[21],[25],[28],[30],[31],[33]	10
4.	Result Expectancy	Value Belief (VB), Performance Expectancy (PE), Effort Expectancy (EE)	[15],[16],[17],[20],[22],[33]	6
5.	Content Quality	Content Quality (CQ)	[17],[25],[30],[33],[34]	5
6.	Information Quality	Information Quality (IQ)	[34]	1
7.	System Quality	System Quality (SQ)	[34]	1
8.	Subject	Subject (SUB)	[18]	1
9.	Demographic Factors	Demographic Factors (DF)	[21]	1
10.	Enjoyment	Enjoyment (ENY)	[21],[30],[34]	3
11.	Interactivity	interactivity (ITV)	[21]	1
12.	Hedonic Motivation	Hedonic Motivation (HM)	[17],[20]	2
13.	Price Value	Price Value (PV)	[22]	1
14.	Perceived Risk	Perceived Risk (PR)	[22]	1
15.	Innovativeness	Innovativeness (INO)	[23],[24],[26]	3
16.	Trustworthiness	Trustworthiness (TW)	[29]	1

Figure-4: Dominant external factors influence on data studied

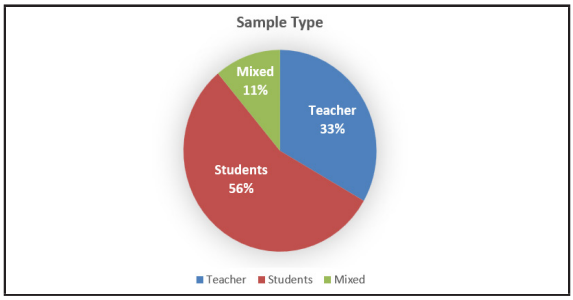


As shown in Figure 4 above, the most used external variables identified in the systematic review were social influence, self-efficacy, and Facilitating conditions, followed by result expectancy and Content quality. Other factors such as Information and system quality, Demographic factors, Subject, Enjoyment, Interactivity. Hedonic motivation, price value, perceived risks, innovativeness, and trustworthiness received less attention, but are worth mentioning in our analysis.

Research Samples and Technologies Used

The current analysis showed that the largest sample proportion were students, which explains finding in the Indian research studies. The students were mainly university students, which could be due to the Covid-19 pandemic as they had no access to campus and had problems with equipment and techniques. Only five research studies used teachers/lecturers as samples. Three studies used a mixed sample of students and teachers. The largest sample used in the reviewed articles were 665 university students surveyed on the adoption of mobile learning, Kampa, et al. (2023). Also, 650 teachers surveyed for adopting the online virtual labs, Kolil. Et al. (2022). The smallest student sample size was 112 undergraduate students, which were included in the study by Thakar, Vagheli (2021).

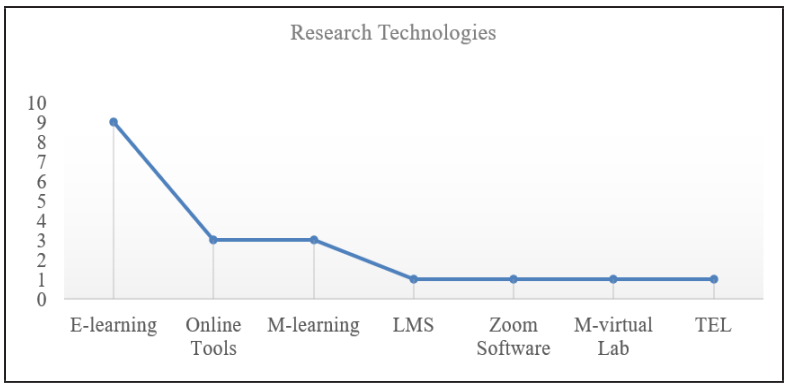
Figure-5: Division of Sample Type



The most prevalent research technology in the selected studies was online learning (e-learning). In fact, the online platform was mainly used by various Indian universities during the pandemic. Other technologies have also gained importance in higher education, such as virtual laboratories and learning management systems.

The chart below provides details of the various technologies used in our selected research papers.

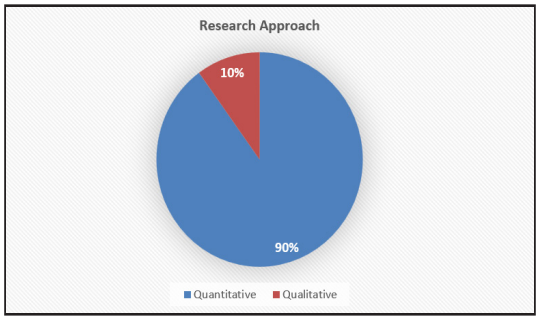
Figure-6: Recurrence of Research Technologies in Indian Studies



Analytic Technique and Research Approach

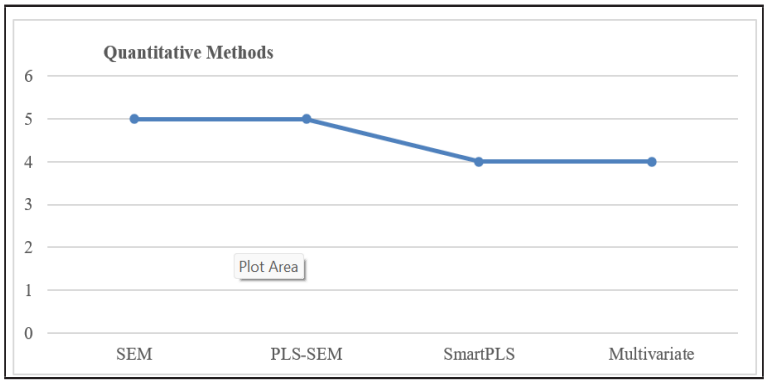
The most used research method was the quantitative approaches in eighteen Indian studies and only two articles were qualitative in nature as shown in Fig 7.

Figure-7: Distribution of Research Approach in Indian Studies



The most common quantitative method was structural equation modeling (SEM) analysis, which used SPSS and AMOS tools. PLS-SEM analysis was equally used in the Indian studies. Multivariable regression analysis and SmartPLS were used in 4 studies each. The details of the quantitative methods used is represented in figure 8 below.

Figure-8: Prevalent Quantitative Technique



Development of Conceptual Model through Casual Relationship

This section attempts to make a relationship between five identified dominant external factors and construct of technology acceptance models by reviewing the literature, tested models and data analysis by Indian authors. The correlation coefficient (r value) and regression coefficients (β) were used to determine the strength of the relationship between the variables. The correlation coefficient can vary between -1 and +1. The plus and minus signs indicate whether there is a positive or negative relationship. Statistical significance between the independent variable and the dependent variable was recorded using the P value. Sample sizes and values were collected to establish relationships using arithmetic means of all correlation coefficients.

The causal relationship emerging from our research analysis is presented below for each dominant external factor in this study:

Social Influence:

Social influence is defined as the influence of neighbors' perceptions on a person's attitude toward technology adoption (Venkatesh et al., 2003). It refers to the influence of social factors such as norms, opinions, and recommendations from peers, administrators, or other influential people on technology adoption decisions. From the selected studies, the following table summarizes a systematic analysis of relationship between two variables using a quantitative approach:

Table-5: Association between SI and TAM constructs of selected Indian Studies

Indian Research	Relationship	N	Correlation Value	B	p value	Significant
Sharma.et al. (2020)	SI>BI	235	0.216		P<0.05	Yes
Sangeeta.et al. (2021)	SI>BI	643	0.21		P<0.05	Yes
R Bansal.et al. (2022)	SI>BI	480	0.536		P<0.05	Yes
Dubey, Sahu (2022)	SI>BI	600	0.597		P<0.05	Yes
Duggal (2022)	SI>BI	331	0.441		0.08	No
Sum of Sample Size		**2289**				
Average Correlation Value			**0.413**			
Kolil. Et al. (2022)	SI>BI	650		0.179	P<0.05	Yes
Antonetta. et al. (2019)	SI>BI	205		0.363	P<0.05	Yes
Thakar, Vaghela (2021)	SI>BI	112		0.09	0.274	No
Chahal. et al. (2022)	SI>PU	570		0.285	P<0.05	Yes
Murari, Rai (2022)	SI>PU	506		0.198	P<0.05	Yes
Murari, Rai (2022)	SI>PEOU	506		-0.06	0.1	No
Chahal. et al. (2022)	SI>PEOU	570		0.348	P<0.05	Yes

The results Sharma.et al. (2020), Sangeeta.et al. (2021), R. Bansal. Et al. (2022), Dubey, Sahu (2022), Kolil. Et al. (2022), Antonette. Et al. (2019) found a significant relationship between social influence and behavioral intention to use technology in education.

Two studies by Duggal [33] (2022), Thakar, Vaghela (2021) were unable to demonstrate this connection. As shown in Table, 6 out of 8 studies (75 per cent) showed a positive and significant relationship between SI and BI with an average correlation coefficient (r value) of 0.413. Therefore, this hypothesis and relationship were supported and included as H1a in our conceptual model.

The similar relationship has been established in several international studies Luo N. et al. (2017), Zhang M. et al. (2019) which asserts that social influence and subjective norms have a favorable positive impact on BI.

The results for Chahal. et al. (2022), Murari and Rai (2022) found a significant relationship between social influence and perceived usefulness of technology in Indian education. From Table 5 above, SI and PU indicate a positive relationship with the value of the regression coefficient (β) ranging between 0.19 and 0.28. Therefore, this hypothesis and relationship were supported and included as H1b in our conceptual model.

According to Murari, Rai (2022), no significant relationship was found between social influence and the perceived ease of use of technology in education. However, Chahal. et al. (2022) made this connection. Because there is only one study that has demonstrated this association, we did not consider it significant and have not included it in our conceptual model.

Result expectancy:

This factor is important if the user is satisfied with their willingness to use the system and also depends on the user's desired level of success in using the system. Teachers are more likely to accept and implement online learning or educational technologies when they see tangible evidence of their effectiveness in achieving desired educational outcomes or improving student outcomes. From the selected studies, the following table summarizes a systematic analysis of relationship between two variables using a quantitative approach:

Table-6: Association between RE and TAM constructs of selected Indian Studies

Indian Research	Relationship	N	R	B	p value	Significant
Sharma.et al. (2020)	RE>BI	235	0.48		P<0.05	Yes
Sangeeta.et al. (2021)	RE>BI	643	0.144		0=0.03	Yes
R Bansal.et al. (2022)	RE>BI	480	0.61		P<0.05	Yes
Duggal (2022)	RE>BI	331	0.456		P<0.05	Yes
Sum of Sample Size		**1689**				
Average Correlation Value			**0.38**			
Kolil. Et al (2022)	RE>BI	650		0.212	P<0.05	Yes
Chatterjee. et al. (2020)	RE>BI	271		0.32	P<0.05	Yes

Analysis of selected Indian studies revealed a significant relationship between Result Expectancy (RE) and behavioral intentions (BI) regarding the

use of technology in Indian education. All the 6 studies shown in the above table have a positive relationship between these two constructs, with an average correlation co-efficient (r-value) of 0.385 and a regression coefficient (β) in the range of 0.21-0.32. Therefore, this hypothesis and relationship were supported and included as H2a in our conceptual model.

Similar relationship has been observed in the international studies (Nikolopoulou et al., 2021a), (Hu et al,,2020) , the greater is result expectancy, the faster the adoption of mobile learning in education.

Content Quality (CQ):

This concept was introduced by Wang,Y.S ,2003. This construct explains that the content of an information system is important to its educational success. High-quality content (audio, video, and visual elements) is often considered as an important factor influencing technology adoption in education.

From selected studies, the following table summarizes a systematic analysis using a quantitative approach of the relationship of the independent factor of Content Quality with the various dependent factors of TAM model:

Table-7: Association between CQ and TAM constructs of selected Indian Studies

Indian Research	Relationship	N	R	β	p value	Significant
R Bansal.et al. (2022)	CQ>BI	480	0.497		P<0.05	Yes
Duggal (2022)	CQ>BI	331	0.49	0.159	P<0.05	Yes
Sum of Sample Size		**811**				
Average Correlation Value			**0.494**			
Chughs. et al. (2023)	CQ>PU	384	0.748		P<0.05	Yes
Murari, Rai (2022)	CQ>PU	506		0.107	P=0.016	Yes
Murari, Rai (2022)	CQ>PEOU	506		-0.301	P=0.26	No

The results of R Bansal.et al. (2022) and Duggal (2022) found a significant relationship between content quality (CQ) and behavioral intention (BI) to use the technology in education. Two studies found a positive relationship between these two constructs with an average correlation coefficient (r value) of 0.494. Therefore, this hypothesis and relationship were supported and included as H3a in our conceptual model.

The results of Chughs. et al. (2023) and Murari, Rai (2022) found a significant positive relationship between content quality (CQ) and perceived usefulness (PU) of technology in Indian education with regression coefficients (β) equal to 0.107 and correlation coefficient (r value) of 0.748. Therefore, this hypothesis and relationship were supported and included as H3b in our conceptual model.

Similar international studies have shown that quality of content significantly influences PU. (Sami Saeed Binyamin, Rutter, & Smith, 2019; Mailizar et al., 2021; Salloum et al., 2019).

The result of Murari, Rai (2022) found no significant relationship between Content quality and perceived ease of use of the technology in education. Therefore, we did not include this relationship in our conceptual model.

Self-Efficacy (SE):

Self-efficacy is "The degree to which a person believes that he or she is

capable of performing a particular task/ work at the computer," according to one definition. From the selected studies, the following table summarizes a systematic analysis of relationship between two variables using a quantitative approach:

Table-8 Association between SE and TAM constructs of selected Indian Studies

Indian Research	Relationship	N	R	β	p value	Significant
Sharma.et al (2020)	SE>BI	235	0.026		0.68	No
Dubey, Sahu (2022)	SE>BI	600	0.506		P<0.05	Yes
Kampa. Et al. (2023)	SE>PEOU	665	0.457		P<0.05	Yes
Bhatt. Et Al. (2020)	SE>PEOU	125	0.74		P<0.05	Yes
Chahal. et al. (2022)	SE>PEOU	570		0.603	P<0.05	Yes
Murari, Rai (2022)	SE>PEOU	506		0.205	P<0.05	Yes
Bhatt. Et Al. (2020)	SE>PU	125	0.66		p=0.19	No
Mahindravada [(2015)	SE>PU	139	0.576		p=0.434	No
Chahal. et al. (2022)	SE>PU	570		0.231	P<0.05	Yes
Kampa. Et al. (2023)	SE>PU	665	0.428		p>0.05	No
Murari, Rai (2022)	SE>PU	506		-0.005	p=0.403	No
Kaur, Gopal. (2022)	SE>PU	300		0.935	P<0.05	Yes
Chughs. et al. (2023)	SE>PU	384	0.633		p>0.05	No

The results of Sharma.et al. (2020) found no significant relationship between self-efficacy (SE) and behavioral intention (BI) to use the technology in education. Dubey, Sahu (2022) had established the relationship between Self-Efficacy (SE) and Behavioral Intention (BI). But no other Indian study found a positive relationship between these two constructs in our analysis, hence we did not include this relationship in our conceptual model.

The results of Kampa. Et al. (2023), Bhatt. Et Al. (2020), Chahal. et al. (2022), Murari, Rai (2022) found a significant positive relationship between self-efficacy (SI) and the perceived ease of use (PEOU) of technology in Indian education with regression coefficient (β) range from 0.20 to 0.60. Therefore, this hypothesis and relationship were supported and included as H4a in our conceptual model.

Similarly international research has shown positive relationship between these two factors in (Chang et al., 2017 ; Ejdys, 2021;Salloum et al., 2019 ; Salloum & Shaalan, 2018).

As shown in the table above, 5 out of 7 studies found no relationship between self-efficacy (SE) and perceived usefulness (PU) of technology in education. We, therefore, did not include this relationship between these two constructs in our conceptual model.

Facilitating Conditions:

The Facilitating Conditions (FC) is "the extent to which a person believes that an organization exists that supports the system and technical infrastructure." (Venkatesh et al., 2003, p. 453). Adequate facility conditions, such as reliable internet connectivity, appropriate hardware and software, technical support, and training opportunities, can

have a positively impact on teachers and students' acceptance of online learning or educational technology. From the selected studies, the following table summarizes a systematic analysis of relationship between two variables using a quantitative approach:

Table-9: Association between FC and TAM constructs of selected Indian Studies

Indian Research	Relationship	N	R Value	β	p value	Significant
Sangeeta.et al. (2021)	FC >BI	643	0.39		p=0.04	Yes
R Bansal.et al. (2022)	FC >BI	480	0.532		P<0.05	Yes
Dubey, Sahu (2022)	FC >PEOU	600	0.502		P<0.05	Yes
Sum of Sample Size		**1723**				
Average Correlation Value			**0.47**			
Kaur,Gopal (2022)	FC >BI	300		0.716	P<0.05	Yes
Kolil. Et all. (2022)	FC >BI	650		-0.105	p=0.128	No
Duggal (2022)	FC >PEOU	331		0.217	P<0.05	Yes
Bhatt. Et Al. (2020)	FC >PEOU	125		0.316	P<0.05	Yes

The results of Sangeeta.et al. (2021), R Bansal.et al. (2022), Dubey, Sahu (2022) Sharma.et al. (2020) and Kaur, Gopal. (2022) found a significant relationship between the facilitating condition and behavioral intention to use the technology in education but Kolil. Et al. (2022) could not establish a connection. Regarding the association between FC and BI, 4 out of 5 (80 per cent) reported a positive and significant association between these two constructs. with an average correlation coefficient (r value) of 0.47. Therefore, this relationship was supported and included as H5a in our conceptual model.

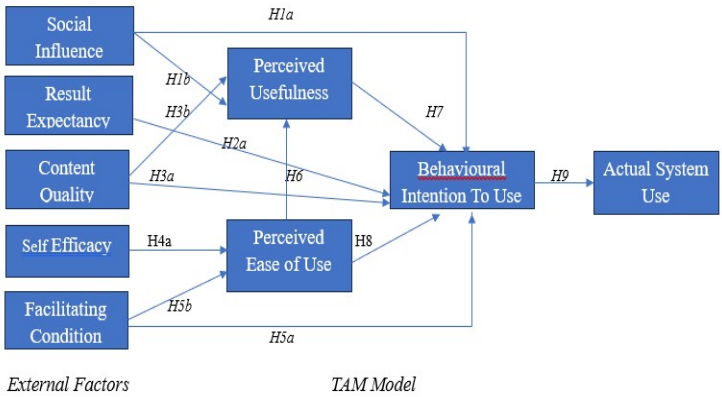
According to a global study, a supportive environment has a positive impact on behavioral intentions, (Jairak et al., 2009 ; Tseng et al., 2019)

The results of Duggal (2022), Bhatt. Et Al. (2020) found a significant relationship between environment i.e., facilitating conditions and perceived ease of use of technology in Indian education. The two constructs have regression coefficient value (β) range from 0.21 to 0.32. Therefore, this relationship was supported and included as H5b in our conceptual model.

The default hypotheses of TAM theoretical model establishing the relationship between PU, PEOU and BI were included in our conceptual model as H6, H7 and H8.

The recommended research model based on the systematic review analysis of Indian research articles and the causal association between five dominant external factors and TAM constructs is presented below:

Figure-9: Conceptual framework based on Systematics Review analysis



Conclusion and Future Scope

Numerous review studies have been conducted on the use of technology in education using the TAM model at the international level. However, there is no review study on the most commonly used external factors for technology adoption in Indian education. Therefore, this study analyzed 20 recent research articles to develop a conceptual model for technology adoption in the Indian education system. The research used 39 factors, which were grouped into 16 main external factors. Based on the frequency of use, social influence, result expectancy, content quality, self-efficacy and facilitating condition were found to be the most used external factors.

To confirm hypothesis and relationship between external factors and TAM dependent variables, the author analyzed the correlation (r value), path coefficient (β value) and significance value (p value) between the two constructs. These accepted relationships are incorporated into our conceptual model, as depicted in FIGURE 9.

The significance of these findings has potential to influence educational policies, strategies, and practices in India. Understanding these factors can help higher education institutions to design effective online learning environments, promote digital inclusion, and improve the quality of education. In addition, it can be used in secondary education as these external variables can guide tailored interventions and help in implementation of large digital education products in various states of the country. The next step is to empirically test this conceptual model with teachers, students, and other technology users to use it as a predictive tool. The model can be improved or modified as per the participant's behavior and their demographic positions.

As new technologies continue to evolve and the diversity of educational contexts increases, there are many opportunities for further research to deepen our understanding of technology adoption and use in education. The intersection of education and technology is a dynamic and constantly evolving field. The importance of this paper goes beyond the scope of this study as it lays the foundation for future research aimed at assessing technology adoption, particularly given the growing interest in India. Additionally, this research will be a valuable resource of information for researchers interested in development and implementation of digital educational technologies in India.

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General Article

Multimedia Education for Inclusive Development: Exploring NCERT's Open-Access Initiatives in India's School Education System

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Abstract

The foundation for realising the national objective of a developed country rests on the provision of School Education. India's school education system is the world's largest, with a growing youthful population contributing to its potential for development. As a result, guaranteeing education accessible to everyone and providing multiple modes of access to educational resources for students and teachers have significant challenges and concerns.

Several national-level organisations have taken numerous initiatives to enhance the quality of school education. This paper aims to elucidate the availability of multimedia content for disseminating and reaching all levels of school education. This study focuses on open-access materials developed and coordinated by NCERT. This research aims to bring to light the existence of e-content accessible to all stakeholders, such as students, teachers, parents, and educators in school education, which a trustworthy national institution in India has created.

Keywords: E-Content, Multimedia, School Education

Introduction

In the contemporary era of Information and Communication Technology (ICT), e-content has emerged as a prominent trend for teaching and learning, even in school education. E-content is a form of digital content accessible via the internet and can be accessed at any time and from any electronic device with internet connectivity. This learning material encompasses different multimedia formats, including text, audio, video, audio-visual, graphics, and slides, designed to facilitate and enhance educators' and students' teaching and learning processes. Numerous resources are available for various stages of school education through open-access platforms developed by diverse institutions and government bodies, ensuring equal access to fundamental materials and fulfilling the objective of Education for All. In the Indian education landscape, e-content has become a significant trend for school education, incorporating multimedia elements like text, videos, animations, simulations, and interactive components. The advantages of e-content include accessible learning materials for diverse student populations, enhanced engagement

and interactivity, personalization and differentiation, augmenting teacher effectiveness, bridging socio-economic divides, and national initiatives. E-Content has revolutionized the way teaching and learning occur in schools, enhancing educational outcomes and fostering a more inclusive and equitable education system in India.

Literature Review

The NCERT has embarked on a transformative endeavour through an open-access initiative, aimed at fostering inclusive development within the Indian school education system. Utilizing multimedia education, effectively dismantles barriers and improves accessibility, ensuring that high-quality educational resources are made available to students across the entirety of the country, regardless of their diverse needs. The NCERT's forward-thinking approach in providing such open-access resources is a commendable step towards promoting inclusive education for both students and educators alike. According to Monika et al. (2023), multimedia provides a platform for revolutionising traditional educational methods by enhancing learning materials through visually appealing presentations, and educational videos which cater to the diverse learning styles of the learners. This further expands to facilitating remote education through the usage of virtual learning environments on online platforms and interactive software. These platforms using multimedia elements provide a comprehensive evaluation of understanding for the students. Further, the paper discusses the use of multimedia in education to enhance teaching and learning, through technology, diverse content, interactivity, and accessibility. Virtual Reality and Augmented Reality can provide immersive learning experiences. Artificial Intelligence can personalize learning. Gamification techniques can increase motivation. Mobile technologies enable flexible learning. Cloud computing promotes accessibility and collaboration. Interactive white boards and touchscreens facilitate engagement. Adaptive learning systems personalize instruction and provide feedback.

Abdul Rahaman et al. (2020) iterate that "Multimedia or digital learning resources assist learners to get on well with mental representations with the use of different media elements, which support information processing". Quality education is not easily accessible in developing countries, but multimedia technology can help overcome this challenge. This review examines various multimedia tools used in teaching and learning, including developing new tools, evaluating their impact, and exploring emerging technologies. The success of these tools is attributed to their technology and components, with a focus on pedagogical content and user audience. Future research should examine the role of teachers in facilitating their use and their scalability and sustainability in different educational contexts. As cited from Abdulrahaman et al. classify multimedia technology for educational purposes based on its use in teaching or learning; Eady and Lockyer (2013) list different multimedia and digital learning resources, emphasizing their importance in education; Guan et al. (2018) highlight the significance of multimedia technologies in education, as emphasized by Almara'beh et al. (2015). The benefits of multimedia tools for teaching and learning include transforming abstract concepts into concrete content, presenting large volumes of information efficiently, stimulating student interest, and providing insights into students' learning positions.

Multimedia for learning involves constructing mental representations

from words and pictures across different contexts. This design includes tools for presentations, classroom or laboratory learning, simulations, e-learning, computer games, and virtual reality. Alemdag and Cagiltay (2018) stress the importance of cognitive theory in multimedia learning. This theory assumes dual-channel, limited capacity, and active processing. Dual-channel recognizes learners' ability to separate visual and auditory information; limited capacity acknowledges data processing constraints, and active processing asserts learners' active role in selecting, organizing, and integrating information. This understanding helps teachers deliver effective multimedia learning experiences without overwhelming learners.

Multimedia is disseminating e-content in various formats, such as text, audio, video, animations and images. This interactive medium facilitates two-way communication between educators and students. In the early stages of the computer era, the content was stored on Floppy Disks, then on CD-ROMs, CD R-Ws (Rewritable Compact Disks), Pen Drives, Hard Drives, and email storage, and has now advanced to Cloud Storage. The technological landscape offers a plethora of alternatives. However, the diffusion of technology is a gradual process, and sometimes a significant environmental change can trigger a surge in a particular technology. Google Meet is a prime example of a technology that experienced a surge in usage during the pandemic and has now become a crucial part of our professional and educational pursuits in the post-COVID era.

A diverse range of definitions for Multimedia exist. The website GeeksforGeeks mentions, that multimedia "refers to the computer-assisted integration of text, drawings, still and moving videos, graphics, audio, animation and any other media in which any type of information can be expressed, stored. Communicated, and processed digitally" (GeeksforGeeks, 2024).

In the context of Indian multimedia used in school education and e-content, the two types, interactive multimedia, and non-interactive multimedia, play distinct roles in enhancing the teaching and learning experience (Anderson, 2019).

Interactive Multimedia:

Interactive multimedia refers to content that allows users, such as students and teachers, to actively engage with the material and participate in the learning process. This type of multimedia facilitates dynamic interactions, enabling learners to control the pace and direction of their learning. In the Indian education system, interactive multimedia has gained significant traction due to its ability to cater to diverse learning styles and promote active learning. It includes virtual simulations, gamification, collaborative learning, and personalized learning paths. Gamification increases participation and retention, while collaborative tools encourage teamwork and communication. Personalized learning platforms adapt to individual progress, strengths, and weaknesses.

Non-Interactive Multimedia:

Non-interactive multimedia, on the other hand, is content that presents information in a static or linear format, where users have limited or no control over the flow of the material. While it may not offer the same level of engagement as interactive multimedia, it remains a valuable component in Indian school education, especially for delivering information efficiently. Four ways in which non-interactive multimedia is utilized are video-based learning, audio content, e-books and digital texts, and infographics and presentations.

These resources offer visual aids, demonstrations, expert insights, accessibility, portability, easy access, multimedia elements, and concise and visually appealing presentations.

In the context of e-content, both interactive and non-interactive multimedia play crucial roles in transforming traditional teaching methods in Indian schools. Educators and content creators are continually exploring innovative ways to leverage these multimedia formats to create engaging, accessible, and effective learning resources. As technology continues to advance, the integration of multimedia in Indian education is expected to further evolve, enriching the learning journey and contributing to a more inclusive and comprehensive education system.

The principal aim of multimedia content is thus to serve as a means for self-directed learning, enhance the appeal of subjects, reinforce classroom-based pedagogy, and foster an engaged pattern of student learning. A multimedia platform removes physical and psychological barriers, like in the case of a traditional teaching environment, where the learning effectiveness of a lesson solely depends on the teacher's performance and teaching strategies. These platforms help the students by providing a chance to see the content again and repeatedly when required to clear the topic/concept/subject.

The utilisation of this technologically advanced tool has had a ground-breaking impact on the process of pedagogy at the academic level. However, as a consequence, an urgent need has arisen to authenticate the veracity of the material available on the internet. The internet presents a confluence of counterfeit and genuine information, thus making it imperative for the Indian government to guarantee the credibility of the content by relying on sources such as national organisations like NCERT, NIOS, CBSE, etc. Moreover, this tool facilitates continuous learning and improvement by enabling swift feedback and allowing students to access PowerPoint presentations for note-taking and examination purposes. In the current era, PowerPoint presentations (PPT) have emerged as a crucial resource for generating and disseminating content among students. These resources, available in various formats, can also be utilised by parents to teach their children at home. Considering the technological advancements of the era, it has become imperative to integrate information and communication technology (ICT) at all levels with the aim of creating, receiving, sharing, and utilising knowledge without any bias towards caste, religion, race, gender, or financial status for the purpose of social, economic, financial, and cultural development. The incorporation of e-content as a powerful pedagogical resource transforms and reinforces teaching methodologies through the facilitation of broader sharing and dissemination.

Benefits of the e-Content

- Multiple user access at the same time
- Cost-effective in terms of routine maintenance and preservation for future use
- Longevity as there is no shelf-life of e-content; it can be preserved in a variety of ways for generations with the advent of new technologies
- Content is intended to be used by the teaching community, students and parents
- The uploaded content can be accessed by an unlimited number of users worldwide simultaneously

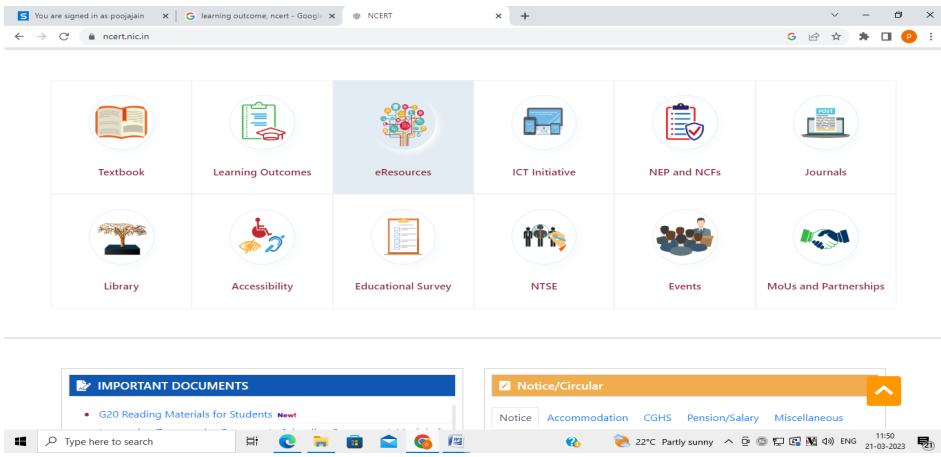
Drawbacks of the e-Content

- Electronic gadgets and an internet connection are basic requirements for e-content access.
- Increased screen time may adversely impact children
- Cost is a hindrance for the underprivileged population of India and remote areas
- The on-the-spot study is compromised when students rely on the fact that everything is available on the school portal
- Split attention among children is on the rise as children over-access multimedia content

The emergence of e-content has ushered in a new era of digital learning in the field of Indian school education, providing numerous advantages such as accessibility, cost-effectiveness, and global reach. However, in order to fully capitalize on its potential, it is vital to address the obstacles associated with digital infrastructure, screen time, and just distribution of resources. Through a balanced and comprehensive approach to the incorporation of e-content, India can pave the way for a more dynamic and equitable educational landscape, thereby empowering both learners and educators in their quest for knowledge and progress (Mishra, Patel and Doshi, 2017).

E-Content for School Education in a variety of formats by NCERT:

The National Council of Educational Research and Training (NCERT) is a government entity that operates within the realm of primary and secondary education as well as pre-service and in-service teacher education. The NCERT website currently offers a plethora of educational resources and materials.



(Screenshot for the e-Content developed and coordinated by NCERT)

For Students:

1. **Syllabus** - The syllabus serves as the foundation for any course preparation and holds significant importance. Within this link, one may find the syllabus for elementary levels (grades I to VIII) contained within volume one. Furthermore, syllabi for secondary and higher secondary classes are available and can be accessed in a grade-wise and subject-wise manner, providing a multilingual experience in English,

Hindi, and Urdu languages (NCERT Syllabus, 2024).

2. **E-books**: This online platform comprehensively archives all academic literature, including textbooks, reference materials, and other vital resources crucial for teacher training. Within the e-book section, one can acquire school textbooks aligned with the National Curriculum Framework of 2005, spanning from grades I through XII, conveniently accessible in PDF format. Furthermore, this platform streamlines obtaining and printing individual chapters as needed (NCERT E-books, 2024)

3. **Flipbook**: The flip book, a collection of pages of a book in sequential image format, is capable of being read and viewed in a manner similar to that of a tangible book. Inclusive of English, Hindi, and Urdu language options, all textbooks in PDF format are also made available in flipbook form for classes I through XII. The flip book may be accessed via the aforementioned link or the E-Pathshala application that can be downloaded from the Play Store (NCERT ePathsala, 2024).

4. **Audio Books: Audio books** are a format that has garnered widespread popularity and has found significant use in the context of class I to XII education (CIET, 2024). These audiobooks are designed to provide a chapter-wise listening experience to students, allowing them to engage with the content more dynamically. Furthermore, a considerable number of audiobooks are available on YouTube, which spans approximately 130 different titles. These audiobooks cover a range of famous personalities and are available in Hindi, ranging from 15 to 25 minutes. (NCERT Youtube, 2024)

5. **State/UTs Textbooks**: NCERT provides state textbooks of some states, such as Haryana, Delhi, Uttar Pradesh, Andhra Pradesh, and Mizoram (NCERT Ebooks of States/ UT, 2024).

6. **Material on Vocational Education:** The National Council of Educational Research and Training (NCERT) has a dedicated institute, the PSSCIVE, which focuses on vocational education. The PSSCIVE website (https://psscive.ac.in/publications) provides syllabuses, textbooks, and other educational materials on vocational education for students in grades IX to XII, covering various vocational subjects at both secondary and higher secondary levels.

7. **NCERT YouTube Official channel:** For audio and audio-visual content related to academic subjects, as well as national programs, live training sessions, counselling sessions, and audiobooks, the best source is the NCERT YouTube Official channel (https://www.youtube.com/@NCERTOFFICIAL). With more than 17,000 videos and 1.1 million subscribers, this channel offers a wide variety of videos on all subjects, from subjective videos to career counselling. It is a valuable resource for reaching the massive population of India and bridging the digital divide to provide quality and equal education for all, with only the internet and smartphones.

For Teachers, Researchers, Policy makers, Teacher educators and other stakeholders of Education:

1. **Policies & Frameworks**

- **National Policy on Education**: National Policy on Education (NEP) 1986 with the modified version in 1992 is accessible through this link.

The NEP 2020 (66 pages) document is also available in Hindi and English. This document can be disseminated through an audio format for broader outreach (NCERT NEP, 2024).

- **NCF and XXI National Focus Group Position Papers**: NCERT facilitates in obtaining the complete texts of National Curriculum Frameworks (NCF) and 21 National Focus Group position papers in Hindi and English Language (NCERT-NCF, 2024).

2. **Journals:** Currently, there are a total of eight journals published by NCERT that are available in open access in full-text form, beginning from the year 2010. Two of these eight journals, namely Voice of Teachers & Teacher Educators and the Indian Journal of Educational Technology, were produced after the year 2015 (NCERT Journals, 2024).

3. **Educational Survey**: NCERT surveys and analyses through the National Achievement Survey, All India School Education Survey, and the most current Foundational Learning Study reports. These surveys are highly beneficial for facilitating research at all levels of school education (NCERT Educational Survey, 2024).

4. **Learning Outcomes:** Learning outcomes represent the quantifiable and measurable objectives that evaluate student learning performance at distinct educational stages. These objectives encompass published benchmarks for elementary and secondary education and draft benchmarks for higher secondary education. In particular, learning outcomes at the elementary stage are available in three languages: English, Hindi, and Urdu (NCERT Learning Outcomes, 2024).

5. **Resources for Inclusive and Equitable Education:** There exists a diverse range of resources at one's disposal to enable personalised adaptive learning as per the initiatives implemented by the National Council of Educational Research and Training (NCERT) for Social-Economic Disadvantaged Groups (SEDGs) under the National Education Policy (NEP) of 2020. Additionally, such measures have been taken to cater to the educational requirements of children with special needs to provide equal access to education for all (NCERT Accessibility, 2024). For instance, there exists a mobile application that enables the auditory consumption of NCERT textbooks. Another innovative tool is PRASHAST, a disability screening checklist custom-made for schools. Barkhaa is a unique reading series based on UDL that caters to the needs of all learners. Furthermore, there are teaching and learning resources available in Indian Sign Language (ISL) as well as Bhasha Sangam, a platform that provides education in 22 scheduled Indian languages and Indian Sign Language. Additionally, teacher support material on inclusive education is accessible to those who require it. Lastly, there are tactile map books that serve as a valuable resource for the visually impaired.

Other Documents: The latest significant materials can be accessed on the homepage of NCERT, specifically under the heading 'Important Documents'. The collection of materials comprises novel additions such as G20 reading materials intended for students, Draft of Integrating Transgender Concerns in the Schooling process: a module designed for school staff, Guidelines for Vidya Parvesh (Three Month Play-based School Preparation for Grade–I),

National Curriculum Framework for Foundational Stage for 2022, Handbooks, Training and Resource material on Health and Wellbeing, Cyber Safety and Security, Counselling Services (Region wise), and more.

Other Initiatives: The MOE-Government of India has implemented several initiatives under the aegis of NCERT to augment the teaching-learning experience for educators and students. These include DIKSHA, a digital infrastructure that fosters knowledge sharing; NISHTHA, which seeks to enhance the overall advancement of school heads and teachers; SWAYAM, an online course platform; and the Swayam Prabha TV channel. Such endeavours aim to elevate the calibre of education.

Conclusion

School Education serves as the fundamental basis for each education system. The National Council of Educational Research and Training (NCERT), an eminent apex organization operating under the Ministry of Education (MOE) of the Government of India, has been striving to enhance the quality of school education. In recent times, this organization has been particularly focused on innovating and disseminating progressive educational techniques and practices, while ensuring that educational resources are interactive, user-friendly, and accessible globally, 24X7. The NCERT is renowned for its noteworthy contribution in developing various National Curriculum Frameworks, syllabi, and textbooks, alongside supplementary material, for teaching purposes. Currently, the National Council of Educational Research and Training (NCERT) is creating a new National Curriculum Framework (NCF) to align with the National Education Policy (NEP) 2020. The NCF is crucial in guiding curriculum development, teaching, and evaluation practices in India's education system. The framework aims to foster holistic development, critical thinking, and creativity among students by incorporating a novel approach of 5+3+3+4 that covers the Foundational, Preparatory, Middle, and Secondary levels. The NCF emphasizes play-based and activity-oriented learning for foundational learners, experiential and discovery-based learning for preparatory learners, a flexible and multidisciplinary curriculum for middle learners, and specialized and in-depth study for secondary learners. The framework promotes learner-centric pedagogies, digital and technology-enabled learning, interdisciplinary knowledge acquisition, and the inclusion of art, culture, and sports to advance holistic development. The successful implementation of the NCF will lead to an inclusive, relevant, and empowering educational experience for students nationwide. Additionally, it serves as a crucial nodal point for the production, organization, and dissemination of teaching and learning e-resources, catering to a vast target group of users in the fields of School Education and Teacher Education.

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General Article

Developing Competencies for Technology- Pedagogy Integration among In-service Teachers: Reflections

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Abstract

National Education Policy, 2020 (NEP-2020) of India emphasises the interplay of education and technology. The policy notes that one of the central principles to steer the education system will be the 'extensive use of technology in teaching and learning, removing language barriers, increasing access as well as education planning and management'. In this context, ICT intervention in the school system to leverage the outcome of education is also a goal. To achieve this goal, human resources, i.e. teachers, are the game changers, and hence the emphasis lies on the capacity building of teachers. NEP 2020 recommends rigorous training in learner-centred pedagogy, teachers becoming high-quality eContent creators, and also integrating technology in the teaching-learning process. It also emphasises the teacher's role in facilitating active student engagement with the content and with each other through the use of technology.

Training teachers in the use of technology was emphasised through the ICT@School Scheme under RMSA, and also funds were provided for establishing infrastructure for technology in schools. The fourteen studies done as a third-party evaluation of the ICT@ School Scheme reveal that there is no systematic way for holistic training of teachers in the use of technology. Most of the training has focused only on office packages which couldn't transform the teaching-learning process. Even when the Samagra Shiksha was launched, the ICT component in the Samagra shiksha clearly elaborates on the need for training teachers on the use of ICT and recommends systematic training. The budget announcement emphasises developing every teacher as a digital teacher. In this context, developing the competencies of teachers to integrate digital technology becomes the core goal of achieving quality education.

Curricula for ICT in Education for School System developed by the Central Institute of Educational Technology (CIET), a constituent unit of the National Council of Educational Research and Training (NCERT) is a national curriculum to define the focus, content, and strategy for in-service training to build the competencies of teachers in integrating ICT in Education. This curriculum is being implemented to build the competencies of teachers in integrating content, pedagogy, and ICT in teaching and learning. It proposes a blended approach for training integrating face-to-face and online modes. This article brings out the features and scope of ICT in the education curriculum for teachers through the lessons learned for its implementation at various levels. Reflections based on the implementation bring out the need for systematic planning in training teachers, the content that can support the development of their knowledge and also the strategies to be followed for effective implementation. With this competency-based curriculum, it is possible to prepare teachers to face the expectations of the current digital era.

Keywords: ICT training, CPD, Capacity Building, In-service teacher training, ICT in Education

Introduction

Digitalisation of education is becoming an ongoing phenomenon (Szyszka et al., 2022). In the world of technology, there is a revolution in the education system having an impact on the expected competencies of a teacher. Teachers are not just expected to be a knowledge repository but also to keep pace with the advancement in technology and build competencies in integrating those into the teaching-learning process Digital skills have become more important in the 21st century, having a significant impact on social interactions, education, work, and other areas of life (Niyazova et al., 2023). The ICT proficiency of instructors within the academic community or institution is one of the fundamental prerequisites for providing stakeholders with high-quality teaching and learning. When using new technology to deliver successful education, individual skills are a crucial component. Technological and pedagogical advances in ICT and Education have highlighted the need to support teachers' professional development (Santiañez, 2023). In order to effectively use information and communication technology (ICT), teachers need to have sufficient proficiency in employing a range of media and expertise to present the material to their students (Farisa et al., 2023). The mastery of Information and Communication Technologies (ICTs) abilities and competencies is now crucial for the efficient administration of studies or teaching (Molero Jurado et al., 2022).

Pre-service teacher education is gaining a lot of momentum towards improving its quality in terms of curriculum to deliver standard teachers to society. However, the need for in-service training in building the competencies of teachers with the technological developments and innovative pedagogies is recognised, and efforts are being made in various ways. National Education Policy 2020 (NEP-2020) emphasises developing every teacher as a digital teacher to leverage digital technology to improve school education to ensure quality and accessible education to all. In the digital era, innovation is evident and its growth is exponential in nature. Hence the teacher who is well trained during pre-service on the use of Information and communication technology (ICT) in the teaching-learning process is expected to keep swimming along the changes and keep themselves sustainable during the changes. There arises the need for capacity-building programs as and when there is a change in expectations. There were several efforts in India to build the competencies of teachers in the use of technology. Based on the experiences and learning from the third-party evaluation study of ICT@ school schemes, it was realised that a holistic approach to capacity building of teachers is required for building competencies in teachers towards technology integration.

Hence, under the aegis of the Ministry of Education, Department of School Education and Literacy, a curriculum for ICT in Education for School System was developed by the Central Institute of Educational Technology (CIET), a constituent unit of the National Council of Educational Research and Training (NCERT). This curriculum for teachers defines the need, scope, content, methodology, etc, for building the competencies of in-service teachers in the use and integration of ICT. The document also guides the path for integration of this content in the pre-service teacher education curriculum. It encompasses courses that focus on skill development where knowledge acquisition is seen to be incidental. Also, it follows the blended approach for delivery of the courses which gives scope for continuous professional development of teachers overcoming

the challenge of time, place, etc. ICT in Education curriculum is a model for building competencies in teachers to integrate content, pedagogy, and ICT effectively. This curriculum was piloted in Navodaya Vidyalayas and in all four Demonstration Multipurpose Schools of NCERT at Ajmer, Bhopal, Bhubaneswar and Mysore. It was also implemented in the state of Karnataka on a large scale covering all teachers at the secondary stage of school education. Learnings and experiences from these implementations have revealed that a holistic approach to capacity building is essential and effective in developing the competencies of teachers.

Need for ICT in Education Curriculum for Teachers

The importance of using ICT in education has increased dramatically as the global environment continues to change. Teachers are required to be able to use ICT successfully in order to combine their students' learning experiences and sufficiently prepare them for the issues they will encounter in the future. While the use of ICT in education has several advantages, including the ability to design practical courses, manage a classroom, and increase stakeholder communication, its successful implementation depends on instructors having the necessary abilities, information, and motivation (Nawastheen et al., 2023). The integration of information technology and educational endeavours is getting closer in the mobile Internet era, and there are more resources available for information technology. The ability of teachers to use Information and Communications Technology (ICT) effectively has become a must in the teaching process, and the main challenge is knowing how to assess it properly (Xiao et al., 2020).

The use of contemporary digital tools by teachers, which is a crucial component of the digital transformation of the educational environment, has given rise to a new area of problem-solving in the field of education (Golodov et al., 2022). The use of ICT by teachers in the classroom is becoming more and more crucial since technology is now a necessary component of effective teaching (Bariu et al., 2022). The behavioural intentions of instructors have a significant role in determining whether they would use ICT in their classroom instruction (Moosa & Ramnarain, 2023). Due to the extensive use of Information and Communication Technologies (ICTs) in education, teachers must be extremely digitally proficient and have a positive outlook in order to efficiently manage their students (Rahimi & Tafazoli, 2022). Evidence from experiments has shown that affective-motivational factors including pre-service teachers' attitudes, have a significant effect on their pedagogical judgments about whether and how to include technology in their classroom practices (Pozas et al., 2022). Hence, it is essential for the administrators at schools to take steps to assure the dependability and accessibility of technology, such as offering timely upgrades and ongoing maintenance services. In order to help teachers deal with techno-insecurity, mentoring the teachers on constructive coping mechanisms including venting, finding social support, and attending technical training to cope with the changes due to technology in educational setup (Wang & Zhao, 2023).

It is crucial throughout the world that information and communication technology be included in educational environments. Technology in education has potential benefits. Technology in education is always evolving, presenting new opportunities (Yuting et al., 2022).

The introduction of new technology into educational settings has the potential to improve learning opportunities in terms of quantity and quality. Information and communications technology (ICT) is becoming more and more common in educational settings because it enhances learning, creates a pleasant environment, and encourages pupils to develop analytical skills and confidence (Pandey et al., 2022).

The capacity to utilise digital tools appropriately has evolved into a basic component of daily living, and the widespread use of digital tools has established its importance in educational institutions (Rohatgi et al., 2021). Many countries have realised ICT skills need to be mastered alongside reading, writing, and numeracy skills. National Policy on ICT in Education (2012) states that capacity building of teachers is key to the widespread infusion of ICT-enabled practices in the school system. Several efforts have been taken by the Government of India (GoI) to deepen the use of ICT in Education. One such initiative is the ICT component under Samagara Shiksha, through which GoI was funding the states a lump sum amount to establish infrastructure, train teachers, and establish ICT resources. Though investments have been made in these areas, third-party evaluation of the ICT@School Scheme done in several states (CIET, 2014) has revealed that there is no significant improvement in the use of ICT in classroom transactions that could impact the learning outcome of students. At several schools, ICT infrastructure is unused due to a lack of confidence in teachers to use it or due to a lack of leadership among teachers/ administrators in taking responsibility for managing the ICT environment. Though five days of training has been provided at the state level on the use of ICT, a lack of competency in integrating ICT in the teaching and learning of curricular subjects was reported as one of the major barriers by teachers during interviews (CIET, 2014) and various training conducted at national and state level.

So, rather than providing ICT literacy training, it is necessary to develop competencies so that teachers can sustain themselves by adapting to the changes and building the ICT environment as per the requirement. This can be achieved only when the teacher is confident in adapting to changes. Software or hardware-based training only builds confidence in handling the specified tools rather than building skills to address their needs. Also, time and location become barriers to bringing teachers to get training as and when the requirement arises. To address these challenges, there is a need to bring a blended approach to the content to be derived as well as in the mode of delivering training.

Though the ICT component of Samagara Shiksha defines the training scheme with content, a detailed description of the content and strategy for training teachers was required for the implementers to enable effective technology integration in school education. ICT in Education Curriculum for teachers was developed by the Central Institute of Educational Technology (CIET) and acts as a model that has realised all these requirements in developing teachers' competencies to sustain themselves in the use of ICT in education in the changing world.

Guiding Principles of the Curriculum

ICT in Education curriculum for teachers is generic in nature and could be adopted/ adapted/ customised as per the specific needs of chosen stakeholders. The courses specified in the curriculum give exposure to a wide range of technological applications with a focus on educational purposes. E.g., Planning, presenting, assessing, transaction, communication, etc. To

discourage software piracy, Free and Open Source Software (FOSS) is explored across the curriculum. This curriculum focuses on learning to compute, which includes learning to create using various tools and techniques, whereas ICT literacy, i.e., knowledge about the tools and ability to use them, is seen as the incidental outcome in the process of learning.

Adequate opportunity for hands-on practice is part and parcel of methodology, and also, the opportunity is provided for open-ended exploration of ICT applications rather than imposing a specific application. The course content has an inbuilt scope for critical evaluation and sharing of learning for feedback and improvement. Peer sharing and review are built as part of the course strategy. Awareness of the social, ethical, and legal aspects of using ICT is integrated across the course content to build a healthy ICT environment and ensure the safe and secure use of ICT. It is integrated such that it is practised intentionally. Creation of original content, taking pride in their creation, and duly recognising others' contributions are the core essence of the curriculum. This curriculum aims at ensuring the full utilisation of infrastructure and resources, integrating it with the school system. This fosters a sense of ownership and also enables universal access among the stakeholders. Keeping these guiding principles as a base, the courses are developed and delivered to the teachers to instil the same principles further in action.

Learning strands of the Curriculum

ICT in the education curriculum for teachers focuses on six major strands that explain the objectives and content of the courses delivered based on this curriculum. Information is spread across the universe, and the internet is the gateway that gives access to this information in the digital space. Having access to such updated and authentic information is a boon to teachers in providing appropriate information to students. A teacher needs to develop the skill to search for appropriate information based on the requirement, access it from various resources like text, audio, video, interactive activities, etc., organise it and use it as per the need in a safe and secure manner. Such skills in terms of searching, retrieving, organising and presenting information through the internet are provided as part of the courses, enabling the teacher to be connected with the world.

ICT provides space for people to be connected with each other through various subject-based forums, groups like telegram, WhatsApp etc., and electronic communication systems like email etc. This feature provides an opportunity for teachers to interact with other teachers crossing the barrier of location, time, demographic difference, etc. It also can provide a warm environment, overcoming the fear of being tagged, named, titled, etc., with even unknown teachers across the country to clarify doubts, queries, discussions, etc., providing a better learning environment. Practising skills to connect with each other in terms of participation through various communication techniques and systems is the scope of the strand - connecting with each other.

Creating various resources using different tools and techniques supports teachers in planning the use of ICT in the process of teaching, learning, and assessment based on context. The wider the range of tools, devices, software applications, and techniques the teachers are aware of and can productively use, the wider the opportunities for developing their

imagination and expression that impact the student's learning to a greater extent. This enables a teacher also to use ICT not as a mere information delivery tool but as an enabler to construct knowledge. Thus, teachers acquire skills in creating with ICT using various tools and techniques that enable a teacher to become a prosumer rather than just a consumer.

While creating with ICT, teachers also encounter various devices where a broad conceptual understanding of how ICT devices and tools work, along with operational knowledge of safe and efficient use of ICT, is the aim; learning basic ways to troubleshoot and work around problems is developed (NCERT, 2012). By interacting with ICT, skills for handling ICT tools are developed and not through rote learning.

Understanding the possibilities of using ICT in education includes understanding the use of various resources for addressing educational needs, tapping the potentials of digital resources and tools in improving the learning outcome of students, developing a conducive learning environment, planning learning experiences effectively, implementing in a meaningful way, etc. Skills to bridge the gap that exists in terms of social and geographical differences is the sole responsibility of the teacher while providing a learning experience. Tapping the potential of ICT to bridge the gap needs exploration and understanding of the tools and techniques. Building such skills is the focus of this strand, known as bridging the gap.

ICT in Education Course for Teachers

Courses are majorly classified as induction and refresher. Induction is basically a face-to-face training where only materials are accessed from the course portal, and portfolios are maintained digitally. Whereas refreshers are delivered in blended mode or completely online. Course content is delivered in various forms in a blended mode, like face-to-face demonstrations, online sessions, video lectures, online discussions, interactive activities, etc. Induction courses focus on developing ICT skills, whereas refresher courses focus on developing pedagogical skills for integrating ICT into Education. Teachers need to practice teaching and instructional design skills so that they can engage students in constructivist thinking, experimentation, problem-solving and learning linked to real-life situations using various ICT tools and techniques and capturing them as portfolios (Kheng et al., 2000).

Courses are offered at two levels. The first level recommends mandatory courses for teachers to become users of digital technology and integrate it effectively in teaching, learning and assessment. However, level two recommends courses for developing advanced knowledge and skills in building the digital ecosystem and operating effectively to provide quality and accessible education to all.

As the course is built with more hands-on activities, the teachers who undergo this course will develop confidence from practising. Support for handhold is also devised in terms of e-groups, forums, chat rooms, etc. The approach of the course is such that activities are extended and practised in the school in real classroom setup and portfolios are maintained to provide timely feedback for improvement. Advanced courses are delivered online.

Insights from the Pilot Study in Demonstration Multipurpose Schools of NCERT

Demonstration multipurpose Schools of NCERT at Ajmer, Bhopal, Bhubaneswar and Mysore act as lab schools where all innovations are piloted and shared for further implementation in schools

across the country. The major research questions for the pilot were:

- Whether ICT competency of teachers can be developed through Induction and refresher courses?
- Whether attitude towards integrating technology in education changes after the intervention of induction and refresher courses?

During the pilot, the focus was also to study the time requirement for implementing these courses and also to check the suitability of the course content towards developing the competencies. The courses suggested by ICT in the Education Curriculum for teachers were implemented in all four schools, and all teachers were trained in induction and refresher courses. The induction course was implemented for 10 days, refresher course -1 was implemented for 11 days and refresher course -2 was implemented for 5 days in face-to-face mode. The effectiveness of this training was studied in terms of ICT competency and the attitude of teachers towards the use of technology. Data was collected through the ICT competency and attitude scale at the start of every training.

The data reveals that there was no significant change in attitude at the end of the first training, where teachers were trained on using technology for creating and sharing digital information. Around 12 per cent of the teachers still showed a negative attitude towards the use of technology in terms of time and skill of teachers. However, at the end of the second training on ICT-Pedagogy integration, around 79 per cent of the teachers were found to have a highly positive attitude towards using technology in the teaching-learning process. No teachers showed a negative attitude towards technology use.

ICT competency was studied with the following dimensions: use of hardware, use of the digital application, building a digital ecosystem, integration of ICT in the teaching-learning process and safety & security aspects. At the end of refresher course 2, teachers showed improvements in all dimensions of the ICT competency. Teachers showed only a 23 per cent improvement in safety and security aspects. Whereas in all other dimensions, on average 92 per cent of the teachers were able to use technology without any support.

This pilot study revealed very clearly that a systematic, holistic approach to the curriculum supports in development of knowledge, attitude and skill in the use of ICT in the teaching-learning process.

Insights from the Implementation of Induction Course in the State of Karnataka

The induction course was implemented in the state of Karnataka for teachers working at the secondary stage of school education. The training was implemented in a cascade model where the CIET team (National level experts) trained the State Resource Groups (SRGs), SRGs trained the Key Resource Persons (KRPs), and in turn, KRPs trained the teachers. To implement the training successfully, the following strategies were implemented:

1. A training manual was prepared so that the content is shared uniformly
2. SRGs were trained on the content as well as the methodology of training so that the transaction of the content goes uniformly
3. The training was conducted as a residential programme so that the learners could make use of their time in more practice
4. A team of mentors doing the complete training of 10 days that supported building trust, and

continuous support was provided

5. All the handouts were provided for ready reference so that the learners were able to refer to them immediately. The text-based handout was supported by regional language (Kannada) videos for better demonstration and explanation.
6. Allocation of mentors enabled discussion and handholding of the teachers
7. Follow up at the school level in using the competencies gained during training and support by cohorts when the learner was not able to practice motivated and push the learners to use technology in classrooms
8. A baseline data collection was felt as a need to understand the growth in individuals
9. Review at the end of every year helped to address the challenges
10. Systematic planning helped in the coverage of teachers and scaling up the implementation

After implementation for two years, a short study was conducted by the state to understand the impact on classroom practices. Around 710 schools were visited by 290 field investigators observing the classroom interaction and also collecting data from 734 respondents. The data collected reveals the following:

1. Digital infrastructure is available in 75 per cent of the schools with laptops, which were distributed by the states under the ICT@School scheme
2. 52 per cent use both proprietary and Linux operating systems. Around 29 per cent of the schools use proprietary operating systems, and 19 per cent of schools use only Linux operating systems. This data shows the readiness of the school system to use Free and Open-source software (FOSS).
3. Not less than 50 per cent of schools had digital infrastructure like desktops, multimedia projectors, pen drives, printers, TVs, radios, computer labs, UPS and wi-fi facilities that enable the use of technology after the training.
4. In 42 per cent of the schools visited, at least four teachers were found to use technology on a regular basis, i.e. 4 periods in a week.
5. Not less than 65 per cent of teachers used videos and presentations as digital resources. Around 40 per cent of the teachers were found to develop their own digital resources based on the need for the content. Around 12 per cent of teachers extensively used simulations in the classroom.
6. The percentage of teachers using technology in the class increased from 41.16 per cent to 75,22 per cent as the maturity level of the teachers in using technology improved due to the training and follow-up activities. Continuous mentoring and support systems established by the state enabled the progress.
7. Digital resources from various sources were used by the teachers after the first level of training. However, teachers started developing their own resources after one year of training.
8. Even administrative efforts were taken to enable ICT integration, like mentioning log books in the use of digital infrastructure, ICT integration in school timetables, lessons the ICT integrated lesson plans among teachers, etc.

A detailed study of the implementation is required to get insights and learning

from the large-scale implementation in the state.

Conclusion

ICT in Education curriculum developed for teachers is a model curriculum encompassing innovative methodologies in integrating ICT. Thus, the curriculum aims at building the competencies of each teacher towards integrating ICT in Education to improve the teaching-learning process. As the teachers provide a rich learning environment, the students have a scope of improving and achieving the learning outcome. This curriculum focuses not just on developing skills to use ICT but focuses more on building skills for integrating content, pedagogy and ICT meaningfully. A holistic approach is required for developing digital competencies in teachers. Not only knowledge but change in attitude and also competence in skill is a requirement for effective implementation of ICT in school education. Other states/ UTs in India have also released this based on various studies done across the country and efforts are being taken to follow this holistic approach. Changes due to the pandemic have brought in new learnings and challenges that are considered, and new strategies are evolving to address the current need. There is scope for studying the new strategies being evolved and integrating them into the curriculum for a better solution in capacity building of teachers in the use and integration of digital technology.

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Cyber-Safety: Concepts, Threats, and Essential Measures

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Abstract

The rapid advancement of technology has led to a digital revolution, impacting various aspects of our lives and elevating the importance of cybersecurity. As society increasingly relies on technology for communication and learning, cybersecurity awareness has become crucial. The COVID-19 pandemic accelerated the adoption of digital tools in education, necessitating a comprehensive approach to address cybersecurity challenges for students and teachers. This research article explores the background and significance of cybersecurity, focusing on evolving cyber threats faced by educational institutions and society. It addresses cyberbullying, misinformation, and fake news, advocating for responsible netizenship and media literacy among students. The study comprehensively examines cyber threats, ranging from malware-based attacks to social engineering and denial-of-service incidents. Emphasising cybersecurity as an integral pillar of the digital age, the research stresses the need for robust strategies to safeguard data, ensure privacy, and create a safe online environment for students, teachers, and the broader community.

The study aims to gain insights into the profound impact of cyber threats on individuals and institutions, highlighting the significance of cybersecurity in the digital landscape. Essential measures like user education, device configuration, network security, and identity management are proposed to strengthen defences and secure the digital environment. The paper addresses children's cyber safety concerns, focusing on combating cyberbullying, misinformation, and scams. It presents effective awareness-raising strategies and preventive measures, emphasising the role of education campaigns and parental involvement. This research strives to safeguard education in the digital age by promoting responsible online behaviour and fostering a secure digital environment. The research contributes to the current initiatives towards cyber safety and security by demonstrating the importance and critical role of awareness in the cyber safety and security strategy of the country. The major contribution is the advancement of the theoretical and practical basis for cyber security awareness in proposing a model framework for developing awareness.

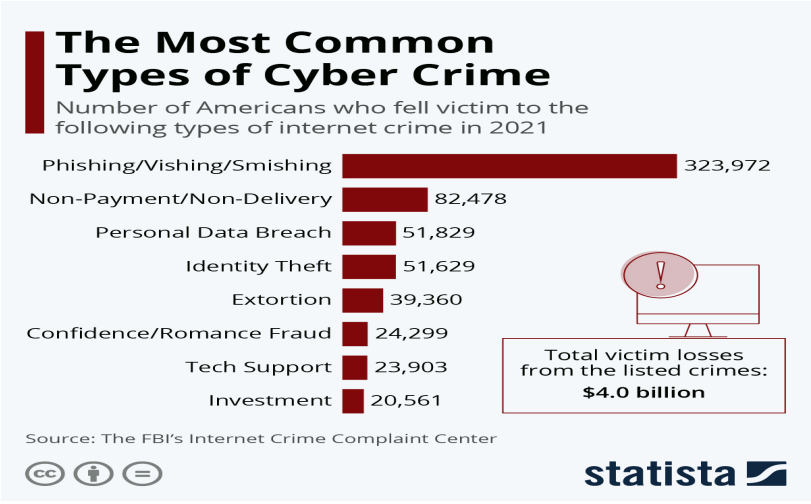
Keywords: Cybersecurity, Cyber safety, Cyber threats, Cyberbullying, Digital Education

Introduction

In recent years, the rapid advancement of technology has ushered in a new era of digital connectivity that permeates every aspect of our lives. As our society increasingly relies on technology for communication, learning, and information dissemination, the significance of cybersecurity has reached unprecedented heights (Clark & Hakim, 2017). The COVID-19

pandemic has further catalysed the adoption of digital technology by teachers, students, and schools, propelling them to embrace these tools at an accelerated pace (Jena, 2020; Kidd & Murray, 2020). The digital landscape offers tremendous opportunities for education, empowering students, schools and educators with innovative learning tools and access to a vast pool of knowledge. However, this digital revolution also comes with inherent risks, as the cyber world presents an ever-expanding frontier for threats and vulnerabilities (Schia, 2018). It exposes educational institutions as well as society as a whole to diverse cyber threats, ranging from malicious attacks, data breaches, misinformation, and cyberbullying. As we embrace the benefits of a digital world, it becomes imperative to have a comprehensive understanding of the intricacies of cybersecurity and to develop robust strategies that safeguard the data and its integrity, preserve privacy, and ensure a safe online environment for students, educators, and the broader community.

Figure-1: Cybercrimes in US for the year 2021 (image source, CC BY-ND)



This research article aims to explore the background and significance of cybersecurity in light of these developments. It seeks to shed light on the multifaceted challenges posed by cyber threats that have evolved into sophisticated and pervasive forms while exploring the strategies to ensure the safety and security of individuals and institutions in the digital domain. The article sheds light on the rising instances of cyberbullying, misinformation, and fake news, emphasising the promotion of responsible netizenship and media literacy among students. The objectives of this study encompass a holistic examination of cyber threats, ranging from malware-based attacks and social engineering schemes to denial-of-service incidents. By gaining a deeper insight into the various facets of cyber threats, this work aims to elucidate their profound impact on individuals, organisations, and society. Moreover, the research aims to highlight the importance of cybersecurity as an integral pillar of the digital age, elucidating the key components of a robust cybersecurity strategy to fortify defences against potential threats. Special attention is devoted to enhancing cybersecurity awareness

and implementing safety measures within educational settings, recognising the pivotal roles of students, teachers, and parents in fostering a secure online environment for future generations.

The rest of the article is organised as follows - Section 2 reviews existing guidelines and mechanisms about cyber safety. Section 3 defines the related key concepts, section 4 explores major categories of cyber threats, and section 5 is about cybersecurity measures and awareness. Section 6 delves into cyber safety concerns and the need for awareness. Section 7 focuses on cyber safety and responsible behaviours. Finally, Section 8 is on discussions and the way forward.

Review of Literature

Given the importance of awareness about cyber safety and security (Rahman et al., 2020, Zwilling et al., 2022), various countries are adopting specific measures for awareness through their education system. Many countries assign cyber-security awareness and education to one or more dedicated government departments or organisations (Kortjan & Von Solms, 2014). The Cybersecurity and Infrastructure Security Agency (CISA) of the USA acknowledged the heightened risks of cybersecurity for the K-12 sector and it has come out with an online toolkit (CISA, 2023) containing guidelines and resources for schools to combat cyber threats and various resources for students and teachers to learn about cyber concepts are available (NICCS, 2022). Recognising limitations at the school level, these guidelines recommend for reporting and collaboration with dedicated expert agencies to combat cyber issues. The United Kingdom (UK) also has national policies for cybersecurity education and skill development, including national curriculum, and cyber security, and online safety content (Knott et al., 2023). In Canada, the organisation Public Safety Canada coordinates across departments and agencies for cyber safety and security. In India, the Indian Computer Emergency Response Team (CERT-In, 2023) is the nodal cyber incident response centre that also works on raising security awareness among citizens., and provides technical assistance and advice to deal with cyber crimes.

The Cyber-security awareness and education framework by Kortjan & Von Solms (2014) for South Africa proposes five layers:

i. Strategic layer for reflecting the overall vision of the government regarding cyber-security awareness and education.

ii. The tactical layer lists the schemes to be employed to realise cybersecurity awareness and education goals.

iii. Preparation layer detailing the schemes identified in the tactical layer.

iv. The delivery layer identifies the target beneficiaries.

v. Monitoring layer for monitoring the progress of the scheme towards fulfilling the goals.

Zwilling et al., (2022) studied the relationships between cyber security awareness, knowledge and behaviour among management students across four countries: Israel, Slovenia, Poland and Turkey. Two broad aspects analysed were the connections between - a) previous cyber knowledge and level of cyber security awareness and b) awareness and safe habits or behaviour.

The arrival of the 5G mobile network is further pushing the emergence of Internet of Things (IoT) where the vulnerabilities are beyond the traditional measures like firewalls, passwords, etc. (Fagen et al., 2021; Hero et al., 2023).

This indicates the need for students as well as teachers to be fairly equipped with cybersecurity knowledge in order to safeguard them in the cyber world.

Key Concepts and Definitions

Cyber Threat

A cyber threat is a potential security risk that might exploit weaknesses or vulnerabilities of a digital system or asset, including its users (Abomhara & Køien, 2015). Cyber threats encompass an array of malicious activities, such as malware, social engineering, data breaches, and more, which could compromise the confidentiality, integrity, or availability of information. Preventative measures can mitigate cyber threats and safeguard information security (Safa et al., 2019). Preventive measures include, among others, putting robust cybersecurity protocols, periodic risk assessments, user education, and advanced security technologies.

Cyber Attack

A cyber attack involves deliberately exploiting weaknesses or vulnerabilities within an information system, intending to infiltrate, disrupt, or cause damage to a digital system, network, or asset (Li & Liu, 2021). These malicious acts are carried out by cybercriminals, commonly referred to as hackers, who can be individuals, organisations, or even state-sponsored entities. Cyber attacks encompass various forms, such as ransomware, phishing, online fraud, and identity theft, among others (Sabillon et al., 2016). To counter the threat posed by cyber-attacks, implementing preventative measures such as regularly updating software, conducting security audits, and user education is crucial.

Cybersecurity

Cybersecurity safeguards ICT (Information and Communication Technology) systems and their contents from various threats, such as attacks, disruptions, and unauthorised access (Fischer, 2014). It encompasses a range of activities and measures aimed at protecting computers, computer networks, related hardware and devices, software, and the information they store and communicate within cyberspace (Clark & Hakim, 2017). Cybersecurity refers to the state of being protected from these threats and encompasses the broader field of efforts dedicated to implementing and enhancing protective activities and measures.

There is no precise definition of cybersecurity due to its multifaceted nature. However, cybersecurity remains a crucial and constantly evolving area of awareness for every individual and organisation in ensuring the security and integrity of digital systems and information in the modern digital landscape (Dash & Ansari, 2022).

Cyber Safety

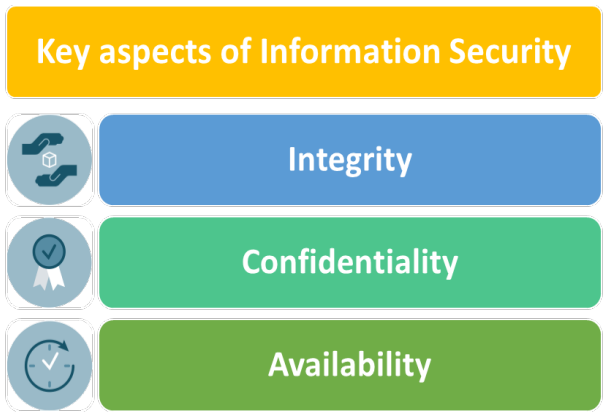
Cyber safety is a subset of cybersecurity that promotes safe and responsible behaviour in the cyber world (Bada et al., 2019; Chang & Coppel, 2020). It involves educating individuals, especially children and young people, about the potential risks of using the internet and how to protect themselves from online dangers, such as cyberbullying, scams, and inappropriate content (Rahman et al., 2020). By teaching safe browsing practices, safeguarding personal information, and recognising online threats, cyber safety helps build a resilient digital community. Cyber safety practices ensure a healthier and more secure online experience for students, parents and teachers.

Information Security

A closely related concept is information security, which safeguards information and information systems from unauthorised access, use, disclosure,

disruption, modification, or destruction (Fischer, 2014). This includes creating a robust and secure environment to safeguard sensitive data and maintain the trust, confidentiality, and reliability of information and the systems that store and manage it (Zissis & Lekkas, 2012). The primary objective of information security is to ensure the protection of information in three key aspects:

Figure-2: Aspects of information security



a. **Integrity:** ensuring that information remains unaltered and protected against improper modification or destruction. This includes measures to ensure that an individual can't falsely deny having performed a particular action and to determine whether a given individual took a specific action, such as creating information, sending a message, approving information, and receiving a message.

b. **Confidentiality:** preserving authorised restrictions on access and disclosure of information. This involves implementing methods to protect personal privacy and proprietary information from being accessed or disclosed by unauthorised entities.

c. **Availability:** ensuring that information is readily and reliably available for access and use by authorised users when needed, avoiding disruptions or downtime that could hinder its access or use.

Cyber Threats: Categories and Impact

There exist diverse types of cyber threats, with cybercriminals and hackers continually striving to devise novel methods to infiltrate digital systems with diverse objectives. Mitigating certain cyber-attacks requires considerable technical intricacy in manipulating program code and software configurations. However, in consideration for the readers' comprehension, this section exclusively addresses commonly encountered cyber threats that exhibit a lesser degree of technical complexity. Starting from this point, the terms cybersecurity, cyber threat, online safety, and cyber attack will be used interchangeably in this article to discuss security issues in the digital world.

Malware-based threats

Malware-based threats arise from malicious software designed to infiltrate, damage, or steal information from computer systems. These malicious software include, among others, viruses, ransomware, and spyware.

Viruses

Computer viruses are malicious programs that can infect regular files on a computer and get transferred from one computer to another through a pen drive, as email attachments, and in various other ways. Viruses can attach themselves to other documents, executable files or multimedia contents, and when those infected files are opened, the virus starts doing bad things to your computer. Viruses may also propagate through email attachments, whereby, upon opening or downloading such attachments, the virus program becomes operational and initiates its malicious activities (Serazzi & Zanero, 2003). Viruses have the capacity to remain concealed within various types of files, including videos, software, documents, and images. Obtaining such content from unreliable or unfamiliar persons or websites may lead to the inadvertent downloading of viruses into a system. Viruses can corrupt data, steal information, or disrupt the normal functioning of the infected device.

Ransomware

Ransomware is a malware that infects crucial data and files within a user's computer system. It encrypts the victim's files and data, or locks the system's screen, and then demands a ransom payment for getting the key required to decrypt those files or unlock the computer and regain access (Beaman et al., 2021). The infamous WannaCry ransomware attack in 2017 (Mohurle & Patil, 2017) was a large-scale global assault, resulting in significant financial repercussions across numerous sectors worldwide, including hospitals, companies, universities, and government organisations in over 150 countries. Ransomware is typically disseminated through unsolicited email attachments or embedded web links within email communications.

Spyware and Keyloggers

Spyware is a type of malicious software that scammers try to install on users' computers secretly. It is intended to spy on the user's activities and gather sensitive data such as browsing habits, websites they visit, passwords, login credentials, and documents stored on the targeted computer (Talukder & Talukder, 2020). It allows the cybercriminal to spy on what users are doing on their computers: the websites they visit, the files they create/use and other details they store on PC.

Keyloggers is a particular type of spyware that secretly records every keystroke a user makes on their keyboard and sends this data back to the scammer over the internet (Talukder & Talukder, 2020). Cybercriminals exploit this captured keystroke information to access sensitive information, such as usernames, passwords, credit card details, and other confidential data.

Attackers use a wide range of tricks to get their spyware and keyloggers installed onto the user's computer. This involves luring users into clicking on spam email links or visiting specially designed websites intended to infect their computers. Other sources of spyware and keyloggers are free games or music that one can download online.

Social engineering attacks

Social engineering refers to the art of influencing individuals or organisations to disclose sensitive information, and the process of doing so is known as a social engineering attack. It involves leveraging social interactions to persuade a target to comply with a specific request from an attacker, wherein the social interaction, persuasion, or request involves a computer or related entity. This form of attack relies on exploiting human psychology, trust, and vulnerability to gain unauthorised access to confidential data, systems, or resources. Social engineering attacks do not directly

target technological vulnerabilities but instead exploit the inherent weaknesses in human behaviour to achieve their malicious objectives.

Figure-3: Major types of social engineering attacks

Phishing attacks

Phishing attacks are the most common form of fraudulently obtaining private and confidential information through deceptive phone calls or emails. These attacks often involve using fake websites, emails, advertisements, and various false offers or advertisements (Salahdine & Kaabouch, 2019; Quayyum et al., 2021). For instance, calls, messages, or emails from a fake lottery department about winning prize money, and requesting the target to click on a malicious link and provide credit card details, insurance information, personal details, or asking for a transfer of some processing fee. Other types of social engineering attacks include:

- *Baiting* - offering free software or media downloads that contain malware.
- *Pretexting* - impersonating someone with authority and obtaining information from individuals or organisations.
- *Quid pro quo*: promising service or benefit in exchange for sensitive information.

Denial-of-service (DoS)

It involves overwhelming the target system with excessive illegitimate traffic or data, causing it to fail to respond to legitimate users (Dong et al., 2019). A Distributed Denial-of-Service (DDoS) attack aims to disrupt the normal functioning of a target website, server, or network resource, and thereby denying service to legitimate users. DDoS attacks use multiple compromised computers, known as "botnets," to carry out the attack. The objectives of DDoS attacks include causing financial losses due to downtime and damaging the organisation's reputation.

Essential Measures to Ensure Cybersecurity

Need for Cybersecurity Measures

The digital economy is expected to constitute approximately 24.3 per cent of the global GDP (Xuetong, 2020) by 2025. Additionally, e-Conomy India (2023) projections indicate that India's internet economy will likely represent 12-13 per cent of its GDP by 2030. The dynamic growth of the digital economy,

fuelled by Internet-based digital technology innovation, leads to fierce international competition while also drawing the attention of cybercriminals.

In the digital age, schools increasingly use technology for various purposes, such as online classes, student records management, examination processing, and administrative tasks. Given their handling of vital personal data, schools are vulnerable to cyber threats. As a result, cybersecurity becomes indispensable for schools and students as well to protect their sensitive information.

In a nutshell, cybersecurity is essential and indispensable in the digital age to protect individuals, organisations, and nation, due to the following reasons:

i. **Protecting Sensitive Data**: personal data, financial records, personal communication, and other information are stored and exchanged online. Likewise, schools collect and store vast amounts of sensitive student data, including personal information and academic records. Robust Hence, cybersecurity measures are necessary to safeguard this data from unauthorised access or use.

ii. **Preserving Privacy**: As individuals and organisations carry out more online activities, ensuring their privacy protection is essential. In the context of education, schools rely heavily on online learning platforms and communication tools. Security and privacy of online learning environments are crucial for students. Cybersecurity helps prevent unauthorised surveillance, identity theft, and other privacy violations.

iii. **Ensuring Business Continuity**: As organisations rely heavily on digital systems and networks for their operations, strong cybersecurity can safeguard against attack and ensure business continuity.

iv. **Protecting Critical Infrastructure**: Cybersecurity is vital to protect critical infrastructures such as power grids, transportation networks, and healthcare systems, as they can severely paralyse cities and challenge national security.

v. **Protecting National Interests**: Today, cybersecurity is closely linked to national security. Protecting critical infrastructure, government systems, and sensitive information is essential to safeguard a nation's interests and sovereignty.

Basic Cybersecurity Measures

A comprehensive cybersecurity plan for organisations to defend against cyberattacks is built upon its three key pillars:

a. **People**: Users must be educated about and adhere to fundamental data security principles, such as using strong passwords, being cautious about email attachments, and regularly backing up data.

b. **Processes**: The plan should include a well-defined framework to handle attempted and successful cyber-attacks. It should cover various aspects, such as identifying attacks, safeguarding systems, detecting and responding to threats, and recovering from successful attacks.

c. **Technology**: Utilising computer security tools like firewalls, DNS filtering, antivirus software, and email security solutions is essential to protect devices such as computers, smartphones, routers, and cloud services.

The essential cybersecurity measures for all organisations, regardless of their size, include the following:

a. **Device configuration**: Ensure systems have unnecessary functionalities removed or disabled. Set higher system security configurations and regularly update the operating system and other application software.

b. **Identity and access management**: Grant users system privileges and rights based on their specific roles. For example, it is necessary to define roles and access privileges for technical administrators, teachers, and students in a school setting. Implement multifactor authentication, requiring both passwords and OTP through mobile networks to log in to the school portal/LMS. Practice lifecycle management of users, like removing student credentials when they leave the school or when a teacher resigns.

c. **Network security**: Establish robust security settings in firewalls and routers. Employ authentication-based access for both incoming and outgoing network connections. Implement password-based access for your devices, such as printers, scanners, etc., linked to Wi-Fi or other networks.

d. **Removable media controls**: Discourage using pen drives, hard drives, or other portable storage devices on systems and disable such ports. Prefer cloud-based data transfer methods instead. If necessary to use removable media, scan all devices for malware before their use.

By implementing these basic cybersecurity measures, organisations can have the first level of readiness against cyber threats while maintaining a safer and more secure digital environment.

Cyber Safety Concerns and Awareness for Children

Cyber Safety Concerns for Children

Cybersecurity awareness is an approach to educating users about the diverse cyber threats and the vulnerability of computers and data to such threats (Rahim et al., 2015). Children nowadays spend a considerable amount of time on online activities, either for education or for entertainment. While the Internet provides numerous opportunities, it also presents various risks. Because of their young age, children frequently overlook safety and security concerns. They get lured with malicious offers and prompts, putting their privacy and safety at risk and often realising the consequences only after it's too late (Quayyum et al., 2021).

- In the context of **social networks**, raising awareness among young individuals regarding the potential privacy-related risks they may encounter is crucial. Children frequently tend to divulge their real-time locations online to a broad audience. Moreover, they often engage in geo-tagging photographs taken with smartphones and share them on online platforms. Regrettably, such geo-tagging practices can risk their online privacy, making them vulnerable to potential threats.
- The use of **smart toys** by young children introduces another dimension of risk, as inadvertent disclosure of sensitive information can occur during interactions with these devices. Particularly concerning are voice-based smart toys, which may inadvertently expose children's voice content to eavesdroppers, consequently exposing them to the possibility of audio injection attacks facilitated through these devices.

- **Online games** are becoming more interactive and immersive in nature. As children engage in virtual worlds and multiplayer environments, they may encounter various risks and threats, such as,
    - communication with strangers, disclosing their personal information,
    - getting lured through fake websites promising free in-game currency, rewards, or cheats,
    - in-game purchases, financial loss and conflicts with parents
    - addiction and excessive screen time negatively impact children's physical health, mental well-being, and academic performance, including social isolation, addiction, aggression, and even self-harm and suicide in extreme cases (Dahabiyeh et al., 2021).

Cyber Bullying

Cyberbullying is the act of harassing, intimidating, or causing harm to others through online or digital communication channels. Among school students, cyberbullying is a significant issue on social media, instant messaging, email, as well as online gaming platforms. The victims of cyberbullying are often peers, teachers, or anyone else within the school community. While online, students often perceive a sense of unchecked autonomy, believing they have the liberty to engage in any activities of their choosing while remaining unnoticed. Cyberbullying encompasses several harmful actions, including:

- **Sending Hurtful, Offensive, or Threatening Messages**: Cyberbullies use social media platforms, messaging apps, or email to send messages that are hurtful, offensive, or threatening. They may use derogatory language, insults, or name-calling to humiliate the victim.
- **Social Exclusion**: Cyberbullies spread rumours or gossip about the victim while deliberately excluding them from online groups, isolating them from their peers.
- **Creating Fake Profiles or Impersonation:** Cyberbullies create fake profiles or accounts in the victim's name and use them to post offensive content online or engage in harmful interactions with others, causing harm to the victim's reputation.
- **Publicly Sharing Embarrassing or Private Information:** Cyberbullies publicly share embarrassing or private information, photos, or videos of the victim without their consent. This humiliation can cause significant emotional distress and even instigate the victim to consider drastic measures.
- **Online Polls and Surveys for Public Shaming:** Cyberbullies create online polls or surveys targeting the victim, posing hurtful or offensive questions to shame or embarrass them publicly. This further contributes to their emotional distress and humiliation.

Combating Cyber Bullying

Cyberbullying can have severe and long-lasting effects on the victim's mental, emotional, and even physical well-being. Understanding the different forms of cyberbullying is essential to effectively recognise and address this harmful behaviour. Preventing and combating cyberbullying among school students requires a comprehensive approach involving preventive measures and intervention strategies, such as:

a. **Educating about Responsible Online Behaviour**: Students should be educated on responsible online behaviour, including understanding digital footprints, cyber ethics, and the potential consequences of cyberbullying. Additionally, they should be made aware of the importance of responsible social media use and safeguarding personal information.

b. **Implementing Anti-Cyberbullying Policies**: Schools should develop and enforce anti-cyberbullying policies, ensuring that students are well-informed about the repercussions of engaging in cyberbullying behaviour. If needed, schools can employ trained counsellors to resolve conflicts between the victim and the cyberbully,

c. **Fostering a Positive and Inclusive School Culture**: To cultivate a positive and inclusive school environment, promoting respect, kindness, and empathy among students can reduce cyberbullying incidents.

d. **Establishing an Anonymous Reporting System**: Schools should establish a confidential reporting system, allowing students to report cyberbullying incidents without fear of retaliation. If cyberbullying incidents get noticed, schools must immediately investigate the incidents, identify the perpetrators, and protect the victim. Schools should involve law enforcement agencies in severe cases of criminal cyberbullying incidents.

e. **Involving Parents in Monitoring Digital Activities**: Encouraging parents to become role models for their children by adhering to a structured schedule for digital gadget usage, maintaining open communication, and monitoring their children's online experiences and behaviours.

Misinformation and Fake News

In recent years, fake news and misinformation have gained significant traction through social media and other online platforms. Fake news refers to intentionally fabricated or distorted news items presented as factual information, while misinformation consists of factually incorrect information presented as news to deceive consumers. The prevalence of social media has exacerbated the problem, enabling rapid dissemination and a broader reach of false information (Sharma et al., 2019).

Deceptive communication through the Internet can have far-reaching consequences, affecting financial, political, and societal aspects. Fake news has been linked to influencing national elections, damaging reputations, and inciting violence and chaos. Photographs or videos of past events are often misrepresented as something else on social media. False and provoking captions accompanying these images or videos lead to the rapid spread of rumours or fake stories and, at times, escalate into physical violence, riots, and social chaos. Misinformation about health tips, home remedies, etc., spread through social media and instant messaging groups can also harm public health.

Research suggests that people tend to believe in information aligned with their ideologies, leading to the sharing of false information within like-minded communities. Given the vast amount of information available online and the speed at which it can spread, combating misinformation and fake news in the age of the internet is a complex and ongoing challenge. Dealing with Misinformation and Fake News requires a multifaceted approach, including media literacy

education, fact-checking initiatives, responsible sharing, technological solutions, and global cooperation.

Cyber Safety Awareness

The importance of cyber safety and cybersecurity awareness for everyone is significant, especially with the added complexity of cyber threats during the COVID-19 pandemic (Bada et al., 2019; Chang & Coppel, 2020; Dash & Ansari, 2022;). Education and awareness campaigns are crucial in promoting cybersecurity awareness among individuals, organisations, and society (Jena, 2020; Khan et al., 2020; Rahim et al., 2015). These campaigns teach people about online threats in the forms of malware, phishing, ransomware, and social engineering, making them more cautious online. They also educate about essential security measures, like strong passwords, two-factor authentication, and safe browsing habits. Moreover, these programs are vital in educating children and teenagers about data privacy, cyberbullying, responsible social media use, and avoiding financial fraud through phishing and other tactics. Raising awareness through such campaigns is essential for inculcating secure and vigilant online behaviour.

Cyber Safety and Responsible Behaviour

This section enlists some of the good practices for safeguarding against cyber threats. It also talks about the practice of cyber hygiene in a digital environment and the online behaviours can save us from the ethical and legal concerns related to the cyber world.

Strategies for Safeguarding Against Online Scams

a. **Be vigilant and think critically** - on receiving a message claiming to be from authority and asking for urgent action, take a moment to pause and question its legitimacy. Consider whether a genuine authority figure would demand such quick action.

b. **Search on the Internet** - if a message or news appears suspicious, perform a quick Internet search with a brief description of the matter along with the term "scam".

    a. **Second level verification** - even while you receive an email from a supposedly trusted organisation, verify its authenticity by calling it. Ensure not to use the phone number provided in the email footer.

    b. **Caution during online payment** - Use known and trusted platforms for handling credit card transactions and other online payments

    c. **Report suspicious incidents** - don't feel embarrassment or reluctance in reporting scams. File a police report or notify relevant authorities such as the National cybercrime portal (https://cybercrime.gov.in/) or cybercrime helpline number 1930 about any cybercrime.

Safety Measures to Prevent Cyber Attacks

This subsection summarises the cybersecurity best practices that can mitigate the chances of cyberattacks. It recapitulates a list of best practices related to social media usage, password management, software updates, hardware updates, and other cybersecurity measures.

Social Media Usage

i. Be cautious on social media platforms and avoid accepting friend requests from strangers. Trust online users only if you know them in real life.

ii. Refrain from sharing sensitive personal information on social

media, such as address, phone number, and date of birth, etc., to prevent identity theft.

iii. Share personal photos and videos only with trusted friends using appropriate privacy settings on social media platforms.

iv. Immediately notify the social media service provider if you come across a fake account created with your personal information.

v. Verify each message, photo or video before posting or sharing on social media, as they may contain fake news, misinformation, or sensitive information.

Password Management

i. Never use easy-to-guess passwords such as your mobile number, email address, home address, PIN code, date of birth, etc.

ii. Always set strong passwords containing a mix of alphabets - both uppercase and lowercase, numbers, and special characters (e.g., @ # $ % ^ & * ( ) _ + | ~ - - = Thank you for reaching out ' { } [ ] : " ; < > / , etc.) for social media accounts and all other websites requiring username and password to access.

iii. Regularly change passwords (usually once every 3 months) to enhance security and prevent malicious activities. Never reuse the same password for multiple accounts or websites.

iv. Use two-factor or multi-factor authentication (e.g., requiring both password and mobile OTP to log in to your banking portal) to add an extra layer of security to your accounts.

Software and Network Management

i. Regularly update your operating system, antivirus software, and other installed software applications to remove vulnerabilities that hackers may exploit.

ii. Download software from the original website only, and never go for websites that promise software for free.

iii. install mobile apps only from legitimate and trusted sources or app stores and keep your mobile device updated with the latest Android/iOS version.

iv. Install trusted and legitimate anti-virus protection software.

v. Keep the firewall in the operating system always on.

vi. Secure your Wi-Fi networks by setting a password to access them. Avoid using public Wi-Fi without a VPN to prevent unauthorised access to your data.

Email and Data Protection

i. Avoid opening emails from unknown senders and carefully scrutinise email attachments or the links given for potential threats and phishing links.

ii. While forwarding an email from a chain of emails to a new user, check whether that email chain contains any sensitive or confidential information. Before forwarding an email that is part of an email chain with a new user, ensure that it does not contain any sensitive or confidential information

iii. Regularly backup your important data on different devices or cloud storage to ensure data availability and recovery during a cyber-attack.

Discussion and Way Forward

Cybercriminal gangs are continuously innovating ways to exploit vulnerabilities and enhance the efficiency of their attacks. As time progresses, the

complexity of these attacks is on the rise. For instance, the Ransomware report (2023) from the Indian Computer Emergency Response Team (CERT-In) highlights a notable 53 per cent increase in reported Ransomware incidents in 2022 compared to the previous year. The report also draws attention to a worrying skill gap in managing Ransomware attacks, assessing the scope of infections, inadequate IT inventory lists, and improper computer network configurations, identified as critical areas of concern while combating cyber threats.

Promoting digital literacy among common citizens, especially in rural areas, is a challenging but crucial task to empower them with the knowledge and skills for safe internet navigation. The National Education Policy (NEP, 2020) has advocated the integration of digital technology across education, encompassing enrollment, transfer, assessment, and providing access to interactive learning resources utilising AR, VR, 3D, and other emerging technologies. Consequently, it becomes imperative to incorporate age-appropriate cybersecurity education programs into schools (Pencheva et al., 2020) and teacher education curriculums, equipping students and teachers to address the intricacies of cyber safety and security effectively.

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Book Review

Technology Assessment in a Globalized World: Facing the Challenges of Transnational Technology Governance

(Editors: Leonhard Hennen, Julia Hahn, Miltos Ladikas, Ralf Lindner, Walter Peissl and Rinie van Est)

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Technology has brought radical transformations to the world and has broken the barriers of national borders. This book explores the complex issues around the global impact of technology and technology governance in detail. Edited by a team of experts, this book is a valuable resource for understanding the critical role of technology assessment (TA) in addressing global challenges.

The book, at the beginning, acknowledges the fast-paced technological advancement and its far-reaching implications for society, the environment, and international relations. It argues that technology is no longer confined to individual countries but has become a global phenomenon, mandating a parallel shift in governance mechanisms, bringing out the need for a transnational approach to technology governance that transcends national boundaries

The structure of book is properly organized into three parts or volumes covering TA in a globalised world, Challenges of global TA and Global challenges and TA, with chapters in each part dedicated to a specific aspect of transnational technology governance. The contributors have dealt with diverse topics, including the relevance of TA in international governance, technological challenges, fundamental, ethical & societal considerations, TA for developing countries, regulatory frameworks, health issues, environmental implications, and the role of international organisations. This comprehensive coverage allows readers to gain an overall understanding of the challenges posed by globalised technology and the different strategies employed to address them. The chapters are coherently organised and well-structured, making it easy for readers to follow the arguments and concepts presented.

Part 1 deals with tracing TA activities internationally and clustering them for reflection according to the key identified areas of science, politics and public. It covers multilateral cooperation in TA to enhance the outcome and impact of strategies targeted towards global challenges.

Part 2 draws its basis from the interdependence of globalisation and technological change while discussing TA. It establishes a need for global awareness of the global character for the upcoming challenges of globalisation and responsibility for taking joint action on a global scale to overcome those challenges. The globalisation of science and technology affects people, and the need to address the relationship between public spheres and technology

has been established. Further, the relevance of TA in developing countries has been discussed taking examples from the developing country.

Part 3 discusses the major global challenges: climate change, biotechnology, artificial intelligence and the pandemic disease and the role of TA in dealing with them. It sheds light upon the applicability and effectiveness of models and frameworks of TA being applied in these fields of study.

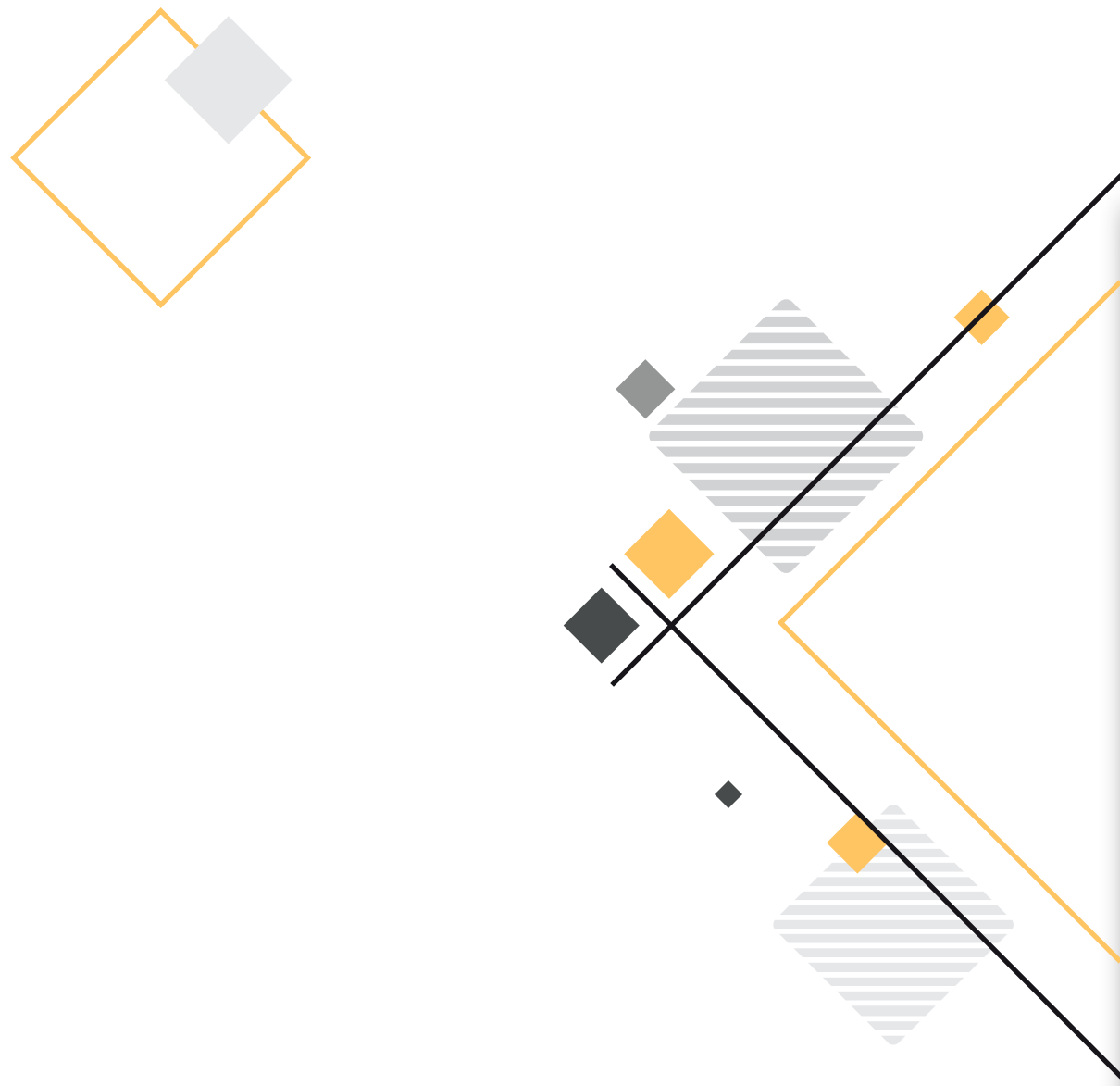
The outlook, while summarising establishes the need for global TA to resolve the global challenges, promote international development and regulate technologies. Further case studies from countries have been presented towards the end.

The chapters emphasise the importance of interdisciplinary collaboration and collaboration among nations and international organisations. The authors have acknowledged the diverse perspectives and interests and brought out the need for inclusive and participatory approaches to Technology Assessment. This emphasis on collaboration aligns with contemporary calls for responsible and inclusive technology development.

The focus on real-world case studies and practical examples is a notable strength of the book. The authors have examined specific instances of transnational technology governance from different regions and industries and provided concrete insights into the opportunities and limitations of existing approaches. This empirical approach utilising real-world examples has added depth and relevance to the theoretical discussions, making the content relatable to a broad audience, including scholars, policymakers, and practitioners.

While the book presents a comprehensive overview of the challenges and solutions related to transnational technology governance, the fast pace of technological change may become one potential limitation. Considering the rapid evolution of technology, a few aspects of the book may become outdated comparatively early. However, this remains a common challenge in the field of technology assessment, and the book's strength lies in its framework and principles for addressing transnational technology governance challenges.

Conclusively, the book "Technology Assessment in a Globalized World: Facing the Challenges of Transnational Technology Governance" is a good resource for scholars, practitioners and policymakers interested in technology and governance on a global scale. It gives an insightful exploration of the challenges presented by today's globalised technology and a roadmap for addressing these challenges along with tapping the opportunities buried in them.



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