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The Role of Technology Integration in Mediating the Relationship Between Teaching Quality and Academic Engagement

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Abstract— *In the context of changing educational environments, comprehending the impact of digital tools on learning processes has become increasingly essential. This study employed a mediation analysis design to investigate the relationships between technology integration, teaching quality, and academic engagement among 123 in one of the higher institutions in Misamis Occidental. Students were selected through random sampling. Using a quantitative mediation analysis design, the research the research employed established survey instruments, including the Academic Engagement Questionnaire, the Teaching Quality Questionnaire, and a custom-made Technology Integration Questionnaire. findings revealed very high level of student academic engagement (M= 3.51, SD= 0.50), very high level in teacher's teaching quality (M= 3.56, SD= 0.51), very high level in technology integration (M= 3.49, SD= 0.52). The result also shows a highly significant relationship with academic engagement and teaching quality (p <.0001), Highly significant relationship between academic engagement and technology integration (p<.0001), Highly significant relationship between technology integration and teaching quality (p<. 0001). Mediation analysis revealed that the integration of technology accounted for 31% of the total effect between teaching quality and student engagement. These results indicate that although excellent pedagogy directly facilitates student engagement, the inclusion of technology further enhances this effect. The research emphasizes the need to blend effective teaching practices with the intentional use of digital tools to develop more engaging and interactive learning environments.*

Keywords—*Academic engagement, mediation technology integration, teaching quality.*

I. Introduction

Rationale of the Study

In today's educational landscape, digital tools are reshaping the way we teach and learn. Education is no longer limited to the four walls of a classroom, chalkboards, and textbooks. Online learning platforms, educational software, and digital resources have democratized education, fostering collaboration among students and educators (Hussain et al., 2024). Teaching quality plays a central role in encouraging student engagement, whereas integration of technology into the teaching and learning process can significantly mediate this relationship. Technology is not just a supplement to teaching but also an educational innovation for improving the teaching and learning processes in the 21st century (Backfisch et al., 2021).

Teaching quality remains as one of the most potent tools for students' learning and academic success. Establishing a culture of learning, instructional quality and delivery, managing classroom procedure, content pedagogical knowledge, presentation/instructional resources, and questioning are the six key phases that define effective teaching quality (Nwadinigwe et al., 2020). Each of these phases plays a significant role in shaping the learning environment and students' participation. As technology continues to evolve, teaching quality is increasingly influenced by how effectively teachers incorporate digital tools into their instruction. Students are likely to improve academically if exposed to effective teaching strategies. Still, the potential of these teaching practices is enhanced when supported with technology that allows greater interactivity, personalization, and accessibility among students Engida et al., 2024).

Academic engagement is a complex idea with behavioral, emotional, and cognitive components. Due to increased motivation, effort, and perseverance in finishing assignments, students who are more academically engaged can attain better learning outcomes (Meng & Zhang, 2023). Academic engagement is a crucial component that significantly impacts the academic performance of university students (García-Martínez, 2021). High academic engagement among undergraduates has been linked to lower academic fatigue and higher self-esteem (Olatunbosun & Pillay, 2024).

Several factors influenced academic engagement, including the quality of teaching and the learning environment. Studies have defined effective teaching as that which is transparent, interactive, and student-centered (Huang, 2024). Moreover, students' engagement increases when technology is integrated into the teaching and learning process. Digital and collaborative tools such as simulations and virtual reality can make learning more enjoyable and deepen students' involvement and participation in class (Pandita & Ravi, 2023).

Integrating technology is one of the key areas of focus in teaching and learning approaches today, as it reflects the global shift toward more participatory and creative methods. Over recent years, there has been an increased interest in utilizing instructional technology to enhance student engagement, boost learning outcomes, and foster creativity (Pandita & Ravi, 2023). Various studies have highlighted how the project study model of technology education, with its focus on hands-on learning activities, promotes both cognitive processes and technological understanding (Niiranen, 2021). Moreover, new tools such as artificial intelligence (AI), augmented reality (AR), and virtual reality (VR) have revolutionized traditional teaching paradigms by enabling deeper learning processes and creating immersive learning environments (Al Yakin & Seraj, 2023).

Educational technology has gained popularity in the classroom for increasing student engagement, improving learning outcomes, and fostering creativity. However, hands-on and practical learning experiences offered in technology education contribute significantly to the development of cognitive processes and knowledge essential for acquiring technological knowledge (Niiranen, 2021). In addition to that, traditional teaching paradigms are also changing with the "integration" of new digital tools, such as artificial intelligence (AI), augmented reality (AR), and virtual reality (VR), which facilitate deeper learning processes and immersive learning environments (Al Yakin & Seraj, 2023). These developments signal the growing importance of technology in 21st-century instruction (Carstens, 2021).

Although numerous studies have explored the effects of academic engagement, teaching quality, and technology integration individually, research examining the role of technology integration in mediating the relationship between teaching quality and academic engagement remains limited. Studies emphasize how technology integration, when aligned with pedagogical approaches and supported by effective leadership, can enhance student learning outcomes (Aljehani, 2024). High-quality technology integration is positively linked to students' behavioral engagement and digital competencies, crucial for modern academic achievement (Consoli et al., 2024). However, few studies explore how these elements interact and influence each other in shaping the quality of student engagement in learning environments where digital tools enhance teaching practices.

When technology is combined with pedagogical and content knowledge, it can enhance instructional quality, student engagement, and learning (Backfisch et al., 2021). Although teaching quality has been recognized as a fundamental driver of student success (Engida et al., 2024), the nuances of how it intersects with technology to foster better outcomes remain underexplored.

There appears to be an empirical gap in the prior research. There is a lack of rigorous research in the prior literature. Some of these unexplored interactions between academic engagement, teaching quality, and technology integration are essential and worthy of investigation in the context of a better learning environment. An empirical investigation of these issues is crucial because understanding how these factors intersect can provide valuable insights for enhancing teaching and learning processes. Furthermore, previous research has primarily focused on qualitative studies concerning individual factors, such as engagement, teaching quality, or technology use, in isolation. To date, no study has directly attempted to empirically evaluate the mediating effect of technology integration on the relationship between teaching quality and academic engagement. Very little empirical research has been done on the interplay of these factors in influencing academic outcomes (Miles, 2017).

By investigating how technology integration mediates the relationship between academic engagement and teaching quality, this study seeks to close this crucial gap. It specifically seeks to determine whether and how educational technology can improve or alter the impact of excellent instruction on students' academic engagement. It is anticipated that the research's conclusions will provide educators, administrators, and legislators with practical guidance on how to enhance teaching methods, make informed technology investments, and create more engaging and productive learning environments.

Theoretical Framework

This study is anchored on Self-efficacy Theory (Bandura, 1977), Reflective Practice Theory (Dewey & Schön, 1933), TPACK Theory —Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006), and TAM — Technology Acceptance Model (Davis, 1986).

Self-efficacy theory was defined by the psychologist, Albert Bandura. Self-efficacy refers to the particular set of beliefs of an individual about their ability to execute a plan of action in prospective situations (Bandura, 1977). It sheds light on why this relationship is beneficial in informing strategies for achieving favorable academic outcomes and can guide educational practice toward enhancing student engagement and success. Self-efficacy is a key motivational factor that influences decisions, effort, persistence, and success. Rooted in Bandura's social cognitive theory, it is a personal belief that both impacts and is shaped by individual behaviors and social or environmental factors (Schunk & DiBenedetto, 2021).

Employing the Self-Efficacy theory in this study will enable the assessment of learners to understand how their own beliefs about their abilities influence their academic behaviors, motivation, and outcomes. Also, this can show the significant impact of self-efficacy on academic engagement. Self-efficacy is positively correlated with academic performance, with academic engagement serving as an essential mediator in this relationship (Alzabidi et al., 2024). Students with higher self-efficacy are better equipped to adapt to academic challenges, leading to improved academic performance. These studies suggest that enhancing students' self-efficacy may be a practical approach to improving their engagement and academic performance (Meng & Zhang, 2023).

This study also draws on Reflective Practice Theory, pioneered by John Dewey and Donald Schön in 1933. They believed that experiences can shape individuals, and when reflective practice is part of learning, meaning and relevance are created, which initiates growth and change. Reflective practice is a complex and nuanced "term of art" in professional education, and it has been the object of a vast scientific literature. It is widely taught and assessed in professions such as medicine, nursing, teacher education, and engineering. The Reflective practice theory acts as a guide, helping teachers or professionals learn from the muddles, uncertainties, and mistakes. Reflective practice also helps to compare the theories-in-use (what we actually do) with the espoused theories (what we believe we do) in order to become more effective (Schön, 1980).

Integrating the Reflective Practice Theory into the study of the influence of teaching quality on students' academic engagement provides a valuable framework for improving educational outcomes. Focusing on this theory enables a deeper understanding of one's thoughts, perspectives, and experiences, helping us understand why things happened the way they did

and learn how to improve these experiences. The results of this study will provide educators with valuable feedback, and they are expected to continuously evaluate their work, including its strengths and areas for improvement. They need to become reflective practitioners. Although the idea of reflective practice is not frequently applied in schools, it has been recognized as a crucial element in enhancing the quality of teaching. This practice represents an ongoing process that helps educators step away from habitual behaviors (Maksimović & Osmanović, 2018).

TPACK Theory — Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006) is relevant because it provides an understanding of how teaching and learning can be influenced by the use of technological tools in various ways. The TPACK model emphasizes the intersection of three core components: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK), asserting that their harmonious integration is essential for successful technology-enhanced learning. This involves being knowledgeable of the pedagogical affordances and constraints of various technological tools in relation to disciplined and developmentally appropriate pedagogical designs and strategies (Mishra and Koehler 2007). TPACK serves as the foundation for effective teaching with technology. It involves knowing how to use technology to explain concepts, applying teaching methods that make good use of technology, understanding what makes specific topics hard for students and how technology can help, knowing what students already know, and using technology to build on their knowledge and improve their understanding (Mishra and Koehler 2007).

Incorporating the Technological Pedagogical Content Knowledge (TPACK) framework into the study of the role of technology integration in mediating the relationship between teaching quality and academic engagement provides a comprehensive approach to understanding effective educational practices. Using this framework, pre-service and in-service teachers can assess their proficiency in blending these domains, which in turn influences instructional quality and, consequently, student outcomes. A recent study found that integrating TPACK in science lessons can enhance students' academic achievement (Villador, 2022).

Using the TPACK framework, educators can create instruction that not only effectively conveys content but also encourages students to engage in self-directed learning, thereby improving academic performance. Students can enhance their digital and scientific literacy by engaging in TPACK-based active learning, which integrates technology, teaching strategies, and subject knowledge (Zubaidah, 2023).

TAM, or the Technology Acceptance Model (Davis, 1986), is a widely accepted hypothesis that explains why people adopt and use technology. Perceived Utility (PU) and Perceived Ease of Use (PEOU) are the two primary factors identified. PEOU is the assumption that using a particular technology would be effortless, whereas PU is the notion that using the technology will enhance performance. These constructs impact users' attitudes, which in turn impact their intention to use and actual usage of technology (Davis, 1989). Since then, TAM has been expanded and utilized in various settings, particularly in educational contexts where teaching and learning procedures are increasingly incorporating digital resources.

TAM provides a theoretical foundation for investigating how technology integration mediates the connection between academic engagement and teaching quality in the context of this study. Several recent studies support this viewpoint. For example, PU and PEOU have a substantial impact on students' behavioral intentions to use online learning platforms, which improves their learning results (Alshahrani and Ally, 2021). Similarly, it is highlighted that improved academic performance and higher levels of engagement are correlated with students' favorable perceptions of educational technology tools (Nugroho et al., 2022). Technology-supported teaching practices buffer the relationship between student involvement and teaching quality (Chien et al, 2023). These studies support the current body of research, which suggests that students' interaction with instructional content and overall engagement are improved when they believe educational technology is practical and easy to use. As a result, TAM is used to describe how technology integration enhances the impact of excellent instruction on students' academic engagement.

Conceptual Framework

Technological advancements have significantly impacted various fields, including education, and are recognized as a crucial component in enhancing instruction. Technology is crucial to modern education in terms of quality and enhancing student learning results. (Ma, 2024). Technology can aid in the learning process and support various activities, particularly educational ones (Fitriasari, 2019). Technology integration can be beneficial in two key areas: enhancing technology integration within the classroom and facilitating self-directed learning.

Technology integration within the classroom involves utilizing digital resources to enhance instruction, thereby engaging students in interactive, interesting, and effective ways. It improves participation from students, enhances understanding, and encourages the development of critical thinking skills. The impact of computer-based technology can enhance students' engagement in the classroom (Schindler, 2017). Integration of technology enhances student participation and skill development (Ma, 2024).

Technology integration has significantly enhanced self-directed learning (SDL) by providing students with access to a diverse range of digital tools and materials, enabling more individualized and flexible learning experiences. Self-directed learning has emerged as an effective teaching method in the digital age, resulting in the development of instructional class activities. This approach has resulted in a study examining its impact on the effectiveness of education in K-12 settings. Meta-analyses support the acceptance of self-directed learning as a crucial teaching strategy in K–12 education, highlighting its significant capacity to improve learning outcomes. (Lee, 2024). Similarly, a study emphasized that students' capacity to manage their learning and apply learning technologies has a significant influence on their learning efficiency (Geng, 2019). Since the quality of online learning depends on high levels of self-directed learning (Al, 2023). Technology helps learners become independent by providing them with access to rich educational

resources and tools.

Academic engagement has been identified as a key factor influencing the academic performance of university students (Garcia-Martinez et al., 2021). This can be categorized into affective, behavioral, and cognitive engagement (Hart, 2021). Affective engagement was the most critical factor influencing institutional reputation, well-being, and transformative learning. Behavioral engagement determined self-efficacy and self-esteem. Cognitive and social engagement were required, but not sufficient, for student success (Bowden & Naumann, 2021).

Teaching quality is an essential factor in influencing students' academic performance (Hammond, 2000). Good teachers create a learning–friendly environment using a range of strategies, such as establishing a culture of learning, ensuring instructional quality and delivery, managing classroom procedures, possessing content and pedagogical knowledge, creating effective presentations or instructional resources, and using questioning techniques. A positive culture of learning lays the groundwork for student motivation and academic achievement. Teachers who have high expectations and create a caring learning environment enhance student motivation and engagement (Marzano, 2003). Developing a culture of learning involves establishing relationships, setting high academic expectations, and fostering student collaboration (Dweck, 2006).

Effective instructional practices, including scaffolding and differentiated instruction, have been shown to significantly improve students' understanding and motivation (Tomlinson, 2001). Clear directions and successful lesson delivery are essential for teachers, as they have a direct impact on student understanding and overall learning achievement. Students are better able to grasp lessons, execute tasks appropriately, and remain attentive. Teachers with explicit instructions tend to utilize evidence-based teaching practices to guarantee lesson effectiveness and support diverse learners (Hattie, 2009).

Students' academic achievement depends on teachers' motivation and efficient classroom management. (Joseph, 2024). Good classroom management in a variety of settings, contexts, and educational levels. Classroom management is a crucial concept that teachers should prioritize to enhance student performance in any learning environment. (Putra and Yanto, 2025). Students' academic achievement depends on teachers' motivation and efficient classroom management. (Joseph, 2024). Effective procedures involve entering the classroom, establishing rules, building a warm and emotional relationship, and becoming acquainted with the students (Ahmadi, 2023).

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To prepare the teaching workforce, it is essential to determine the type of competence required to teach a specific subject. The subject-specific aspect of such expertise has been emphasized, as teachers require specific manifestations of content-specific knowledge and skills to teach a given subject matter (Copur-Gencturk and Tolar, 2022). Teachers are experts in the classroom, which enables them to be knowledgeable in their subject matter, allowing students to acquire information effectively. The students' understanding of a particular subject is positively related to teachers' pedagogical knowledge in specific areas taught (Pagiling and Nur'aini, 2022).

The application of various instructional materials, including visual aids, technology, and laboratory materials, makes learning more interactive and engaging for students (Mayer, 2009). Well-designed presentations that use multimedia components make learning more interactive and engaging (Clark and Mayer, 2016).

The importance of questioning as an art form in the field of teaching is underscored by its significant influence on students' growth as critical thinkers (Obidovna, 2023). Questioning is an essential teaching technique for supporting critical thinking and greater understanding among students (Chin, 2007). Higher–order questioning, informed by Bloom's Taxonomy, supports analytical and evaluative thought within students (Krathwohl, 2002).

Affective Engagement refers to students' emotional responses to learning, such as interest, enjoyment, and a sense of belonging in the educational setting. Positive affective engagement has been linked to increased motivation and persistence in academic tasks (McDowell, 2024). Behavioral Engagement refers to students' observable actions, such as class participation, adherence to rules, and involvement in extracurricular activities. Active behavioral engagement is crucial for academic success, which is often reflected in consistent attendance, timely submission of assignments, and active participation in class. According to research, students

with high levels of behavioral engagement are more likely to achieve academic success (Li & Xue, 2023). Cognitive engagement refers to the intellectual investment and thoughtful processing that students bring to their learning. It includes strategies such as critical thinking, self-regulation, and a willingness to confront complex problems. Deep cognitive engagement enables students to connect new information with existing knowledge, leading to more meaningful learning experiences. A recent literature review emphasized that cognitive engagement refers to students' psychological investment in understanding and mastering the material presented (Metu,2024).

Affective, behavioral, and cognitive engagement positively predict perceived learning among university students. Students who actively engage in understanding and applying information tend to perceive their learning experiences more positively, which can positively impact their academic performance (Navarro et al., 2024).

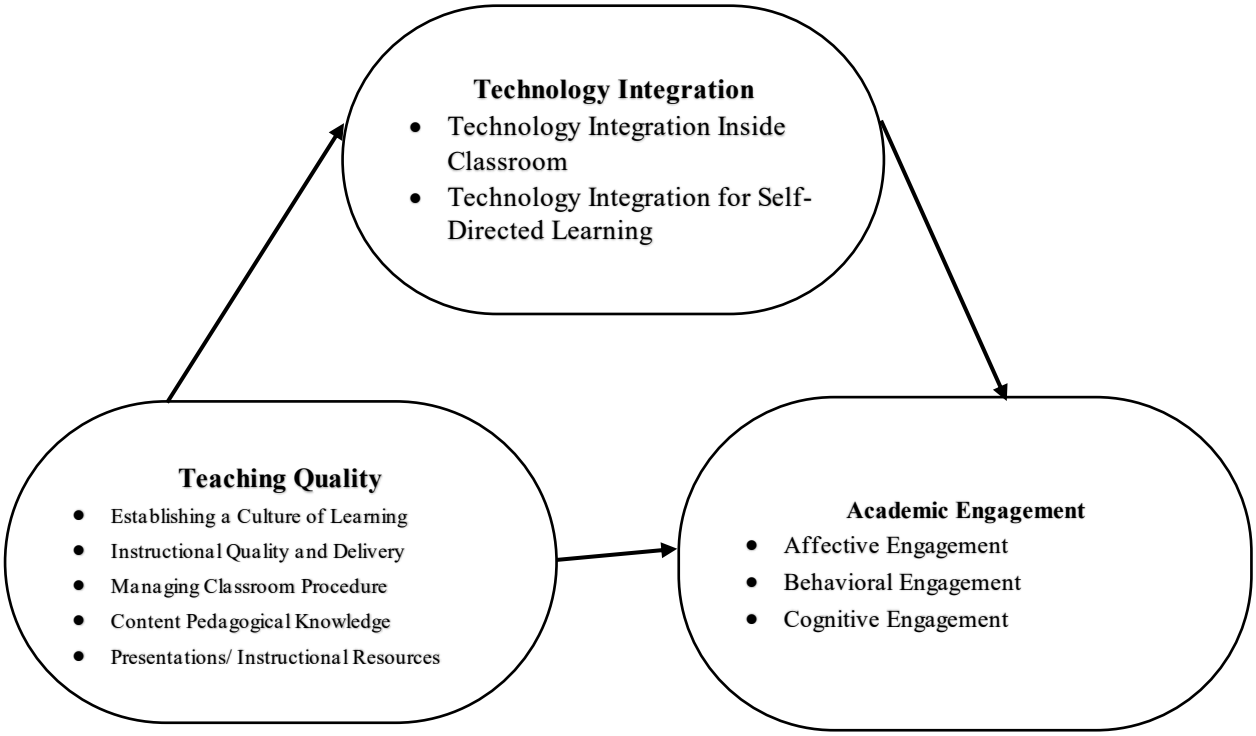

Figure 1. Schematic Diagram of the Study

Statement of the Problem

This study examined the role of technology integration in mediating the relationship between teaching quality and academic performance among education students at Misamis University during the 2024-2025 academic year. Specially, it sought to answer the following:

1. What is the level of students' academic engagement?
2. What is the level of teachers' teaching quality?
3. What is the level of technology integration?
4. Is there a significant relationship between academic engagement and teaching quality?
5. Is there a significant relationship between academic engagement and technology integration?
6. Is there a significant relationship between technology integration and teaching quality?
7. Is there a mediation on the extent of technology integration mediate the relationship between teaching quality and academic engagement?

II. Methods

Research Design

This quantitative approach used the mediation analysis design to investigate the indirect effects of teaching quality on students' academic engagement, with technology integration serving as the mediating variable. Mediation analysis determines how a treatment affects an outcome by revealing the intermediate steps through which this occurs. This technique serves as a fundamental tool to advance scientific knowledge across multiple fields, ranging from education to psychology and public health. Researchers in education studies rely on mediation analysis to understand how educational programs and interventions function to achieve their goals (Qin, 2024). This design is deemed appropriate for this study as it will investigate the role of technology integration in mediating the relationship between teaching quality and students' academic engagement.

Research Setting

This study was conducted in one of the higher institutions

of learning in Ozamiz City, particularly in the College of Education. The College of Education is recognized as a Center of Development, a leading center of teacher education in the region. It has produced regional and national topnotchers in the Licensure Examination for Teachers. It offers programs such as the Bachelor of Elementary Education (BEEd), majoring in General or Early Childhood Education, and the Bachelor of Secondary Education (BSEd), majoring in English, Filipino, Biological Sciences, Social Studies, and Mathematics.

Respondents of the Study

This study included 123 Education students, as this is the minimum sample size recommended by Raosoft. The respondents would be chosen through stratified random sampling on the following criteria: (1) currently enrolled Education students at Misamis University, and (2) willing to provide informed consent. The exclusion criteria include students from other programs and those who do not provide consent to participate in the study.

Research Instruments

The survey questionnaire was the primary data collection tool for this research, with the aim of collecting quantitative information from the respondents. The questionnaire is divided into three parts, addressing the following topics: The Role of Student Engagement in Schools (Hart, 2011), The Role of Teaching Quality (Nwadinigwe, 2020), and The Role of Technology Integration (Fitriasari & Abadi, 2019).

A. Academic Engagement Questionnaire (Appendix A). This questionnaire was adopted from the study of Hart (2011). The items are constructed using a 4-point Likert scale format, and the students responded to the statements on a scale ranging from (4) Strongly Agree; (3)-Agree; (2)-Neutral; (1)- Disagree. The instrument consisted of 32 items, organized into three constructs: affective engagement (8 items), behavioral engagement (12 items), and cognitive engagement (12 items). Ensuring the validity, experts in education review the questionnaire, refining it for clarity, relevance, and accuracy. Then, experts conduct a pilot test to assess its effectiveness. To check reliability, Cronbach's alpha was used, where results showed (M= 3. 51, SD= 0. 50) indicates that the questionnaire is consistent. The items were relevant to this study since they emphasize the level of students' engagement.

Responses	Continuum	Interpretation
4- Strongly Agree	3.25-4.0	Very High
3- Agree	2.5-3.24	High
2- Neutral	1.75-2.49	Neutral
1- Disagree	1.75-2.49	Low

In determining the level of students' engagement, the following scale was used:

A. The Teaching Quality questionnaire was adopted from Nwadinigwe (2020). The items were constructed using a 4-point Likert scale format, and the students responded to the statements on a scale ranging from (4) Strongly Agree; (3)-Agree; (2)-Neutral; (1)-Disagree. The instrument comprises 32 items organized into five constructs: establishing a culture for learning (2 items), instructional quality and delivery (4 items), managing classroom procedures (29 items), presentations/instructional resources (6 items), and questioning (20 items). To ensure validity, experts in education reviewed the questionnaire, refining it for clarity, relevance, and accuracy. Then, experts conduct a pilot test to assess its effectiveness. To check reliability, Cronbach's alpha was used, where results showed (M= 3.56, SD= 0.51) indicates that the questionnaire is consistent. The items were relevant to this study since they emphasize the level of teaching quality.

In determining the level of teaching quality, the following scale was used:

Responses	Continuum	Interpretation
4- Strongly Agree	3.25-4.0	Very High
3- Agree	2.5-3.24	High
2- Neutral	1.75-2.49	Neutral
1- Disagree	1.75-2.49	Low

A. The Technology Integration questionnaire was a researcher-made questionnaire. The items were constructed using a 4-point Likert scale format, and the students responded to the statements on a scale ranging from (4) Strongly Agree; (3) Agree; (2) Neutral; (1) Disagree. The instrument consisted of 10 items, divided into two constructs: technology integration within the classroom (5 items) and technology integration for self-directed learning (5 items). To ensure validity, experts in education reviewed the questionnaire, refining it for clarity, relevance, and accuracy. Then, experts conduct a pilot test to assess its effectiveness. To assess reliability, Cronbach's alpha was used, where a results showed (M= 3.49, SD= 0.52) indicates consistency. The items were relevant to this study since they emphasize the role of technology integration in students' academic engagement.

In determining the role of technology integration in students' engagement, the following scale was used:

Responses	Continuum	Interpretation
4- Strongly Agree	3.25-4.0	Very High
3- Agree	2.5-3.24	High
2- Neutral	1.75-2.49	Neutral
1- Disagree	1.75-2.49	Low

Data Collection

The researchers submitted a letter of permission to the Dean of the College of Education in order to conduct the study. Then, the researchers obtained approval from the Dean and research adviser. After that, the purpose of the study was explained, the ethical considerations were discussed, and informed consent was provided to the respondents. Thereafter, the researcher created a Google Form comprising the three research variables and forwarded the link to the respondents. After completing the questionnaires, the data were tallied using the Excel application, and then statistically computed using the Jamovi software. The results were then presented in a table for analysis and interpretation.

Ethical Consideration

The ethical standard in conducting the study was maintained by sticking to the Data Privacy Act of 2012 (Republic Act No. 10173). In section 3 of the law, it was highlighted that the data

subject agrees to the collection and processing of personal information about and/or relating to them. Consent forms were given to the respondents to ensure that they understood the information thoroughly before signing. All personal data was strictly confidential; respondents were given free will to write their personal information. The right to withdraw was explicitly stated in the consent form; therefore, respondents can withdraw from the survey at any time, and their responses will remain confidential. To ensure data safety, all information gathered was stored in password-protected computer files and secure physical storage. The data was then presented with unique identifiers rather than names to ensure anonymity. All electronic data was encrypted, and access was restricted to authorized personnel. After the study was completed, the data was stored securely for a specified period before being permanently erased to prevent unauthorized use.

Data Analysis

The study used the following tools in analyzing the data gathered with the use of Jamovi Software:

Mean and *Standard Deviation* were used in determining students' engagement, teaching quality, and technology integration.

Frequency and Percentage will be used to determine the mediating role of the institution's perceived service quality.

The *Pearson Product-Moment Correlation Coefficient* was utilized to explore the significant relationship between academic engagement, teaching quality, and technology integration.

Medmod was used to identify the constructs in the mediating role of technology integration in the relationship between teaching quality and students' engagement.

III. Results and Discussions

Students' Level of Academic Engagement

Table 1 showed a very high level of academic engagement (M=3.51, SD=0.50).

With the highest result (M 3.55, SD = 0.46) among the three constructs evaluated, cognitive engagement indicates that students are highly engaged in cognitive processes. Then came affective and behavioral engagements, both of which had a mean (M = 3.49). However, affective engagement showed somewhat more variability (SD = 0.54) than behavioral engagement (SD = 0.49), suggesting that participants' emotional reactions ranged more widely.

The interaction of behavioral, emotional, and cognitive aspects significantly contributes to academic engagement (Hasanov et al., 2021). However, behavioral engagement alone does not ensure academic success, especially when motivation is lacking. They also note that affective engagement tends to be less influential in tech-based learning settings, where self-directed learning and motivation are more important. (Xu et al., 2024). School support helps increase students' engagement (Olantunbosun and Pila, 2024), and it serves as a key factor in the relationship between emotional intelligence, resilience, and academic success (García-Martínez et al., 2021). This highlights the need for learning environments that support not only thinking but also emotional and social development. To improve engagement, schools should promote metacognitive strategies, real-world learning, and socio-emotional support, as recommended by Acosta-Gonzaga (2023). Further emphasize the impact of achievement goals and instructional design. A comprehensive approach that includes teacher support, motivation, and reflection can foster meaningful and sustained academic engagement (Isaeva et al., 2023).

In light of these findings, educational stakeholders must address the variability in affective engagement while maintaining the strengths in cognitive engagement that have been observed. Schools are encouraged to employ strategies that foster students' emotional connection to learning, such as creating inclusive learning environments, recognizing student achievements, and integrating real-world applications into academic subjects. Additionally, creating intentional, introspective activities and providing regular feedback are necessary to ensure that behavioral engagement leads to meaningful learning. Differentiated instruction and socio-emotionally learning-focused professional development programs can also help teachers meet the needs of a wide range of students. Through these measures, academic engagement can be enhanced holistically, promoting more profound and more equitable learning experiences for all students.

TABLE 1. Students' Level of Academic Engagement

Constructs	M	SD	Remarks
Affective Engagement	3.49	0.54	Very High
Behavioral Engagement	3.49	0.49	Very High
Cognitive Engagement	3.55	0.46	Very High
Overall Academic Engagement	3.51	0.50	Very High

Scale: 3.25-4.0 (Very High); 2.5-3.24 (High); 1.75-2.49 (low); 1.75-2.49 (Very low)

Teacher's Level of Teaching Quality

Table 2 presented the perceptions of the respondents towards the teaching quality among teachers. According to the data, the teaching quality was rated as Very High (M = 3.56, SD = 0.51). Out of the five constructs of teaching quality, Questioning received the highest rating (M = 3.60, SD = 0.48), followed by Establishing a Culture of Learning (M =3.58, SD = 0.51) though Managing Classroom Procedures and Presentations/Instructional Resources had the same mean score (M = 3.54) but with a bit of difference in their standard deviations (SD = 0.52 and SD = 0.51). All the constructs under the teaching quality category fall within the "Very High" category, indicating that the respondents perceived the teaching quality of the teachers at their institution to be positive. The findings from this data indicate that the respondents believed teachers were competent in using teaching approaches, specifically in motivating pupils by effective questioning.

The results show that respondents viewed teachers as highly skilled in their roles, especially in using effective questioning techniques to engage students. This indicates that teachers are effective in encouraging student motivation, which is crucial for academic success, and are also confident in their ability to impart knowledge (Obidovna, 2023). This favorable impression is further reinforced by high ratings for classroom management and the use of instructional materials, which suggest a well-organized and resource-rich learning environment. The

comparatively low instructional delivery score, however, points to a need for improvement. The difficulties some seasoned educators face in adjusting to contemporary teaching technologies may be the cause of this disparity (Ahmadi, 2023). The results suggest that, although fundamental teaching abilities are solid, professional development focused on integrating technology could enhance the quality of instruction by making it more dynamic and responsive to the needs of today's students.

Nevertheless, the general positive perception of teaching quality emphasizes the value of incorporating technology to continue enhancing instruction and student engagement. There was a report on how excessive screen use in the classroom can cause distractions as well as teacher burnout (Korn, 2025). Technology, by itself, does not ensure increased outcomes—its effectiveness lies in how pedagogically it is employed (Lindín et al., 2023). However, other studies affirm the better results of incorporating technology with good teaching methods. Utilizing new technologies that are both fun and interactive, such as gamification and project-based learning, can significantly boost students' motivation.

To address instruction gaps, schools must introduce blended learning workshops that enable instructors to develop interactive, student-centered lessons with resources such as Google Classroom and simulations. Offering digital lesson templates and peer feedback loops can enhance innovative instruction. Promoting action research will also enable teachers to evaluate and improve their instruction. These measures can maximize the utilization of technology, enhance teaching effectiveness, and improve student engagement in current classrooms.

TABLE 2. Teacher's Level of Teaching Quality

Constructs	M	SD	Remarks
Establishing a Culture of Learning	3.58	0.51	Very Good
Instructional Quality and Delivery	3.52	0.51	Very Good
Managing Classroom Procedures	3.54	0.52	Very Good
Presentations/Instructional Resources	3.54	0.51	Very Good
Questioning	3.60	0.48	Very Good
Overall Teaching Quality	3. 56	0. 51	Very Good

Scale: 3.25-4.0 (Very Good); 2.5-3.24 (Good); 1.75-2.49 (Poor); 1.75-2.49 (Very Poor)

Technology Integration

Table 3 showed the level of technology integration, with the constructs: self-directed learning and technology integration in the classroom. The results demonstrate a very high degree of technology integration (M = 3.49, SD = 0.52), suggesting that technology use is prevalent in both autonomous and instructional learning settings. Technology Integration for Self-directed Learning had the highest mean score of all the components (M = 3.50, SD = 0.51), indicating that students are very interested in using technology outside of teacher-directed assignments. Technology Integration Inside the Classroom (M = 3.47, SD = 0.54), which likewise shows a very high level of integration, comes in close second.

The integration of digital technologies in independent learning and in-class teaching is prevalent in Philippine private and public schools (Hero et al., 2021), where students exhibit increased autonomy and engagement in technology-driven learning spaces due to teachers' enhanced digital literacy. Despite the identified advantages of technology in improving students' engagement and instructional approaches, instructors are confronted with a range of challenges, including poor connectivity to online platforms, limited ICT competencies, inadequate resources, and a lack of orientation towards embracing new tools (Requillo and Bauyot, 2024). Furthermore, to increase educational standards, teachers and educational institutions continue to develop and use technology (Basyiroh, 2025).

These results emphasize that, while technology integration is typically high overall, inequities persist due to unequal infrastructure, professional development, and differences in digital expertise among teachers, necessitating targeted interventions to facilitate equitable and effective technology use in all learning environments. To maintain and balance the usage of technology in all learning modes. Among the suggested actions are: conducting frequent professional development for educators with an emphasis on ICT; investing in modern educational technology and reliable internet access; creating self-paced, structured learning modules that encourage self-directed learning; and establishing peer support networks so that tech-savvy teachers can guide their peers. In addition to maintaining the current level of integration, these steps aim to close the gaps identified in contradictory research, ensuring the fair and efficient use of technology in both teacher-led and student-centered learning environments.

TABLE 3. Technology Integration

Constructs	M	SD	Remarks
Technology Integration Inside the Classroom	3.47	0.54	Very High
Technology Integration for Self-directed Learning	3.50	0.51	Very High
Overall Technology Integration	3.49	0.52	Very High

Scale: 3.25-4.0 (Very high); 2.5-3.24 (High); 1.75-2.49 (Low); 1.75-2.49 (Very Low)

Significant Relationship Between Academic Engagement and Teaching Quality

Table 4 shows the significant relationship between the constructs of teaching quality and the three academic engagement domains: affective, behavioral, and cognitive. Overall, it is observed that all variables exhibit highly significant positive correlations with academic engagement ($p < .001$), which validates the hypothesis that high teaching quality leads to increased student engagement. The highest correlations existed between Questioning and Cognitive Engagement ($r = 0.677$, $p < .001$), and between Instructional Quality and Delivery and Affective Engagement ($r = 0.642$, $p < .001$), as well as between Managing Classroom Procedures and Affective Engagement ($r = 0.624$, $p < .001$). The lowest, though statistically significant, correlation was between Presentations/Instructional Resources and Cognitive Engagement ($r = 0.481$, $p < .001$).

These findings align with the TPACK framework, which emphasizes that effective pedagogy and subject-matter expertise are essential for technology to enhance learning. Similarly, the Technology Acceptance Model (TAM) suggests

that teachers' perceptions of the value of technology influence their effective use of it in the classroom. Self-Efficacy Theory is also supported by the results, which show that teachers believe they have the power to affect learning due to their high levels of questioning and classroom management. Last but not least, the connection between student engagement and instructional quality supports Reflective Practice Theory, emphasizing the importance of consistently enhancing teaching methods in light of classroom experiences.

Integrating technology in the classroom does not necessarily enhance student engagement or learning. It is not the frequency but the pedagogy of teachers when they use technology that matters. In the absence of a connection to the lesson, technology may not facilitate active student participation or the acquisition of digital competencies (Consoli et al., 2025). Students become more concentrated and reflect more intensely when digital technologies are employed meaningfully to facilitate learning (Cattaneo et al., 2025). These studies complement our findings, which indicate that blending effective teaching practices—such as posing the correct questions and classifying the classroom effectively—with considerate deployment of technology can enhance student engagement and academic achievement.

To enhance participation in the classroom and learning, schools can provide teachers with frequent training on how to effectively apply technology. This entails equipment such as virtual simulations, learning games, and collaborative software that actively engage students. Blended learning, which integrates online content with direct instruction, should also be promoted. Teachers can benefit from peer learning groups, where they exchange tips and support one another in applying digital tools. These methods not only enhance teaching practice but also enhance student engagement. Finally, they create a more stimulating, inclusive, and efficient learning environment.

Table 4. Significant Relationship Between Academic Engagement and Teaching Quality

Variables		Affective Engagement	Behavioral Engagement	Cognitive Engagement
Establishing Culture of Learning	*r*	0.619***	0.555***	0.576***
	p	<.001	<.001	<.001
Instructional Quality and Delivery	*r*	0.642***	0.592***	0.607***
	p	<.001	<.001	<.001
Managing Classroom Procedures	*r*	0.624***	0.562***	0.573***
	p	<.001	<.001	<.001
Presentations/Instructional Resources	*r*	0.514***	0.494***	0.481***
	p	<.001	<.001	<.001
Questioning	*r*	0.583***	0.634***	0.677***
	p	<.001	<.001	<.001

Notes: Ho: There is a significant relationship between teaching quality and academic engagement.
Probability Value Scale: *** p < .001 *(Highly Significant);**p<0.01 (Highly Significant); *p<0.05 (Significant); p>0.05 (Not significant)*

Significant Relationship Between Academic Engagement and Technology Integration

The table 5 showed the significant relationship between students' academic engagement and technological integration across affective, behavioral, and cognitive aspects are shown (p<.001) the study showed that every association was statistically significant. In particular, affective engagement (r = 0.554, p < .001), behavioral engagement (r = 0.584, p < .001), and cognitive engagement (r = 0.578, p < .001) were all positively and significantly correlated with the use of technology in the classroom. Affective engagement (r = 0.564, p < .001), behavioral engagement (r = 0.519, p < .001), and cognitive engagement (r = 0.550, p < .001) also demonstrated substantial positive relationships with the use of technology for self-directed learning. These results offer compelling proof of a significant relationship between all types of academic engagement and technological integration.

The use of technology tools, such as interactive media and educational platforms, promotes affective engagement by making learning more enjoyable and motivating, which is supported by a strong, positive relationship between technology integration and academic engagement. The deliberate use of technology in the classroom supports behavioral and cognitive engagement by increasing task involvement and maintaining student attention (Dizon–Rosales et al., 2022). When students used digital resources independently, they tended ti have an ownership of what they learned, which enhanced both cognitive and personal interest in tasks (Balinas and Hernandez, 2021). Students who utilized technology for self-directed learning demonstrated increased focus and engagement with academic content. (Sampang and de Vera, 2023).

Technology catalyzes deeper learning engagement (Manlangit et al., 2021). The strong positive associations show that incorporating technology into both autonomous learning contexts and structured classroom settings greatly enhances all aspects of students' engagement. Schools may encourage more motivated, engaged, and self-reliant students by creating a learning environment that encourages both structured and unstructured technology use. In addition to enhancing immediate academic results, these activities may provide students with the 21st-century skills required for flexibility and lifelong learning.

TABLE 5. Significant Relationship Between Academic Engagement and Technology Integration

Variables		Affective Engagement	Behavioral Engagement	Cognitive Engagement
Technology Integration Inside the Classroom	*r*	0.554***	0.584***	0.578***
	p	<.001	<.001	<.001
Technology Integration for Self-directed Learning	*r*	0.564***	0.519***	0.550***
	p	<.001	<.001	<.001

Notes: Ho: There is a significant relationship between technology integration and academic engagement.
Probability Value Scale: *** p < .001 *(Highly Significant);**p<0.01 (Highly Significant); *p<0.05 (Significant); p>0.05 (Not significant)*

Significant Relationship Between Technology Integration and Teaching Quality

Table 6 shows the relationship between the constructs of teaching quality and two constructs of technology integration: inside the classroom and for self-directed learning. Results indicate that all correlation coefficients are highly significant (p < .001), reflecting strong correlations among the variables. The strongest correlation was found between Managing Classroom Procedures and Technology Integration Inside the Classroom (r

= .613, p < .001), followed by Instructional Quality and Delivery (r = .576, p < .001) and Questioning (r = .558, p < .001). Moderate but substantial correlations were found with Presentations/Instructional Resources (r = 0.524, p < 0.001) and Establishing a Culture of Learning (r = 0.507, p < 0.001). For Technology Integration for Self-directed Learning, the most significant correlations were again found with Managing Classroom Procedures (r = .539, p < .001) and Questioning (r = .510, p < .001), with Instructional Quality and Delivery (r = .507, p < .001) following closely behind. The lowest correlations were observed with Presentations/Instructional Resources (r = .453, p < .001) and Establishing a Culture of Learning (r = .439, p < .001).

These results are supported by the TPACK framework and the Technology Acceptance Model (TAM), which highlight that effective technology integration depends not only on having access to digital tools but also on teachers' opinions about their value and their capacity to incorporate them with good teaching practices. Instructors are more likely to utilize technology in ways that enhance student learning if they believe it enhances instruction. Furthermore, the findings are consistent with the Reflective Practice Theory, which holds that educators who consistently evaluate and modify their approaches—for example, by enhancing digital instruction or classroom procedures—are better equipped to match technology with learning objectives. These ideas collectively clarify how technology integration and high-quality instruction can complement one another to create more stimulating and productive learning environments.

The findings indicate that classroom routine and instructional clarity are key drivers of successful technology integration. As teachers effectively manage routine, they open cognitive and physical space to use digital tools successfully. Ordered environments maximize the use of instructional technologies (Putra and Yanto, 2025). Likewise, the strong correlation with Instructional Quality and Delivery indicates that teachers who teach clearly and structure learning effectively are more likely to incorporate technology in a more meaningful way. This concurs with the concept that quality teaching is characterized by adaptive practices, such as digital pedagogy (Darling-Hammond 2021). The strong correlation with Questioning also aligns with the inquiry-based approaches, when complemented with digital tools, promotes higher-order thinking and engagement (Obidovna, 2023)

The relatively lower scores for Presentations/Instructional Resources and Establishing a Culture of Learning suggest areas for improvement. These results suggest that although technology can be used to present material, its application may still be passive or teacher-focused, rather than interactive or student-led. This aligns with the concept that having access to technology is not enough; its utilization in the teaching process is what matters the most. Additionally, the weaker correlation with Developing a Culture of Learning could indicate that there are no regular approaches that integrate digital citizenship, motivation, and autonomy into daily classroom practice, which are critical in developing a culture of learning over the long term in digital environments (Schunk & DiBenedetto, 2021).

The results in Table 6 have several implications for improving teaching quality and academic engagement through the integration of technology. Firstly, professional development initiatives must focus not only on the utilization of digital tools but also on classroom management techniques that enable active student-driven tech application. Lessons such as digital project-based learning, peer-to-peer learning/collaboration through online platforms, and interactive questioning via applications like Mentimeter or Padlet can foster engagement and self-direction. Additionally, incorporating self-paced learning modules or AI-guided tutors can enhance students' control and self-efficacy over their learning (Meng and Zhang, 2023). Increasing both structural teaching components and digital strategy alignment can enable teachers to provide a more personalized and engaging learning environment, thereby harnessing the mediating power of technology integration to bridge the gap between teaching quality and academic engagement.

TABLE 6. Significant Relationship Between Technology Integration and Teaching Quality

Variables		Technology Integration Inside the Classroom	Technology Integration for Self-Directed Learning
Establishing Culture for Learning	r	0.507***	0.439***
	p	<.001	<.001
Instructional Quality and Delivery	r	0.576***	0.507***
	p	<.001	<.001
Managing Classroom Procedures	r	0 .613***	0.539***
	p	<. 001	<.001
Presentations/Instructional Resources	r	0.524***	0.453***
	p	<.001	<.001
Questioning	R	0.558***	0.510***
	p	<.001	<.001

Notes: Ho: There is a significant relationship between teaching quality and technology integration.
Probability Value Scale: *** p < .001 *(Highly Significant);* **p<0.01 *(Highly Significant);* *p<0.05 *(Significant); p>0.05 (Not significant)*

Mediation Analysis on the Extent of Technology Integration Mediates the Relationship Between Teaching Quality and Academic Engagement

Table 7 presents a mediation analysis, indicating that technology integration significantly mediates the relationship between teaching quality and academic engagement. The total effect was strong (Estimate = 0.729, SE = 0.0587, 95% CI [0.614, 0.844], p < .001), confirming that effective teaching substantially enhances student engagement. Of this total effect, 69.0% was due to the direct impact of teaching quality (Estimate = 0.503, SE = 0.0704, p < .001), emphasizing the role of instructional clarity, interaction, and support (Huang, 2024; Darling-Hammond, 2021). Meanwhile, 31.0% of the effect was mediated by technology integration (Estimate = 0.226, SE = 0.0515, p < .001), indicating that technology plays a crucial role in translating high-quality teaching into improved student engagement. Teaching quality significantly predicted technology use (Estimate = 0.696, SE = 0.0737, p < .001), while technology integration also significantly predicted academic engagement (Estimate = 0.325, SE = 0.0656, p < .001), supporting research that links technology-enhanced pedagogy with deeper learning and motivation (Aljehani, 2024).

These findings suggest that improving both teaching quality and digital integration is essential for fostering student engagement. School leaders and administrators are encouraged to invest in sustained professional development focused on TPACK-based training to help teachers integrate content, pedagogy, and technology effectively (Zubaidah et al., 2023). Leadership support is also critical in creating an innovation-friendly environment where technology use complements instruction (Aljehani, 2024). Teachers and curriculum designers should adopt learner-centered digital tools, such as interactive platforms and virtual simulations, to support active and self-directed learning (Backfisch et al., 2021). Curriculum planners can integrate performance-based, tech-driven tasks to promote real-world problem-solving and student autonomy (Niiranen, 2021). Suggested initiatives include digital pedagogy bootcamps, innovation labs, peer mentorship programs, and reflective practice modules to foster continuous improvement (Maksimović and Osmanović, 2018). Finally, policymakers must ensure equitable access to technology, particularly in underserved areas, to prevent digital learning gaps and support inclusive academic engagement (Hanaysha et al., 2023).

TABLE 7. Mediation Analysis on the Extent of Technology Integration Mediates the Relationship Between Teaching Quality and Academic Engagement

Effect			Label	Estimate	SE	95% Confidence Interval		Z	p	% Mediation
						Lower	Upper			
Indirect			a x b	0.226	0.0515	0.125	0.327	4.39	< .001	31.0
Direct			c	0.503	0.0704	0.365	0.641	7.14	< .001	69.0
Total			c+a x b	0.729	0.0587	0.614	0.844	12.41	< .001	100.0
Path Estimates										
Teaching Quality	→	Technology Integration	a	0.696	0.0737	0.551	0.840	9.43	< .001	
Technology Integration	→	Academic Engagement	b	0.325	0.0656	0.196	0.453	4.95	< .001	
Teaching Quality	→	Academic Engagement	c	0.503	0.0704	0.365	0.641	7.14	< .001	

IV. Summary, Findings, Conclusion, Recommendation

Summary

This study explored how technology integration affects the connection between teaching quality and academic engagement among education students at Misamis University in the 2024–2025 school year. The research focused on several goals: measuring students' academic engagement, evaluating teachers' teaching quality, assessing technology integration, and examining how these factors relate to each other. It also aimed to find out how much technology integration influences the connection between teaching quality and academic engagement.

The research used a quantitative mediation analysis and took place at the College of Education, in one of the higher institutions in Misamis Occidental. A total of 123 education students participated, chosen through stratified random sampling. Data came from three tools: The Academic Engagement Questionnaire, the Teaching Quality Questionnaire, and a custom Technology Integration Questionnaire. The study followed ethical guidelines, including informed consent and confidentiality. Data analysis involved descriptive statistics to measure levels, Pearson correlation to test relationships, and mediation analysis to see how technology integration played a role.

Findings

The following are the notable findings of the study:

1. The students' academic engagement was very high, particularly in terms of cognitive engagement.
2. The teacher's teaching quality was evaluated as very high, with "questioning" and "developing a culture of learning" being the highest-rated aspects.
3. Technology integration within the classroom and for self-directed learning was also viewed as very high.
4. A significant positive relationship was found between teaching quality and academic engagement, particularly between questioning and cognitive engagement.
5. A significant relationship was found between the integration of technology and students' academic engagement.
6. A significant relationship was found between teaching quality and technology integration, particularly in classroom procedure management.
7. Mediation analysis validated that integration of technology strongly mediated the association between teaching quality and academic engagement, explaining (31%) of overall effect. These results point to the critical importance of both teaching quality ang technology in driving student engagement.

Conclusion

Based on the findings, the following conclusions were made:

1. Students were very driven to engage in active learning, think critically, and solve problems.
2. Students highly valued classrooms that were encouraging and interactive. These components not only improved comprehension but also stimulated curiosity and self-directed thought, demonstrating that effective teaching strategies were essential factors in fostering significant student involvement.
3. Integrating technology effectively fostered greater engagement, flexibility, and ownership of learning among students.
4. Students were more likely to think critically, maintain focus, and comprehend the lesson material thoroughly when teachers asked them meaningful and purposeful questions. Thus, effective questioning strategies can lead to improved learning outcomes and increased academic engagement.
5. Technology integration creates more engaging and learning- centered educational environments.

6. Teaching quality was significantly related to technology integration, particularly in classroom procedure management, indicating that effective teaching supports meaningful tech use.
7. Intentional technology used combined with excellent instruction was crucial for increasing student engagement and developing more productive learning environments.

Recommendations

Based on the findings and conclusions, the following are recommended.

1. Learners can take charge of their learning by utilizing online resources and peer collaboration. Learners can also enhance their digital skills by actively participating in classroom activities, exploring e-learning platforms, and applying critical thinking to individual study.
2. Teachers can ask probing questions facilitated by digital tools to enhance critical thinking and engagement. Possible means include using Bloom's Taxonomy, interactive apps, and online quizzes.
3. School authorities may support ingestion by providing reliable internet, up-to-date devices, and IT technical support. Funds allocated to the ICT upgrade and the establishment of a technical support unit may serve as an option.
4. Teachers can use more learner-centered techniques like differentiated instruction, collaborative learning, and formative feedback in order to improve the correlation between academic engagement and teaching quality. By ensuring that students stay engaged, motivated, and responsive to lessons, these strategies enhance student engagement and the efficacy of instruction.
5. Schools and educators can create technology-based activities that go beyond simple use to strengthen the link between academic engagement and technology integration. Virtual simulations, gamified learning, and interactive platforms can be in line with learning objectives to make sure that students' use of technology encourages greater engagement, curiosity, and self-directed learning.
6. Schools may set up routine monitoring and assessment procedures to determine how integrating technology into the classroom affects instruction. Performance reviews, learner feedback, and classroom observations can all help achieve this. The information acquired could direct ongoing development, guaranteeing that technology is not only used but also has a purpose in raising the efficacy of instruction.
7. Future researchers may expand the study by including more institutions and year levels, while adding factors like digital literacy. This could be implemented by designing mixed-method studies, conducting interviews and surveys, and employing experimental approaches to explore the impacts of emerging technologies.

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