

Original Article

# A Study on Examining the Relationship Between Educational Technology Usage and Academic Excellence

\*Abigail Chiwaka

Founder & CEO, Abbeys Group of Schools.

## Abstract:

The application of digital technology has witnessed tremendous revolution in the area of education and learning process today. This research paper focuses on Educational Technology Usage and Academic Excellence as well as the impact of Leadership Support and Educational Technology Readiness in technology-based learning process. This research is conducted using mixed research method involving descriptive and correlation studies. A total of 100 subjects (students, teachers and educational leaders) from selected educational institutions were used for the study, data collected using structured questionnaires on 5-point Likert scale. The data was statistically analyzed with IBM SPSS software. The results showed that the use of educational technology has a positive effect on academic achievement in terms of student engagement, participation in the classroom, collaboration, motivation for learning and understanding of concepts. Based on correlation analysis, there was a strong positive correlation among the variables of Educational Technology Usage and Academic Excellence. Leadership Support also showed great impact in regards to effective technology integration and the improvement of education. Moreover, the research revealed that digital engagement practices, adaptive instructional technology and collaborative digital learning are the main dimensions that facilitate technology-enhanced learning. The study finds that there is a possibility of educational technology to improve academic performance under proper infrastructure and infrastructure support, teacher readiness, institutional support and strategic leadership practices.

## Keywords:

Educational Technology, Academic Excellence, Technology Integration, Leadership Support, Digital Learning, Student Engagement, Learning Outcomes, Institutional Readiness.

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## 1. Introduction

Among the most significant changes in its nature, education in the 21st century has been largely influenced by the digital transformation. The introduction of learning management systems, virtual classrooms, and massive open online courses has made educational systems the most Tech-reliant worldwide. The COVID-19 pandemic played a significant role in hastening this transition when educational establishments had no choice but to turn to digital platforms to keep learning going as there were no other options. Tech has been radically changed by a global shift to become not only a means of teaching but also a major factor that influences the quality and fairness of education. Therefore, executive management plays a crucial role in this changing context to ensure that such technological innovation is consistent with the school's goals, it makes the learning operations better and it is a means of easy access to the digital culture for the educational institution to be sustainable.



Much of society has been affected by the COVID-19 pandemic, and the educational system is no exception. The lessons learned from remote learning can inform a rethinking of post-pandemic “Higher Education” (HE) that prioritizes resilience building and the use of adaptable digital methods for sustainable education [1]. While the situation persists, we have time to reconsider how we will handle HE in the aftermath of the epidemic. Not only will this change help with the pressing issues brought on by the epidemic, but it will also provide us an opportunity to fix the existing issues and put new techniques in place to make learning better for everyone.

Schools and universities quickly turned to remote learning as a response to the pandemic, which could not have taken place without digital platforms and virtual classrooms [2]. This transition brought out the opportunities as well as the limitations of OL. According to Rapanta et al. (2021), some institutions of HE managed to successfully adjust to remote teaching, but some faced significant challenges in preserving the quality of pedagogy and student experience. All these experiences led to the critical re-evaluation of the old models of education and the necessity of new strategies that would be useful both to students and educators Rapanta et al. (2021).

In contemporary education, academic excellence goes beyond how well one performs on tests [4]. Academic excellence involves the active participation of the learners, critical thinking, collaboration, innovation, creativity, and motivation to learn. Technology plays an important role in ensuring academic excellence by allowing learners to interact dynamically with the learning materials. Some of these technologies include Interactive Learning Platforms, Virtual Simulations, Digital Assessments, and Multimedia Presentations [5]. The role played by teachers is equally important [6].

While investments have been made towards educational technology, the relationship between using educational technology and success in school needs to be studied. Constraints like infrastructure limitations, teachers' reluctance, availability of digital tools and lack of training for the teachers pose barriers to some schools. It is for these reasons that the current study seeks to explore the effects of educational technology on academic excellence and the conditions under which such results occur.

### 1.1. Motivation and Contribution

The rapid advancement of digital technologies and the increasing dependence on technology-enabled learning environments have transformed educational systems across the world. To enhance teaching and learning in education institutions, virtual classrooms, learning management systems, multimedia systems and online learning platforms are becoming more and more popular. This shift has been further accelerated by the COVID-19 pandemic, which has required schools and universities to shift to online and blended learning to a greater extent. Despite significant investments in learning technology, questions remain about its effectiveness in enhancing academic excellence, student engagement and learning outcomes. Challenges with regard to digital infrastructure, access, teacher preparedness, and institutional preparedness continue to pose challenges to many organizations. The present research arose from the above-mentioned issues and was conducted to explore the relationship between educational technology implementation and academic performance in the current education environment. The contributions of the research are discussed below.

- Provides empirical evidence regarding the impact of educational technology usage on academic excellence.
- Examines the role of leadership support and institutional readiness in successful technology integration.
- Integrates perspectives from students, teachers, and educational leaders for comprehensive analysis.
- Offers practical recommendations for improving technology-enabled teaching and learning environments.

### 1.2. Structure of the Paper

The essay is divided into five parts. The first part describes the introduction to the study, the motivation for conducting the study, and the contribution of the study. The literature review is explained in Part II and includes the identified research gap. Methodology and data analysis methods are described in Part III, while Part IV provides findings and interpretations.

## 2. Literature Review

Integration of educational technology has emerged as one of the significant areas of education research owing to its possible impact on learning outcomes and institutional efficiency. There have been several studies that have explored how technology integration, digital learning environments, and academic performance are related.

Ponmozhi and Sangeetha (2025) in Chengalpattu District, Tamil Nadu, to compare the effectiveness of using Tech in science lessons with more conventional methods of instruction. Students' performance on standardized tests served as the study's dependent variable, while the method of instruction served as the independent variable. In this investigation, cluster sampling is employed. Thirty-

three tenth graders participated in the research. Post-test-post-test research is what this is. The 33 students in the control group initially learned chemical reactions and equations using the conventional classroom approach. The student's performance was evaluated right away. After one week, students in the TI group learned about acids, bases, and salts using the Embibe software tool, and their progress was evaluated right away in the Treatment group. Both groups' Achievement examinations had five parts and a total of nineteen questions. Memory, analysis, synthesis, and evaluation are the abilities that students will be tested on in the accomplishment test. Each group would have one and a half hours to complete the test. Forty is the greatest possible score on the accomplishment test. For the subsequent calculations, IBM SPSS 23 was utilized with data obtained from both groups. Both groups had seen the student's impressive performance. The incorporation of Tech into the classroom does not affect the AP of high school pupils in science. According to the stepwise regression results, the Treatment group's achievement was explained by the mothers' qualification (48%) and the fathers' qualification (22%). The structural coefficient analysis revealed that parental income and fathers' qualifications were weak predictors of treatment group performance. However, mothers' qualifications were rather robust markers of treatment group success [7].

Zhao Ma et al. (2024) studied how “incorporating Tech” into the classroom in Shenzhen, China, affected the academic achievement of kids. It zeroes in on the ways in which instructors' “use of Tech” in the classroom impacts students' ability to “think critically, solve problems, and work together”. Presently, this qualitative research endeavor is built on a case study design. To collect data from school administrators, instructors, and students, researchers use methods such as document analysis, participatory observation, and in-depth interviews. In addition, they use thematic analysis to extract important ideas and motifs from the participants' stories. Despite these challenges, technology incorporation has been seen to have a positive influence on SE and skills development. The final step of this paper is to give practical advice on how EdTech can be put to good use in order to improve student performance [8].

Schmitz et al. (2023) assess the assumption that TL-oriented principals encourage their teachers to involve students in the Use of Technology (UOT) process which engages students in critical thinking. The research aims to examine whether attitudes towards technology, technological skills, technological infrastructure of the school, and pedagogical knowledge can be considered mediating factors in the TL-TI connection. The digital school infrastructure was positively and significantly affected by TL, according to structural equation modeling and multilevel correlation analysis. These factors encompassed educators' dispositions toward Tech, their level of technical expertise, and their ability to implement technological strategies in the classroom. All told, 22,47 secondary school teachers in Switzerland contributed to this study's data set. Every one of these metrics, with the exception of the digital school infrastructure, anticipated a greater degree of TI. Research of this nature demonstrates that administrators' employment of TL styles is critical in engaging classroom instructors in the UOT to improve SL [9].

Cavanaugh, Jacquemin and Junker (2023), examined the impact of online learning during the COVID-19 pandemic. The impact on academic attainment and the interactions between numerous variables are the focus of this research. By compiling information from 837 student assessments at 191 public colleges in the US, it constructs a generic linear model. Some examples of such factors are the institution's size, the academic discipline, and the level of expertise of the faculty members in online training. Their statistical analysis revealed that online learning did not reduce academic performance and, in some cases, improved student GPA outcomes [10].

AlAjmi (2022) takes a look at the idea that school principals who use Transformational Leadership Theory (TLT) motivate teachers to use Tech in ways that attract kids and get them thinking, like with assignments and class discussions. To that end, they investigated the mediating roles of teachers' tech-friendly attitudes, technical competence, school digital infrastructure, and digital “Pedagogical Knowledge” (PK) in the connections between TLT and educational Technology Integration (TI). Among the digital school infrastructure aspects that were positively and substantially impacted by TL were teachers' abilities to use Tech effectively in the classroom, their technical competence, and their positive attitudes toward Tech (results from structural equation modeling and multilevel correlation analysis). There were 22,47 secondary school teachers in Switzerland who provided data for this study. A higher level of technological integration was predicted by all of these criteria except the digital school infrastructure. According to studies like these, administrators' use of TL is critical in motivating classroom teachers to proactively use Tech into SL [11].

Clark et al. (2021) calculated the effect of online instruction on students' test scores using administrative data collected from Chinese middle schools throughout the COVID-19 quarantine. Using a difference-in-differences strategy, the researchers discovered that children who had access to online education outperformed their non-school-supported learning peers by 0.22 standard deviations in Academic Performance (AP). Students who had access to recorded lessons given by outside, higher-quality instructors did better than those whose lecturers were employed by their own institution. Based on these results, it seems that the quality of the teacher has an

effect on how well online courses work. The results were also impacted by the device type; people who used laptops had better results than those who used smartphones. The benefits of online education were obvious in both urban and rural areas, and this deserves special attention. Students with lower achievement levels improved the most when given access to high-quality education, most students made progress when taught online [12].

The literature consistently demonstrates that educational technology positively contributes to academic excellence when supported by leadership commitment, infrastructure availability, teacher competence, and equitable access to digital resources. Table I presents a comparative analysis of previous studies highlighting the positive impact of educational technology integration, online learning, and leadership support on student engagement, skill development, and academic performance, while also identifying limitations such as small sample sizes, context-specific findings, and lack of long-term analysis.

**Table 1. Comparative Analysis of Previous Studies**

Author(s) & Year	Study Area / Context	Research Objective	Methodology & Sample	Key Findings	Limitations
Ponmozhi & Sangeetha (2025)	Chengalpattu District, Tamil Nadu	To compare technology-integrated science teaching with conventional teaching methods	Experimental design using cluster sampling; 33 tenth-grade students; SPSS-23 analysis	Technology integration improved classroom participation and conceptual understanding; parental educational background significantly influenced achievement	Small sample size; focused only on science subjects and school-level students
Zhao Ma et al. (2024)	Shenzhen, China	To examine how classroom technology usage influences critical thinking, collaboration, and problem-solving skills	Qualitative case study using interviews, observations, and document analysis	Educational technology positively influenced student engagement and skill development despite infrastructure challenges	Lack of quantitative statistical validation; context-specific findings
Schmitz et al. (2023)	Switzerland	To analyze the influence of transformational leadership on technology integration	Quantitative study with structural equation modeling and multilevel correlation analysis; 2,247 teachers	Leadership support significantly improved teachers' willingness and capability to adopt educational technology	Focused mainly on leadership and teacher perspectives rather than direct academic outcomes
Cavanaugh, Jacquemin & Junker (2023)	United States	To examine the impact of online learning during COVID-19 on academic performance	Statistical analysis of 837 student evaluations from 191 colleges	Online learning did not reduce academic performance and slightly improved GPA outcomes	Relied on GPA and self-reported evaluation data; lacked long-term analysis
AlAjmi (2022)	Switzerland / Middle East educational context	To investigate the role of transformational leadership in	Survey research using structural equation modeling; 2,247 secondary	Positive teacher attitudes, digital competence, and leadership support	Limited focus on student academic excellence and

		educational technology integration	school teachers	enhanced technology integration	broader institutional variables
Clark et al. (2021)	Chinese Middle Schools during COVID-19	To evaluate the effect of online learning on student academic performance	Difference-in-differences quantitative analysis using administrative school data	Students receiving online education performed better academically, especially when taught by high-quality instructors	Focused mainly on pandemic-related online learning rather than long-term technology integration

**2.1. Research Gap**

While prior research has identified positive relationships between educational technology and student engagement, collaboration and academic outcomes, several gaps remain. Research on academic excellence and the use of educational technology has been limited to specific areas, such as leadership, online learning, and teachers' attitudes and behaviors toward its use. In addition, many studies use only quantitative or qualitative methods, which don't provide much contextual understanding. Few studies have combined the three elements of institutional support, digital engagement, and academic excellence. Furthermore, there has been little consideration of the educational context of mixed contexts with different infrastructure and digital accessibility. This study aims to address these gaps, and for this reason, is an all-encompassing mixed methods study.

**3. Research Methodology**

This research was designed with a mixed-method research strategy involving quantitative and qualitative strategies. The quantitative portion was employed to explore statistical relationships between educational technology use and academic excellence and the qualitative portion was used to facilitate interpretation of the educational experiences in context.

**3.1. Research Design**

This study was descriptive and correlational because it aimed to investigate the relationship between Educational Technology Usage and Academic Excellence in Technology-enabled Learning Environment. The descriptive approach was employed to describe the trends, perceptions and patterns regarding the integration of educational technologies in education and the correlational design was used to investigate the relationships between the study variables.

**3.2. Population and Sampling**

The study was carried out with students, teachers and education leaders in selected Educational Institutions. The total sample was 100 respondents comprising 31 students and 69 teachers/educational leaders/educational administrators (both urban and rural education) Stratified Sampling and Purposive Sampling methods were used to ensure equal representation of the various groups of respondents and institutional backgrounds. To ensure representation of participants across different levels of education, stratified sampling was used and to ensure respondents were informed about technology-enabled learning environments, purposive sampling was used.

**3.3. Data Collection Methods**

Both primary and secondary sources of data were used (Table II). To gather primary data, structured questionnaires were designed with statements with Likert scale questions regarding the use of educational technology, student engagement, leadership support, readiness for educational technology, and educational excellence. Secondary data were gathered from the journal articles, conference papers, educational reports, policy documents, and institutional publications on educational technology and digital learning systems.

**Table 2. Sources of Data Collection**

Data Source	Description
Primary Data	Structured questionnaires distributed to respondents

Secondary Data	Journals, policy reports, books, and institutional documents
Measurement Scale	Five-Point Likert Scale
Data Collection Tool	Questionnaire Survey

**3.4. Research Variables**

The study examined the influence of Educational Technology Usage on Academic Excellence while considering institutional and leadership-related support factors. Hence, in this study, the key variables are: Educational Technology Usage, Academic Excellence and Leadership Support, Technology Readiness.

**3.5. Data Analysis Techniques**

Analysis of the data obtained was done using IBM SPSS (Statistical Packages for Social Sciences). The descriptive statistics approach was employed to analyze demographic data and perceptions about the use of education technology and excellence in academics. Correlation analysis was utilized to assess the association between education technology use, leadership support, and academic excellence.

**3.6. Ethical Considerations**

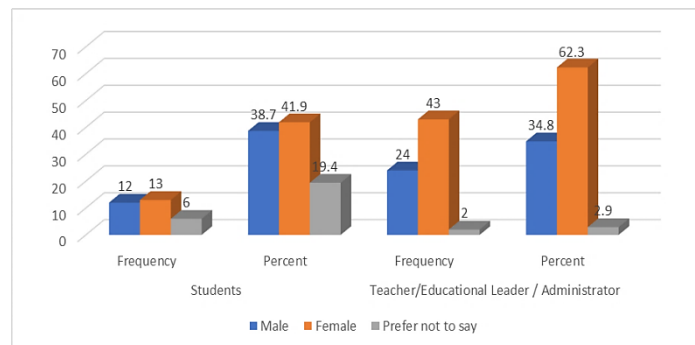
The ethical aspects of this study have been strictly observed. Participation in this survey was strictly voluntary, and prior to the data collection phase, the participants were informed about the objectives of the research. The confidentiality and anonymity of the participants were assured and the data collected were used solely for research purposes. It has also been ensured that the participants could opt out of the survey whenever they wanted. Moreover, during the data analysis stage, no confidential information about the respondents was disclosed.

**4. Results and Discussion**

These findings have been presented in this section after analyzing the data collected through the use of statistical tools.

**4.1. Demographic Profile of Respondents**

The profile of the respondents who have participated in the study has been highlighted in this section. The demographics were performed to understand the respondents' distribution in terms of their gender, age groups, and institution-wise distribution. These findings are very crucial in understanding the demographic profile of the participants of technology-based learning environment.



**Figure 1. Gender Distribution**

As illustrated in Figure 1 below, the gender composition of students (N=31) is composed of; Female gender - 41.9% (n=13), Male gender - 38.7% (n=12), while 19.4% (n=6) did not indicate their gender. The same breakdown applies to teachers (N = 69) where the majority are females with a share of 62.3% (n = 43), and the least are males with 34.8% (n = 24), and another 2.9% (n = 2) who have not indicated their gender. This shows a higher female representation among both groups.

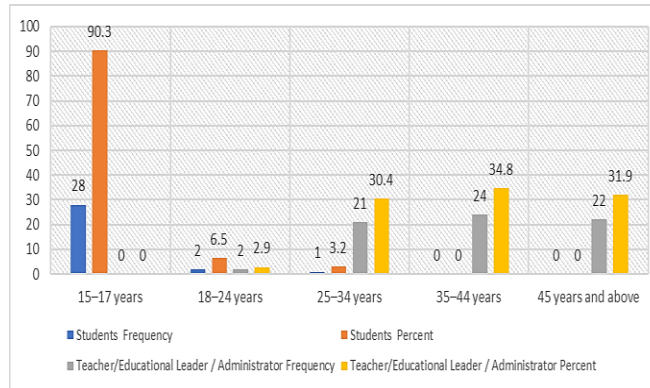


Figure 2. Age Group

According to Figure 2, students predominantly come from the 15-17-year age bracket, accounting for 90.3% (28 individuals), while the secondary age groups are 18-24 years (6.5%, 2 individuals) and 25-34 years (3.2%, 1 individual). Conversely, teachers' ages are mostly spread out among the older generations, with 35-44 years (34.8%, n=24) being the most significant age bracket, followed by 45 years and older (31.9%, n=22), 25-34 years (30.4%, n=21), and 18-24 years (2.9%, n=2).

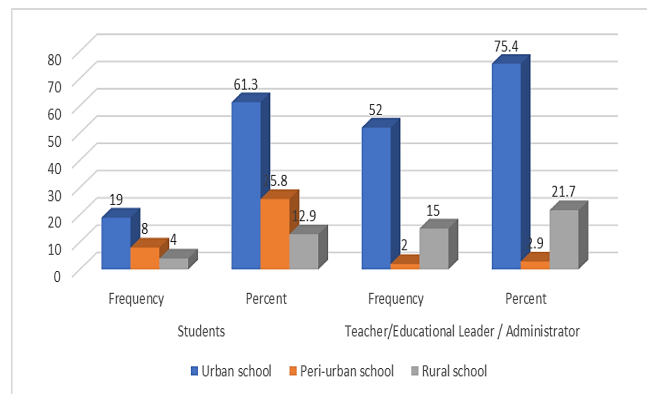


Figure 3. Type of School

According to Figure 3, the majority of students attend urban schools (61.3%, n = 19), followed by peri-urban schools (25.8%, n = 8) and rural schools (12.9%, n = 4). Likewise, urban schools accounted for the largest percentage of teachers (75.4%, n = 52), while rural schools accounted for 21.7% (n = 15) and peri-urban schools accounted for only 2.9% (n = 2).

4.2. Influence of Educational Technology on Learning Experience

This section presents the descriptive statistics of the respondents and the major study variables related to Educational Technology Usage and Academic Excellence. The descriptive analysis provides an overview of the demographic characteristics, technology usage patterns, institutional support, and perceptions regarding technology-enhanced learning environments among students, teachers, and educational administrators. The results will provide insights into the overall trends and reactions of the participants taking part in the study. Show in Table III

Table 3. Comprehensive Descriptive Statistics of Respondents and Key Variables

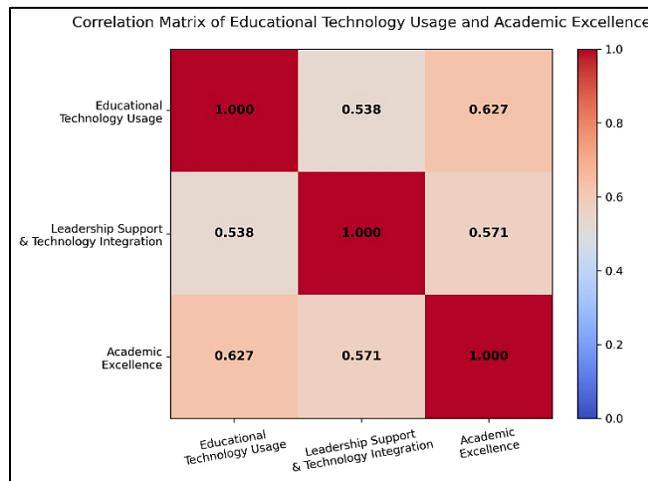
Variables	Students (N=31) Mean ± SD	Teachers/Leaders (N=69) Mean ± SD	Interpretation
Gender Distribution	1.81 ± 0.749	1.68 ± 0.528	Slightly higher female representation
Age Category	1.13 ± 0.428	3.96 ± 0.865	Students mainly younger;

			educators experienced
Institutional Type	1.52 ± 0.724	1.46 ± 0.833	Majority from urban institutions
Educational Technology Usage	3.84 ± 0.934	4.38 ± 0.842	High level of technology integration
Leadership and Institutional Support	—	4.25 ± 0.881	Strong institutional encouragement
Digital Teaching and Learning Practices	—	4.26 ± 0.816	Positive adoption of technology-enabled instruction
Student Engagement and Academic Excellence	3.84 ± 0.934	4.49 ± 0.720	Strong positive perception of academic improvement
Technology Accessibility and Resource Availability	—	1.77 ± 0.942	Moderate access to digital resources
Experience with Technology-Integrated Learning	—	2.71 ± 1.189	Moderate practical experience with digital teaching

The results of the descriptive analysis found high levels of consensus among the respondents regarding the importance of educational technology to enhance the learning process. The respondents agreed that technological learning tools helped to increase class participation, improve knowledge acquisition, and make learning experiences more engaging. It was noted by the students that through the use of educational technology in the learning processes, the classes became more interactive and flexible for them. Teachers also stated that educational technology facilitated better instruction and collaboration among learners.

**4.3. Relationship Between Technology Integration and Academic Excellence**

As seen in Figure. 4 below, there is a strong positive correlation between Educational Technology Usage, Leadership Support, and Academic Excellence. The correlation between Educational Technology Usage and Academic Excellence is particularly high ( $\rho = 0.627$ ). This suggests that more technology use leads to positive learning outcomes such as higher student involvement, participation, and academic success. There is also a positive correlation between Leadership Support and Technology Integration ( $\rho = 0.538$ ).



**Figure 4. Correlation Matrix**

Furthermore, Academic Excellence and Leadership The Support variables are positively correlated ( $\rho = 0.571$ ), thus emphasizing the need for proper administration in boosting education results. On a general note, the correlation matrix indicates that good technology integration and supportive institutions lead to academic excellence.

#### 4.4. Emerging Dimensions of Educational Technology Practices

For purposes of achieving greater insight into the educational technology practices, the study categorized them into three major components which included; digital engagement practices, adaptive instructional technology, and collaborative digital learning [13]. The digital engagement approaches that were used include multimedia teaching, virtual classroom, and interactive learning system [14] [15]. Adaptive instructional technology was defined as personalized learning systems and AI-enabling educational applications. Collaborative digital learning included online group discussions, shared learning platforms and collaborative tasks [16].

The findings revealed that digital engagement practices resulted in the greatest effects on students' motivation and in-class participation. Adaptive instructional technology was found to have positive impacts on individual learning and conceptual understanding, and collaborative digital learning was found to have positive impacts on communication, teamwork and peer interaction among students.

#### 4.5. Implications of the Findings

The results are consistent with earlier research showing that the use of educational technology positively impacts academic achievement, engagement, and motivation to learn. The findings also substantiate the Technology Acceptance Model, which considers perceived usefulness and ease of use as factors influencing technology acceptance in education.

The findings also validate Transformational Leadership Theory; it shows that the leadership within the institution has a great impact on technology integration practices. Teachers who are encouraged by their educational leaders to think creatively, receive professional development, and have access to digital tools have the opportunity to establish enabling learning ecosystems that enhance educational results.

But the results also illustrate that learning technology is not enough to ensure academic excellence. To be effective, the implementation will rely on the competence of teachers, institutional infrastructure, accessibility and strategic leadership practices. If an educational institution does not establish adequate support systems, it may not benefit from the use of technology in education.

### 5. Conclusions and Recommendations

The investigation analyzed the connection between the integration of technological methods of education and student performance in tech-enabled learning environments. The findings indicated that the integration of technology had significantly improved the involvement, participation, collaboration, motivation, and conceptualization of the learning process, leading to improved academic performance. Statistical analysis revealed that there was a very strong correlation between technology integration and performance. Additionally, institutional readiness was established as one of the main factors influencing the success of technology integration in educational institutions.

The findings of the current research suggest that with proper application of technology-enabled methods, one can achieve improved academic performance. However, the mere integration of technological tools is not enough if educators are not prepared to utilize these technologies, there is no institutional support for them, and students do not have equal access to digital learning opportunities. Therefore, educational organizations should develop robust digital infrastructures, provide teacher training, adopt blended learning strategies, and build digital cultures.

#### References

- [1] A. Aristovnik, D. Keržič, D. Ravšelj, N. Tomaževič, and L. Umek, "Impacts of the COVID-19 Pandemic on Life of Higher Education Students: A Global Perspective," *Sustainability*, vol. 12, no. 20, p. 8438, Oct. 2020, doi: 10.3390/su12208438.
- [2] I. E. Allen and J. Seaman, "Grade Level: Tracking Online Education in the United States," 2021.
- [3] C. Rapanta, L. Botturi, P. Goodyear, L. Guàrdia, and M. Koole, "Balancing Technology, Pedagogy and the New Normal: Post-pandemic Challenges for Higher Education," *Postdigital Sci. Educ.*, vol. 3, no. 3, pp. 715–742, Oct. 2021, doi: 10.1007/s42438-021-00249-1.
- [4] W. Cao, S. Gnana Sanga Mithra, and A. B. R., "Unraveling the factors shaping academic success: A structural equation modeling approach for college students," *Heliyon*, vol. 10, no. 4, p. e25775, Feb. 2024, doi: 10.1016/j.heliyon.2024.e25775.
- [5] B. Thornhill-Miller *et al.*, "Creativity, Critical Thinking, Communication, and Collaboration: Assessment, Certification, and Promotion of 21st Century Skills for the Future of Work and Education," *J. Intell.*, vol. 11, no. 3, p. 54, Mar. 2023, doi: 10.3390/jintelligence11030054.
- [6] M.-L. Schmitz, C. Antonietti, T. Consoli, A. Cattaneo, P. Gonon, and D. Petko, "Transformational leadership for technology integration in schools: Empowering teachers to use technology in a more demanding way," *Comput. Educ.*, vol. 204, p. 104880, Oct. 2023, doi:

- 10.1016/j.compedu.2023.104880.
- [7] D. Pomozhi and K. Sangeetha, "Impact of Technology Integration on Student Learning Outcomes," *Int. J. Res. Publ. Rev.*, vol. 6, no. 3, p. 5, 2025.
- [8] X. Zhao Ma, P. A. Ertmer, C. P. M. Pelgrumen, J. R. Watsonta, and M. C. Sengha Tanu, "The Impact of Technology Integration on Student Learning Outcomes," *J. Teach. Learn.*, vol. 1, no. 1, pp. 73–90, Jul. 2024, doi: 10.71305/jtl.v1i1.108.
- [9] M.-L. Schmitz, C. Antonietti, T. Consoli, A. Cattaneo, P. Gonon, and D. Petko, "Transformational leadership for technology integration in schools: Empowering teachers to use technology in a more demanding way," *Comput. Educ.*, vol. 204, p. 104880, Oct. 2023, doi: 10.1016/j.compedu.2023.104880.
- [10] J. Cavanaugh, S. Jacquemin, and C. Junker, "A look at student performance during the COVID-19 pandemic," *Qual. Assur. Educ.*, vol. 31, no. 1, pp. 33–43, Jan. 2023, doi: 10.1108/QAE-01-2022-0008.
- [11] M. K. AlAjmi, "The impact of digital leadership on teachers' technology integration during the COVID-19 pandemic in Kuwait," *Int. J. Educ. Res.*, vol. 112, p. 101928, 2022, doi: 10.1016/j.ijer.2022.101928.
- [12] A. E. Clark, H. Nong, H. Zhu, and R. Zhu, "Compensating for academic loss: Online learning and student performance during the COVID-19 pandemic," *China Econ. Rev.*, vol. 68, p. 101629, Aug. 2021, doi: 10.1016/j.chieco.2021.101629.
- [13] H. Yaseen, A. S. Mohammad, N. Ashal, H. Abusaimah, A. Ali, and A.-A. A. Sharabati, "The Impact of Adaptive Learning Technologies, Personalized Feedback, and Interactive AI Tools on Student Engagement: The Moderating Role of Digital Literacy," *Sustainability*, vol. 17, no. 3, p. 1133, Jan. 2025, doi: 10.3390/su17031133.
- [14] D. Chaerani, J. E. Harianto, L. Baehaqi, D. Frantius, and R. Mulvia, "Digital Literacy in the 21st Century Classroom: Bridging the Gap Between Technology Integration and Student Engagement," *Glob. Int. J. Innov. Res.*, vol. 2, no. 9, pp. 2104–2116, Sept. 2024, doi: 10.59613/global.v2i9.303.
- [15] A. Haleem, M. Javaid, M. A. Qadri, and R. Suman, "Understanding the role of digital technologies in education: A review," *Sustain. Oper. Comput.*, vol. 3, pp. 275–285, 2022, doi: 10.1016/j.susoc.2022.05.004.
- [16] S. Prakash, "Role of Digital Technology in Enhancing Student Engagement in Classrooms," *Naveen Int. J. Multidiscip. Sci.*, vol. 2, no. 3, pp. 55–63, Jan. 2026, doi: 10.71126/nijms.v2i3.114.