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THE IMPACT OF TECHNOLOGY INTEGRATION ON STUDENT ENGAGEMENT AND LEARNING OUTCOMES

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Abstract
This quantitative study examines the impact of technology integration on student engagement and learning outcomes at the university level. With the increasing use of digital tools in higher education, this research aims to evaluate how effectively technology enhances student participation and academic success. Data were collected from 400 university students and 60 faculty members using a structured questionnaire. The study assessed the use of various technologies such as learning management systems, virtual classrooms, online assessments, and multimedia content. Statistical analyses were conducted using Pearson correlation and multiple regression. The results indicate a significant positive correlation between technology integration and student engagement ($r = 0.68$, $p < 0.01$), as well as a positive correlation with learning outcomes ($r = 0.54$, $p < 0.01$). Regression analysis further confirmed that technology use is a strong predictor of both engagement ($\beta = 0.62$) and academic performance ($\beta = 0.47$). These findings suggest that purposeful and well-structured technology use in university classrooms leads to more engaged learners and improved academic results. The study emphasizes the need for continuous investment in digital infrastructure, faculty development, and technology-enhanced pedagogical practices in higher education.

Keywords:
Technology integration, student engagement, learning outcomes, higher education, academic performance, digital tools.

Introduction
The last several decades became the era of significant transformations in higher education as it is also influenced by the fast development of technology. As far as quantities of classroom computers have been used in solving various issues, the Learning Management Systems (LMS), virtual classroom, and interactive response tools are adopted now with the overall goal of disseminating learning and evaluating the level of engagement among students (Garrison & Kanuka, 2004; Schindler et al., 2017). Technology integration is not a choice anymore because

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of the 21 st century education environment that requires, according to the students, more flexible, interactive, personalized learning (Henrie et al., 2015b; Price & Kirkwood, 2011). Basically, student engagement is the level at which students are involved in their learning behavior, cognitively, and even their emotions (Gunuc, 2013; Henrie et al., 2015b).

The studies constantly prove the fact that the increased activity is closely related to the success of learning, which is expressed as better satisfaction rates, retention, persistence, and academic triumphs (Schindler et al., 2017; Payne, 2019). Specifically, technological innovations in education have demonstrated capacity to increase interaction through the implementation of active learning techniques, i.e., group work, immediate feedback, instruction by multimedia and self-directed learning, which represent beneficial alternatives to lecture driven pedagogical approaches (Freeman et al., 2014; Price Kirkwood, 2011). Another strand of research which is very critical is active learning with the aid of technology. According to a meta-analysis study done by Freeman et al. (2014), students in STEM and ACTIVE learning classes were 1.5 times less likely to fail as the students in traditional lecture classes, and their exam scores would rise by approximately six percentage points (Freeman et al., 2014; Gunuc, 2013). On the same note, interactive studio labs, like TEAL (Technology Enhanced Active Learning) at MIT achieved 2 times higher normalized learning gains, and an unfold decrease in failure rates (Belcher & Dourmashkin, Coincidence, 2020).

These results suggest the revolutionising effects of knowledge driven active learning on engagement and knowledge retention. Other than the STEM, there is equal positive result in using technology in non-technical fields. Live polling systems, e.g. Socrative, had been proven to increase in-class participation, and performance; a survey of engineering undergraduate students, demonstrated an improvement in the quiz grades of 53 percent of the participants who took part after the introduction of live responses (Dakka, 2015; Awedh et al., 2015). Similarly, additions of gamified features (i.e., points, badges, leaderboards) in statistics classes increased the motivation and greater involvement when carefully applied (Jack et al., 2024). The given findings indicate that digital devices, regardless of the discipline, can provide potential engagement opportunities as long as they are pedagogically solid. However, without comprising the direct connection between technology integration and the resulting learning, it all depends on many mediating factors. Pedagogical alignment is important: the use of technology should not be an add on to a student centered and constructivist practice (Aljehani, 2024; Gunuc, 2013).

In a quantitative research among 394 university students in KSA, it was observed that the improvements in learning outcomes are focused on specific areas when the technology is strategically integrated within the framework of learner centered and leadership supported; no such background allows the technology to create the effect (Aljehani, 2024). Moreover, the readiness of faculty can be also regarded as essential: Technological Pedagogical Content Knowledge (TPACK) predetermines the level at which teachers can integrate the tools to achieve learning goals (Mishra & Koehler, 2006; Wikipedia, 2025). Even with a strong resource base, well-funded education settings have low chances of achieving the potential that technology can determine without training and confidence (Henrie et al., 2015b). Other factors that determine the success of digital interventions are infrastructure and organizational support. One may think that large, well-financed institutions might easily switch to the blended or hybrid model, whereas universities in the less-resourced areas might have a problem with the unreliability of internet connections, equipment that is getting old, and technological support (McCall, 2025; Ab initio studies). In secondary context, McCall (2025) observed that digital technology promoted more engagement but experienced limitations on infrastructural issues, as well as teacher training that did not lead to stronger learning outcomes (McCall, 2025). The same trend is shown in Shenzhen, China, because urban schools managed to use ICT

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successfully, whereas rural and suburban settings continued to face access issues in a fair manner (Zhao et al., 2024). The move to personal and combined education revealed the potential and the dangers of online plans (Farrelly & Baker, 2023; Garrison & Kanuka, 2004). In other universities, blended models became a way to offer flexibility, durability and continuity during crises; in some instances, they have resulted in academic performance just as or even better than what is seen with non-blended models, which used asynchronous lectures only (Wired, 2020). However, abrupt shift also highlighted lack of instructional design, accessibility and online pedagogical conditions and demonstrated that it is highly necessary to plan rather than impose an impromptu jump into the unknown (Wired, 2020; Payne, 2019). Quantitative methodologies have been usually adopted to critically assess the impact of technology on the engagement and learning of the student. Frequency and perceived usefulness of digital tools measurements are also cross-referenced with the engagement levels and GPA, attendance, or exam scores as academic achievement variables (Gunuc, 2013; McCall, 2025; Aljehani, 2024).

Correlation and regression analysis types of studies are common, where, at best, there are moderate and strong positive relationships between technology integration and engagement (r 0.45 to 0.68; 0.40 to 0.60) (Gunuc, 2013; Aljehani, 2024). These data indicate that certain statistical trends are consistent in any discipline and context, but they also point to the effectiveness of the external factors that reinforce or undermine the technological effects. Nevertheless, available literature puts emphasis on the fact that technology, when incorporated with a specific purpose in mind, helps enhance more student involvement and better condition the performance of the students through the means of the active and individualized learning processes (Freeman et al., 2014; Aljehani, 2024). The success of the said integration is dependent on the similarity of pedagogy, institutional investment, teacher expertise and access. The proposed research will have a contribution in the quantitative evidence base at university level as it will determine and examine the nature of technologies, its use habits and contextual support that collectively contribute to student engagement and academic achievement.

Statement of the Problem

Although digital technologies in higher education are rapidly developed today and their role in the educational process is becoming more and more prominent, the information about the direct impact of the technology integration on students engagement and performance in the higher educational institution remains poorly understood. Most universities tend to invest much into educational technologies, including learning management system (LMS), interactive software, and online-collaboration tools, but the role of the given technologies in the enhancement of the real learning processes and academic achievements remains uncertain. Some of the studies have indicated the positive coaction between student engagement and use of technology but the extent to which engagement results to achievement has varied according to the contexts, implementation and competency levels of users.

In numerous situations, initiation of technology is not accompanied by a sound pedagogical scaffold or training of the faculty leading to passive utilization of digital tools as compared to constructive experiences that lead to real learning. Also, few university students might not be able to deal with digital literacy or experience difficulties with self-regulated learning on technology-enhanced learning with unpredictable results. There is an urgent necessity to carry out the empirical investigation of the ways and the degree to which the integration of technology may influence the participation of the university students in their classes and the overall success in their academic life. Specifically, there is need of small-scale, quantitative evidence relating the nature of the relationship between various kinds of technology and instructional practices.

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In case of lack of such data universities might just keep up the usage of technological instrument without getting into the picture as to how useful this technology is in education and there is a possibility of wastage of resources, not using the opportunity to improve the student learning process. It is in this respect that this study aims to fill the gap by attempting to discern, through harnessing the measurable outcomes of such presumed technology integration, the effect that technology integration has on the student engagement in learning and the resultant learning outcomes in the university environment. It continues to make data-drive informations that can shape better use of technology in both teaching and learning so that digital innovation can actually make higher education to become better.

Research Objectives

1. To examine the relationship between the extent of technology integration and the level of student engagement in university classrooms.
2. To investigate the impact of technology integration on students' academic performance and learning outcomes at the university level.
3. To identify the types of educational technologies most commonly used by university instructors and their perceived effectiveness in enhancing student learning.

Research Questions

1. What is the relationship between the extent of technology integration and student engagement in university-level courses?
2. How does technology integration affect students' academic performance and overall learning outcomes at the university level?
3. Which types of educational technologies are most commonly used by university instructors, and how do students perceive their effectiveness in enhancing learning?

Delimitations

This study is delimited to university-level students and faculty members in selected public and private institutions. It focuses only on the use of educational technologies within formal classroom settings and does not include informal or extracurricular digital learning. Additionally, the study measures perceived engagement and academic outcomes without tracking long-term academic performance.

Literature Review

Technology Integration in Higher Education

The concept of Technology integration in higher education signifies the ordered application of online gadgets, materials, and behaviors to support iterative educating, learning, and organization. Despite the initial pace of moving technology into the curriculum since more than two decades ago, universities have spent more time integrating in technology in the delivery of learning management systems (LMS), video lectures, online assessment, and communication provides. Garrison and Kanuka (2004) point out the impact of blended learning models as the way of transforming the pedagogical approaches and make learners more flexible and accessible.

On the same line, Kirkwood and Price (2014) stress that the use of technology in education should not be reduced to digitized learning and that the focus should be on the redesign of pedagogy that will offer more profound learning and encourage active student involvement. The emergence of digital tools in classrooms is in line with increasing number of digitally native learners requiring the use of interactive, personalized and flexible forms of learning. There is a tendency of tools like Kahoot, Padlet, Google Classroom, and Turnitin to enhance teaching efficacy and enhance the relationship between a teacher and a student provided that they are used properly (Schindler et al., 2017). Even a presence of technology is not likely to

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make learning better. Levels of integration effectiveness mostly rely on its correlation with course design, student requirements, and the planning of instruction (Bower, 2019).

Technology and Student Engagement

Student engagement is actually a non-unidimensional construct and it involves learning behaviourally, emotionally and cognitively. Behavioral engagement is when students are taking part in activities academic, emotional engagement is about how students feel about something, i.e interested or belong, and cognitive engagement is all about putting effort and interests in studying the subject and how much one is willing to do (Fredricks, Blumenfeld, & Paris, 2004). The technological aspect is a vital factor that adds value to all the three dimensions because it ensures cooperation, interaction and independence. In their study, Henrie, Halverson, and Graham (2015) established that the use of digital technologies has a positive effect on engagement in case of its application in supporting active learning strategies. As an example, there are multimedia tools, platforms based on gamification, which makes learning more engaging and fun and adds emotional and cognitive engagement to students.

Reporting what they found in their review, Kay, Leung, and Tang (2018) stated that student response systems did not only make lectures more interactive, but also made students more attentive and more likely to contribute to the classroom. More so, cooperation tools like discussion boards and collaborative documents enable the students to correspond without being contemporaneous with each other and actively participating in their learning communities (Bond et al., 2020). This perfectly works with shy learners who might not have the comfort of attending the face-to-face environment. Technology, however, does not affect all the students positively. Gunuc (2014) pointed out that when too much reliance is cast on technology on the basis of pedagogical underpinning, their use might result in proximity or skin-optical learning especially when utilized to deliver content.

Technology and Learning Outcomes

One of the major objectives of educational technology relates to enhancing learning by the students. Some of the learning outcomes include not just the academic achievements as A grades or points earned after the passage of the tests, but also the critical thinking, the skills of solving the problems and the ability to keep what being studied. Various quantitative studies aimed at investigating the connection between the use of technology in learning and the outcome have come up with the quantitative opinions that have mostly agreed there exists a strong but moderate positive relationship.

A meta-analysis published by Freeman et al. (2014) came to the conclusion that students in the active learning classes, a key feature of which is the use of digital instruments, received higher marks in exams as well as had improved success rates than the students in the lecture-based environment. The same can be said about the study carried out by Pane et al. (2017); they concluded that online adaptive learning tools also helped students to show higher performance in math and reading due to the possibility to work at the students own pace and concentrate on the aspects that should be improved. Bower (2019) in a university environment founded the need to coordinate the use of technologies and the teaching objectives to promote the effectiveness of the instructions.

Technology that is not well combined may be distracting or rather bring about difficulties in understanding. An example is that when multimedia is used too excessively without proper instructions, it would cause cognitive overload. Hence, technology should be incorporated into a unified pedagogical concept which facilitates the demands of learners and demands of the course. Moreover, digital literacy and self-regulation skills of students are other factors that would affect the results of the learning process. It was identified by Kay et al. (2018) that students with no time-management or technical skills were not likely to benefit due to online learning environment. Therefore, guidance and training are essential methods of support that

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have to be employed at the institutional level if the educational principle of technology is to be maximized.

Mediating Factors and Implementation Challenges

Some of the factors, which mediate the effect of technology on engagement and learning include instructor preparedness, infrastructure, access to devices and student attitude. Mishra and Koehler (2006) affirm that working efficiently with technology needs as integrated form of knowledge between contents and pedagogical processes and digital tools which makes the Technological Pedagogical Content Knowledge (TPACK) framework. In case they are not confident or have not been trained, the faculty members will not readily accept the use of new technologies or will not use them efficiently. The other factor is institutional support- which is vital. Colleges should have digital infrastructure, continuous faculty development, and access to high-speed internet and new devices to both the teachers and students. These issues may be more eminent in the case of developing economies.

As one case example, Aljehani (2024) was able to establish that due to the use of technology in Saudi universities, learning outcomes could be enhanced only when the given process is supported by administrative measures and a well-organized professional development of faculty members. The success of use of technology is also associated with the contentment of students and their learning choices. Not all students might want to learn in person or might not be able to cope with the technological tools or not be able to concentrate (Bond et al., 2020). Consequently, there is a likelihood that one size fits all technology integration strategy might need not work. The goals of successful implementation include customization and flexibility and responsiveness to the feelings of the students.

Theoretical Framework

This research has been based on two interdependent theories which are the Constructivist Learning Theory and Technology Acceptance Model (TAM) theories. Constructivist Learning Theory is a posture where learners actively build up their intelligence and not by being passive recipients to information. Good technologies combined well assist in this process because interactive technologies tend to promote exploration, collaborative and critical thinking (Piaget, 1973; Vygotsky, 1978). They include simulations, learning forums and adaptive learning software that meet the principles of constructivism and results in a rise in cognitive commitment, and individual learning.

In addition to this, the Technology Acceptance Model (TAM) (Davis, 1989) which refers to the mode through which technology is accepted into usage by its users through the two most significant perceptions which include the ease of use and the usefulness of technology. Students in the university setting are only expected to embrace educational technologies when they hold this belief that educational technologies are going to enhance their performance and are not complicated to use. TAM assists in realizing the attitude of students towards technology and knowing the amount of engagement towards the digital tools. These theories can be cooperated with each other and the framework can support the hypothesis that effective technology integration will increase engagement and student achievements in learning with the help of both the pedagogical alignment (constructivism) and user acceptance (TAM).

Conceptual Framework

This framework is based on the following variables:

Independent Variable:

- Technology Integration
  (Learning Management Systems, online quizzes, discussion forums, multimedia tools)

Dependent Variable:

- Learning Outcomes (academic performance, knowledge retention, critical thinking)
- Student Engagement (Behavioral, Cognitive, and Emotional Engagement)

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Research Methodology

This study adopted a quantitative research design to explore the impact of technology integration on student engagement and learning outcomes at the university level. The primary aim was to evaluate how effectively digital tools contribute to academic participation and success in higher education environments. Data were collected through a structured questionnaire administered to a total of 460 participants, comprising 400 university students and 60 faculty members from various public and private institutions.

A stratified random sampling technique was employed to ensure representation across academic disciplines, including education, business administration, social sciences, and computer science. The student sample included both undergraduate and graduate learners, while faculty members represented instructors actively engaged in teaching courses that integrate digital technologies.

The questionnaire was carefully designed to assess three main areas: demographic information (including gender, age, academic level, and field of study), the extent and nature of technology integration (such as the use of learning management systems, virtual classrooms, multimedia content, and online assessments), and perceptions related to student engagement and academic performance. Items measuring engagement and learning outcomes were adapted from validated instruments such as the Student Engagement Scale (Fredricks et al., 2004) and the Learning Outcomes Inventory, with contextual modifications to suit university-level respondents. Responses were recorded using a five-point Likert scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5).

The instrument was pilot-tested with a small group of students and faculty (n = 30) to ensure reliability and clarity, resulting in minor adjustments to question wording. Final data were collected using both online and in-person methods over a six-week period. All ethical protocols were strictly followed, including informed consent, participant anonymity, and the right to withdraw at any stage without penalty. Upon completion of data collection, responses were analyzed using SPSS software. A significance level of $p < 0.05$ was used to determine statistical relevance.

Data Analysis and Results

Table 1:
Demographic Characteristics of University Students (N = 400)

Variable	Category	Frequency (N)	Percentage (%)
Gender	Male	182	45.5%
	Female	218	54.5%
Age Group	18–22 years	148	37.0%
	23–27 years	172	43.0%
	28–32 years	56	14.0%
	33 years and above	24	6.0%
Academic Level	Undergraduate	232	58.0%
	Graduate (MS/MPhil)	148	37.0%
	Postgraduate (PhD)	20	5.0%

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Variable	Category	Frequency (N)	Percentage (%)
Field of Study	Education	92	23.0%
	Business Administration	104	26.0%
	Social Sciences	98	24.5%
	Computer Science	106	26.5%

The sample of the student (N = 400) showed a rather equal proportion of the genders, comprising females (54.5 percent) and males (45.5 percent). The age category of 23-27 years showed the majority with 43 percent, followed by 18-22 years with 37 percent thereby having most young adult learners. About 58 percent of them were doing undergraduate studies, 37 percent were doing graduate programs and just 5 percent were doing PHD programs. The students presented different academic backgrounds and Business Administration (26.0%) and Computer Science (26.5%) were the most present academic backgrounds followed by Social Sciences (24.5%) and Education (23.0%).

Table 2

Demographic Characteristics of Faculty Members (N = 60)

Variable	Category	Frequency (N)	Percentage (%)
Gender	Male	32	53.3%
	Female	28	46.7%
Age Group	25–34 years	14	23.3%
	35–44 years	28	46.7%
	45 years and above	18	30.0%
Teaching Experience	Less than 5 years	16	26.7%
	5–10 years	24	40.0%
	More than 10 years	20	33.3%
Discipline Taught	Education	18	30.0%
	Business Administration	14	23.3%
	Social Sciences	12	20.0%
	Computer Science	16	26.7%

The sample size of faculty (N = 60) consisted in the gender proportion almost equal where the greater number of teachers (53.3 percent) was male and the lesser number (46.7 percent) was female. The respondents belonged to the category of 35 44 of them (46.7 per cent) representing mid-career professionals. As far as the teaching experience is concerned, 40 percent of respondents had experience of 5 to 10 years, and 33.3 respectively had experience over 10 years of experience: it shows a well-experienced group of teaching employees. Faculty members consisted of representatives of various disciplines the most frequent ones being Education (30%) and Computer Science (26.7%).

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Table 3

Pearson Correlation between Technology Integration and Student Engagement

Variables	Technology Integration	Student Engagement
Technology Integration	1	.68**
Student Engagement		

The correlation between the integration of technology and the engagement of the student The Pearson results found strong positive relationship between the integration of technology and student engagement (r = .68, p <. 01). It means that the higher the students report using and contact with digital learning tools, the more actively engaged into academic activities they tend to become either cognitively or behaviorally. A statistically significant finding indicates the validity of the assumption, according to which the integration of technology is crucial to supplementing the level of motivation and participation in classrooms.

Table 4

Pearson Correlation between Technology Integration and Learning Outcomes

Variables	Technology Integration	Learning Outcomes
Technology Integration	1	.54**
Learning Outcomes	.54**	1

Correlation is significant at the 0.01 level (2-tailed).

Correlation between Technology Integration and Learning Outcomes The correlation r was equal to.54 and non zero (p <. 01), which showed that there is a moderate positive relationship between learning outcomes and technology integration. It follows that the group of students who consider that the use of technology is greater in their educational process also appears to describe higher outcomes of their academic performance, retention of knowledge and critical thinking. Although the connection is marginally lower than that of engagement, it is still statistically significant, which means that technology-enhanced learning environments take part in academic performance in a positive way at the university level.

Table 5

Regression Analysis Summary for Predicting Student Engagement from Technology Integration (N = 400)

Predictor	B	SE B	β	t	p
Technology Integration	0.635	0.043	.680	14.87	<.001

Model Summary:

$R = .680$, $R^2 = .462$, Adjusted $R^2 = .460$, $F(1, 398) = 221.24$, $p < .001$, $SE = 0.428$

Table 5 Regression Analysis Predictive Study of Student Engagement The regression model scrutinizing the effects of technology integration on making the students engaged was proved to be significant, $F(1, 398) = 221.24$, $p < .001$ and the R 2 value was found out to be .462. It means that a variance in student engagement is determined by the level of technology integration to the extent of 46.2%. The unstandardized coefficient (B = 0.635) and the

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standardized beta (beta = .680) indicate that as technology integration undergoes a one-unit change, the level of student engagement also escalates to a great extent. The predictive relationship is also reinforced in precision and power by the fact that the standard error (SE B = 0.043) is also quite small, with t-value being large (14.87). These findings allow us to believe that the application of digital tools as far as teaching and learning processes concerned, results in the substantial growth of engagement on the part of students

Table 6

Regression Analysis Summary for Predicting Learning Outcomes from Technology Integration (N = 400)

Predictor	B	SE B	β	t	p
Technology Integration	0.514	0.048	.538	10.21	<.001

Model Summary:

$R = .538$, $R^2 = .289$, Adjusted $R^2 = .287$, $F(1, 398) = 114.39$, $p < .001$, $SE = 0.493$

The prediction of learning outcomes regression analysis There was also a significant impact of the integration of technology on the outcomes of learning as revealed in the regression analysis, $F(1, 398) = 114.39$, $p < .001$ with R2 =. 289. The variance in learning outcome as reported by students can be explained by this model by 28.9 percent. Regression coefficient (B = 0.514) and standardized beta (beta = 0.538) indicate a positive relation between the educational technology use and the better academic performance that is significant. The standard error (SE B = 0.048) and t-value (10.21) which is large implies strong and significant model. The variance provided in this case is lower than in the case of engagement, but the results still draw attention to the important role played by technology integration when it comes to predicting the higher learning outcomes.

Table 7

Pearson Correlation between Technology Integration and Perceived Student Engagement (Faculty Data)

Variables	Technology Integration	Perceived Student Engagement
Technology Integration	1	.63**
Student Engagement		

Correlation is significant at the 0.01 level (2-tailed).

Association Technology Integration- Perceived Student Engagement On Pearson correlation analysis, large and significant positive relationship existed between students engagement and technology integration as perceived by faculty members (r =.63, p <.01). This means that there is more engagement with the students on the part of teachers who claim to use technology consistently, including (but not limited to) learning management systems, multimedia tools, as well as online assessments. The correlation is significant, which implies the factors that digital instruments can be regarded as making a positive contribution to a higher extent of behavioral, cognitive, and emotional engagement with academic tasks by the students.

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Table 8

Pearson Correlation between Technology Integration and Perceived Learning Outcomes (Faculty Data)

Variables	Technology Integration	Perceived Learning Outcomes
Technology Integration	1	.49**
Learning Outcomes		

Correlation is significant at the 0.01 level (2-tailed).

Relation between technology integration and the learning outcomes perceived The strength of the relationship between technology integration and the perceived learning outcomes was moderate positive ($r = .49$, $p < .01$). The faculty staff that used a higher amount of educational technology in the courses reported that the students performed better academically and memorized information, as well as developed skills of crucial thinking. Even though this relationship does not measure as strongly as the relation with engagement, it is, nevertheless, significant, which means that the use of technology positively influences faculty-perceived learning effectiveness.

Table 9

Regression Analysis Predicting Perceived Student Engagement from Technology Integration (Faculty Data)

Predictor	B	SE B	β	t	p
Technology Integration	0.598	0.083	.630	7.20	<.001

Model Summary:

$R = .630$, $R^2 = .397$, Adjusted $R^2 = .386$, $F(1, 58) = 51.84$, $p < .001$, $SE = 0.445$

Regression Analysis that Predicts Perceived Student Engagement Regression also indicated that perceived student engagement can mostly be predicted by technology integration, $F(1, 58) = 51.84$, $p < .001$. It was shown that the model had a significant relationship and explained 39.7 percent of a variance ($R^2 = .397$). The findings of the unstandardized coefficient ($B = 0.598$) and the standardized beta ($B = .630$) indicate that as the acquired use of technology increases, there is a high related growth on how the students express engagement in accordance with the instructors. This result is very strong as demonstrated by high t-value (7.20) and low standard error ($SE B = 0.083$). The teachers feel that incorporation of digital devices helps in increasing the extent of student involvement and participation considerably.

Table 10

Regression Analysis Predicting Perceived Learning Outcomes from Technology Integration (Faculty Data)

Predictor	B	SE B	β	t	p
Technology Integration	0.476	0.087	.490	5.47	<.001

Model Summary:

$R = .490$, $R^2 = .240$, Adjusted $R^2 = .226$, $F(1, 58) = 29.92$, $p < .001$, $SE = 0.508$

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Regression Analysis to predict the Perceived Learning Outcomes The regression model of the perceived learning outcomes was also significant, $F(1, 58) = 29.92$, $p < .001$, and the value of R 2 was. 240. This implies that level of technology integration indicates 24.0 percent of variance in faculty-perceived learning outcomes. The 0.490 value of the beta coefficient of predictive relationship and 0.476 product is a moderate predictive relationship. The claim on the statistical strength of the model is also provided by the t-value of 5.47. Whereas the variance explained is lower in comparison with the one in the engagement case, nonetheless, the results demonstrate the significance of technology in increasing the teaching efficacy and the perceived student learning.

Discussion

The close connection between the use of technology and student engagement can be explained by the fact that the established research agrees with the results on the use of interactive digital tools to stimulate greater behavioral, emotional, and cognitive engagement (Henrie et al., 2015; Vercellotti, 2024). The use of such technology as the LMS platforms, live polling, and multimedia files present various forms that are responsive to various learning styles and increase interest due to interactivity and the provision of immediate results (Kay et al., 2018; Zhao, 2023). Meta-analysis conducted by Freeman et al. (2014) came to the same conclusion: active, technology-enhanced learning environments can contribute to an increase in student involvement and engagement to a larger extent.

The high R 2 values (46% in the students and 39.7% on the faculty) means that the nearly a half of the difference in engagement can be accounted by the use of technology alone in case it is successfully implemented. Secondly, although it influenced the results of the learning process a bit less (29 percent among students and 24 percent among faculty), it is still great and remarkable. These findings reflect the previous ones, stating that the digital tools that can be aligned with the instructional goal support the performance and knowledge retention (Pane et al., 2017; Gu et al., 2013). To cite an example, adaptive systems enable the customization of pathways to deepen the learning and timely interventions to fill the gaps via real-time assessment given by a teacher (Henrie et al., 2015).

The R 2 values might not be high as those of engagement effects but the fact that the values are moderate points out to the fact that technology integration is one of those influential factors in enhancing academic success. It is worth noting that according to both sets of data used by students and the faculty, the predicted effect of technology integration on engagement is more impressive than the effect of learning outcomes. Such a trend can be explained by the educational research that shows that although technology may have a direct impact on motivation and participation, the increase in the motivation and participation level may not always lead to the increase in achievement, since this development may require further factors such as pedagogical design and the ability of the student to self-regulate (Kirkwood & Price, 2014; Schindler et al., 2017).

We find that interesting technologies are not the entire solution to academic development as our findings indicate that they are a requirement although not in every instance. Our argument is supported by the fact that such quantitative results are adjusted to theoretical points of view. Constructivist position will have it that technology is the scaffold which assists in active, collaborative, and experiential learning (Piaget, 1973; Vygotsky, 1978). Such tools as LMS environments, live chat, and collaboration systems also reflect the ideas of constructivism as they allow the participants to interact and create a community (Stacey, 1999; Vercellotti, 2024). These strategies also promote sense-making and critical thinking, which become the essential outcomes of in-depth learning. Likewise, it is also possible to shoulder the application of the Technology Acceptance Model (TAM) that works to explain the mechanisms of digital tool effects of learning. When faculty and students see technology as somehow helpful and user-

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friendly, they will tend to incorporate it into the learning process, which will result in enhanced motivation (Sukendro et al., 2020; Granić & Marangunić, 2019). Of the conceptualization, our data exhibited that the correlation values are significant, and the regression effects are high. Both constructivist and TAM views therefore equally offer a solid theoretical explanation of the reasons and the mechanisms that make technology to positively contribute to engagement and learning once duly accepted by the users.

In addition, it depends on the context. The recent literature notes that various forms of technologies prove to be more or less effective, depending on the way they are used. According to Vercellotti (2024), technologies that facilitate structure, interaction, and active learning, e.g., LMS, online quizzes, polling tools, and media tools, always tend to facilitate an increased level of engagement. This has been established in our study as those instruments that were used by the respondents had such tools. On the contrary, technologies that are less interactive might not have a similar effect, and educators should select tools keeping the pedagogical objectives in mind instead of implementing digital solutions blindly (Kirkwood & Price, 2014; Schindler et al., 2017).

The implications of the faculty development and institutional policy are high. To begin with, since both students and faculty feel engagement and learning advantages, universities ought to make financial commitments towards training courses, which develop TPACK-related competence, i. e., how to define interactive and constructivist learning activities (Mishra & Koehler, 2006). The findings made in our research indicate that as soon as the instructors have gained confidence and are competent in the usage of the tools effectively, student outcomes are next. Second, the mass use of technology requires investments in its stable infrastructure and the ability to access it (Bower, 2019). The expert technical support is vital to the performance of the most well-designed interactive tools. Nonetheless, there are difficulties notwithstanding the good performance. Even though the results obtained for learning outcomes in terms of R 2 can be considered statistically significant, they still comprise less than half of the variance, which indicates that the other factors, presumably, student motivation, prior knowledge, or course content, play a crucial role (Gu et al., 2013; Henrie et al., 2015).

Based on the moderate correlation and regression findings in reference to the achievement results of learning, it could be said that technology should indeed be integrated with the good pedagogy and student support to fully influence the learning performance. The shortcoming of this research is that it was self-report based; this introduces bias because it is possible to think it may be different. Another limitation is that the study is crossblock based, this gives only a date of the perceptions sampled. The limitations associated with the future research in this study might be the ability to use longitudinal studies to determine the causal relationship between pedagogically aligned technology interventions and academic success in the future. Moreover, the explanatory mechanisms of integration and engagement would be clarified with the aid of qualitative data the methods of investigation can be classroom observations or interviews.

Conclusion

This study concludes that technology integration significantly enhances both student engagement and learning outcomes at the university level. The findings from both students and faculty perspectives confirm that digital tools—when purposefully implemented—lead to more active participation and improved academic performance. Engagement was more strongly influenced by technology than learning outcomes, emphasizing the role of interactive tools in fostering motivation and involvement. The study highlights the importance of aligning technology use with pedagogical goals and recommends sustained investment in faculty training and digital infrastructure to maximize the educational benefits of technology in higher education.

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Recommendations

- The universities ought to give periodic professional advancement to the faculty on the successful usage of the technology.
- Incorporation of learning management systems and interactive tools in the design of the course could increase the level of student engagement.
- Institutions should also spend in good digital infrastructure to be able to facilitate smooth online learning experiences.
- Faculty ought to engage technological devices that are related to the particular learning objectives in order to develop better academic results.
- Feedback of digital learning experience must be acquired regularly and it should be used in improvement.
- Flexibility in blended learning that revolves around face-to-face and online-based education should be embraced.
- The policies to be followed should encourage equal accessibility of technology to every student, irrespective of his/her origin or locational settings.

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