

Role of Technology in Improvement of Education

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Abstract

Technology has fundamentally transformed the way students learn and teachers teach in contemporary education systems. Beyond traditional lecture-based instruction, students now engage with digital tools, multimedia content, and online platforms that facilitate differentiated understanding of academic concepts [1]. These resources empower learners to explore information autonomously and progress at individually appropriate paces [2]. For educators, technology streamlines pedagogical tasks including assessment, feedback delivery, and record maintenance, thereby enhancing instructional efficiency [3]. However, persistent challenges including inequitable device and internet access, coupled with varying levels of digital competency among educators, impede universal benefit [4]. This study examines technology's contribution to educational improvement and identifies challenges requiring systematic resolution for effective and safe implementation [5].

Keywords

Educational Technology, Digital Learning, ICT in Education, Student-Centered Learning, Learning Outcomes, Online Learning, Smart Classrooms, Personalized Learning, Digital Divide, Teacher Training, E-learning, Technology Accessibility, Blended Learning, Digital Literacy, Technology Integration.

1. Introduction

The educational landscape has undergone remarkable changes with technology becoming deeply embedded in daily academic activities [1]. Students no longer rely solely on physical textbooks or chalkboard teaching; instead they interact with digital content through computers, tablets, and smartphones [6]. Classrooms now feature multimedia presentations, educational videos, and interactive software that make complex topics easier to grasp [2]. These resources empower learners to control their study pace, repeat challenging sections, and delve deeper into areas of interest without depending entirely on teacher explanations [7].

For teaching professionals, technology serves as a valuable assistant that reduces manual workload [3]. Lesson planning becomes faster when digital resources are available, sharing materials with students happens instantly through learning management systems, and tracking individual progress becomes more systematic [8]. Online platforms enable continuous communication between teachers and students beyond school hours, allowing quick clarification of doubts and timely submission of assignments [9]. This efficiency gives educators more time to focus on mentoring rather than paperwork [10].

Beyond school boundaries, technology has opened new avenues for learning through virtual classrooms and digital libraries [4]. Students from remote locations can now access quality educational content previously unavailable to them [11]. Online discussion forums encourage exchange of ideas among learners from different backgrounds, building confidence and broadening perspectives [5]. However, challenges persist regarding equal access to technology, as many students lack reliable internet connections or adequate devices [12]. Some learners find digital environments distracting without proper guidance, and teachers often need additional training to use technological tools effectively [13]. This study investigates both the positive contributions and existing obstacles related to technology in education [14].

2. Motivation for the Research

Several factors prompted this investigation into technology's role in education. The rapid expansion of digital tools within academic settings over the past decade has fundamentally altered classroom dynamics [1]. What was once considered supplementary has now become central to how lessons are delivered and received [2]. This shift raises important questions about whether these changes genuinely benefit learners or simply represent technological trends [3].

Another driving force behind this research stems from conversations with fellow students who shared mixed experiences with online learning platforms. Some described how educational apps helped them grasp difficult concepts quickly, while others expressed frustration with technical glitches and confusing interfaces [4]. These contrasting accounts suggested that technology's effectiveness might depend heavily on how it is introduced and supported [5].

The gap between technology availability and actual usage also captured our attention. Many institutions have invested significantly in smart classrooms, software licenses, and device procurement [6]. Yet observations reveal that such resources sometimes remain underutilized or used in ways that do not fully leverage their potential [7]. This disconnect between investment and outcomes deserves closer examination [8].

Personal observations during the transition to online learning further shaped this research direction. Some classmates adapted quickly to digital platforms, finding new ways to collaborate and learn [9]. Others struggled with basic tasks like submitting assignments or participating in discussion forums [10]. These differences highlighted how individual comfort levels with technology can influence academic success [11].

Additionally, discussions with teachers revealed their perspectives on digital tools. Many appreciated the convenience of automated grading and online resource sharing [12]. However several mentioned feeling overwhelmed by the constant need to learn new applications and troubleshoot technical problems [13]. Their experiences pointed to the importance of adequate training and support systems [14].

Finally, the absence of age-based comparisons in existing literature motivated this study's approach. Most available research focuses on younger students or higher education separately [15]. Examining how different generations experience educational technology could reveal patterns that inform better implementation strategies across all levels [1].

3. Justification

Although many people assume technology automatically improves education, actual experiences vary greatly across different settings [10]. Digital tools and online platforms have become widespread, yet numerous students and teachers continue facing difficulties using them properly [11]. This gap between expected benefits and everyday realities makes it necessary to carefully examine current situations [12].

This research matters because it investigates whether available technology genuinely helps learning or simply exists without being used effectively [13]. Educational institutions frequently introduce digital resources without providing adequate training, ensuring reliable internet access, or supplying enough devices for all students [14]. As a result technology often fails to bring expected improvements in student performance or classroom engagement [1]. Studying these issues can reveal specific areas where changes are needed [2].

The study also addresses urgent concerns because education systems are moving rapidly toward digital approaches, especially following the pandemic period [3]. Without solving problems related to connectivity, device availability, and digital skills, many students may continue struggling academically [4]. Understanding these difficulties will help policymakers and school administrators create better plans, provide meaningful training, and ensure technology reaches everyone fairly [5].

Most importantly this research captures experiences of students and teachers using technology daily [6]. Their perspectives and challenges can guide future improvements so that technology becomes not just available but genuinely useful [7]. Therefore this study contributes to building more supportive and effective educational environments for all learners [8].

4. Research Objectives

1. To examine various technological tools used in classrooms and understand how they help students learn better [9].
 2. To analyze how digital applications assist teachers in delivering lessons, organizing coursework, and supporting individual student needs [10].
 3. To explore the extent to which technology enables personalized learning experiences tailored to individual student capabilities [11].
 4. To identify obstacles faced by both educators and learners when incorporating technology into academic activities [12].
 5. To propose practical recommendations for educational institutions to implement technology more effectively and equitably [13].
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5. Literature Review

5.1 Theoretical Understanding of Technology in Education

Educational researchers have long recognized that technology fundamentally changes how teaching and learning occur [1]. The shift from teacher-dominated classrooms to environments where students actively engage with content represents a major transformation supported by digital tools [2]. Theoretical perspectives such as constructivism explain that learners build knowledge through interaction and experience, which aligns well with collaborative technologies [3]. Connectivism theory further suggests that learning happens through networks and connections, making digital platforms particularly relevant for modern education [4].

Recent scholarly work has expanded these frameworks to include emerging technologies like artificial intelligence [14]. The Intelligent-TPACK framework now includes specific knowledge areas related to teaching about AI and using AI for professional development [14]. This framework emphasizes that educators need understanding of both technical and ethical aspects of AI to integrate it responsibly into their teaching practice [14].

5.2 Effects of Technology on Learning Achievement

Multiple research studies have examined how technology influences academic performance [2]. A comprehensive study involving over 300,000 students from more than 50 countries revealed complex relationships between attitudes toward technology and actual achievement levels [2]. Students who demonstrated positive engagement with digital tools tended to perform better in mathematics and science subjects, though researchers emphasized that individual, school, and national factors all play important roles [2].

Another analysis combining 13 different studies across eight countries found that artificial intelligence applications significantly benefit student learning [10]. Chatbots and generative AI tools showed particularly strong positive effects, while online learning and virtual reality also contributed moderately to improved outcomes [10]. Learning management systems demonstrated promising but more modest impacts on student achievement [10].

Research focusing on adaptive learning technologies indicates that while these tools can support personalized instruction, teachers' needs must receive careful attention [6]. When automated systems provide reliable assessments alongside opportunities for teacher intervention, educators feel more capable and connected with their students [6]. However current adaptive technologies sometimes limit these features, reducing teachers' sense of effectiveness [6].

5.3 Challenges Related to Digital Access

Despite documented benefits, research consistently highlights persistent problems with equal access to technology [4]. Studies examining digital divide issues reveal that students from low-income families face significant disadvantages in both device availability and internet connectivity [3]. One investigation found that 70% of economically disadvantaged students reported disengagement during remote learning due to lack of motivation and inadequate support [3]. Importantly, students with consistent technology access scored approximately 15% higher on standardized assessments, demonstrating technology's critical role in academic success [3].

Further research distinguishes between first-level divides involving physical access to devices and connectivity, and second-level divides related to digital skills and meaningful usage [8]. Underserved college students experience both types of disadvantages, affecting their ability to participate fully in online learning [8]. These findings led to recommendations for targeted interventions to promote digital equity [8].

5.4 Technology Integration Across Different Subjects

The extent of technology adoption varies considerably across academic disciplines [7]. Reviews of ICT use in social science education reveal slower integration compared to science and mathematics fields [7]. Most studies in social sciences focus on perceptions rather than introducing new digital tools or measuring performance changes [7]. These reviews identify both advantages and limitations of online learning while suggesting ways to improve technology incorporation in social science teaching [7].

Conversely, research on artificial intelligence in Indian higher education involving 200 participants showed that AI tools significantly increase student engagement, enable personalized learning, and improve administrative efficiency [5]. Automated grading systems, virtual classrooms, and AI-powered research assistance correlated with better academic performance [5]. However concerns emerged regarding data privacy, potential plagiarism, and psychological effects of excessive AI dependence, indicating the need for institutional policies and ethics guidelines [5].

5.5 Teacher Preparation and Ongoing Support

Technology substantially affects how teachers work by simplifying routine tasks, yet successful integration depends heavily on educator preparation [9]. Studies evaluating professional development programs demonstrate significant improvements in teacher competencies and classroom practices following well-designed training sessions [9]. Effective programs incorporate active learning, collaborative activities, and sustained support to enhance technology integration skills [9].

The i-TPACK framework emphasizes that teachers require more than basic technical knowledge [14]. Without understanding how to teach about AI concepts, educators cannot help students develop responsible technology habits [14]. Without using AI for their own professional growth, teachers struggle to keep pace with rapid technological changes [14]. Integrating ethical decision-making throughout training helps teachers recognize and address important considerations in their daily practice [14].

5.6 Personalized Learning Through Technology

Digital tools enable unprecedented customization of learning experiences [11]. Adaptive platforms analyze student performance and adjust content accordingly, offering additional practice where needed and advancing when mastery is demonstrated [11]. Teachers who recognize long-term benefits of such tools show greater willingness to invest time learning and implementing them [6]. However ongoing technical support and institutional encouragement remain essential for sustained use [6]. Teacher dashboards providing realtime student progress information support differentiated instruction, though interpreting this data requires new skills that many educators still need to develop [11].

5.7 Overall Research Implications

The collective evidence indicates that technology significantly enhances education when implemented with careful planning, equitable access, and continuous teacher support [1]. Digital tools improve engagement, enable personalized learning, and streamline teaching processes [13]. However researchers emphasize that responsible use, ongoing training, and strong policies are essential for maximizing benefits [15]. Technology integration requires strategic planning, involvement of all stakeholders, and sustained investment in both infrastructure and human development [14].

6. Identified Research Gaps

After examining numerous studies on educational technology, several underexplored areas become apparent. The majority of scholarly work emphasizes the benefits of digital tools in learning environments, often focusing on increased student involvement and better academic results [1]. What remains less documented is whether these advantages hold true across various types of classrooms with different resources and student populations [2]. This creates uncertainty when trying to apply research conclusions to real-world educational settings [3].

Access to technology presents another area needing deeper investigation. Many publications mention that certain groups of students lack proper devices or reliable internet connections [4]. However detailed examinations of exactly how these limitations affect learning outcomes are not commonly found in the literature [8]. Knowing simply that some learners do not have computers tells us little about the specific ways their education suffers or what interventions might help [3].

Personal experiences of users with particular digital platforms also warrant more attention. Current research tends to gather information through questionnaires that ask broad questions about technology habits [5]. While useful for identifying general patterns, this method fails to capture the specific frustrations students face when software crashes, instructions are unclear, or features do not work as expected [7]. Without understanding these concrete difficulties, efforts to improve support systems may miss their mark [6].

The move toward remote instruction during recent years introduced challenges that earlier research did not address [9]. Questions about how ongoing exposure to screens affects concentration, memory, and study approaches remain mostly unanswered [10]. Whether children, teenagers, and adults respond differently to extended periods of digital learning is another topic requiring more investigation through long-term studies [11].

Differences in technology impact across educational stages represent another gap. Existing work typically separates school-level studies from college-level research [12]. Comparative analyses that examine how the same digital tool performs with elementary students versus university attendees are rare [13]. Findings from such comparisons could help educators choose age-appropriate technologies [14].

Teacher viewpoints also receive less attention than they deserve in academic publications. While student opinions dominate the research landscape [15], the challenges instructors face when incorporating new tools into their teaching routines are documented less thoroughly [9]. Understanding what makes technology adoption difficult for educators is crucial for developing realistic implementation plans that work in actual classrooms [1].

This research aims to fill these gaps by collecting firsthand accounts from both learners and teachers about their daily encounters with educational technology. The results seek to add practical insights to existing knowledge and propose changes grounded in genuine user experiences [2].

7. Research Methodology

7.1 Research Design

This study employed a descriptive quantitative research design to examine the role of technology in educational improvement. The descriptive approach was selected because it allows researchers to observe and document existing conditions without manipulating any variables [1]. This design is particularly suitable for understanding current technology usage patterns, perceptions, and challenges exactly as they occur in real educational settings [2].

The research followed a survey-based strategy to collect numerical data that could be analyzed statistically to identify trends and relationships across different respondent groups [3].

7.2 Population and Sample

The target population for this study included students, teachers, and other individuals associated with educational institutions across school, college, and university levels. A total of **202 respondents** participated in the survey, providing their perspectives on technology use in education [4].

The sampling technique employed was convenience sampling, where participants were selected based on their accessibility and willingness to respond to the online questionnaire [5]. This method enabled efficient data collection while ensuring representation from diverse educational backgrounds and age groups.

The sample composition included:

- Students from school, college, and university levels
- Teachers working in various educational institutions
- Other individuals connected to the education sector

7.3 Data Collection Instrument

Primary data was gathered using a structured online questionnaire created through Google Forms [6]. The survey was distributed through social media platforms and messaging applications to reach a wide range of respondents.

Google Form Link: <https://forms.gle/j1UVtiCLD7TqR84RA>

The questionnaire consisted of ten close-ended questions covering the following areas:

- Respondent demographics (role and education level)
- Access to digital devices for learning
- Frequency of technology use
- Confidence levels with educational technology

- Perceived impact of technology on subject understanding
- Engagement levels with technology-enhanced learning
- Difficulties encountered while using technology
- Opinions on training requirements
- Overall assessment of technology's impact on education quality

The close-ended format ensured uniformity in responses and facilitated quantitative analysis [7].

7.4 Data Collection Procedure

Data collection took place over several months, with responses recorded between November 2025 and February 2026. The Google Form link was shared through WhatsApp groups, email lists, and social media posts. Participation was entirely voluntary, and all responses were anonymous to encourage honest feedback [8]. Responses were automatically recorded in Google Sheets, providing an organized dataset ready for analysis.

7.5 Data Analysis Methods

The collected data was exported from Google Sheets to Microsoft Excel for comprehensive analysis [9]. The following analytical techniques were applied:

Descriptive Statistics: Frequency counts and percentages were calculated for each question to understand the distribution of responses across different categories [10].

Cross-tabulation: Responses were analyzed by role (student, teacher, other) and education level to identify patterns and differences between groups [11].

Visual Representations: Bar charts and pie charts were created to visually present the findings and make patterns more accessible to readers [12].

7.6 Ethical Considerations

Several ethical measures were observed during this research:

- Participants were informed about the purpose of the study before responding
 - No personally identifiable information was collected
 - Participation was completely voluntary
 - Respondents could withdraw at any point before submitting the form
- Data was used solely for academic research purposes [13]

7.7 Limitations of the Methodology

The methodology has certain limitations that should be acknowledged. The convenience sampling approach may not produce results that generalize to all educational settings [14]. Self-reported data relies on respondents' honesty and accurate self-assessment, which may not always reflect actual behaviors [15]. The online nature of the survey may have excluded individuals without regular internet access, potentially skewing results toward more digitally

connected populations [4]. Despite these limitations, the methodology provides valuable insights into technology's role in education from the perspective of those directly involved in learning environments.

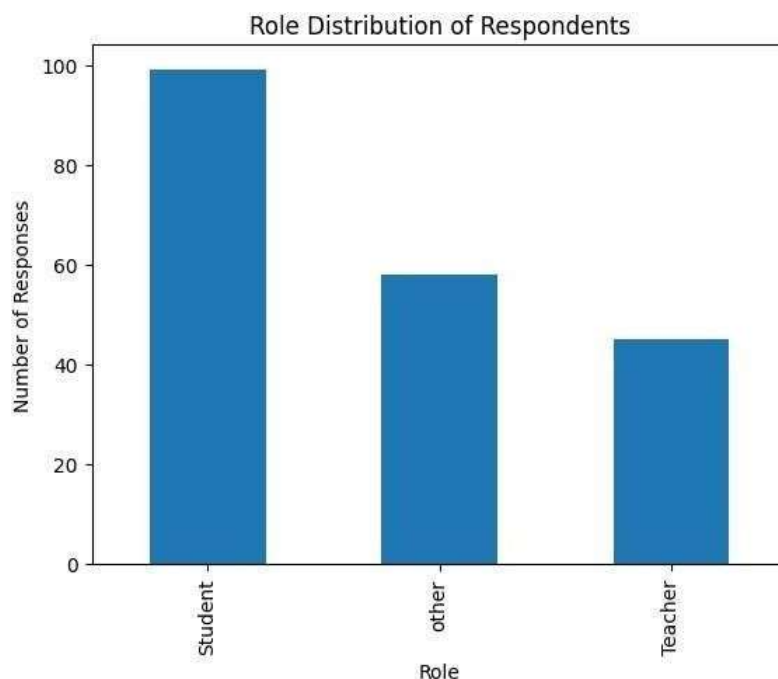
8. Data Analysis and Interpretation

1. Respondent Profile

The majority of responses were obtained from students, while teachers and other participants formed a smaller proportion.

Interpretation:

Since students represent the primary users of educational technology, their higher participation strengthens the reliability of the study in understanding learning-related outcomes rather than administrative perspectives.



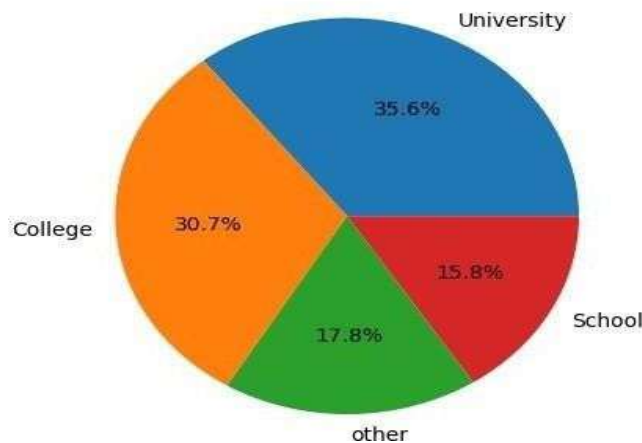
2. Education Level of Participants

Most participants belong to college and university levels, with fewer school-level respondents.

Interpretation:

Technology adoption appears more prominent in higher education environments, suggesting that advanced learning stages depend more heavily on digital platforms such as online lectures, digital notes, and e-resources.

Education Level Distribution

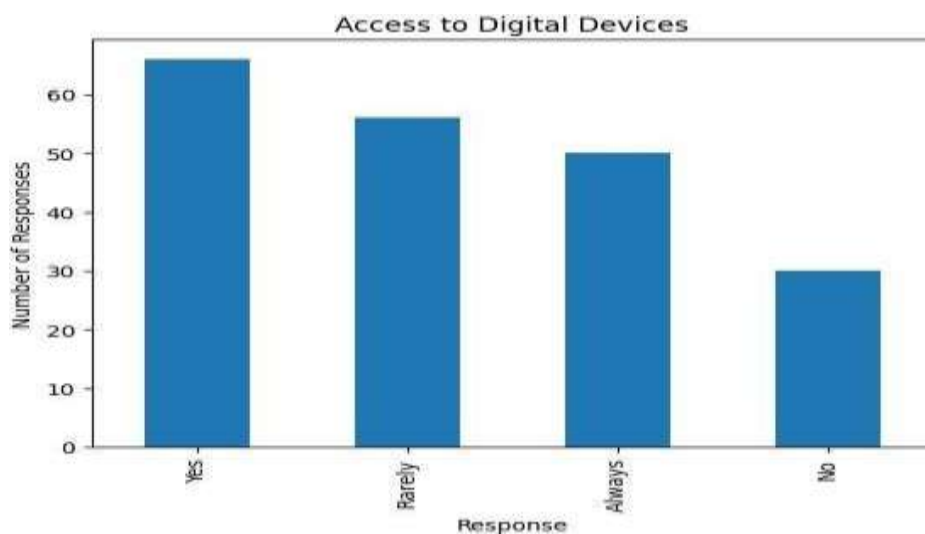


3. Availability of Digital Devices

A large proportion of respondents reported regular access to digital devices, while a smaller group indicated limited availability.

Interpretation:

Although technology is widely accessible, a noticeable minority still lacks consistent access. This indicates that infrastructure inequality continues to influence the effectiveness of digital learning.

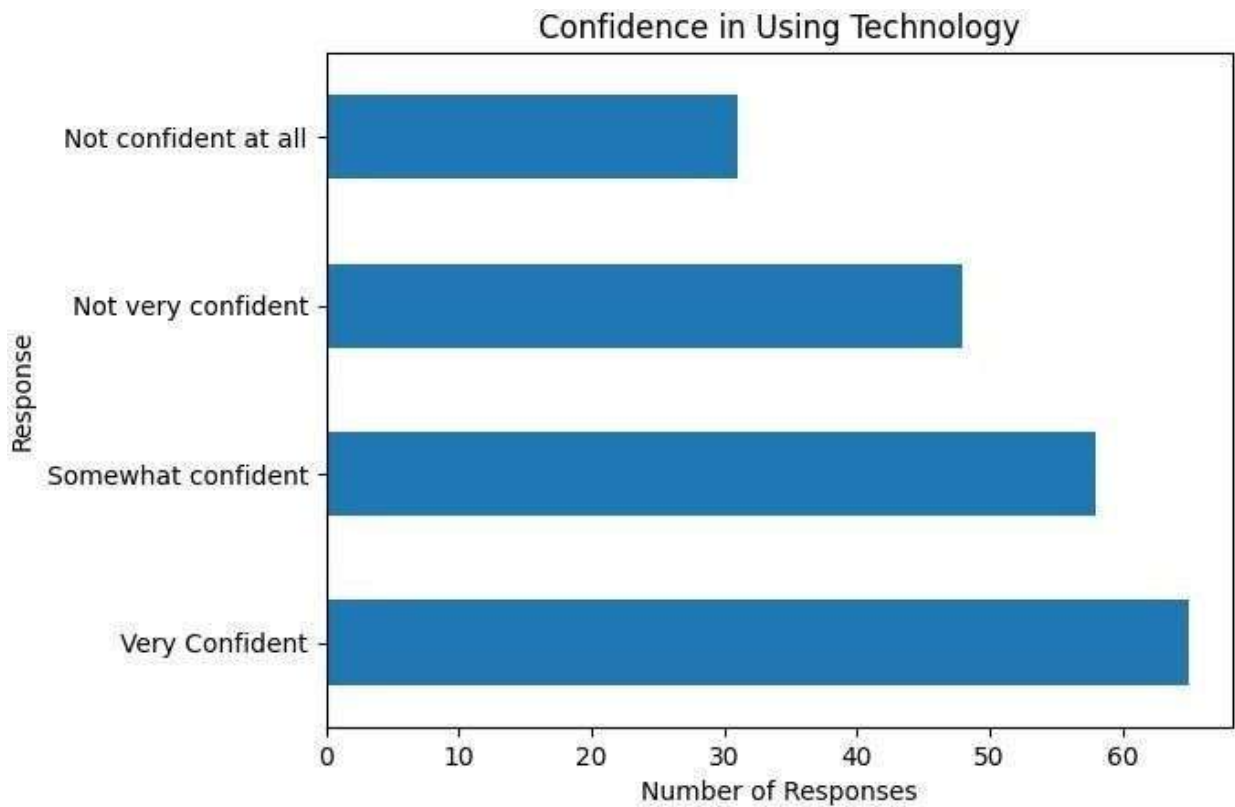


4. Confidence in Using Educational Technology

Most respondents expressed confidence, whereas a smaller segment reported difficulty in using technology.

Interpretation:

The findings suggest that familiarity with digital tools is generally high. However, the presence of less confident users highlights the importance of training programs to maximize educational benefits.

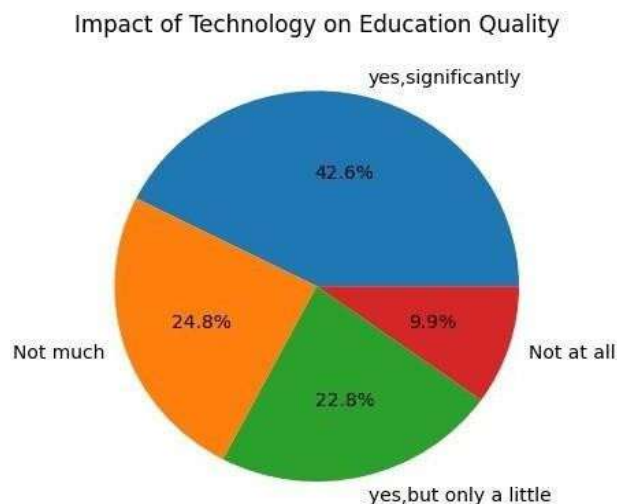


5. Perceived Impact on Education Quality

The majority believe that technology positively influences learning outcomes.

Interpretation:

Technology enhances learning flexibility, accessibility, and clarity of concepts. The strong positive perception confirms its role as a supportive educational tool rather than merely a supplementary resource.



6. Difficulties Encountered During Technology Use

The major challenges reported by respondents are summarized in below Table

Interpretation:

Distraction and technical issues were the most common barriers. This indicates that effectiveness of digital learning depends not only on availability but also on disciplined usage and stable infrastructure.

Difficulty Type	Percentage
Distraction	52%
Technical Issues	50.5%
Poor Internet	45.5%
Lack of Training	44.6%
No Difficulty	7.4%

Overall Analytical Insight

The combined interpretation of visual evidence suggests that technology has a significant positive role in education. However, its effectiveness is influenced by access inequality, digital skills, and behavioral factors such as distraction. Therefore, successful integration requires both infrastructure development and user training.

Recommendations for Educational Institutions

Invest in Reliable Infrastructure: Institutions should prioritize stable internet connections and maintain technical support systems to address the 45.5% of users facing connectivity issues and 50.5% experiencing technical problems [4].

Provide Comprehensive Training Programs: Given that 84.6% support more training, schools should implement ongoing digital literacy programs for both students and teachers [9].

Address the Distraction Challenge: With 52.0% reporting distraction from non-educational apps, institutions should teach focused technology use strategies and consider tools that minimize distractions during learning time [11].

Recommendations for Policymakers

Bridge the Access Gap: Policies should ensure that the 27% of students lacking regular device access receive necessary resources through subsidized programs or device lending initiatives [3].

Fund Technical Support: Allocate resources for technical staff who can maintain systems and assist users when problems arise [7].

Recommendations for Technology Developers

Design for Education: Create applications with fewer distractions and clearer educational focus [5].

Build Training into Platforms: Develop built-in tutorials and support features that help users build confidence and skills [12].

9. Discussion of Findings

9.1 Summary of Key Patterns

The survey results from 202 respondents reveal several important patterns about technology use in education. First, technology has become deeply embedded in daily learning routines, with 76.3% of respondents using digital tools at least weekly [4]. Second, most users perceive clear benefits, with 82.6% reporting improved subject understanding and 84.1% indicating overall positive impact on education quality [1]. Third, despite these benefits, challenges are widespread, with only 7.4% reporting no difficulties [4].

9.2 The Access and Confidence Divide

While 72.8% of respondents have regular device access, nearly 27% face limitations [4]. This access gap creates inequities in who can fully participate in technology-enhanced learning. Similarly, although 79.7% feel confident using technology, one-fifth lack confidence [9]. These divides suggest that benefits of educational technology are not uniformly distributed. Students with reliable access and higher confidence likely gain more from digital tools, potentially widening achievement gaps [3].

9.3 The Challenge of Distraction

The finding that 52.0% of respondents struggle with distraction from non-educational apps represents a significant concern [11]. Educational technology exists alongside entertainment and social media on the same devices, creating constant competition for attention. This aligns with broader research showing that digital environments can fragment focus and reduce sustained concentration [5].

9.4 Infrastructure and Technical Barriers

Poor internet connections (45.5%) and technical issues (50.5%) affect approximately half of respondents [4]. These infrastructure problems disrupt learning, cause frustration, and may discourage technology use altogether when they become too frequent [7].

9.5 The Training Imperative

Nearly 85% of respondents either affirmatively or tentatively support the need for more training [12]. Combined with the 44.6% who specifically identified lack of training as a difficulty, this finding strongly suggests that current preparation for technology use is inadequate [9].

10. Conclusion

This research examined the role of technology in improving education by gathering perspectives from 202 students, teachers, and other individuals involved in educational processes. The analysis yields several important conclusions.

Technology is Widely Used and Generally Valued

The findings confirm that technology has become a routine part of education for most participants, with 76.3% using digital tools at least weekly [4]. A strong majority perceive technology as beneficial, with 82.6% reporting improved subject understanding and 84.1% indicating overall positive impact on education quality [1].

Benefits are Accompanied by Significant Challenges

Despite positive perceptions, challenges are nearly universal. Only 7.4% of respondents reported experiencing no difficulties [4]. Distraction from non-educational apps affects 52.0% of users, technical issues affect 50.5%, and poor internet connectivity affects 45.5% [11].

Access and Confidence Gaps Persist

Approximately 27% of respondents face limitations in device access, and 20.3% lack confidence in using technology for educational tasks [4], [9]. These gaps create inequities in who can benefit from technology-enhanced learning.

Training is Widely Recognized as Necessary

Nearly 85% of respondents support the need for additional training in technology use [12], indicating that current preparation is insufficient [9].

In summary, technology plays a significantly beneficial role in education for most participants, but its effectiveness is constrained by infrastructure limitations, training gaps, and the challenge of distraction.

11. Future Scope of the Study

The following areas offer opportunities for extending this research:

Longitudinal Studies: Future research could track the same participants over several years to examine how technology's impact on learning evolves over time [2].

Regional Comparisons: Studies comparing technology use across different geographic areas and urban versus rural settings would help identify location-specific challenges and solutions [3].

Subject-Specific Research: Investigating how technology affects learning in particular subjects like mathematics, science, or languages could reveal which tools work best for different disciplines [7].

Age-Based Analysis: More detailed comparisons between school, college, and university learners would help tailor technology approaches to developmental stages [4].

Intervention Studies: Experimental research testing specific solutions for distraction, training gaps, and technical issues could identify effective strategies [9].

Emerging Technologies: Examining the educational potential of artificial intelligence, virtual reality, and gamified learning platforms represents an important direction [6].

Mental Health Focus: Deeper investigation into how educational technology use relates to screen time, digital fatigue, and student well-being is needed [11].

Teacher-Centered Research: Studies focusing exclusively on educator experiences with technology integration would inform better professional development programs [9].

Cross-Cultural Comparisons: Comparing technology adoption across different countries could reveal adaptable best practices [2].

Policy Evaluation: Research examining whether government and institutional investments in technology actually improve learning outcomes would guide future planning [3].

Accessibility Studies: Investigating how technology can better serve students with disabilities or special learning needs remains essential [14].

Replication with Larger Samples: Conducting similar research with more diverse and larger participant groups would strengthen the generalizability of findings [4].

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Appendix: Survey Questionnaire

The Google Form survey included the following ten questions:

1. **What is your role?**
 - Student
 - Teacher
 - Other
2. **What level of education are you currently part of?**
 - School
 - College
 - University
 - Other
3. **Do you have regular access to a digital device for learning?**

- Yes
- Always
- Rarely
- No

4. How often do you use technology for learning or teaching?

- Everyday
- A few times week
- Occasionally
- Almost never

5. Do you feel confident using technology for educational tasks?

- Very Confident
- Somewhat confident
- Not very confident
- Not confident at all

6. Has technology improved your understanding of the subjects?

- Yes a lot
- Yes to some extent
- Very little
- Not at all

7. Does technology make learning more engaging and interesting?

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

8. What major difficulties do you face while using technology in education? (Select all that apply)

- Poor internet connection
- Lack of devices

- Technical Issues
- Lack of training
- Distraction from non-educational apps
- None

9. Do you think teachers/students need more training to use technology effectively?

- Yes
- No
- maybe

10. Overall, do you feel technology has improved the quality of education for you?

- Yes, significantly
- Yes, but only a little
- Not much
- Not at all