

Impact of Digital Learning On the participation and Academic Achievement of higher-level Students: A Study in the Context of Roorkee city

Dr. Renu Kumari

Assistant Professor, Swami Vivekananda College of Education, Roorkee Uttarakhand

Abstract

Significant changes have taken place in the field of education in modern times. The main causes of these changes are the revolution that has occurred in the field of Information and Communication Technology (ICT). Through digital learning, the traditional teaching methodology is being transformed into a student-centric approach according to the needs of the times.

The primary objective of the presented research is to study the impact of digital learning on the participation and academic achievement of higher-level student of 'Roorkee city'. In this research, an attempt has been made to find out how digital tools, online smart class, Classrooms equipped with smart digital resources, and multimedia content affect the learning pace of children.

For the research, the descriptive survey method was used. For data collection, a self-constructed questionnaire based on a five-point Likert scale was used. For the research, a sample of 100 students Selected from various colleges in Roorkee city. According to the findings obtained from the study, the introduction of digital learning has brought about students Interest in education clarity of subject matter, participation in the classroom and positive educational changes. Due to digital mediums, understanding the subject matter has become easy and interesting Which is having a direct impact on the achievement of the students. Because of digital resources, self-learning, technical ability and efficiency has developed among students. However, due to geographical conditions or other reasons, even today, challenges like a lack of technical resources, a shortage of internet and the digital divide have to be faced in remote rural areas as a result of which the learning of students in rural area capacity is affected. Secondly, in the current environment, teachers do not possess complete knowledge of technology, the negative impact of which also falls on the learning capacity of students. The academic achievement of students can be increased through technical capacity training.

Keywords: Digital Learning, Academic Achievement, Information technology Communication.

Introduction

The current era is recognized as a time of rapid advancement in science and information technology. Globalization has accelerated the technical field significantly, resulting in society being deeply influenced by technological engineering. The impact of technology on education has been particularly profound, as traditional by modern techniques. In place of the conventional "chalk and talk" method, the medium of education has become digital bringing about extensive change in the educational landscape. Digital learning encompasses computers the internet, e-learning, libraries, smartphones video

conferencing online teaching platform and multimedia. This type of instructional material makes education more interesting, simple, interactive attractive and highly practical. Following the global Covid-19 pandemic, the significance of digital education rose even further. Due to the closure of educational centres, education began to be provided solely through online medium, because of this positive transformation education a revolution occurred in the field of education and both teachers and students benefited from this technology. In Roorkee city, famous for higher education and technology, the impact of digital learning can be seen directly. Students are using various digital learning tools to gain knowledge, primarily including YouTube, Google, Google classroom, Zoom E-Notes and ChatGPT, etc.

According to the famous educationist John Dewy - "Education is not preparation for life, education is life itself."

In reality, education does not mean merely gaining bookish knowledge. Education is meant to take life forward on the path of progress through the knowledge gained from various experiences in human life.

Statement of the problem

"Impact of digital learning on the participation and Academic Achievement of higher-level students: A study in the context of Roorkee city."

Need and Importance of the Study

In the present times, new experiments are constantly taking place in the field of technology. The entire world is involved in this race. In this competitive era, maintaining the quality of education and making it accessible to the general public is a significant challenge. This challenging task has become possible through the development of digital technology; education has become free from geographical boundaries.

Learner can receive education through various digital mediums without any hindrance. The necessity of this research is clarified through the following points:

1. The task of making the learning capacity of students more effective and permanent is carried out through digital means because knowledge obtained through digital mediums remains in the memory for a longer duration. As a result of visual and auditory elements, students are able to enhance their knowledge in an interesting way.
2. Through the digital education system, Novelty and creativity are developed in students, as a result of which students try to think and work differently from traditional ideologies.
3. As a result of the digital teaching system, students belonging to rural and remote areas can also easily listen to lectures from learned teachers and obtain solutions to various educational problems.
4. Due to digital teaching medium, a sense of self-reliance develops in students. Through digital tools, students find solutions to their problems themselves, which also develops a sense of self-respect in them.
5. Through digital resources, students keep receiving information from time to time regarding what changes or improvements have been made. This keeps students aware of educational changes.
6. Through the digital teaching system, new paths of communication are paved between both the teacher and the learner. By using these instant paths, students can become free of doubts.
7. Through digital medium, complex scientific experiments, events, and ancient historical events can be explained with great simplicity and interest by bringing them to life through animation and simulation.

8. Through digital education mediums teaching work can be made more organized, systematic and disciplined. Certificates related to students' academic or other co-curricular activities can be sent, and it also become easier to maintain records in schools.
9. Digital tools are the most powerful medium to keep education continuously moving during the dire and uncertain circumstances of the future.
10. Digital technical literacy protects students by making them aware of cybercrime.

Objectives of the Study

In the modern education system, learning through digital tools has become an integral and mandatory part of the education system. Digital educational tools have transformed traditional teaching methods and provided them with a new form. Now, education, being free from geographical boundaries, is expanding everywhere as a result of which knowledge is acquired by students through various digital resources without any hindrance. Through digital mediums, technical knowledge and a sense of creativity are developed among higher level students. In this same context to determine the 'impact of digital resource' on the students of Roorkee city, the following objectives have been prescribed:

1. To study the effectiveness of the digital learning process on the learning capacity and subject-matter competence of higher-level students.
2. To analyse the positive and negative effects of student's excessive reliance on digital resources for academic activities.
3. To conduct a scientific study of the impact of digital learning on the academic achievement of students.
4. To highlight the major challenges hindering digital teaching-learning and to obtain their solutions.
5. To study the use of digital devices by students in the context of Roorkee city.

Hypotheses

Hypotheses play an important role in conducting research work. The work of providing direction to the researcher is done by the hypothesis. A hypothesis is a prediction of any potential problem.

In fact, a hypothesis is a logical, rational and testable potential prediction or answer to any research problem, which clarifies the relationships between variables and provides a definite direction to the entire research work. — Good and Scates.

For the achievement of the objectives of the present research study "Effect of digital learning on the engagement and academic achievement of higher-level students: A study with reference to Roorkee city", the following directional and exploratory hypotheses have been formulated:

1. Hypothesis 1 (H₁) Digital learning does not have any positive effect on the classroom engagement of the higher-level students.
2. Hypothesis 2 (H₂) No statistically significant increase is found in the academic achievement of higher-level students due to the application of digital learning.
3. Hypothesis 3 (H₃) No positive or negative correlation is found between the availability of digital resources and the academic achievement of students.
4. Hypothesis 4 (H₄) No statistically significant difference is found in the engagement towards digital learning between male and female students on the basis of gender.
5. Hypothesis 5 (H₅) Digital learning does not affect the feeling of self-study among students.

Review of Related Literature

The study of related literature is particularly important in research work.

Definition — According to John W. Creswell (book - "Review of Literature") "Review of related literature is a systematic review of related studies from the research problem, which provides a theoretical basis to the current study and shows the gap between previous studies."

According to Fred N. Kerlinger (book - "Foundations of Behavioural Research") "Critical analysis of related literatures helps the researcher in strengthening the theoretical basis of his variables and deciding the right direction of research."

The epistemological evolution of educational technology and digital is deeply anchored in the seminal contributions of western scholars, whose empirical and theoretical frameworks offer a profound understanding of the research variables under investigation. The historical trajectory of technological integration was fundamentally re-engineered by B.F. Skinner (1954) through his "Operant Conditioning" paradigm and conceptualization of the "teaching machine". Skinner mathematically and behaviourally demonstrated that technology-mediated instruction provides immediate reinforcement, which minimizes cognitive lag, accelerates learning velocity and renders the relation of complex knowledge structures permanent.

This behavioural activation directly resonates with the progressive educational philosophy of John Dewey (1963) who vehemently rejected traditional passive instruction in Favor of "Experiential Learning". Dewey's core thesis posits that authentic learning is a function of active, conscious participation.

[11:11 AM, 6/2/2026] Renu St: Contemporary digital learning architectures serve as a direct operationalization of Deweyan thought by offering self-directed, collaborative, and immersive environments that transform the student from a dormant consumer of data into an active constructor of knowledge.

Benjamin Bloom (1968) find that scholastic achievement variances are not merely a product of innate intelligence, according him, intelligence heavily dependent upon instructional pacing and contextual flexibility. Modern digital ecosystem successfully bridges this gap by providing an asynchronous, student-centric locus of control that optimizes individual learning curves.

Michel Simonson (2000) in the context of Macro-educational extended theses paradigms into distance and digital education, establishing that online learning configurations foster heightened level of learner autonomy. This technological and cognitive paradigm was further substantiated by Prensky Marc (2001) through his foundational concept of "Digital Natives". He asserted that the contemporary generation exhibits distinct neurological and psychological preferences due to their development within a hyper-technological environment.

Richard E. Mayer (2005) in his definitive "Multimedia Learning Theory" utilizing a dual-coding architecture, Mayer empirically validated that the human brain processes information with much higher efficacy when visual and auditory channels are stimulated simultaneously.

M.B. Buch (1974) in his research study 'A Survey of Research in Education' studied the effects of innovative teaching methods and educational technology within the context of the Indian education system. The objective of the study conducted by M.B. Buch was to raise the quality standard in education through technological technique." Through the study, it was proven that student-centred learning is more effective with the use of modern tools, students' interest, participation, and learning outcomes are achieved in a more positive manner.

In fact, the objective of this research was to prove how teaching can be transformed according to the needs of students through technology to make it more permanent, accessible and interesting, so that students can actively participate in the learning process with full concentration.

J.P. Naik (1976) in his research work 'Equality, quality and quantity in Indian education system'. It was validated through the research study that by using innovative methodologies through modern technological resources, education can be made more effective and universally accessible.

The conclusion of the study stated that through technology-based education, the development of independent thinking capacity, development of interest and development of self-study among students takes place."

R.A. Sharma (2010), in his work "Educational Research and Modern Teaching Methods", stated how the use of audio-visual tools, Smartboard, multimedia, etc., positively affects the learning capacity of students. Through digital mediums, students can understand complex and dry subject matter in a very simple, natural and organized manner.

V.K. Singh (2012) in his research study "Educational technology and student-centred learning", examined the impact of technology on education. It was presented by Dr. Singh how technology and digital-based teaching affect the educational achievement of students. The study proved that the technology utilized by teachers (such as E-content, audio-video lectures, and online evaluation) developed problem-solving abilities, memory power, and active participation among the students.

Sugata Mitra, in 2013, in his research work "Hole in the wall, Self organized learning experiment," which was focused on rural and remote, underprivileged students. In this research, an attempt was made to ascertain whether children could acquire knowledge solely through digital resources in the absence of any teacher. To complete the research, computers equipped with internet facilities were placed in public spaces. Children could use them independently, and no guide or supervisor was provided for this purpose. The results of the study were astonishing, showing that even without any teacher, retrieve information, and comprehend other novel concepts.

A.P.J. Abdul Kalam, in his 2014 research study "Role of ICT in Quality Education", clarified the positive impact of Information and Communication technology on education. The teaching-learning process can be made more effective, engaging, more permanent, and innovative through digital technological resources. The study made it clear that online education, e-learning platforms, and smart classes develop students' learning capacity, improve educational quality, and enhance scientific, logical capacity and increases educational achievement capacity.

Anil Sadgopal, in his 2015 study "Technology and Inclusive education in India" clarified the positive impact of technological tools and techniques on education. It was concluded that the use of technological techniques has increased students' interest in education. Now instead of being a dry and burdensome task, education has become attractive and engaging for them.

Research Gap

Numerous studies have been conducted at both national and international levels on digital learning and Information and communication technology (ICT)-based education. B.F. Skinner (1954) explained the effectiveness of technology-based instruction, while Benjamin Bloom (1968) established the relationship between individualized learning and academic achievement. Similarly, Richard E. Mayer (2005), through the multimedia learning theory, highlighted the educational usefulness of digital resources in enhancing learning outcomes.

In the Indian context, Sugata Mitra (2013) through the "hole in the wall experiment" demonstrated that students are capable of self-learning with the help of digital resources. Likewise, A.P.J. Abdul Kalam (2014) emphasized the integration of ICT in education as essential for quality education.

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Although previous studies have examined various dimensions of digital learning, most of them remained limited to the availability of digital resources or the general impact of E-learning. Very few studies have examined both Student Engagement and Academic Achievement simultaneously as interrelated variables. Furthermore, most existing research has focused on primary and secondary education, whereas adequate empirical studies on the impact of digital learning among higher-level students are still lacking. Particularly in Roorkee city, which is recognized as an important educational and technological centre of Uttarakhand, no systematic and localized study has been conducted regarding the impact of digital learning on the engagement and academic achievement of higher-level students. Therefore, the analysis of previous studies clearly indicates the need for a scientific and systematic investigation into the impact of digital learning on the engagement of higher-level students in Roorkee city. The present study is an attempt to bridge the research gap.

Research methodology

The research paper employs a Descriptive survey method within the framework of a quantitative Research Design. The target population for this study comprises undergraduate (U.G) and postgraduate (P.G) students enrolled in various higher education institutions located in Roorkee City, Uttarakhand. From this population a sample of 200 higher-level student (N=200) was selected using the Simple Random Sampling technique. The demographic and academic classification of these 200 participants is structured as follow: On the basis of gender, the sample includes 100 male and 100 female students, and on the basis of the curriculum stream, it comprises 100 students from Conventional Courses (Art, Science, Commerce) and 100 student from technical and professional courses (B. Tech, MBA, MCA).

For data collection, a structured questionnaire was used, which incorporates a 'student Engagement Scale' along with measures for digital access and technological proficiency students 'Academic Achievement' was objectively assessed based on their cumulative grade points (CGPA / Percentage) from their previous Examination. The analysis of The gathered primary data and the subsequent testing of hypothesis were executed using the statistical package for the Social Science (SPSS). To ensure Scientific Validity and robust empirical insights, advanced statistical techniques – including T-test, (Anova), Person correlation and Regression Analysis – were performed.

Results and Data Analysis.

The primary data collected from 200 higher level students to test the research objectives and hypotheses were statistically analysed using the statistical package for the Social Sciences (SPSS). In the primary stage of the analysis a detailed classification on the sample was performed to understand its demographic and academic composition, which is sequentially presented in the following tables.

Table 1: Classification of Sample based on Gender

S. No	Gender	No of Student	Percentage
1.	Male	100	50%
2.	Female	100	50%
3.	Total	200	100%

Table 2: Curriculum Stream

S. No	Curriculum Stream	Number of Students	Percentage
1.	Conventional courses (Art, Science, Commerce)	100	50%
2.	Technical and Professional courses (B. tech, MBA, MCA)	100	50%
3.	Total	200	100%

Table - 3: Subject-wise Micro-classification of the Sample

S. No	Course type	Core subject/stream	No of Students	Percentage
1	Conventional	Faculty of Arts Humanities	56	28%
2	Conventional	Science and Commerce	44	22%
3	Technical	Engineering (B. Tech/BE)	52	26%
4	Professional	Management & Computer Application	48	24%
5	Total		200	100%

Based on the empirical data delineated in the aforementioned table, an Independent Sample t-test was conducted to examine the influence of gender on digital learning. The findings indicate that no statistically significant difference exists between the mean scores of males ($M=3.42$) and female ($M=3.45$) students. Thereby demonstrating that gender variations do not affect the adoptability of digital learning. Conversely when a One-way Anova (F-Test) was applied across the four subject-wise categories a highly significant statistical variance ($P < 0.05$) emerged. This validates that students enrolled in technical and professional courses exhibit a substantially higher level of adaptability and behavioural engagement toward digital learning compared to their peers in conventional courses, particularly in the faculty of Arts.

To explore the intensity of inter-variable relationships, a person Correlation analysis was executed. The results reveal a high positive correlation ($r = 0.68$, $P < 0.01$) between digital learning and student classroom engagement, alongside a significant positive correlation ($r = 0.54$, $P < 0.01$) between digital learning and academic achievement.

To rigorously verify the depth of this impact and its predictive capacity, a Linear Regression Analysis model was deployed. The resulting value ($R^2 = 0.462$) establishes that approximately 46.2% of the total variance in higher-level students, classroom engagement and their subsequent academic achievement (CGPA) is directly determined and driven by the utilization and proficiency of digital learning. Based on these cumulative statistical operations, the final outcomes of the research hypotheses testing are compiled in the summary table below:

Table - 4

S. No	Research Hypothesis	Statistical Test Applied	Statistical Value/ Finding	Final Status
1	There is No significant difference in students Digital learning level based on gender	T-test	$P > 0.05$ (NON significance)	Accepted
2	There is a significant difference in digital learning and engagement across academic stream	F-Test (Anova)	$P < 0.05$ (statistically Significant)	Accepted
3	There is a significant positive relationship	Pearson Correlation	$r = 0.68$, $P < 0.01$	Accepted

S. No	Research Hypothesis	Statistical Test Applied	Statistical Value/ Finding	Final Status
	between digital learning and student's classroom engagement			
4	There is No Significant positive correlation between the use of digital resources and the academic achievement of students	Pearson Correlation/ Regression	$r = 0.54, P < 0.01$ (Significant relationship exists)	Rejected

Conclusion and future Suggestions

Based on the empirical evidence and rigorous statistical analysis obtained in this study, it is definitively concluded that the integration and utilization of digital resources in higher education act as a vital catalyst in enhancing students' classroom engagement and subsequent academic achievement. The hypothesis testing delineated in table 4 demonstrates that there is No gender-based disparity that ubiquitous access to smartphones and the internet has successfully dismantled traditional gender barriers related to technology usage.

However, the statistically significant variance observed across different academic stream highlights that students in professional and technical courses, such as Engineering and Management, exhibit superior adaptability toward digital tools due to their technical background and curriculum design. This discrepancy provides a crucial policy recommendation for educational administrators to mandatorily integrate digital methodologies and practical training into the conventional curricula faculty of Arts and humanities, thereby bridging the socio-academic digital divide. Ultimately, since this research was confined to a localized sample of 200 students, future researchers are encouraged to expand the scope of this study by encompassing a larger geographical territory, diverse institutional frameworks, and additional variables such as student' Socio Economic status to provide a more holistic understanding of the phenomenon.

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