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IMPACT OF DIGITAL LEARNING TOOL USAGE ON STUDENT ENGAGEMENT AND ACADEMIC PERFORMANCE: A QUANTITATIVE ANALYSIS OF BEHAVIOURAL AND ACHIEVEMENT INDICATORS

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ABSTRACT

The increasing integration of digital learning tools in educational environments has transformed traditional teaching and learning processes, making it essential to understand their impact on student outcomes. This study examines the relationship between digital learning tool usage, student engagement, and academic performance using a quantitative research design. The analysis is based on a secondary dataset comprising behavioral indicators of engagement, usage patterns of digital tools, and academic performance measures. Descriptive statistics, correlation analysis, regression models, and mediation analysis were employed to explore the relationships among the variables. The findings reveal a significant positive relationship between digital learning tool usage and student engagement, indicating that increased interaction with digital platforms enhances participation, attendance, and study consistency. Student engagement was also found to have a strong positive effect on academic performance, highlighting its role as a key determinant of learning outcomes. Furthermore, digital learning tool usage demonstrated a direct positive impact on academic performance, although this effect was partially mediated by student engagement. The mediation analysis confirms that a substantial portion of the influence of digital tools on performance operates through enhanced engagement. The study underscores the importance of integrating digital learning tools with pedagogical practices that promote active student involvement. It concludes that the effectiveness of digital tools is maximized when they are used to foster meaningful engagement rather than passive learning. The findings contribute to the field of educational technology by providing empirical evidence on the interconnected roles of digital tool usage, engagement, and academic achievement. Practical implications suggest that educators and policymakers should focus on structured and engagement-driven implementation of digital tools to improve educational outcomes.

Keywords – Digital Learning Tools, Student Engagement, Academic Performance, Educational Technology, Quantitative Analysis

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1. Introduction

The high rate of adoption of digital technologies in learning settings has greatly altered the teaching and learning processes around the world. Digital learning tools are being widely incorporated in educational institutions to promote instruction delivery, enhance accessibility, and provide interactive learning experiences. They are online tools such as online platforms, learning management systems, and interactive digital resources that facilitate student-centered learning and active engagement. Consequently, the impacts of such tools on student engagement and academic performance have come to be an important topic of investigation in the field of education research (Uzorka & Odebiyi, 2025). Student engagement has been proposed as one of the most important factors in academic success, including behavioral, emotional, and cognitive aspects of engagement that determine the final effect on academic achievements. In technology-enhanced learning, engagement is frequently indicated by quantifiable variables like participation, attendance, regularity of studying practices, and use of digital platforms. Digital learning tools have demonstrated the ability to make learning environments more dynamic and interactive, thus motivating the students to become more involved in the learning process (Zafeer et al., 2025). This higher interaction plays a critical role, especially in modern-day education, which is slowly being overtaken by more participatory and technology-based learning styles.

The linkage between digital learning tools and academic performance has also been the focus of many studies in which teachers have tried to establish whether technological interventions result in better learning outcomes. Empirical data indicate that students who actively interact with digital resources show an improved academic performance, as such tools offer them a chance to learn individually, receive feedback in real time, and have a constant evaluation. In addition, the digital tools enable teachers to track student progression in a more active way and provide instructional plans demanding specific learning requirements of students (Nyongesa & Van Der Westhuizein, 2025). As a result, online learning communities could help to close the divide between the conventional pedagogical practices and improve the overall performance of education. Besides enhancing performance, digital learning tools can be used to develop critical thinking and problem-solving skills because they prompt the students to engage with the content in more significant ways. This relationship has been further enhanced through learning analytics and data-driven techniques that have allowed studying the patterns of student engagement and their influence on academic performance. Such methods of analysis can be helpful in understanding how students engage with digital platforms, which educators can use to create more effective interventions that can facilitate learning and interaction (Johar et al., 2023). These developments underscore the need to incorporate technology in pedagogical practices in order to attain the best educational results.

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Additionally, the presence of various digital sources of learning has widened the horizons of learning beyond the confines of a classroom. Students are now able to access educational material wherever they want and whenever they wish, thus enhancing flexibility and autonomy in the learning process. This change has created more focus on self-directed learning through which students embrace the responsibility of their learning. Research has shown that both engagement and academic achievement have a positive relationship with the successful use of digital resources, especially in cases where the tools are planned into the curriculum (Wong et al., 2025). This highlights the importance of a systematic study of the impact of the use of digital tools on critical variables of education. Although there is an increasing literature base, empirical studies are still lacking that use quantitative data to investigate the relationships among the use of digital learning tools, student engagement, and academic performance. Current literature concentrates on engagement or performance alone, without discussing in sufficient depth how the two are interrelated. Also, the studies that use behavioral indicators to quantify engagement are insufficient and do not allow for measuring it in a more objective and data-driven way. This gap needs to be addressed to create an overall picture of the effects of digital learning environments on student outcomes (Zen & Ariani, 2022).

The contribution of behavioral engagement, specifically, has become more prominent during the last few years, as behavioral engagement offers tangible and quantifiable evidence of the student's participation in learning processes. The behavioral engagement factors involve: attendance, participation, and consistency in studying, and these are key to academic success. It has been proven that students with increased behavioral engagement tend to obtain higher academic outcomes, demonstrating the need to promote active engagement in learning environments (Wang et al., 2025). Digital learning tools are capable of contributing a lot to these behaviors through interactive and engaging ways of learning. Additionally, the quantitative study of digital learning environments has shown that there are notable correlations between the use of technology and student engagement. The need to incorporate digital tools in a way that promotes active learning and student engagement is stressed in these studies. Understanding the patterns of usage and measuring the level of engagement, researchers will be able to learn more about the effectiveness of digital learning tools and their influence on academic outcomes (Qadeer et al., 2025). These insights can be useful to teachers and policymakers who want to maximize the application of technology to education.

Digital tools have a wide range of impacts on various levels of education, which evidences their flexibility and adaptability to various academic settings. In secondary, higher, and primary education, digital learning tools have been proven to boost engagement and improve academic performance when introduced productively. This cross-level applicability indicates the general applicability of digital technologies in the educational process and the necessity of additional studies to investigate their role in particular circumstances (Hardiyanti et al., 2023). The use of digital learning tools in secondary education, especially, has been linked to more student

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engagement and better learning. Younger learners tend to be more open to technology-based learning methods, so online resources can be a successful way of improving learning experiences. Studies in the secondary school setting have shown that using digital tools can greatly enhance student engagement and academic performance, thus supporting the significance of technology in contemporary education (Alenezi and Alenezi, 2025). Equally, research studies carried out within the primary education setting have shown that technology-based learning has the potential to impact both engagement and performance favorably. These results indicate that the advantages of the digital learning tools are not confined to certain educational levels but can be applied to various levels of learning. Digital tools help to achieve better learning outcomes and promote the acquisition of the necessary skills by creating interactive and engaging learning environments (Ibrahim et al., 2025).

The positive correlation between digital technologies and student engagement is also confirmed by systematic reviews of the literature, which show the significance of implementing technology in learning activities. These reviews highlight the importance of having a holistic approach that takes into consideration various dimensions of engagement and how they relate to learning outcomes. Evaluating the results of multiple studies, researchers have outlined the most important factors that determine the success of digital learning tools, such as design, usability, and alignment with the pedagogical goals (Nkomo et al., 2021). Moreover, the effectiveness of digital learning tools in terms of academic performance has been investigated in different institutional settings, with uniform positive results. Research that has been done in colleges and technical schools has revealed that students who make good use of digital tools are likely to perform well academically. These results confirm the necessity to incorporate technology into educational systems to improve the learning process and facilitate student success (Keonyenasoa & Golley, 2025).

Increased focus on technology in the learning process has also prompted the identification of new methods that can be used to utilize digital technology in order to improve engagement and learning outcomes. The current studies in this field point to the opportunities of digital technologies to radically change the practice of traditional education and make the learning process more interactive and engaging. Through studying the effects of these tools on student engagement and performance, researchers will be able to help create even more efficient educational strategies (Diputra et al., 2025). As the use of digital learning tools continues to rise, and they have the potential to improve educational outcomes, there is a need to undertake empirical studies that explore their effects on student engagement and academic performance. This paper attempts to respond to this requirement by using quantitative data to evaluate the correlations between the use of digital tools, behavioral involvement, and academic performance. The paper will seek to give a detailed insight into the impact of digital learning tools on the most important educational variables by concentrating on measurable variables and using statistical analysis.

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- To examine the impact of digital learning tool usage on student engagement.
- To analyze the relationship between student engagement and academic performance.
- To determine the direct effect of digital learning tool usage on academic performance.

2. Methodology

2.1 Research Design

The present study can be considered as a quantitative research design to explore the connection between the use of digital learning tools, engagement with learners, and academic achievement. The cross-sectional method is utilized because the analysis is conducted on one dataset that defines various variables at a particular time. Quantitative design is suitable to this study as it enables statistical analysis of the relationship between variables and enables objective measurement of behavioral and performance indicators. The study is based on numerical data and empirical analysis, which guarantees methodological rigor and makes results more reliable.

2.2 Data Source

The data used in the current research are the results of a secondary dataset (Narwade, 2026) which contains organized data that pertains to student behavior, the use of digital tools, and academic performance. The data consists of several variables that capture tendencies of using digital learning tools, behavioral indicators, and measures of academic performance. It includes a large enough number of observations, which can be statistically analyzed and provide generalizable findings. This dataset can be used in this study because it offers all the information needed to investigate the relationship between the use of technology and performance in learning.

2.3 Variables Description

The research will be organized in three main types of variables: independent, dependent and mediating variables and some control variables are selected to achieve a better analytical result. The independent variable in this study is the use of digital learning tools and it will be operationalized using digital learning tool usage indicators which include time spent using digital tools, frequency of use, number of tools used and usage purpose. All these are indicators that reflect the level of engagement and the character of the interaction of students with online learning settings. Academic performance is the dependent variable and the indicators that are used to measure the performance are final scores, examination results and average assignment scores. These variables offer an overall depiction of student achievement and learning performance. In this study student engagement is considered a mediating variable. It is assessed

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in the form of behavioral measures, i.e. participation and attendance in classes and consistency of studying. These variables consist of visible patterns of engagement, which are directly connected to academic performance. Control variables are included to ensure that the possible confounding effects are taken into consideration. These are demographic and behavioral variables like age, gender and hours per day of study. Adding these variables will make sure that the relationships determined between the main variables will not be subject to the influence of other factors.

2.4 Data Preprocessing

The dataset is systematically processed before analysis to maintain quality and reliability of the data. Missing data are detected and addressed with suitable methods, including imputation or deletion, which are determined by the amount and the nature of missing data. Data cleaning is conducted to remove inconsistencies, duplications and irrelevant data. Statistical analysis of outliers is conducted to ascertain the possible effect of outliers on the analysis. Extreme values are either handled or eliminated where it is essential to avoid distortion of results. Also, data normalization or standardization is implemented in order to make variables comparable, especially when various scales are used. These preprocessing steps are essential for maintaining the integrity of the analysis and ensuring accurate results.

2.5 Analytical Techniques

A variety of statistical methods is used in the study to examine the relationships between the variables. The data is initially summarized using descriptive statistics to give a summary of the important variables including the mean, standard deviation and distribution patterns. This step assists in getting insight into the overall properties of the dataset. The correlation analysis is then used to test the magnitude and nature of relationships among the use of digital learning tools, engagement, and student academic performance. This gives preliminary information on the associations of the variables with one another. The main method of analysis is the regression analysis to test the objectives of the study. Various regression models are created to evaluate the direct and indirect associations between variables. The former one studies the effects of the use of digital learning tools on student engagement. The second model examines the impact of engagement among students in terms of their academic performance. The third model considers a direct correlation between the use of digital learning tools and academic performance. In the case of mediation analysis, it is done to establish whether student engagement is an intermediary variable between the use of digital tools and academic performance. This will enable a better insight into the process by which digital tools support learning results.

3. Results and Analysis

3.1 Descriptive Statistics

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The first step of the analysis is to analyze the descriptive statistics of the key variables to gain an idea about the general characteristics of the data set. The sample is representative of students with varied ages, learning habits and the degree of exposure to digital learning devices. Mean, standard deviation, minimum and maximum measures are used to give an understanding of central tendency and variability of the data. The variables of digital learning tools use show that there is a variation in time spent using digital learning tools by the students and the frequency and intensity of use. On the same note, the indicators of engagement like participation in classes, percentage attendance, and consistency of studying demonstrate a visible difference, and, therefore, it can be assumed that students are more or less involved in the learning process. The variables of academic performance such as final scores and the average scores of assignments also show a reasonable spread which means that there were both high and low performers in the data set. The descriptive analysis indicates that students who are more engaged are more likely to exhibit more stable academic performance and those who are less engaged are more likely to exhibit variable academic performance. On top of that, the trends on the use of digital tools reveal that moderate and heavy usage of digital tools is more prevalent among students who have organized study habits. These observations can give a pre-view of the relationships which are further analyzed using inferential analysis. As demonstrated in Table 1, the descriptive statistics gives a picture of the important variables, including the usage of digital learning tools, indicators of student engagement, and academic performances.

Table 1. Descriptive Statistics of Key Variables

Variable	Mean	Std. Deviation	Minimum	Maximum
Digital Tool Usage Time (minutes)	85.40	30.25	20	180
Frequency of Tool Usage	4.10	1.20	1	6
Study Hours per Day	3.75	1.15	1	7
Attendance Percentage	82.60	10.45	50	100
Class Participation Score	7.80	1.60	3	10
Study Consistency Index	6.90	1.75	2	10
Final Academic Score	74.50	12.30	40	98
Assignment Average Score	76.20	10.85	45	95

3.2 Correlation Analysis

Correlation analysis is performed to find out the strength and direction of the relationship between the use of digital learning tools, student engagement, and academic performance. The

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findings show a positive relationship between the use of digital learning tools and student engagement, which implies that the more students are engaged with digital tools the more it is likely that they will have higher levels of participation, attendance, and study consistency. This correlation means that digital tools can enhance more active engagement in the learning processes.Student engagement and academic performance also have a strong positive correlation. Academic performance is better in students who are more behaviorally engaged, which is determined by their performance scores in exams and overall performance measures. This result supports the idea that engagement is an important variable in determining the success of students. There is a positive but relatively moderate correlation between the use of digital learning tools and academic performance. This implies that although digital tools lead to better performance, their effect could be partly mediated by engagement. That is, the potential of digital tools in improving academic performance is strongly associated with how they can facilitate student engagement. As Figure 1 reveals, student engagement features the highest positive correlation with academic performance, followed by the correlation between the use of digital tools and engagement.

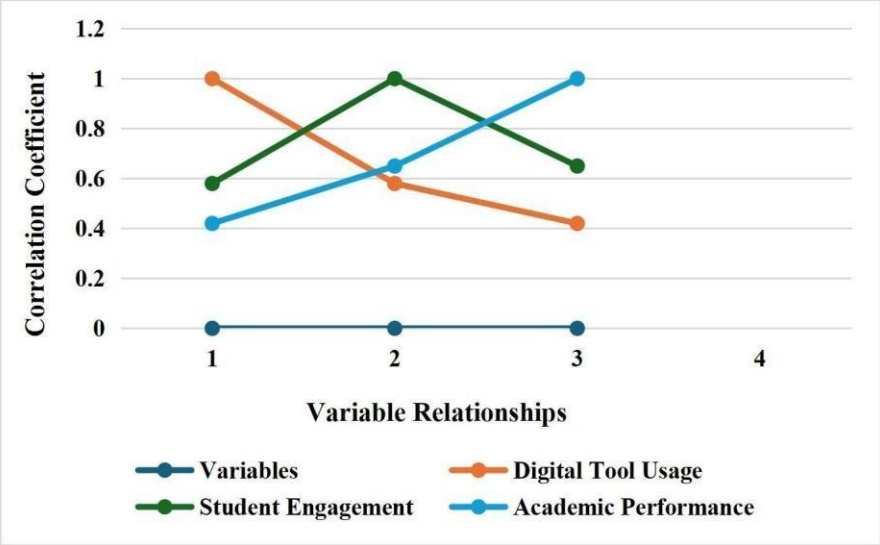


Figure1. Correlation Analysis

3.3 Regression Analysis

In order to further test the relationship between the variables, multiple regression analyses are done. The initial regression equation is used to assess the influence of the use of digital learning tools on student engagement. These findings suggest that the use of digital tools is a strong predictor of engagement whereby the more the tool is used, the more the participation, better attendance and study consistency. The model illustrates a statistically significant relationship which implies that digital learning tools are significant in influencing the behaviors of student engagement. The second regression model analyzes the effect of student engagement on

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academic performance. The results indicate that engagement is a powerful and statistically significant predictor of academic results. The more engaged students are, the higher their performance scores are, which makes the role of active engagement and regular study routines in academic achievements crucial. The model describes a large percentage of the academic performance variation indicating that engagement is a major factor influencing student performance. The third regression model explores the direct correlation between the use of digital learning tools and academic performance. The findings indicate that there is a positive statistically significant relationship though the magnitude of the effect is lower than the effect of engagement on performance. This shows that even though digital tools can have a direct impact on academic performance, they have a greater impact when mediated by engagement. The lowering of the effect size when engagement is added to the model also contributes to the mediating effect of engagement. According to Table 2, the use of digital learning tools is a significant predictor of student engagement, whereas engagement has a strong impact on academic performance.

Table 2. Regression Analysis Results

Model	Independent Variable	Dependent Variable	Beta Coefficient (β)	t-value	Significance (p)	R^2
1	Digital Tool Usage	Student Engagement	0.52	8.45	<0.001	0.27
2	Student Engagement	Academic Performance	0.64	10.12	<0.001	0.41
3	Digital Tool Usage	Academic Performance	0.31	5.76	<0.001	0.18

3.4 Mediation Analysis

In order to examine the indirect impact of the use of digital learning tools on academic performance, a mediation analysis is carried out. The findings support the view that student engagement is a partial mediator between this relationship. The use of digital tools has a positive effect on engagement, and thus, academic performance. The indirect effect via engagement is statistically significant and this suggests that a significant proportion of the influence of the digital tools on the performance is mediated by the increased participation of students in learning processes. Simultaneously, the large direct effect indicates that digital learning resources also impact the academic performance without the need to engage. This dualism underscores the versatile nature of digital tools in learning, which, in addition to facilitating interaction, offers literal academic assistance by having access to resources, feedback, and learning resources. Figure 2 shows the mediation effect of the student engagement on the use of digital learning tool and academic performance.

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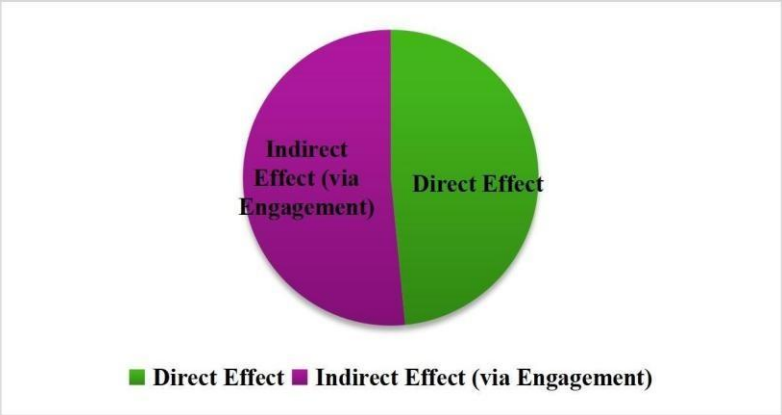


Figure 2. Mediation Analysis

4. Discussion

The results of this work offer empirical evidence to support the growing literature on the significance of digital learning tools to increase student involvement and academic achievement. The correlation found between use of digital learning tools and student engagement indicates positive relationship which implies that technology is facilitative in encouraging student engagement in learning settings. This aligns with the available literature which suggests that digital platforms, and online learning environments open up the possibility of greater interaction, collaboration, and sustained attention among students (Kumar, 2026). The systematic execution of such tools seems to promote the practice of regular study behaviors, which are crucial in ensuring engagement in the long term.

The high correlation between student engagement and academic achievement also supports the importance of engagement as a factor of learning outcomes. There were behavioral indicators like participation, attendance, and study consistency that were identified to have a significant impact on academic achievement, and therefore the importance of an active part in the learning process cannot be underestimated. These results are consistent with the earlier studies which highlight the predictive power of engagement indicators in student success, specifically in technology-mediated learning settings (Alfalasi, 2026). The opportunity to gauge the engagement in terms of tangible behaviors gives teachers a working model to track and improve the performance of the students.

The research also shows that there is a direct, but moderate effect of the use of digital learning tools on academic performance. This implies that, although digital tools can be used to achieve better results, they will be more effective when they are actively used to generate student interest. The mediating nature of engagement revealed in this research lends credence to the fact that technology by itself cannot be relied upon to promote academic achievement unless it is

supplemented with meaningful interaction between the student and the technology. This view is backed by the studies that note the significance of creating technology-based learning spaces that facilitate active learning, as opposed to passive content consumption (Balalle, 2024).

Moreover, the results emphasize the importance of behavioral engagement as the mechanism of the impact of digital tools on the learning outcomes. The mediation effect observed implies that digital learning tools have an academic performance-enhancing effect, which is facilitated through student engagement, and not necessarily due to the direct impact of instruction. This is in line with the theoretical models that highlight the dynamic relationship between the learning setting and the student behaviour and that engagement is a key factor between technological inputs and education outputs (Li and Xue, 2023). This interaction is critical towards designing effective digital learning strategies that yield the best outcomes in students.

Moreover, the findings of this study can be aligned with the overall trend of research that has shown the effectiveness of technology-enhanced learning in enhancing engagement and academic performance in various learning contexts. Digital tools in the learning environment have been demonstrated to offer learning experiences that are flexible, interactive and personalized and meets the needs of individual students. These conditions will motivate the students to become more participatory in their learning and thus improve the level of engagement and performance (Kokoç & Altun, 2021). The findings support the need to adopt a holistic view of educational technology which takes into account both technology and pedagogy.

To sum up, the results of the studies all suggest that the usefulness of digital learning tools is not limited to their availability, but rather to how they are pedagogically incorporated to promote active interaction of students. The findings indicate that technology is most beneficial to education when it is matched with teaching and learning approaches that promote engagement, regularity, and relevance with learning materials. This highlights the need by educators and policymakers to go beyond the technology adoption to purposeful and planned implementation. Through integrating digital resources in the teaching methods that are engagement-based, educational systems will be able to maximize their influence on academic outcomes and design more responsive and efficient learning experiences (Chukwu et al., 2026).

5. Conclusion

This research aims at investigating how the use of digital learning tools affects student engagement and academic performance in a quantitative and data-driven method. The results indicate that digital learning tools can be an important factor in developing student learning behaviors and outcomes especially when they are used in accordance with engagement-oriented practices. The discussion supports the idea that the more people interact with digital learning tools, the more student engagement is observed that subsequently leads to better academic performance. This supports the opinion that engagement is a very crucial process by which

technology can affect educational outcomes. The findings also show that although digital learning resources have a direct positive influence on academic achievement, they have a greater impact when mediated by student engagement. This brings about the need to encourage active learning, regular study and effective engagement with learning resources. The occurrence of direct and indirect effects imply that digital tools are not only sources of academic support but also drivers of behavioral engagement and, thus, they contribute to overall learning effectiveness. Practically, the findings highlight the importance of teachers to incorporate digital learning tools in a manner that is well organized and meaningful. It is not enough to make technology accessible but instead, it is important to create learning experiences that promote active learning and long-term involvement. Learning institutions and policy-makers need to focus on the creation of strategies that can make the use of digital tools consistent with pedagogical goals, so that technology is employed to support, but not replace, the learning process. Although beneficial, the study has some limitations. It is limited by the fact that it uses secondary data and it is not possible to get a deeper qualitative understanding of student experiences and perceptions. Second, the set of data is also a particular situation and this aspect may restrict the ability to generalize the results to other educational environments. The limitations may be overcome in future studies by including mixed-method usage and examining the impact of contextual issues on the learning process, including institutional setting, instructional methods, and student characteristics. Finally, the research offers empirical data to confirm that digital learning tools can be effective in improving student engagement and academic outcomes. It highlights the significance of combining technology and pedagogical approaches that facilitate active learning and active engagement. Through strategic use of digital tools, they can make learning settings more interactive, responsive, and efficient to facilitate student achievements in the education systems.

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