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Digital Classrooms and E-Learning Exploring the Attitudes of Teachers and Learners

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Abstract

The rapid progression of technology and the impact of the COVID-19 pandemic have significantly increased the importance of e-learning in the modern education system. This study examines the role, benefits, and challenges of e-learning in improving educational access and learning experiences. The study draws on findings from previous research as well as primary data collected from teachers and students. The results concluded that teachers and students generally demonstrate positive attitudes toward digital classrooms, particularly due to their flexibility, convenience, accessibility, and availability of learning resources. However, several challenges continue to affect the effective implementation of e-learning, including inadequate digital infrastructure, limited access to technological resources, insufficient training for educators, and reduced teacher-student interaction. The study also observes a gradual increase in secondary and higher-secondary enrollment ratios in recent years, indicating that the expansion of digital learning opportunities may have supported broader access to education. Despite its advantages, e-learning cannot completely replace traditional face-to-face education, particularly in areas requiring direct interaction, practical activities, and hands-on learning. The study concludes that successful and inclusive implementation of e-learning requires improved digital infrastructure, continuous professional development for educators, effective policy support and the development of interactive and engaging digital content. E-learning therefore holds significant potential for the future of education if its technological, pedagogical, and accessibility-related challenges are systematically addressed.

Key Words: Digital Education, Educational Technology and Digital Infrastructure

1. Introduction

Gurukul education, an ancient Indian system of learning, goes back to the Vedic period (1500 BCE– 500 BCE). The gurukul education system emphasis on the importance of the guru–shishya relationship, community living and holistic learning. While it has undergone modify over time, its principles remain relevant today. The Indian education system has evolved significantly undergone through history, moving from a tradition-based, principally religious system to a modern, secular one inclined by British rule and post-independence developments. The modern system was introduced during British rule, aimed to create a more standardized and English-medium education, which shortly evolved to incorporate various subjects and levels of study.

NEP (1986): - The 1986 National Policy on Education (NPE) aimed to provide democratic education in India that emphasized universal access and quality mainly for marginalized groups, and promoting a general education structure (10+2+3) with a focus on vocational education and improving the quality of higher education. NEP (2020): - Presently the National Education Policy (NEP) 2020 aims to transform India's education system. This recent policy aims to reform a new education system emphasizing holistic, multidisciplinary approach, flexible learning, early childhood education, and digital learning with more focus on foundational literacy and numeracy, technology integration and vocational education. The changing of the Indian education system from Gurukul to technology-enabled education is indicative of larger changes in society, economy and communication technology. Education is no longer limited to the classroom. With fast progress of information and communication technologies (ICT), widespread use of smartphones, internet access and digital education resources online. Digital classrooms have been a critical element of this change and the teachers can speak to the students, share learning material, assess them and even provide educational resources beyond the classroom.

The transition towards digital education was particularly dramatic during the COVID-19 pandemic when educational institutions across the world were forced to stop physical classroom teaching. Schools, colleges, and universities used online platforms to maintain education continuity. Teachers and learners quickly learned video-conferencing, learning management systems, digital libraries, recorded lectures, online assignments, and electronic assessment tools to be used in their daily lives in the context of the disruption that came with it. Yet also, it revealed a number of differences in digital access, technology knowledge, internet connection, available devices, and teachers and students' adaptability to the digital mode of education.

E-learning offers several advantages over traditional methods of teaching and learning. It allows for flexibility in time and location and allows for students to access educational materials according to their individual needs and learning pace. Recorded lectures, electronic books, online databases, educational videos, simulations and interactive learning platforms can provide students with an ever more comprehensive range of learning opportunities. Teachers can also use digital tools to convey complex concepts through multimedia content, organize online

assessments, measure student performance and connect students outside of regular classroom hours. Thus, digital classrooms have the potential to make education more flexible, accessible, resource-rich and learner-centered.

E-learning is not about whether we have digital technology. The attitudes and perceptions of teachers and learners are central to the success of digital learning environments and how effectively they are used. Teachers need knowledge of the subject, but also to develop digital pedagogical skills to create engaging online learning experiences. And learners need digital literacy, self-discipline, motivation and access to technology to be successful in online learning. A positive attitude towards e-learning can promote more participation and technology adoption, but technological anxiety, lack of training, poor connectivity, and preference for classroom interaction may limit its efficacy. The issue of accessibility is particularly important in the Indian context. Although digital infrastructure has grown in scope, socioeconomic disadvantage, geographical location, reliable internet connection, ownership of digital devices and digital literacy are still significant factors influencing students' education. Students in poor families might not be able to access smartphones, computers, reliable internet connections or good study environments. Likewise, teachers, who may not have experienced any of the latest technologies in education, must constantly be trained and supported to incorporate digital technology into their teaching skills. Digital education must not be seen simply as a technical change but rather as an educational change in infrastructure, education system, pedagogy, human resources, accessibility and the support of the institutions.

The National Education Policy (NEP) 2020 provides further impetus to the integration of technology into education. The policy acknowledges the importance of technology in education, teaching, learning, assessment, educational planning, and access to quality education. It encourages digital resources and technology-enabled learning which will help close the digital divide. The policy's vision of a flexible, multidisciplinary, inclusive, technology-enabled education system is particularly salient at this time for digital classrooms. In the end, the success of this vision depends on how teachers and learners understand, accept and use digital teaching.

A growing number of teachers and learners have begun to adopt e-learning, and yet there are still questions around their learning experiences and attitudes. If technology offers more flexibility and access to resources, it may also make the social interactions less real and difficult to maintain students' engagement. And lab work, field activities, demonstrations, practical training or close teacher supervision may not always be delivered with e-learning being the best way to teach a subject. Digital and face-to-face learning may be better for us to consider rather than simply substituting e-learning for traditional education. With this context, the views of teachers and students on e-learning are critical to understanding how e-learning will be viewed and used in future digital education. Teacher and learner attitudes on e-learning can also inform education policymakers and educational institutions to design appropriate training programmes, improve digital infrastructure, develop learner-friendly digital content, and formulate strategies for more

inclusive technology-enabled education. This is why in the present study we focus on the approach of teachers and the e-learning and the challenges and benefits of digital classrooms are more on the minds of the teachers and learners. The purpose of this study is to contribute to the ongoing debate on how technology can be integrated with traditional education models and practices to create an accessible, flexible, interactive, learner-centred educational culture in India and how it will be at the same time in its present and future education models as well as in the future.

1.1 E-learning

E-learning refers to the delivery of educational content through digital services like computers, tablets, and smart phones that enabling individuals to access any courses anytime, anywhere. It allows learners to learn at their own pace, and participate in a structured learning experience despite of their physical location that involves interactive elements like quizzes, videos, simulations, and discussing delivered through internet or a dedicated learning management system (LMS), virtual learning or distance education. Digital classrooms have transformed the traditional educational model and providing new opportunities for accessibility and innovation in pedagogy. However, the success of digital learning depends significantly on the attitudes of teachers and learners.

Today, e-learning systems are progressively more used at all levels of education and have several benefits (e.g., Zhang & Nunamaker, 2003, Concannon, Flynn & Campbell, 2005 and Liaw et al., 2007) including location flexibility, cost and time savings, collaborative learning environments, self-paced learning, better access to the instructors, and unlimited use of learning materials (Zhang & Nunamaker, 2003). Numerous studies in the literature revealed sound effects of e-learning (e.g. Ong & Lai, 2006, Liaw et al., 2007, Selim, 2007, Ozkan & Koseler, 2009, Lee, 2010, Fryer, Bovee & Nakao, 2014, Cakiroglu 2014 and Chou & Chen, 2016). However, as Cheng and Weng (2017) noted that success of E-learning classes is highly depends on the creation of highly-interactive environments and increasing teacher-student interaction in the class.

E-learning resources: -E-learning resources includes digital tools and materials that help students learn online like:

1. E-books: - Electronic versions of books.
2. E- journals: - Electronic versions of journals.
3. Databases: - online collection of information.
4. Website: - online learning resources that can include courses, videos and other content.

Digital classrooms

A Digital Classroom is a digital form of classroom in which one or more digital tools are used to teach and learn that includes Interactive Whiteboards or Flat Panels, Computers or Tablets,

Smart Class on Smart TVs and projectors. Here teachers use above mentioned equipment to deliver their lectures that mostly has preloaded learning content. Teachers can use that preloaded contents and operate through either touch or remote that also has functions of write, draw and erase on these smart class setups using digital pens.

Impact on the Digital Classroom: A drastic change of traditional classroom to digital classroom has includes benefits as follows:

1. **Effective Implementation:** -Addressing and understanding the attitudes of both teachers and learners are crucial for successful e-learning implementation.
2. **Personalized Learning:** - Teachers with positive attitudes are more expected to personalize learning experiences and control digital tools to meet individual student needs.
3. **Enhanced Engagement:** -Interactive and engaging e-learning platforms can foster student motivation and participation.
4. **Addressing Challenges:** - Providing adequate resources, training, and support for both teachers and students that can help address the challenges associated with e-learning and promote positive attitudes.

2. Reviews of Literature

The integration of digitalization has fundamentally evolved education from traditional classrooms to flexible digital classrooms that includes web-based tools, virtual learning environments, video conferencing and interactive software. The review of literature establishes that user attitude is one of the most decisive predictors of successful technology assimilation and digital transformation of institutions. (Kumar, R. K. 2023)

Flexibility vs. Isolation: Learners universally be grateful for self-paced progress, 24/7 accessibility and geographical flexibility offered by digital classrooms. However, numerous studies indicated a large percentage of learners/students still observe e-learning as less effective than traditional physical instruction due to diminished face to face real time interaction and team collaboration. (PREMILA, SEPTEMBER 2022)

Most global studies evaluating attitudes towards e-learning used TAM (Technology Acceptance Model) initially formulated by Davis (1989), or modified variations like- *TeLRA* (the *Test of e-Learning Related Attitudes*). These models conceive that a learners' attitude toward e-learning is mainly determined by two core perceptions: (Ayla Güllü 1, 30 November 2022)

1. **Perceived Usefulness (PU)**-The degree to which learners (teacher and student) believe on digital tools to improve teaching efficiency or academic performance.
2. **Perceived Ease of Use (PEOU)**: Whether the user feel to apply digital technology as user-friendly and accessible.

Favorable Yet Moderately Disposed Perceptions:The research literature generally shows that mostly teachers have moderately positive or favorable attitude toward e-learning, identifying potential to present customizable lesson formats, rich and innovative resource. **(Ericson Alieto, 2024)**

An explanatory mixed-method including attitude scale towards E-learning and semi-structured interview form and showed high level of students ‘attitude towards e-learning and concluded students who had prior e-learning experience, personal computers, home internet access, and studying in technical fields had a higher attitude towards e-learning. **(Sharma, July 2016)**

E-learning as a global platform: Revolutionized the entire education system by providing flexibility and easy access to lectures anywhere and anytime, especially it got more prominent after COVID-19 pandemic.(Khushbu kausar, 2023)

Assessment of Online engagement:Subsequently, the effects of self-efficacy on five dimensions of online engagement were assessed i.e. social, cognitive, collaborative, behavioral, and emotional. They have found positive student attitudes and digital literacy significantly contributed to self-efficacy that positively affected the engagement dimensions.(Seyum Getenet, 2024)

Blended learning courses and e-learning: The concept of blended learning courses and e-learning from student’s viewpoints have been surveyed through a questionnaire at English department from eight levels of undergraduate program in boys and girls colleges,Bisha university and found positive students’ perceptions and attitudes towards BL in terms of the three domains in the questionnaire.(Ja’ashan, 2015),(Rahul Chaudhary, 13 August 2026)

The Competence-Attitude Link:Multiple literaturesconcluded a significant correlation among a teacher’s prior computer experience and their enthusiasm to embrace digital tools. Teachers who have formal training in online teaching pedagogy showed a higher satisfaction levels. **(Kisanga, Sepetmber 2016)**

Demographic Nuances:Numerous studies concluded that student background matters. Potentially having a positive influence on the educational sector that may help the educational system to improve and influence the attitude of teachers that leads to applying a technology **(Parisa Aqdas Karimi, 2023)**

The following table highlights distinct attitudes and core social traits between teachers and students based on literature reviews:

Dimension	Teachers' Perspective	Students' Perspective
Key	Earlier technical proficiency and	Individual learning style, self-discipline

Determinant	institutional support.	and device access.
Primary Driver	Ease of grading, efficiency and instructional variety.	Flexibility, convenience and personalized pacing.
Common Complaint	Lack of direct student feedback and Increased prep time,	Digital fatigue, technical glitches, and reduced peer interaction.

Existing review literature provides strong baseline metrics regarding e-learning acceptance, however a clear gap remains in understanding how the intersection of teacher and learner attitudes encourage overall course quality. Previous study conclude that revolution of education is not possible by technology alone therefore to yield positive academic outcomes of digital classrooms, educational bodies must bridge the gap by matching improved ICT infrastructure with ongoing digital literacy training for teachers and learners **(Jaewon Jung¹, May 2024)**

3. Research Objectives

After reviewing all the selected literatures, this study includes the following objectives as shown below:

1. To analyze/ know the perception of teachers and learners regarding digital classrooms.
2. To explore the biggest challenge in the field e-learning process followed by recommendation to overcome those challenges.
3. To analyze the impact of electricity and computer accessibility on Enrollment ratio in all the stage of education in India.

4. Research Methodology

Research design: - This study adopts a mixed-methods approach combining both quantitative and qualitative data to explore the impact of digital classrooms on the teaching and learning experience. The research investigates teachers' and students' perceptions, challenges, and effectiveness of e-learning platforms.

Population sample: - The population includes school and college students as well as teachers engaged in digital learning. A sample of 300 students and 90 teachers was selected from various educational institutions using random sampling to ensure diversity and general ability.

Data collection methods: -

Primary data: - Collected through structured questionnaires for students and teachers, and semi-structured interviews with selected participants for in-depth understanding.

Secondary data: - Gathered from academic journals, reports, government publications, and articles related to digital education and e-learning.

Study sample size: -

Data has been collected by getting responses from 390 users and e-learning teachers/learners whereas a questionnaire has been sent to a large sample size of 555 responses e-learning teachers/learners.

Tools and instruments: -

1. Questionnaires included multiple-choice and likert scale questions to quantify opinions and experiences. The Interview guide was developed with open-ended questions to gather qualitative insights.
2. Quantitative data were analyzed using descriptive statistics (percentages, averages), visual tools like charts and graphs and Ordinary Least square model has also been used to analyze the impact of e-resources on enrollment ratio in India.

5. Data Analysis

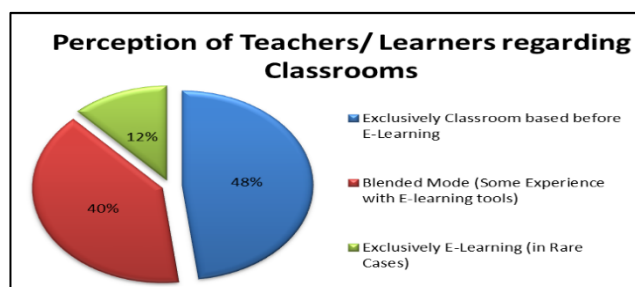
Researcher has got 390 responses including teacher, student and other learners also the descriptive profile of all the selected respondents has given in table no 1:

Table: 1- Descriptive Profile of selected respondents

Gender	Location	Education Qualification	Institution Level	Field of Teaching	Internet Access
Female -156	Rural 219	Intermediate 60	Government Degree College/ School 204	Art 48	Regular & Reliable Access 264
Male 234	Urban 108	Graduation 204	Private Colleges/School 111	Science 141	Intermittent Access 78
	Semi Urban 63	Post graduate 48	Aided College/ School 60	Commerce 141	Personal Access 48
		M.Phil and Doctorate 15	Autonomous Colleges/School	Professional courses 60	
		Diploma/Certification 63	University Department 15		

Source: Responses from Google Form

Objective 1: To analyses the perception of teachers/ learners regarding digital classrooms.

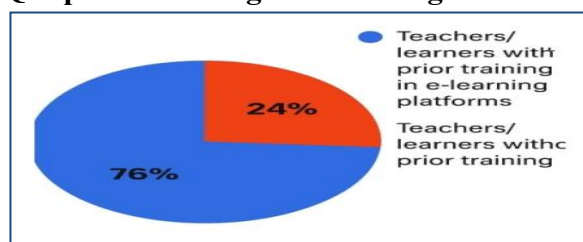


The data suggests that e-learning is becoming increasingly main stream, with a combined 88% having some or full engagement with it. However, there is still a need to address the gaps where digital learning is less accessible or adopted.

Figure: -1 - Mode of teaching/learning

Source: - As per data collection through Google form

Q- Special training in e-learning

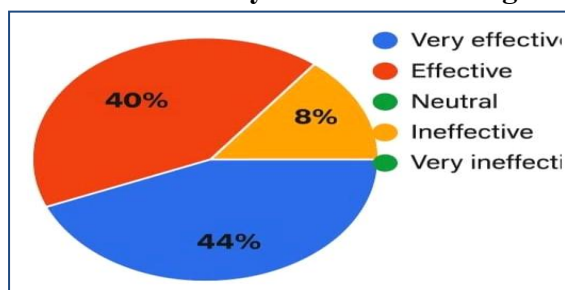


While most participants i.e. 76% are equipped with the necessary skills for e-learning, there is still a notable portion that might benefit from targeted training programs. Addressing this gap can improve the overall effectiveness and inclusivity of e-learning environments.

Figure: -2 Special training in e-learning

Source: - As per data collection through Google form

Q: How effective do you find e -learning in improving your understanding of subjects?

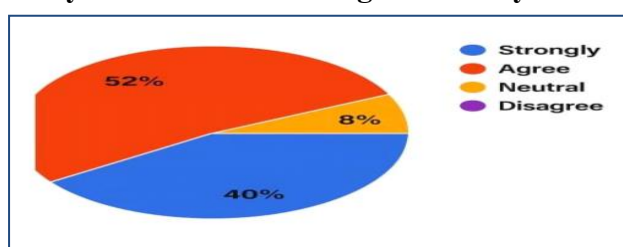


This data represents participants' perception of how effective e-learning is in enhancing their understanding of academic subjects collected via a Google form. This indicates a strongly positive response and suggests that nearly the half (44%) participant's feel e-learning significantly aids their understanding.

Figure: -3 Effectiveness of E-Learning

Source: - As per data collection by Google form

Q. Do you believe e- learning enhances your academic performance?

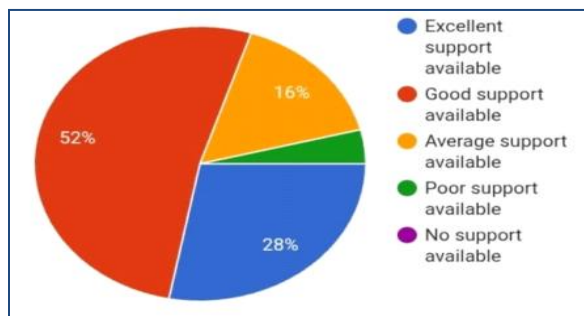


This survey question explores students believe in e-learning enhance their academic via a Google form. This indicates that over half the students feels e-learning positively impacts their academic results.

Figure: -4 – Enhances academic performance

Source: - As per data collection through Google form.

Q. How do you perceive the availability of technical support for e-learning issues?

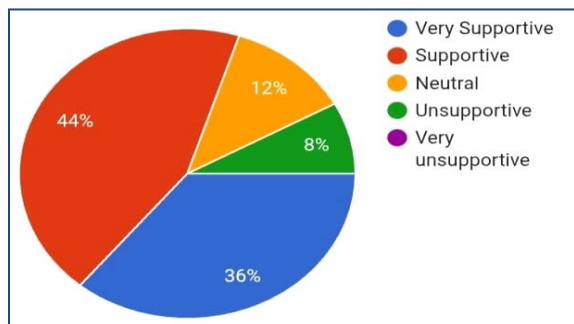


In this pie chart presents data collected on the support for e-learning study by students during e-learning focus on their responsiveness, knowledge and communication skills 52% responded strong assistance and 28% responded includes excellent support available like, email chats or phone and 16% responded average support available.

Figure:-5- Method of technical support for e-learning issues

Source: - As per data collection through Google form

Q. How do you perceive the role of instructors in e-learning environments?

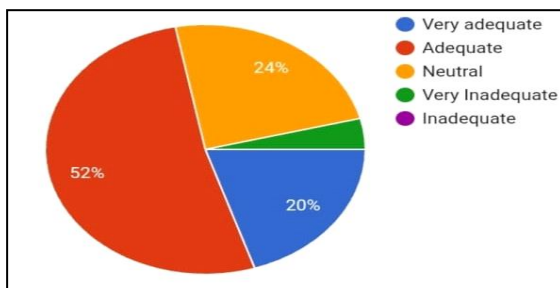


The data suggests e-learning as an instructor that guides, helping students navigate online learning platform and content. Here 44% responded understanding role of instructor in e-learning, 36% responded positive and enthusiastic support and 12% responded not supporting or helping either side in a conflict and 8% responded not providing encouragement.

Figure:- 6-- Role of instructors in e-learning

Source: - As per data collection through Google form

Q. How would you rate the adequacy of resources provided for online learning?



This survey questions explores the adequacy of resources provided for online learning can be rates as generally adequate, but room for improvement and 52% answered is enough for whom provided for online learning and 24% responded not supporting and 20% students highly adequate.

Figure:-7 – The adequacy of resources provided for online learning

Source:- As per my data collection

Q. What is your primary reason for using e-learning?

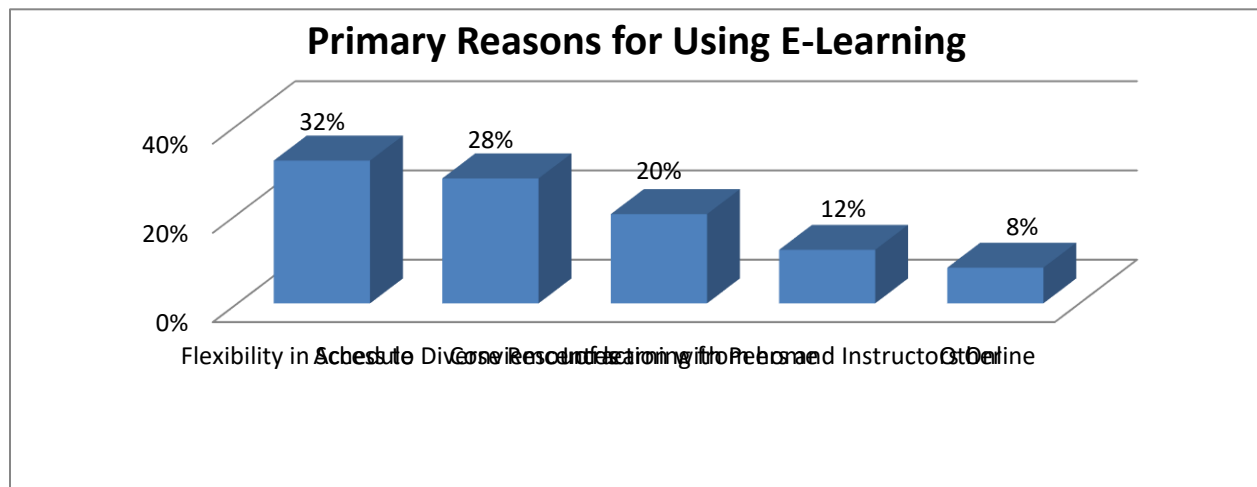
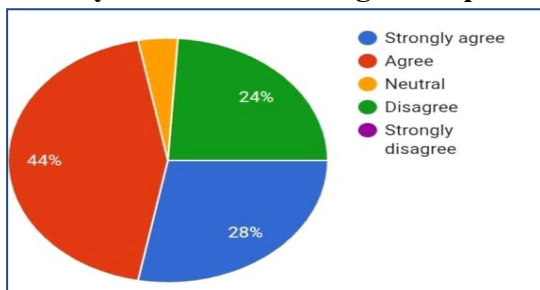


Figure: -8- Primary reason for using e-learning

Source: - As per data collection through Google form

This survey questions explores flexibility and convenience and 32% responded adjustability and 28% responded be entitled to resources and 20% responded convenience of learning to home, 12% students peer communication and 8% responded not using for e-learning.

Q. Do you think e-learning can replace traditional classrooms learning entirely?

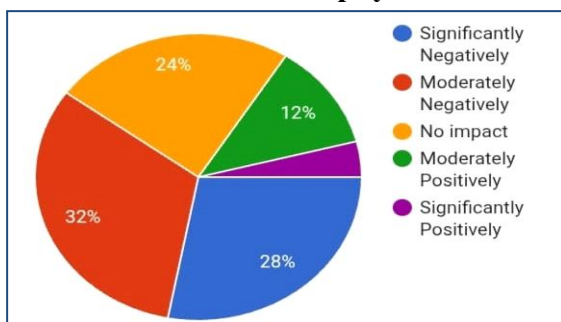


The responses show the diverse e-learning cannot entirely replace traditional classrooms learning while online learning offers flexibility and accessibility 44% responded are agree traditional classrooms learning entirely and 28% some responded definitely ,24% responded express a different opinion.

Figure: - 9 – Traditional classrooms learning entirely

Source: - As per data collection through Google form

Q. How does the lack of physical interaction affect your learning experience?

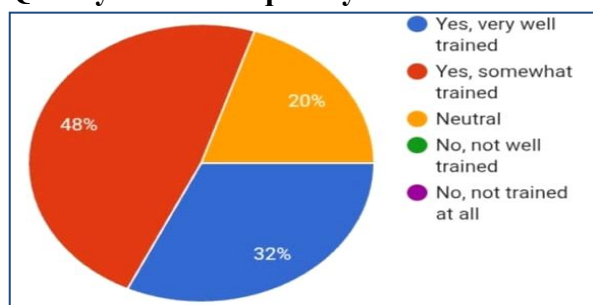


This pie chart shown as physical interaction affect your learning experience by reducing engagement , motivation and overall well-being and 32% responded somewhat negatively affect learning experience , 28% responded says to very poorly experience and 24% responded no effect learning experience and 12% participants feel learning experience somewhat positively.

Figure:-10 – Physical interaction affect your learning experience

Source: - As per data collection through Google form

Q. Do you feel adequately trained to use e-learning tools effectively?



The data collected through pie chart it has been shown that adequately trained to use e-learning tool effectively like, scenarios and produce to enhance understanding and retention , 48% responded yes , somewhat trained and 32% responded highly skilled tools effectively, 20% responded are unbiased.

Figure:-11- Use e-learning tools effectively

Source: - As per data collection through Google form

Q. What type of e-learning content do you find most beneficial?

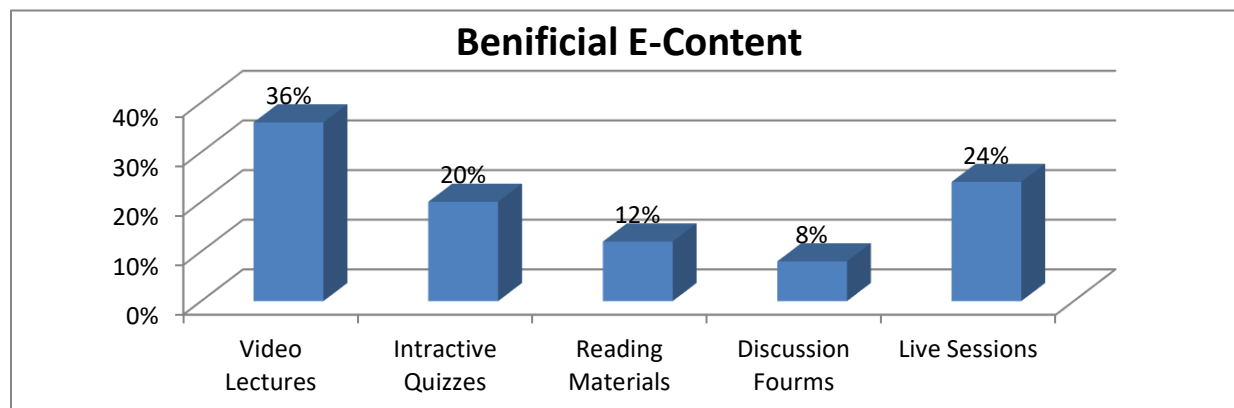


Figure: -12 –Most beneficial E-Learning content

Source: - As per data collection through Google form

The data collected through Google form related to e -learning content find most beneficial likes quizzes, case studies, games etc., 36% responded video lectures satisfy and 24% responded likes live sessions and somewhat 20% responded games-based learning quizzes and 12% participants reading materials and some 8% responded message bored, internet forum.

On the basis of responses on the perception of selected users, this study concludes that most of the users of E-learning are getting benefit in their learning, understanding the subjects and improvement in their academic performance by getting benefited from life session etc.

Objective 2:To explore the biggest challenge in the field of e-learning and to suggest improvements to overcome the challenges of e-learning.

Researchers have conducted a survey to know the biggest challenge faced by selected teachers and learners in the field of digital classrooms. The result of the survey has shown through different graphs and pie charts:

Q: What is the biggest challenge you face with e -learning?

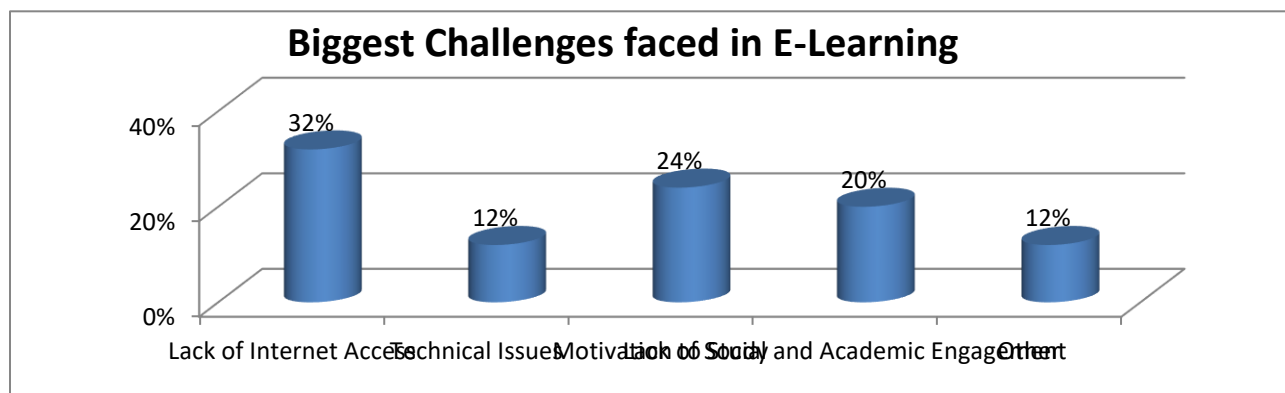
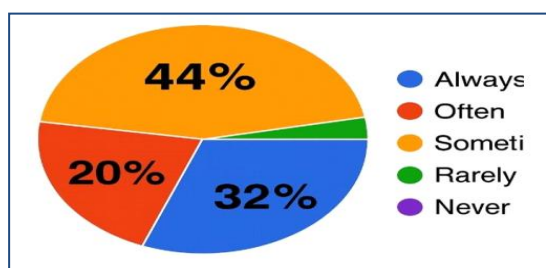


Figure:-13 - Biggest challenge face with e -learning

Source: - As per data collection through Google form.

This graph presents data collected on the key challenges faced by students during e -learning 32% Responded this is most significant challenge and 24% responded includes problem like ,device , software or unfamiliarity with online platform and 20% responded lack of social and academic engagement.

Q. How often do you encounter technical difficulties while using e -learning platforms?

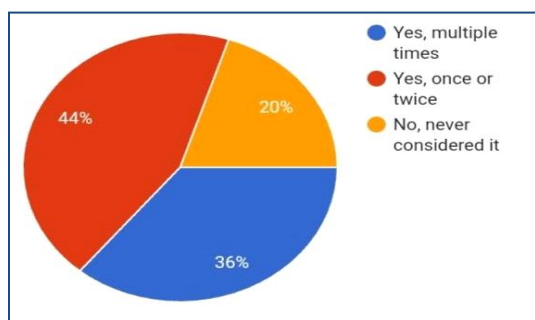


This pie chart reflects the majority of the participants 84% views e-learning as an effective method for understanding subjects that show a positive trend toward digital learning methods, suggesting that e-learning tools and platforms are largely meeting learners' needs.

Figure:-14 - Technical difficulties while using e -learning platforms

Source: - As per data collection through Google form.

Q. Have you ever considered dropping a course due to difficulties with online learning?



The interpretation of this data reveals a significant majority (80%) have contemplated dropping a course due to online learning difficulties, either occasionally or frequently. This highlights a widespread issue with online learning effectiveness and support, indicating a need for improved course design, engagement strategies, and learner support systems to retain students.

Figure:-15 - Dropping a course due to difficulties

Source: - As per data collection by Google Form

Q. What improvements would help overcome challenges in e -learning?

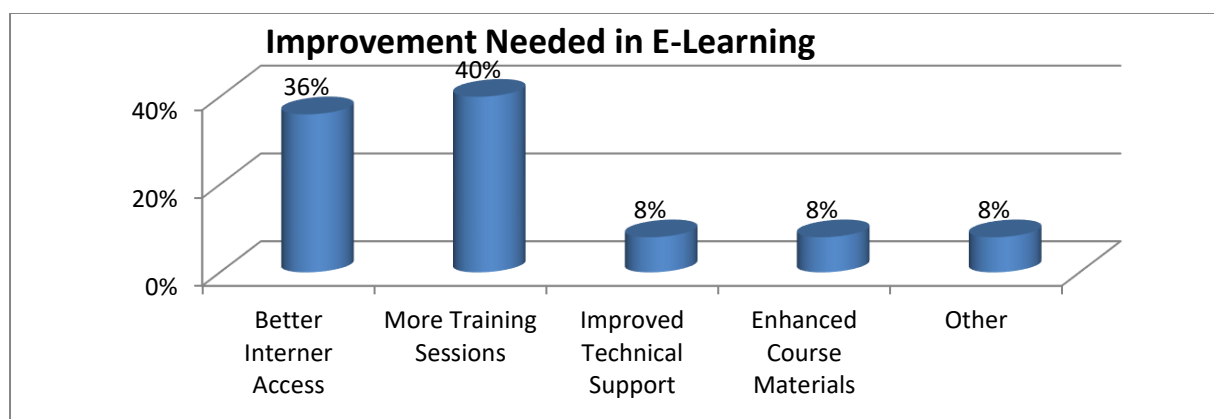


Figure:-16 –Way to overcome challenge in e-learning

Source: - As per data collection through Google form.

The figure 16 has identified the key areas where improvements can enhance e-learning experiences. In which the biggest challenge is the lack of training (40%), followed closely by internet access i.e. 36%. Therefore, efforts to improve e-learning should focus primarily on increasing training opportunities and enhancing internet infrastructure, with secondary attention to technical support.

Objective 3: To analysis the impact of available e-resources on the enrollment ratio in education field.

In order to analysis the impact of available resources on enrollment ratio, researcher has taken last 10 yeardata on providing electricity, computer and internet facility in schools/college and their gross enrollment ratio from primary to higher stage for the year 2015-16 to 2024-25 as shown below :

Table -2: E-Resources provided

Academic year	Functional Electricity (%)	Computer for pedagogical purpose (%) (%)	Internet Facility (%)
2014–15	55.96	26.42	8.05
2015–16	58.55	27.31	8.99
2016–17	60.81	28.24	9.46
2017–18	63.14	31.27	13.61
2018–19	73.86	34.52	18.73
2019–20	80.16	38.54	22.28
2020–21	83.92	41.25	24.51
2021–22	86.6	47.5	33.9
2022–23	89.5	47.7	49.7
2023–24	89.7	57.2	53.9
2024-25	92	64.7	63.5

Source: (UDISE) Unified District Information System for Education Plus) report

Table 2 is showing a clear improvement in infrastructure, particularly in electricity and digital tools. This suggests a stronger emphasis on integrating technology in education, which can enhance teaching and learning outcomes and high increment has been shown especially in last 2 years therefore it leads a strong indication towards digital engagement of teachers and learners as shown in figure 17 as well.

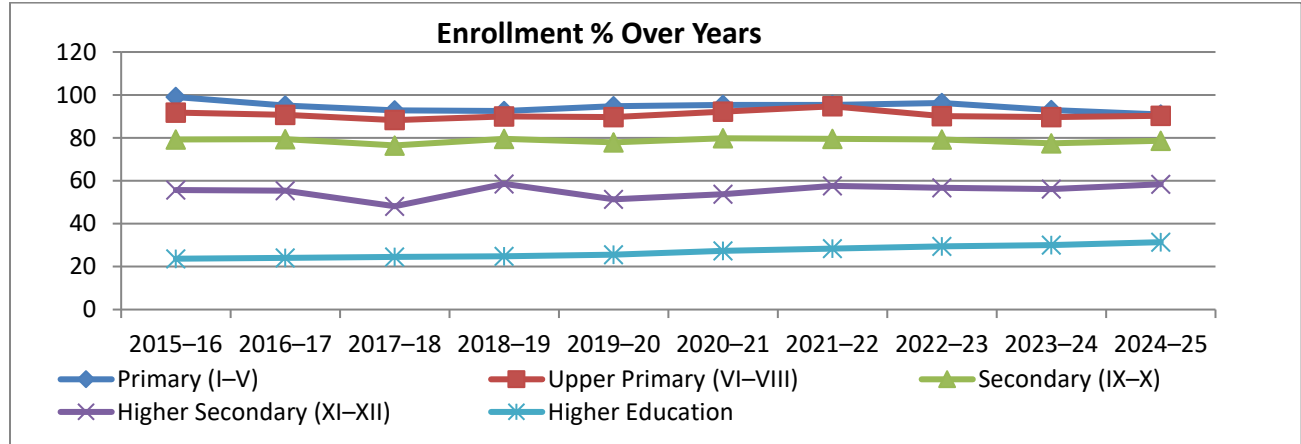


Figure 17: Gross Enrollment Ratio in Education sector

Source: AISHE Final reports, Ministry of Education

The enrollment rates at the primary and upper primary levels are very strong, indicating near-universal access. However, secondary level enrollment, while improving, still lags, suggesting possible dropouts or transition issues after primary and upper primary stages as shown in the above line graph.

6. Ordinary Least Square Model

Further, the impact of available e-resources on gross enrollment ratio at all level has been analyzed through Ordinary Least Square model for each education level i.e. from primary to higher education as shown in equation 1.

$$GER_t = \beta_0 + \beta_1 Electricity_1 + \beta_2 Computer_2 + \beta_3 Internet_3 + \varepsilon_t$$

Where: Y = Enrolment Ratio (GER), X_1 = Electricity availability X_2 = Computer availability X_3 = Internet availability

Based on the above equation, researcher have applied a regression model and concluded the results as shown in table3:

TABLE 3: OLS RESULTS

Education level	R ²	Adj. R ²	Electricity β	Computer β	Internet β	Overall model
Primary	0.899	0.856	+0.124	+0.004	-0.334	Significant

Upper Primary	0.525	0.321	+0.148	+0.202	−0.180	Not significant
Secondary	0.739	0.627	+0.143*	−0.019	−0.037	Significant
Higher Secondary	0.905	0.864	+0.240	+0.074	+0.028	Significant
Higher Education	0.976	0.962	−0.055	+0.239	+0.061	Significant

Interpretation:

1. Primary level: The model explains approximately 89.9% of the variation in GER. Functional electricity has a positive coefficient (+0.124), whereas internet has a negative coefficient (−0.334) after controlling for the other resources. However, neither individual resource coefficient is statistically significant at 5%. Therefore, the high R^2 should not be interpreted as evidence that digital resources caused changes in primary GER.

2. Upper-primary level: The explanatory power falls to 52.5%. Electricity and computers have positive coefficients, while internet has a negative coefficient, but none is statistically significant. Thus, the relationship between E-resources and upper-primary GER is comparatively weak in this specification.

3. Secondary level: The model explains 73.9% of GER variation, and functional electricity has a statistically significant positive coefficient of approximately 0.143. In other words, holding computer and internet availability constant, a 1-percentage-point increase in functional electricity availability is associated with about a 0.143 percentage-point increase in secondary GER.

4. Higher-secondary level: The model has a very high R^2 of 0.905. All three coefficients are positive, although the individual coefficients are not statistically significant at the 5% level. This suggests that the combined expansion of educational infrastructure is strongly associated with the upward movement in higher-secondary GER.

5. Higher education: The model gives $R^2 = 0.976$, meaning that 97.6% of the variation in higher-education GER is statistically explained by the three resource variables in this small-sample model. Computer availability has the largest positive coefficient (+0.239), followed by internet (+0.061), while electricity is slightly negative (−0.055). The computer coefficient is significant at about the 10% level, but not at 5%.

7. Finding

As per the survey of perception of Teachers and Learners, researcher has been found 80% of students convenient with digital classrooms while 65% of teachers expressed positive attitudes towards E-learning and teachers aged below 40 showed more adaptability to E-learning tools.

Educational resources have a strong positive association with enrolment, particularly at the secondary, higher-secondary and higher-education levels. Digital resources become increasingly important at higher levels of education, particularly computers and internet facilities. The findings suggest that improvement in physical and digital educational infrastructure is accompanied by greater educational participation. The particularly strong results in the last few years indicate increasing digitalization of the education system, which may support greater engagement of learners and teachers. However, the results represent statistical associations rather than causal impacts, because GER is also influenced by income, demographic factors, accessibility, teachers, government schemes and other socioeconomic conditions. Overall, the analysis supports the view that strengthening educational infrastructure—especially electricity and digital resources—can play an important role in improving enrolment and educational participation.

8. Conclusion

This study highlights the growing significance of e-learning in the modern education system, especially following the COVID-19 pandemic. E-learning has emerged as a flexible, accessible, and cost-effective alternative to traditional learning, offering interactive and engaging learning experiences through digital platforms. The findings from various research papers and the primary data collected reveal that both teachers and students generally hold positive attitudes toward digital classrooms, appreciating their convenience and resource availability. However, challenges such as lack of digital infrastructure, insufficient training for educators and limited student-teacher interaction still persist. The analysis also shows a steady rise in secondary and higher secondary enrollment ratios over recent years, suggesting that the availability of digital learning options may have contributed to improve educational access. Despite its benefits, e-learning cannot completely replace face-to-face learning, particularly in areas that rely heavily on interaction and hands-on experience. To make e-learning more effective and inclusive, it's essential to invest in better digital infrastructure, training programs for educators, and development of more engaging and interactive content. In conclusion, while e-learning presents a promising future for education, addressing its challenges through strategic planning, policy support, and technological advancement is crucial to ensure its long-term success and acceptance.

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