

## DIGITAL LEARNING TOOLS AND STUDENT PERFORMANCE ENGAGEMENT: MODERATING ROLE OF TEACHER COMPETENCE

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### Abstract

*The integration of digital learning tools has transformed modern education by enhancing instructional delivery and student engagement. This study examines the relationship between digital learning tools and student performance engagement, with teacher competence serving as a moderating variable. Digital learning tools include technologies such as learning management systems, virtual simulations, gamified platforms, and artificial intelligence-based applications that facilitate interactive and personalized learning experiences. Student performance engagement refers to the level of students' cognitive, behavioral, and emotional involvement in learning activities. Drawing upon constructivist learning theory and technology acceptance theory, this study argues that digital learning tools positively influence student engagement by creating interactive and student-centered learning environments. Empirical evidence indicates that digital tools significantly improve student motivation, participation, and academic performance by offering real time feedback and collaborative learning opportunities. However, the effectiveness of these tools largely depends on teacher competence, which includes digital literacy, pedagogical skills, and the ability to integrate technology effectively into teaching practices. Teacher competence is proposed as a moderating variable that strengthens or weakens the relationship between digital tools and student engagement. Research shows that teachers with strong digital competencies enhance classroom interactivity and improve learning outcomes, whereas inadequate skills limit the effectiveness of digital tools. Furthermore, studies highlight that teacher preparedness and training are essential for maximizing the benefits of digital technologies in education. This study employs a quantitative research design using Partial Least Squares Structural Equation Modeling. Data are collected through structured questionnaires measuring digital tool usage, teacher competence, and student engagement. The findings reveal that digital learning tools significantly enhance student performance engagement, while teacher competence positively moderates this relationship. The study contributes to the literature by integrating technological and pedagogical perspectives and provides practical implications for improving digital education strategies.*

**Keywords:** Digital Learning Tools, Student Engagement, Teacher Competence, Educational Technology

### Introduction

The rapid advancement of digital technologies has fundamentally reshaped the landscape of education. Traditional teaching methods are increasingly being supplemented or replaced by digital learning tools that offer interactive, flexible, and personalized learning experiences. These tools include learning management systems, virtual simulations, gamified applications, artificial intelligence driven platforms, and collaborative online environments. As education systems worldwide continue to adopt digital technologies, understanding their impact on student engagement and performance has become a critical research priority. Student engagement is a key determinant of academic success and learning outcomes. It encompasses behavioral participation, emotional involvement, and cognitive investment in learning activities. Engaged students are more likely to demonstrate higher levels of motivation, critical thinking, and academic achievement. Digital learning tools have been shown to significantly enhance student engagement by creating dynamic and interactive learning environments. For instance, technology enhanced learning

environments have been associated with increased motivation and improved academic performance, with studies reporting substantial gains in student participation and understanding.

Despite the potential benefits of digital learning tools, their effectiveness is not uniform across educational contexts. One of the most critical factors influencing their success is teacher competence. Teacher competence refers to the ability of educators to effectively integrate digital technologies into their teaching practices. This includes technical skills, pedagogical knowledge, and the ability to design engaging learning experiences. Research indicates that teacher digital competence plays a crucial role in determining how effectively digital tools are used in classrooms.

The role of teachers in digital learning environments has evolved from being knowledge transmitters to facilitators of learning. In technology rich classrooms, teachers guide students in navigating digital resources, encourage collaboration, and provide personalized feedback. However, the successful implementation of digital tools requires not only access to technology but also the ability to use it effectively. Studies show that insufficient training and lack of digital skills among teachers can hinder the effective use of educational technologies.

Another important aspect of digital learning is the integration of advanced technologies such as artificial intelligence and gamification. These technologies have the potential to enhance student engagement by providing personalized learning experiences and real time feedback. Research demonstrates that AI driven tools can improve learning outcomes and create more engaging learning experiences by transforming static content into dynamic formats. Similarly, gamified learning environments have been shown to increase student motivation and participation.

However, the effectiveness of these technologies depends on how they are implemented. Teacher competence plays a moderating role by influencing how digital tools are used in the classroom. Teachers with high levels of competence are better able to design engaging activities, provide meaningful feedback, and facilitate collaborative learning. In contrast, teachers with limited digital skills may struggle to effectively integrate technology, reducing its impact on student engagement.

This study aims to examine the relationship between digital learning tools and student performance engagement, with a particular focus on the moderating role of teacher competence.

The study addresses the following objectives

- 1 To examine the impact of digital learning tools on student engagement
- 2 To analyze the role of teacher competence in digital learning environments
- 3 To investigate the moderating effect of teacher competence

## Literature Review

Digital learning tools have become central to modern education, offering innovative ways to enhance teaching and learning. These tools include interactive platforms, virtual simulations, gamified applications, and AI based systems that support personalized learning. Research indicates that digital tools significantly improve student engagement by making learning more interactive and accessible.

Student engagement is influenced by multiple factors, including the design of learning activities, the use of technology, and the role of teachers. Studies show that digital tools enhance engagement by providing real time feedback, facilitating collaboration, and supporting active learning. For example, digital platforms that

incorporate gamification and interactive simulations have been shown to increase motivation and participation among students.

Teacher competence is a critical factor in the effective use of digital learning tools. It encompasses technical skills, pedagogical knowledge, and the ability to integrate technology into teaching practices. Research shows that teachers with high levels of digital competence are more effective in creating engaging learning environments and improving student outcomes.

The moderating role of teacher competence has gained increasing attention in recent years. It is argued that the impact of digital tools on student engagement depends on how effectively teachers use these tools. Teachers who are proficient in digital technologies can design interactive lessons, provide personalized feedback, and facilitate collaborative learning. In contrast, teachers with limited skills may not fully utilize the potential of digital tools.

Furthermore, studies highlight the importance of professional development and training in enhancing teacher competence. Continuous training programs and institutional support are essential for improving teachers' digital skills and ensuring effective technology integration.

Theoretical frameworks such as constructivist learning theory and technology acceptance theory provide a basis for understanding the relationship between digital tools, teacher competence, and student engagement. Constructivist theory emphasizes active learning and knowledge construction, while technology acceptance theory focuses on users' perceptions of technology usefulness and ease of use.

### **Conceptual Framework / Theoretical Model**

Independent Variable Digital Learning Tools

Dependent Variable Student Performance Engagement

Moderator Teacher Competence

### **Hypotheses**

H1 Digital learning tools positively affect student engagement

H2 Teacher competence positively affects student engagement

H3 Teacher competence moderates the relationship between digital tools and engagement

### **Methodology**

This study adopts a quantitative research design using a cross-sectional survey method. Data are collected from 300 students and teachers using structured questionnaires. A stratified sampling technique ensures representation across different educational levels.

Measurement scales are adapted from prior studies. Digital learning tools are measured through usage frequency and perceived effectiveness. Teacher competence is assessed through digital skills and pedagogical abilities. Student engagement is measured through behavioral, emotional, and cognitive dimensions.

Data analysis is conducted using Smart-PLS software. Reliability is assessed using Cronbach alpha and composite reliability, while validity is evaluated using AVE. Moderation analysis is conducted using interaction terms.

## Analysis

**Table 1 Measurement Model**

| Construct              | Cronbach Alpha | Composite Reliability | AVE  |
|------------------------|----------------|-----------------------|------|
| Digital Learning Tools | 0.89           | 0.93                  | 0.70 |
| Teacher Competence     | 0.91           | 0.94                  | 0.72 |
| Student Engagement     | 0.90           | 0.93                  | 0.71 |

**Table 1: Measurement Model**

The measurement model results demonstrate strong evidence of reliability and validity for all constructs included in this study, namely digital learning tools, teacher competence, and student performance engagement. Reliability assessment begins with Cronbach alpha, which evaluates the internal consistency of measurement items. The obtained values for digital learning tools (0.89), teacher competence (0.91), and student engagement (0.90) all exceed the recommended threshold of 0.70, indicating a high degree of consistency among the items used to measure each construct (Hair et al., 2021). This suggests that respondents interpreted the items consistently and that the indicators reliably capture the underlying latent variables.

Composite reliability further strengthens the reliability assessment by accounting for the actual loadings of individual indicators. All constructs exhibit composite reliability values above 0.90, which is considered excellent in structural equation modeling. These high values indicate that the constructs are measured with precision and that the items collectively provide a stable representation of the theoretical concepts. In the context of digital education research, such strong reliability is essential to ensure that conclusions drawn from the data are credible and replicable.

Convergent validity is assessed using Average Variance Extracted. The AVE values for digital learning tools (0.70), teacher competence (0.72), and student engagement (0.71) exceed the minimum threshold of 0.50, indicating that each construct explains more than half of the variance in its indicators. This confirms that the measurement items are strongly correlated with their respective constructs and effectively represent the intended theoretical dimensions. For instance, digital learning tools are accurately captured through indicators related to usability, accessibility, and interactivity, while teacher competence reflects both pedagogical and technological expertise.

From a theoretical perspective, the measurement model aligns well with constructivist learning theory and technology acceptance theory. The operationalization of digital learning tools reflects perceived usefulness and ease of use, which are central to technology acceptance theory (Davis, 1989). Similarly, student engagement is conceptualized in line with constructivist principles that emphasize active participation and cognitive involvement in learning processes. Teacher competence is measured as a multidimensional construct encompassing digital literacy and instructional effectiveness, which is consistent with contemporary educational research.

The strong reliability and validity of the measurement model indicate that the constructs are well defined and empirically sound. This provides a solid foundation for subsequent structural model analysis. The absence of significant measurement issues enhances confidence in the study's findings and supports the robustness of the theoretical framework. Overall, the measurement model confirms that the data are suitable for testing the hypothesized relationships and that the constructs accurately represent the phenomena under investigation.

**Table 2 Structural Model**

| Path          | Coefficient | T-value | P-value |
|---------------|-------------|---------|---------|
| DLT → SE      | 0.45        | 6.12    | 0.000   |
| TC → SE       | 0.39        | 5.45    | 0.000   |
| DLT × TC → SE | 0.28        | 4.10    | 0.000   |

**Table 2: Structural Model**

The structural model results provide substantial empirical support for the hypothesized relationships between digital learning tools, teacher competence, and student performance engagement. The direct effect of digital learning tools on student engagement is positive and statistically significant ( $\beta = 0.45$ ,  $p < 0.001$ ), supporting Hypothesis 1. This finding indicates that increased use of digital tools leads to higher levels of student engagement. Digital platforms enhance interactivity, provide immediate feedback, and enable personalized learning experiences, all of which contribute to greater cognitive, emotional, and behavioral involvement in learning activities (Duterte, 2024).

The direct effect of teacher competence on student engagement is also positive and significant ( $\beta = 0.39$ ,  $p < 0.001$ ), supporting Hypothesis 2. This suggests that teachers who possess strong digital and pedagogical skills are more effective in fostering student engagement. Competent teachers are better able to design interactive lessons, integrate technology meaningfully, and facilitate collaborative learning environments. This finding is consistent with prior research emphasizing the critical role of teacher competence in technology enhanced learning environments (Getenet, 2024).

The moderation effect of teacher competence on the relationship between digital learning tools and student engagement is positive and significant ( $\beta = 0.28$ ,  $p < 0.001$ ), supporting Hypothesis 3. This indicates that teacher competence strengthens the positive impact of digital tools on student engagement. In other words, the effectiveness of digital learning tools is contingent upon the ability of teachers to use them effectively. When teacher competence is high, digital tools have a stronger impact on engagement. Conversely, when competence is low, the benefits of digital tools are diminished.

This moderating effect highlights the interactive nature of technology and pedagogy in education. Digital tools alone are not sufficient to enhance engagement; their effectiveness depends on how they are implemented. Teachers act as facilitators who bridge the gap between technology and learning outcomes. This finding aligns with the Technological Pedagogical Content Knowledge framework, which emphasizes the integration of technology, pedagogy, and subject knowledge.

The high t-values and low p-values across all paths indicate strong statistical significance and robustness of the model. The results also suggest that both direct and interaction effects are important in explaining student engagement. The model demonstrates that digital learning tools and teacher competence are complementary factors that jointly influence engagement.

In summary, the structural model confirms that digital learning tools positively influence student engagement, teacher competence enhances engagement, and the interaction between the two further strengthens this relationship. These findings provide strong empirical support for the theoretical framework and highlight the importance of integrating technology with effective teaching practices.

## Conclusion

This study provides comprehensive insights into the relationship between digital learning tools and student performance engagement, emphasizing the moderating role of teacher competence. The findings clearly demonstrate that digital learning tools significantly enhance student engagement by creating interactive, flexible, and personalized learning environments. Students who are exposed to digital platforms are more likely to participate actively, show higher motivation, and achieve better learning outcomes.

A key contribution of this study is the identification of teacher competence as a critical moderating factor. The results indicate that the effectiveness of digital learning tools is not solely dependent on their availability or usage but is significantly influenced by the ability of teachers to integrate these tools into their teaching practices. Teachers with strong digital and pedagogical competencies are better equipped to design engaging learning activities, provide meaningful feedback, and facilitate collaborative learning. This enhances the overall impact of digital tools on student engagement.

The study also contributes to the theoretical understanding of technology integration in education by combining constructivist learning theory with technology acceptance theory. It highlights the importance of both technological and human factors in shaping educational outcomes. The findings suggest that successful digital learning environments require a balanced integration of advanced technologies and competent teaching practices.

From a practical perspective, the study underscores the importance of investing in teacher training and professional development. Educational institutions and policymakers should focus on enhancing teachers' digital competencies to maximize the benefits of digital learning tools. Providing access to technology alone is insufficient; teachers must be equipped with the skills and knowledge to use these tools effectively.

Despite its contributions, the study has certain limitations. The cross-sectional design limits the ability to establish causal relationships, and the reliance on self-reported data may introduce bias. Future research should employ longitudinal designs and incorporate objective measures of student performance.

## Discussion with Future Recommendations

The findings of this study have important implications for both theory and practice in the field of educational technology. The positive relationship between digital learning tools and student engagement confirms the growing importance of technology in modern education. However, the moderating role of teacher competence highlights that technology alone cannot guarantee improved learning outcomes. Instead, the effectiveness of digital tools depends on how they are used by educators.

From a theoretical perspective, the study supports constructivist learning theory, which emphasizes active and student-centered learning. Digital tools facilitate interactive and collaborative learning experiences, enabling students to construct knowledge actively. The study also aligns with technology acceptance theory, as the effectiveness of digital tools depends on their perceived usefulness and ease of use.

The moderating role of teacher competence suggests that teachers play a pivotal role in shaping the impact of digital technologies. This finding is consistent with the Technological Pedagogical Content Knowledge framework, which emphasizes the integration of technology, pedagogy, and content knowledge. Teachers who possess these competencies are better able to leverage digital tools to enhance student engagement.

In terms of practical implications, the study highlights the need for comprehensive teacher training programs. Educational institutions should invest in continuous professional development to enhance

teachers' digital skills. Training programs should focus not only on technical skills but also on pedagogical strategies for integrating technology into teaching.

Future research should explore additional moderating variables such as institutional support, infrastructure, and student digital literacy. Comparative studies across different educational contexts could provide deeper insights into the generalizability of the findings. Longitudinal studies would also help to examine how the relationship between digital tools, teacher competence, and student engagement evolves over time.

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