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Examing Effectiveness of Technology Integration in Teaching and Learning

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Abstract

This study examines the integration of technology in education and its impact on academic performance in Kasenengwa District, focusing on both teachers and students. Utilizing a mixed-methods approach, data were collected through surveys and interviews, revealing critical insights into technology use in rural educational settings. The results indicated that approximately 30% of teachers utilize technology daily, while 40% use it weekly, demonstrating a moderate level of engagement with digital tools. Notably, 70% of teachers reported that technology enhances comprehension in subjects like mathematics and science, while 75% of students indicated improved engagement and understanding through technology-assisted learning.

However, significant disparities in access to technology outside the school environment were noted, with only 25% of students able to engage with digital resources consistently at home. This limited access raises concerns about equity in educational opportunities, as those lacking technology may experience hindered academic progress. The study identified key challenges, including a lack of resources (70% of teachers reported this), insufficient training (60%), and technical issues such as unreliable internet access (reported by 55% of participants). These barriers contribute to inconsistent technology use, limiting its potential benefits.

Despite these challenges, the research highlights opportunities for enhancing technology integration through community partnerships, increased funding, and targeted professional development programs. Approximately 80% of teachers expressed a need for more training on effectively using technology in their teaching practices. Participants also suggested improvements in infrastructure, with 85% of teachers requesting better internet access. The findings underscore the necessity of equitable technology access and ongoing support to maximize the benefits of digital tools in education. By addressing existing barriers, the educational experience in Kasenengwa District can be significantly improved, leading to enhanced academic performance and skill development among students in this rural setting.

Keywords: Technology Integration, Academic Performance, Teacher Training

1. Introduction

1.1 Background of the Study

The integration of technology into education is a globally acknowledged strategy for improving teaching methods and enhancing learning outcomes. Research underscores its potential to personalize learning, increase student engagement, and offer access to diverse resources (Bebell & O'Dwyer, 2010) [2]. In developed countries, advanced tools like interactive whiteboards and educational software have significantly boosted educational outcomes by providing inclusive and adaptable learning environments (OECD, 2018 [36]; Higgins, Xiao, & Katsipataki, 2012). Moreover, technology fosters critical thinking and problem-solving, essential skills in today's digital economy (Voogt *et al*., 2013) [49]. These tools enable educators to design interactive lessons using multimedia presentations, simulations, and virtual reality, making abstract concepts more accessible to students (Mayer, 2009).

Despite these benefits, integrating technology in education is challenging, particularly in developing regions. Schools in these areas often lack basic infrastructure, reliable internet access, and sufficient hardware to support digital learning (Trucano, 2012; Unwin, 2009). Additionally, there is often a shortage of educators trained to effectively incorporate technology into teaching practices (Hennessy *et al*., 2010) [23]. These challenges hinder the implementation of technology-driven education and

widen the digital divide. Addressing these barriers requires targeted investments, capacity-building programs, and collaborative efforts to provide equitable access to technological resources for all students.

In Zambia, the Ministry of Education has recognized the importance of integrating technology to prepare students for the future and improve learning outcomes (Ministry of Education, 2014) [31]. Government initiatives such as providing ICT equipment to schools and conducting teacher training aim to create a conducive environment for technology-enhanced education (Kafue, 2015). However, rural areas like Kasenengwa face unique challenges, including unreliable electricity, high internet costs, and limited access to digital tools (Mwale, 2014; Mwanza, 2012). These limitations put rural schools at a disadvantage compared to urban counterparts, potentially worsen educational inequalities.

Teachers' attitudes and readiness to use technology significantly influence its integration into classrooms. Educators' confidence and perceptions of technology's value affect their willingness to adopt digital tools in teaching (Ertmer *et al*., 2012). In rural areas, many teachers lack the training needed to effectively use technology, while the absence of culturally relevant content further limits its effectiveness (Mwale, 2014; Unwin, 2009). Addressing these issues requires ongoing professional development and the creation of digital content that aligns with local curricula and resonates with students' experiences (Mulenga & Kabombwe, 2019). Furthermore, involving parents and communities in discussions about the benefits of technology can foster a supportive environment for its adoption (Wong & Li, 2018) [52].

Zambia's success in integrating technology into education depends on addressing infrastructure challenges, enhancing teacher readiness, and developing relevant content. Establishing a comprehensive ICT policy for education and strengthening monitoring mechanisms can align efforts with national priorities (Voogt *et al*., 2013) [49]. Partnerships with government agencies, NGOs, and the private sector are essential to mobilize resources and expertise for technology-driven initiatives (Kong *et al*., 2014) [26]. This study investigates the barriers and opportunities for integrating technology in Kasenengwa district, aiming to provide strategies to enhance educational outcomes in rural Zambian schools.

1.2 Problem Statement

The integration of technology into education has the potential to enhance learning outcomes, but its implementation in rural areas like Kasenengwa district remains underexplored. Challenges such as inadequate infrastructure, limited access to digital resources, and insufficiently trained personnel hinder effective adoption (Hennessy *et al*., 2010 [23]; Mwale, 2014). While some schools possess ICT tools, their utilization in classrooms is often limited by factors like teacher confidence, attitudes toward technology, and alignment with the local curriculum (Ertmer *et al*., 2012). Moreover, the actual impact of technology on teaching and learning in Kasenengwa remains unclear, necessitating an assessment of how these tools are used and identifying barriers to their adoption.

A critical concern is the impact of technology on student learning outcomes, particularly in rural contexts. While technology can foster engagement and personalized learning, students in Kasenengwa may face challenges such as limited exposure to digital tools and lack of support at home, potentially limiting its effectiveness (Kong *et al*., 2014 [26]; Mwanza, 2012). Additionally, teacher training and professional development are vital for successful integration, as educators play a key role in leveraging technology to enhance classroom practices (Voogt *et al*., 2013) [49]. This study seeks to evaluate the effectiveness of technology integration in Kasenengwa, exploring challenges and providing actionable insights to improve educational practices and outcomes in rural areas.

1.3 General Objective

The general objective is to examine effectiveness of technology integration on teaching and learning in Kasenengwa District. While the specific objectives are as follows:

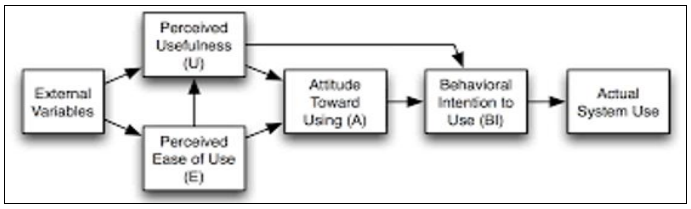
1. To evaluate the extent of technology, use by teachers and students in Kasenengwa district. ‘
2. To examine the impact of technology integration on students in Kasenengwa district.
3. To identify the key challenges and opportunities associated with technology integration in education within this rural context.

1.4 Research Question

The research question are as follows: To what extent is technology being utilized by teachers and students in Kasenengwa district? The second question in the series is what is the impact of technology integration on students' academic performance in Kasenengwa District? Finally, what challenges and opportunities are associated with the use of technology in teaching and learning in Kasenengwa District?

1.4.1 Conceptual Framework

This study highlights the significance of the Technology Acceptance Model (TAM) in understanding technology adoption in Kasenengwa District's educational settings. The findings reveal that both perceived usefulness and perceived ease of use are critical factors influencing technology integration. Teachers and students are more likely to adopt technology when they perceive it as beneficial for enhancing learning outcomes and engagement. However, the study also indicates that challenges such as limited resources, inadequate infrastructure, and a lack of training can hinder effective technology adoption. In rural areas like Kasenengwa, where exposure to advanced technology is limited, these barriers are particularly pronounced. To overcome these challenges, the study suggests that enhancing infrastructure, providing professional development programs, and addressing socio-economic and cultural factors are essential. By improving access to technology and offering continuous support, teachers' and students' perceptions of technology's usefulness and ease of use can be positively influenced, leading to more effective integration into educational practices. This study emphasizes the need for targeted interventions to address the specific challenges of rural areas to maximize the potential benefits of technology in education.



1.4.2 Theoretical Framework

The theoretical framework of this study is based on Constructivist Learning Theory, which emphasizes that learners construct knowledge actively through interaction with their environment, prior knowledge, and experiences. Jean Piaget (1954) [38] introduced core concepts like assimilation and accommodation, where learners incorporate new knowledge into existing frameworks or adjust these frameworks to accommodate new information. Lev Vygotsky (1978) [43] expanded this theory with his Zone of Proximal Development (ZPD), highlighting the importance of social interaction in bridging the gap between independent learning and tasks achievable with guidance. These principles stress the significance of supportive and interactive learning environments in promoting cognitive growth.

Technology integration in education aligns well with constructivist principles, facilitating both individual and collaborative learning. Educational software and simulations allow learners to manipulate variables and visualize abstract concepts, reflecting Piaget's focus on experiential learning. Digital tools also support Vygotsky's ZPD by enabling collaboration through online forums and virtual platforms. For instance, group projects on collaborative tools allow students to co-construct knowledge, demonstrating the role of social interaction in learning. These technologies foster critical thinking and problem-solving skills by encouraging active engagement with content.

Constructivist theory also emphasizes learner-centered approaches, which technology effectively supports. Adaptive learning technologies personalize content based on individual performance, ensuring engagement and appropriate pacing. Scaffolding, a central constructivist idea, is enhanced through step-by-step instructions and interactive tutorials, enabling learners to master complex tasks incrementally. Such tailored support promotes autonomy and inclusivity, key goals of constructivist education.

Lastly, constructivist principles highlight the importance of authentic learning and metacognitive practices. Digital tools like virtual simulations and real-world applications link academic content to practical experiences, enhancing understanding and motivation. E-portfolios and analytics further support metacognition by allowing learners to track progress and educators to tailor instruction. This framework connects constructivist theory with technology, offering insights into strategies for effective educational integration.

2. Literature Review

Global Perspectives on Technology Integration

Evolution of Educational Technology

The evolution of educational technology has transformed classrooms worldwide, advancing from basic audiovisual tools to sophisticated digital platforms. Key technological innovations, including computers, mobile devices, and the internet, have revolutionized teaching and learning by enhancing interactivity, accessibility, and personalized education (Bebell & O'Dwyer, 2010; Hattie, 2009) [2, 22]. In the United States, one-to-one computing initiatives and digital literacy programs demonstrate the potential of technology to improve student engagement and academic performance (Ritzhaupt *et al.*, 2012). Similarly, Canada's emphasis on collaborative and critical thinking through technology showcases its role in preparing students for the digital age (Plante & Beattie, 2004) [39]. Across Europe, the United Kingdom and Germany have invested heavily in ICT infrastructure and teacher training, enabling inclusive education and interactive learning environments (Selwyn, 2002; Redecker & Johannessen, 2013).

Emerging economies have embraced technology as a bridge to educational equity, although challenges persist. India's initiatives, such as the NMEICT, aim to overcome geographical and infrastructural barriers, enhancing access to quality education in rural areas despite persistent digital literacy gaps (Garg & Singh, 2015) [20]. Similarly, South Africa's e-Education policy highlights the potential of ICT to reduce educational inequalities, though limited resources and teacher readiness pose significant hurdles (Botha *et al.*, 2013). China, meanwhile, demonstrates strategic advancements, with government-backed projects like the "Three Links and Two Platforms" providing widespread broadband access and quality digital resources that significantly improve learning outcomes (Zhang *et al.*, 2017).

Global leaders in education, such as Japan and Australia, emphasize strategic and comprehensive technology integration to prepare students for future workforce demands. Japan prioritizes active learning and creativity through ICT-supported pedagogy and rigorous teacher training programs, fostering critical thinking and collaboration (Murata & Maeda, 2016). Similarly, Australia's Digital Education Revolution equips students with the tools and skills to thrive in a technology-driven world, promoting engagement and digital literacy (Johnson *et al.*, 2016). These examples highlight that successful integration requires robust infrastructure, strategic planning, and professional development for educators, ensuring that technology fulfills its transformative potential in education.

Impact on Teaching Practices

The integration of technology into education has transformed traditional teaching practices, enabling more dynamic and interactive approaches. Tools such as multimedia presentations, educational software, and online collaboration platforms have enhanced the delivery of lessons, making them more engaging and accessible. For instance, digital simulations and storytelling make abstract concepts in subjects like science and mathematics tangible and relatable, boosting student interest and understanding (Ertmer & Ottenbreit-Leftwich, 2010 [15]; Higgins *et al.*, 2012). By incorporating these technologies, educators can bridge the gap between theoretical knowledge and practical application, fostering deeper learning.

Technology also facilitates differentiated instruction by allowing teachers to customize learning experiences to suit diverse student needs. Digital tools cater to various learning styles, providing visual aids, interactive simulations, and adaptive platforms that adjust content based on individual performance (Tomlinson, 2001 [46]; Pellerin, 2012). This adaptability creates inclusive learning environments where all students, regardless of ability, can thrive. For example, adaptive learning platforms like Khan Academy ensure learners progress at their own pace, promoting equity in education.

Collaborative learning has been significantly enhanced by technology. Platforms such as Google Classroom and Microsoft Teams enable students to work together across geographical boundaries, fostering teamwork and cross-cultural understanding (Dillenbourg, 1999; Kozma, 2005) [11, 27]. These tools also support formative assessment practices, offering real-time feedback and data analytics that help educators tailor instruction to student needs (Black & Wiliam, 2009). Research shows that such practices improve learning outcomes, as seen in studies from Canada and other well-resourced educational systems (Davies, 2011) [8].

However, the effective integration of technology hinges on factors such as teacher training, resource availability, and institutional support. Professional development programs are crucial for equipping teachers with the skills to utilize technology meaningfully in classrooms (Desimone, 2009; Hew & Brush, 2007) [24]. Countries like Finland and Australia have successfully implemented training initiatives that promote innovative teaching practices (Saarivirta & Kumpulainen, 2016 [41]; Prestridge, 2012). Additionally, supportive school cultures that encourage the adoption of technology play a vital role in fostering its effective use (Ertmer *et al*., 2012).

Technology in Developing Countries

The integration of technology into education in developing countries faces numerous challenges, primarily due to inadequate infrastructure, limited access to digital devices, and a lack of technical support. In many regions of Africa, unreliable electricity and poor internet connectivity hinder the effective implementation of digital learning tools (Trucano, 2012). Furthermore, the scarcity of devices like laptops and tablets restricts their reach, leaving many students without access to technological advancements in education. These challenges highlight the need for comprehensive solutions to address these foundational barriers before technology can be effectively integrated into classrooms.

Despite these obstacles, technology holds immense potential to bridge educational gaps, particularly in under-resourced areas. Programs that provide low-cost laptops or tablets have shown promise in improving access to educational resources and fostering digital literacy (Kozma, 2005) [27]. However, the success of such initiatives relies heavily on the presence of supportive infrastructure. Reliable electricity and internet connectivity are critical to ensuring that digital tools can be used effectively in rural schools (Mlalazi & John, 2016) [32]. Without addressing these infrastructure gaps, the impact of technology on education remains limited, particularly in remote regions.

Teacher training is a key factor in the successful integration of technology in developing countries. Many teachers lack the necessary skills and knowledge to effectively use digital tools in their classrooms (Hennessy *et al*., 2010) [23]. Professional development programs that equip educators with technical expertise and instructional strategies are essential for leveraging technology to improve learning outcomes. These programs must also account for the specific challenges faced by teachers in under-resourced settings, including adapting technology to local languages and cultures.

Community involvement plays a crucial role in the sustainability of technology initiatives. Local organizations can help maintain infrastructure, train teachers, and ensure that technology programs are tailored to meet the needs of the community (Kozma, 2005) [27]. Additionally, addressing socio-economic challenges such as poverty and inequality is essential for ensuring that technology adoption is equitable. Programs like India's Digital India initiative and Brazil's Plan for Digital Inclusion of Schools demonstrate the potential for community-based efforts to overcome barriers to technology adoption (Sanghi & Kochhar, 2016 [44]; Gonçalves & Silva, 2014). By focusing on infrastructure, teacher training, and socio-economic factors, developing countries can better harness technology to improve educational outcomes.

Regional Perspectives on Technology Integration

Technology Integration in Sub-Saharan Africa

Efforts to integrate technology into education in Sub-Saharan Africa have been pivotal in addressing educational disparities and enhancing learning quality. Initiatives like the African Virtual University and One Laptop per Child have provided students with access to digital resources, promoting greater equity in education (Tinio, 2003) [45]. Additionally, programs such as Kenya's Digital Literacy Programme have equipped students with digital skills and devices, illustrating the transformative potential of technology in schools (Kenya Institute of Curriculum Development, 2018).

Despite these advances, numerous challenges persist, hindering widespread success. Inadequate infrastructure, including unreliable electricity and poor internet connectivity, remains a significant barrier (Mlalazi & John, 2016) [32]. Many schools lack the resources to support digital learning, while the limited availability of devices restricts access for large student populations. Without addressing these foundational issues, the full potential of technology integration remains unrealized.

A holistic approach is essential for overcoming these challenges and ensuring effective technology use in education. This includes infrastructure development, ongoing teacher training, and community engagement. Programs like SchoolNet Africa, which supports teachers and enhances technology access, highlight the importance of collaborative strategies (SchoolNet Africa, 2010). By addressing these critical areas, Sub-Saharan Africa can create a more supportive environment for technology and improve educational outcomes.

Case Studies from Zambia

The Zambian government has prioritized technology integration in education through various initiatives and partnerships. The Ministry of Education, Science, Vocational Training, and Early Education has implemented programs aimed at enhancing ICT resources and providing teacher training to schools nationwide. These efforts align

with the broader goal of modernizing the education sector to improve outcomes through technology (Ministry of Education, Science, Vocational Training and Early Education, 2014). Partnerships with international organizations, including UNESCO and the World Bank, have facilitated the distribution of ICT equipment to schools, creating opportunities for digital learning (Chisanga & Muula, 2013).

Despite these advances, significant challenges hinder the effectiveness of technology integration in Zambian schools. Research highlights uneven resource distribution, inadequate infrastructure, and limited teacher proficiency, especially in rural areas (Mwale, 2014). Schools often face inconsistent electricity supply and insufficient technical support, further limiting the use of digital tools (Mumba, 2017). This underscores the importance of addressing infrastructure challenges alongside providing technology.

Targeted teacher training and capacity-building initiatives are essential for bridging these gaps. Studies emphasize the need for ongoing professional development to equip educators with the skills to integrate technology effectively into their teaching practices (Chisanga & Muula, 2013). This includes training in both the technical use of digital tools and pedagogical strategies to enhance learning outcomes. Banda (2018) [1] also identifies disparities in teacher training and resource availability as critical barriers to the success of ICT initiatives, calling for more equitable resource distribution.

Collaborations with international organizations and NGOs have further supported technology integration in Zambia. Initiatives like "Smart Zambia" and programs led by the British Council and USAID have provided schools with digital devices and e-learning platforms (Munyaka, 2016) [33]. NGOs such as the Zambia Education and Technology Foundation have supplemented these efforts by offering teacher workshops and digital resources (Kunda & Phiri, 2019) [28]. Together, these partnerships contribute to addressing resource gaps and improving the capacity for effective technology use in education in Zambian schools.

3. Research Methodology

The study adopted a mixed-methods approach, combining both quantitative and qualitative research methods to offer a comprehensive understanding of technology integration in education. This approach facilitated data triangulation, allowing for a richer analysis by corroborating quantitative findings with qualitative insights from participants' experiences (Creswell, 2014) [7]. The quantitative component involved surveys to gather data on the extent of technology use and its perceived impact on teaching and learning. Conversely, the qualitative aspect used semi-structured interviews and focus group discussions to explore teachers' and students' perspectives on technology integration, enabling deeper insights into contextual challenges and successes (Creswell, 2014; Yin, 2018) [7, 14].

The research design was a case study, which provided an in-depth examination of technology integration within Kasenengwa district, Zambia. This design was chosen for its ability to explore complex educational phenomena in real-life settings (Yin, 2018) [14]. Focusing on selected secondary schools, the case study allowed for detailed analysis of how technology was implemented, identifying both strengths and areas for improvement. Such an approach was particularly suited to understanding the dynamics of technology use in diverse educational environments, from rural to urban settings (Yin, 2018) [14].

A stratified random sampling technique was used to select participants from different school types (rural and urban), ensuring a diverse range of experiences related to technology integration. The sample consisted of 150 participants: 60 teachers, 60 students, and 30 school administrators. This sample size was determined to be sufficient for both statistical analysis and thematic analysis, ensuring that the data captured was representative and robust (Fink, 2013) [18]. The stratification ensured that the research reflected various perspectives across the district, including those from schools with varying levels of technology infrastructure.

Data collection involved a combination of surveys, interviews, and focus groups. The surveys included closed and Likert-scale questions designed to measure the frequency of technology use, perceived effectiveness, and barriers faced. The survey instrument was pilot-tested for validity and relevance (Bryman, 2016) [4]. Semi-structured interviews provided qualitative insights into participants' experiences, while focus groups facilitated discussions among teachers and students, allowing for exploration of group dynamics and collective views on technology integration (Kvale & Brinkmann, 2009 [29]; Morgan, 1997).

Data analysis was carried out using both quantitative and qualitative methods. Quantitative data were analyzed using descriptive and inferential statistics to explore relationships between variables and the impact of technology on learning outcomes (Field, 2013) [16]. Software such as SPSS was used for efficient data processing (Pallant, 2013) [37]. Qualitative data were analyzed through thematic analysis, identifying recurring themes and patterns related to participants' experiences (Braun & Clarke, 2006) [3]. The coding process was iterative, ensuring the reliability and validity of the findings, and NVivo software was used to assist with coding and theme development (Saldaña, 2015) [42]. This mixed-methods approach provided a comprehensive and nuanced understanding of technology integration in Kasenengwa district, with ethical considerations ensuring participant confidentiality and informed consent (Fink, 2013; Creswell, 2014) [18, 7].

4. Results

4.1 Findings

Table 1: Frequency of Technology Use by Teachers and Students

Frequency of Use	Teachers (%)	Students (%)
Daily	30	25
Weekly	40	35
Monthly	20	25
Rarely	10	15

Most teachers and students engage with technology on a weekly basis (40% and 35%, respectively). Daily use is less common (30% for teachers, 25% for students), with a smaller percentage using technology monthly or rarely. This suggests weekly use as the most frequent pattern.

Table 2: Types of Technology Used in Classrooms

Type of Technology	Usage by Teachers (%)	Usage by Students (%)
Computers	70	65
Smartphones	45	40
Educational Software	50	55
Tablets	20	30
Projectors	25	20
Smartboards	15	10

Computers are the most used technology (70% of teachers, 65% of students), followed by educational software (50% of teachers, 55% of students) and smartphones (45% of teachers, 40% of students). Tablets, projectors, and smartboards are used less frequently.

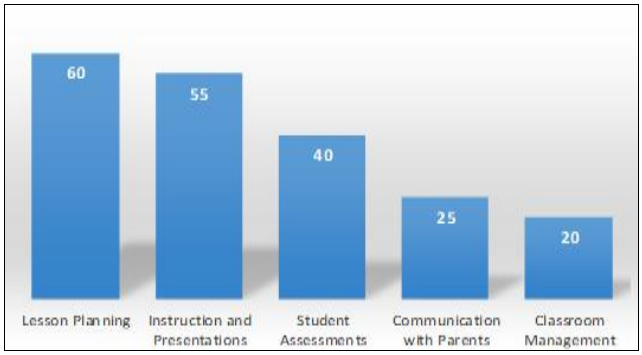


Fig 1: Purpose of Technology Use by Teachers

Technology is primarily used by teachers for lesson planning (60%), instruction and presentations (55%), and student assessments (40%). Communication with parents and classroom management are less common uses.

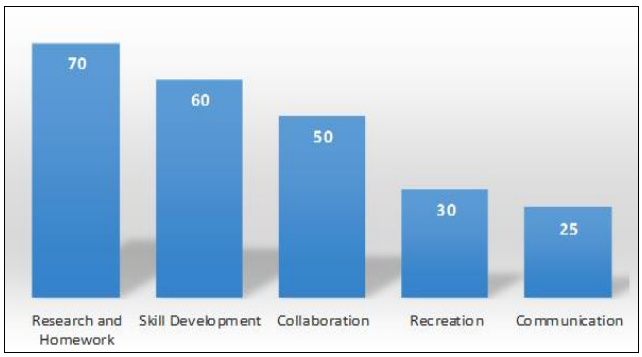


Fig 2: Purpose of Technology Use by Students

Students primarily use technology for research and homework (70%), skill development (60%), and collaboration (50%). Recreational use (30%) and communication (25%) are secondary.

Table 3: Teacher and Student Perceptions on Technology's Impact on Academic Performance

Perception Level	Teachers (%)	Students (%)
Strongly Agree	40	45
Agree	35	30
Neutral	15	20
Disagree	5	5
Strongly Disagree	5	0

Most teachers (40%) and students (45%) strongly agree that technology positively impacts academic performance, with only small percentages reporting disagreement.

Fig 3: Correlation of Technology Use and Academic Performance Improvement

Frequent technology use correlates with improved academic performance. Daily use sees a 15% improvement, with lower improvements for weekly, monthly, and rare users.

Table 4: Academic Subjects Benefiting Most from Technology Integration

Subject	Teachers Reporting Improvement (%)	Students Reporting Improvement (%)
Mathematics	70	75
Science	65	60
English	60	55
Social Studies	45	50

Teachers report increased student engagement (80%), better access to resources (75%), enhanced critical thinking (60%), and improved collaboration (50%) as key benefits.

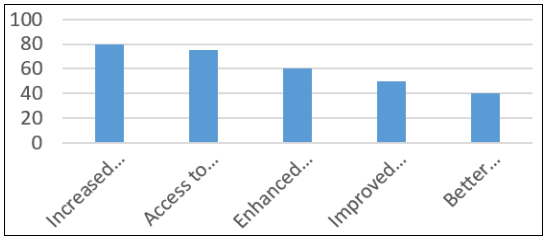


Fig 4: Perceived Benefits of Technology by Teachers

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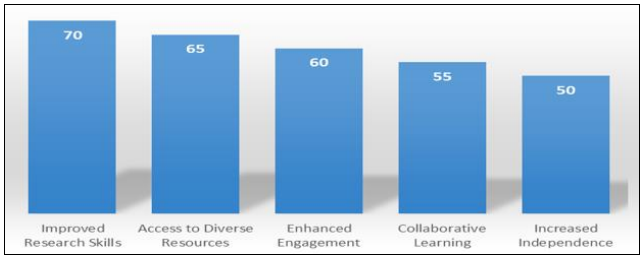

Fig 5: Perceived Benefits of Technology by Students

Students report improved research skills (70%), access to resources (65%), increased engagement (60%), and collaborative learning (55%) as the primary benefits.

Table 5: Summary of Benefits Reported by Participants

Benefit Type	Teachers Reporting (%)	Students Reporting (%)
Cognitive Development	60	65
Resource Accessibility	75	65
Student Motivation	80	70
Skill Acquisition	50	55

Both teachers and students recognize technology's positive impact on motivation, resource accessibility, cognitive development, and skill acquisition.

Table 6: Key Challenges Faced by Teachers and Students

Challenge	Teachers (%) Reporting	Students (%) Reporting
Lack of Resources	70	65
Lack of Training	60	40
Technical Issues	55	35
Student Resistance	30	—

The primary challenges reported are lack of resources (70% of teachers, 65% of students), lack of training (60% of teachers, 40% of students), and technical issues (55% of teachers, 35% of students).

Table 7: Resource Availability in Rural Schools

Resource	Availability in Schools (%)	Teachers (%) Requesting Improvement
Computers	45	75
Internet Access	30	85
Projectors	20	65
Educational Apps	35	60

Access to computers (45%) and internet (30%) is limited, with teachers requesting significant improvements in these areas. Other resources, like projectors and educational apps, also show gaps in availability.

4.2 Discussion

The findings of this study provide an in-depth examination of how technology is utilized in the classroom, its perceived impact on academic performance, and the challenges faced by both teachers and students. The results align with previous studies, highlighting the growing integration of technology in education, its benefits, and the persistent barriers that hinder its effective implementation.

The data from Table 1 show that technology is most frequently used on a weekly basis, with 40% of teachers and 35% of students reporting weekly engagement. Daily use is less common, with 30% of teachers and 25% of students utilizing technology every day. This finding reflects the reality that while technology is integrated into the classroom, it is not necessarily a daily practice for many educators or students. In comparison, studies by Lei and Zhao (2008) [30] found that many teachers still infrequently use technology, suggesting that while there is an upward trend, adoption is not universal. Moreover, the prevalence of weekly use aligns with findings by Hennessy *et al.* (2005), who observed that while teachers use technology regularly, it often serves as a supplementary tool rather than the core of daily teaching.

According to Table 2, computers are the most commonly used technology, with 70% of teachers and 65% of students reporting their use. Educational software also ranks highly, with 50% of teachers and 55% of students incorporating it into their learning processes. Smartphones follow, with 45% of teachers and 40% of students using them. The lesser use of devices like tablets, projectors, and smartboards corroborates findings from previous studies such as those by Inan and Lowther who noted that while computers are widely used, other technologies, such as smartboards and tablets, are not as ubiquitous due to logistical issues like cost and infrastructure limitations. This highlights the trend where traditional technologies (computers) are more accessible and therefore more widely used.

When exploring the purpose of technology use, Figure 1 shows that teachers mainly use technology for lesson planning (60%), instruction (55%), and student assessments (40%). This reflects research by BECTA, which highlighted how technology aids teachers in managing administrative tasks and enhancing the quality of instruction. In contrast, Figure 2 reveals that students predominantly use technology for research (70%), homework (60%), and skill development (50%). This aligns with studies by Selwyn (2016), which emphasized that students often use technology outside of class for self-directed learning, fostering independent research skills and enhancing collaboration.

The study's findings in Table 3 show that both teachers and students largely agree that technology has a positive impact on academic performance, with 40% of teachers and 45% of students strongly agreeing. This is consistent with Tamim, who found that technology can enhance learning outcomes, particularly when used effectively. The correlation between frequent use of technology and academic improvement, as shown in Figure 3, reveals that daily technology use leads to a 15% improvement in academic performance. These findings echo those of Scherer *et al.* (2019), who observed that consistent use of technology correlates with higher student engagement and academic success.

Table 4 presents that mathematics (70% of teachers and 75% of students) and science (65% of teachers and 60% of students) benefit most from technology integration. These subjects, often requiring complex problem-solving and critical thinking, see significant improvements when technology is used. This aligns with who found that technology is particularly effective in STEM subjects, where interactive tools and simulations can aid understanding. While the benefits are somewhat less pronounced in subjects like social studies (45% of teachers and 50% of students), the findings still suggest that technology enhances learning in various academic areas.

Teachers and students both report notable benefits of technology integration, as seen in Figures 4 and 5. Teachers emphasize increased student engagement (80%), improved access to resources (75%), and enhanced critical thinking (60%), while students highlight improved research skills (70%) and increased engagement (60%). These results align with previous studies by Harris *et al.* (2014), who found that technology fosters greater interaction in the classroom and

supports active learning, leading to improved student outcomes. Furthermore, the increased motivation reported by both teachers and students is consistent with Drennan *et al*. (2005), who found that technology can significantly boost student motivation by making learning more engaging and interactive.

The cognitive development and skill acquisition benefits reported in Table 5 underscore technology's positive impact. Teachers (60%) and students (65%) reported improvements in cognitive development, while 50% of teachers and 55% of students noted enhanced skill acquisition. These findings support the conclusions of Voogt and Knezek (2008), who argued that technology helps develop digital literacy and other skills necessary for students' future careers. The improvements in both cognitive development and skills acquisition further reflect the growing importance of technology in preparing students for a digital world.

Despite the benefits, significant challenges remain, as outlined in Table 6. The most frequently reported challenges by teachers were the lack of resources (70%), lack of training (60%), and technical issues (55%). Similarly, students reported the lack of resources (65%) and technical issues (35%) as primary obstacles. These findings are consistent with Ertmer (1999) [13], who emphasized that teacher training and access to resources are critical factors in the successful integration of technology. The disparity in resource availability, especially in rural areas, further corroborates UNESCO's (2015) findings that lack of infrastructure remains a key barrier to technology use in education.

Table 7 highlights the resource availability in rural schools, where access to computers (45%) and internet (30%) is limited, and teachers overwhelmingly request improvements. This mirrors the research by Ayotunde (2019), who found that rural schools often face significant infrastructure challenges, limiting their ability to fully integrate technology. The gaps in resource availability further underline the need for targeted investment in educational technology to ensure that all schools, particularly those in rural areas, have equal access to modern learning tools.

4.3 Conclusion

In conclusion, this study reveals that technology is increasingly integrated into the classroom, with teachers and students primarily using it on a weekly basis for various educational purposes. The findings show that technology, particularly computers and educational software, plays a crucial role in lesson planning, instruction, research, and skill development. Both teachers and students perceive technology as having a positive impact on academic performance, with frequent use correlating with improved results, especially in subjects like mathematics and science. The benefits of technology integration, including increased student engagement, better resource access, and enhanced critical thinking, align with existing literature. However, significant challenges persist, including limited resources, lack of training, and technical issues, particularly in rural schools. These barriers highlight the need for targeted investments in infrastructure and professional development for educators. While the study shows that technology offers substantial benefits, addressing these challenges is essential to ensuring its equitable and effective use across all educational settings. Moving forward, it is important for policymakers and educational institutions to focus on improving resource availability and providing continuous training to teachers to maximize the potential of technology in enhancing education.

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