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Learning motivation mediates student engagement and academic outcomes in digital higher education

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ABSTRACT

The rapid expansion of digital learning in higher education has created new challenges in maintaining student engagement, academic performance, and satisfaction. While previous studies have widely examined the relationship between student engagement and academic outcomes, limited research has explored the psychological mechanisms that explain how engagement influences both academic performance and student satisfaction in digital learning contexts. This study investigates the mediating role of learning motivation in the relationship between student engagement, academic performance, and student satisfaction in digital higher education. A quantitative research design was employed using survey data collected from undergraduate students at a university in Indonesia. The data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM). The findings show that student engagement positively influences learning motivation, which subsequently improves academic performance and student satisfaction. Learning motivation also acts as a key mediating mechanism linking student engagement to both outcomes. These findings highlight the importance of strengthening students' motivation to enhance learning effectiveness and satisfaction in digital learning environments.

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1. INTRODUCTION.

The rapid advancement of information and communication technologies has significantly transformed the landscape of higher education, particularly through the increasing adoption of digital learning environments (He & Ong, 2025). Universities worldwide have integrated various digital platforms and learning management systems to facilitate more flexible and interactive learning processes (Poernomo & Budiwidjojo Putra, 2024; Sari et

al., 2024). These technological developments allow students to access learning resources anytime and anywhere, thereby reshaping the way teaching and learning activities are conducted in higher education institutions (Han et al., 2024; Martin & Bolliger, 2018).

In higher education, student engagement has been widely recognized as a key factor influencing students' learning experiences and academic success (Imstepf et al., 2022). Student engagement refers to the degree of students' behavioral, emotional, and cognitive involvement in learning activities (Evans & Zhu, 2023). Students who demonstrate higher levels of engagement tend to participate more actively in academic tasks, interact more intensively with learning materials, and show stronger commitment to achieving their academic goals (Gan et al., 2024; Sharif Nia et al., 2023). Previous studies have also shown that higher levels of engagement are associated with improved academic performance (Wawrzynski & Jessup-Anger, 2010) and more positive learning outcomes (Liu et al., 2023; Tan et al., 2025).

However, maintaining student engagement in digital learning environments presents additional challenges (Chiu, 2021). Unlike traditional face-to-face learning, digital learning requires students to exercise greater levels of autonomy, self-regulation, and persistence in managing their learning activities. The reduced level of direct interaction between students and instructors may also influence students' learning experiences and potentially affect their motivation and academic outcomes. As a result, understanding the mechanisms through which student engagement influences academic performance and learning satisfaction becomes increasingly important in digital learning contexts (Assefa et al., 2025; Aznam et al., 2022).

One psychological factor that may explain the relationship between student engagement and academic outcomes is learning motivation. Learning motivation refers to the internal and external forces that drive students to initiate, direct, and sustain their learning activities toward achieving academic goals (Deci & Ryan, 2012). Students with higher levels of motivation tend to demonstrate stronger persistence, greater effort, and higher levels of commitment in completing academic tasks (Obiosa, 2020). In digital learning environments, where students must manage their learning more independently, motivation becomes an essential factor influencing both academic performance and students' overall satisfaction with the learning process.

Previous research has examined the relationships among student engagement, learning motivation, and academic performance. However, many studies primarily focus on direct relationships between these variables, while the mediating role of learning motivation in explaining how student engagement influences both academic performance and student satisfaction remains relatively underexplored. Moreover, existing studies often investigate these relationships separately rather than integrating engagement, motivation, academic performance, and satisfaction within a single structural framework (Gray & DiLoreto, 2016; Sharif Nia et al., 2023).

Furthermore, empirical evidence from developing countries, particularly within the context of digital higher education, remains limited. The rapid digitalization of higher education in countries such as Indonesia has created new learning dynamics that may influence students' engagement, motivation, and academic outcomes differently compared with those observed in more established digital learning systems. Therefore, examining these relationships within the Indonesian higher education context may provide valuable insights into how psychological factors shape students' academic experiences in digital learning environments.

Based on these considerations, this study aims to examine the mediating role of learning motivation in the relationship between student engagement, academic performance, and student satisfaction in digital higher education. By integrating these variables into a unified structural model, this study seeks to provide a more comprehensive understanding of how engagement translates into both academic performance and learning satisfaction in digital learning contexts.

This study contributes to the literature in several ways. First, it clarifies the psychological mechanism through which student engagement influences academic outcomes by examining the mediating role of learning motivation. Second, it integrates student engagement, learning motivation, academic performance, and student satisfaction into a single structural framework within digital learning environments. Third, it provides empirical evidence from Indonesian higher education, offering insights into student learning experiences in emerging digital learning contexts.

2. RESEARCH METHOD.

This study employed a quantitative research approach with a cross-sectional survey design to examine the relationships among student engagement, learning motivation, academic performance, and student satisfaction in digital learning environments. A cross-sectional design was considered appropriate because the study aimed to analyze the structural relationships among variables at a specific point in time.

2.1 Population and Sample

The research population consisted of undergraduate students enrolled at XYZ University in Indonesia who participated in digital learning activities. The unit of analysis in this study was individual students who actively engaged in digital learning platforms during their academic activities.

The sample was determined using a purposive sampling technique, where respondents were selected based on specific criteria. The inclusion criteria required participants to be active undergraduate students who had experience participating in digital learning activities such as online classes, hybrid learning sessions, or the use of learning management systems. Using these criteria, a total of 100 valid responses were obtained and used for data analysis.

The respondents consisted of 48% male and 52% female students. In terms of age distribution, the majority of respondents were between 18 and 20 years old, while the rest were between 21 and 23 years old. The respondents were drawn from two study programs, namely Management and Science and Technology, and represented students from the 2022 and 2023 cohorts.

2.2 Data Collection Procedure.

Primary data were collected using a structured questionnaire distributed to students through an online survey platform. The online distribution method was selected to facilitate broader access and ensure that respondents who were actively involved in digital learning could easily participate in the study. The questionnaire contained a series of statements designed to measure the research variables using a Likert-type scale.

Before the main data collection was conducted, the questionnaire items were reviewed to ensure clarity and relevance to the research objectives. Respondents were informed that their participation was voluntary and that their responses would be used solely for academic research purposes.

2.3 Measurement of Variables

This study examined four main constructs: student engagement, learning motivation, academic performance, and student satisfaction. All constructs were measured using multiple indicators adapted from previous studies to ensure measurement validity.

Student engagement was measured using indicators reflecting behavioral, emotional, and cognitive engagement, which capture students' active participation and involvement in learning activities (Gan et al., 2024; Sharif Nia et al., 2023). Learning motivation was

measured using indicators representing intrinsic and extrinsic motivation, which describe students' internal drive and external encouragement to achieve academic goals (Tan et al., 2025).

Academic performance was measured through indicators related to students' learning outcomes, task completion ability, and academic achievement (Q. Liu et al., 2023). Student satisfaction was measured using indicators that capture students' perceptions of learning quality, interactions during the learning process, and satisfaction with digital learning experiences (Assefa et al., 2025; Gray & DiLoreto, 2016).

All measurement items were assessed using a five-point Likert scale, ranging from strongly disagree to strongly agree. The use of the Likert scale is widely applied in studies examining student engagement and learning motivation in higher education contexts.

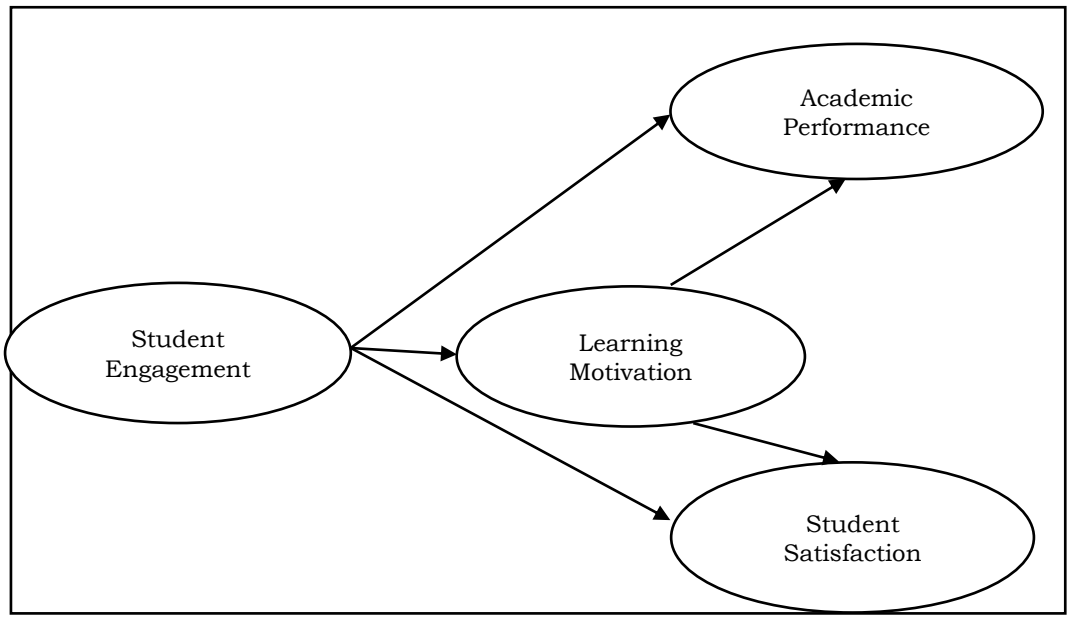

Figure 1. Research Model.

2.4 Data Analysis Technique

The data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) with the assistance of SmartPLS software. PLS-SEM was selected because it is suitable for analyzing complex relationships among latent variables and for examining mediation effects within structural models.

The analysis was conducted in two stages. First, the measurement model was evaluated to assess indicator reliability, construct reliability, and convergent validity. Second, the structural model was examined to analyze the relationships among variables and to test both direct and indirect (mediating) effects.

PLS-SEM is widely applied in educational research when the objective is to examine predictive relationships among constructs and to estimate structural relationships within relatively complex models involving multiple latent variables (Q. Liu et al., 2023; Tan et al., 2025).

3. RESULTS AND DISCUSSIONS.

3.1 Results

The results of this study begin with a presentation of the respondents' demographic profiles, which provide an overview of the characteristics of the research sample. A total of 100 valid responses were collected, with a relatively balanced gender distribution, consisting of 48% male and 52% female students. This composition indicates that the sample adequately represents both genders in the context of digital learning.

In terms of age, the majority of respondents (64%) were between 18 and 20 years old, while the remaining 36% were aged between 21 and 23 years. The respondents were drawn from two study programs, namely Management (41%) and Science and Technology (59%). Based on cohort classification, 38% of the respondents were from the 2022 cohort, while 62% were from the 2023 cohort. Regarding academic achievement, 18% of respondents had a GPA ranging from 2.51 to 3.00, 46% had a GPA between 3.01 and 3.50, and 36% had a GPA above 3.50. These characteristics indicate that the respondents were diverse and sufficiently representative for further analysis.

The measurement model evaluation showed that all retained indicators had outer loading values above the recommended threshold of 0.70, indicating acceptable indicator reliability.

Table 1. Outer Loadings.

Indicator	Construct	Outer Loading	T-Statistic	P-Value
KM2	Student Engagement	0.927	38.137	0.0
KM3	Student Engagement	0.820	13.183	0.0
KM6	Student Engagement	0.893	19.848	0.0
KP4	Academic Performance	0.675	5.642	0.0
KP5	Academic Performance	0.770	15.198	0.0
KP6	Academic Performance	0.887	37.084	0.0
KP7	Academic Performance	0.832	24.862	0.0
MB1	Learning Motivation	0.882	38.288	0.0
MB2	Learning Motivation	0.870	29.328	0.0
MB4	Learning Motivation	0.806	16.116	0.0
MB6	Learning Motivation	0.815	18.216	0.0
SS1	Student Satisfaction	0.892	29.925	0.0
SS3	Student Satisfaction	0.865	31.037	0.0
SS4	Student Satisfaction	0.901	34.061	0.0

In addition, Cronbach's alpha and composite reliability values for all constructs exceeded 0.70, while the Average Variance Extracted (AVE) values were above 0.50. These results confirm that the research instruments met the criteria for convergent validity and construct reliability, demonstrating that the indicators consistently and validly represented their respective latent variables.

Table 2. Construct Reliability and Validity.

Construct	Cronbach's Alpha	Composite Reliability	AVE
Student Engagement	0.857	0.912	0.776
Academic Performance	0.805	0.872	0.632
Learning Motivation	0.811	0.867	0.539
Student Satisfaction	0.863	0.916	0.785

In addition, discriminant validity was assessed using cross-loading analysis. The results indicated that each indicator had a higher loading on its respective construct than on other constructs, confirming adequate discriminant validity.

The structural model assessment revealed varying levels of explanatory power across the endogenous variables. The R-square value for academic performance was 0.377, indicating that 37.7% of the variance in academic performance could be explained by the model. The adjusted R-square value was slightly lower at 0.364, reflecting adjustments for the number of predictors. For learning motivation, the R-square value was 0.095, suggesting that 9.5% of the variance in learning motivation was explained by the independent variables, with an adjusted R-square of 0.086. Meanwhile, the R-square value for student satisfaction was 0.264, indicating that 26.4% of the variance in student satisfaction could be explained by the model, with an adjusted R-square of 0.249. Overall, the model demonstrated moderate explanatory power, with academic performance being the most strongly explained construct.

Table 3. R-Square Overview.

Construct	R-Square	Adjusted R-Square
Academic Performance	0.377	0.364
Learning Motivation	0.095	0.086
Student Satisfaction	0.264	0.249

Path analysis results showed that student engagement had a positive and significant effect on learning motivation ($\beta = 0.309$; $p = 0.001$), supporting the hypothesis that higher levels of engagement are associated with stronger learning motivation. Learning motivation also had a positive and significant effect on academic performance ($\beta = 0.524$; $p < 0.001$), indicating that motivated students tend to achieve better academic outcomes. Furthermore, student engagement exerted a positive effect on academic performance ($\beta = 0.197$). However, the magnitude of this effect was smaller compared to that of learning motivation.

Table 4. Path Coefficients.

Relationship	Path Coefficient	T-Statistic	P-Value
Student Engagement → Academic Performance	0.197	1.815	0.035
Student Engagement → Learning Motivation	0.309	3.11	0.001
Learning Motivation → Academic Performance	0.524	6.018	0.0
Learning Motivation → Student Satisfaction	0.438	4.008	0.0

Regarding student satisfaction, learning motivation was found to have a significant positive effect ($\beta = 0.438$; $p < 0.001$). In contrast, the direct effect of student engagement on student satisfaction was not statistically significant. However, mediation analysis revealed that student engagement influenced student satisfaction indirectly through learning motivation ($\beta = 0.135$; $p = 0.009$). Similarly, learning motivation significantly mediated the relationship between student engagement and academic

performance (β = 0.162; p = 0.005). These findings indicate that learning motivation plays a crucial mediating role in translating student engagement into improved academic performance and higher levels of student satisfaction.

Table 5. Specific Indirect Effects.

Indirect Relationship	Coefficient	T-Statistic	P-Value
Student Engagement → Learning Motivation → Academic Performance	0.162	2.611	0.005
Student Engagement → Learning Motivation → Student Satisfaction	0.135	2.379	0.009

3.2 Discussion

The findings of this study provide important insights into the relationships among student engagement, learning motivation, academic performance, and student satisfaction in digital learning environments. The results show that student engagement positively influences learning motivation. This finding suggests that students who are actively involved in learning activities tend to develop stronger motivation to participate in the learning process. Active participation, interaction with learning materials, and cognitive involvement may strengthen students' internal drive to achieve their academic goals (Taloko et al., 2024). This result supports previous studies indicating that engagement plays an important role in stimulating students' motivation in learning environments (Gan et al., 2024; Sharif Nia et al., 2023).

The results also demonstrate that learning motivation significantly influences academic performance. This finding highlights the importance of motivational factors in determining students' learning outcomes, particularly in digital learning environments where students are required to manage their learning more independently (Akpen et al., 2024). Motivated students tend to show higher levels of persistence, greater effort in completing academic tasks, and stronger commitment to achieving learning objectives (Y. Liu et al., 2024). This finding is consistent with previous research suggesting that learning motivation serves as an important predictor of academic success (Liu et al., 2023; Tan et al., 2025).

Furthermore, the analysis indicates that learning motivation plays a mediating role in the relationship between student engagement and academic performance (Luo et al., 2023). This result suggests that engagement alone may not directly translate into improved academic outcomes unless it is supported by strong motivational factors. In other words, engagement may stimulate students' interest and participation in learning activities, but motivation functions as the psychological mechanism that transforms engagement into sustained effort and academic achievement (Chiu et al., 2024; Salikhova et al., 2020). This finding reinforces the argument that motivation acts as a key mechanism linking engagement and academic outcomes in learning environments (Siddiqi, 2019).

In addition to academic performance, the results also show that learning motivation significantly influences student satisfaction with digital learning. Students who are highly motivated tend to perceive their learning experiences more positively and demonstrate greater satisfaction with the learning process (Han et al., 2024b; Wach et al., 2016). Motivation may encourage students to engage more deeplywith learning materials, overcome learning challenges, and maintain a positive attitude toward digital learning environments (Nasir et al., 2021). This finding is consistent with previous studies highlighting the important role of motivation and engagement in shaping students' satisfaction with online and digital learning experiences (Assefa et al., 2025; Gray & DiLoreto, 2016).

The mediating role of learning motivation also indicates that student engagement indirectly influences student satisfaction through motivational processes (Kok et al., 2025; Sharif Nia et al., 2023). This finding suggests that engagement alone may not be sufficient to generate positive learning experiences if students lack the motivation to

persist in learning activities. Therefore, learning motivation can be understood as a psychological mechanism that strengthens the relationship between engagement and students' overall evaluation of their learning experiences.

Despite these findings, the explanatory power of the model indicates that other factors may also influence learning motivation and student satisfaction in digital learning environments. For example, factors such as digital literacy, perceived teaching support, and learning environment design may play important roles in shaping students' motivation and learning experiences. Future research may therefore incorporate additional variables to provide a more comprehensive understanding of students' academic experiences in digital higher education contexts.

From a practical perspective, the findings of this study suggest that higher education institutions should focus not only on increasing student engagement but also on strengthening students' learning motivation in digital learning environments. Strategies such as interactive learning activities, meaningful feedback, and supportive learning environments may help foster students' intrinsic motivation and encourage deeper engagement with learning materials. By strengthening motivational factors, educators may improve both academic performance and student satisfaction in digital learning contexts.

4. CONCLUSION.

This study examined the role of learning motivation as a mediating variable in the relationship between student engagement, academic performance, and student satisfaction in digital higher education. The findings demonstrate that student engagement contributes to stronger learning motivation, which subsequently enhances students' academic performance and satisfaction with digital learning experiences. These results highlight that engagement alone may not be sufficient to produce optimal academic outcomes unless it is supported by strong motivational factors.

More importantly, this study reveals that learning motivation functions as a key psychological mechanism linking student engagement with both academic performance and student satisfaction. This finding indicates that motivated students are more likely to persist in learning activities, overcome academic challenges, and perceive their learning experiences more positively. Therefore, strengthening students' motivation becomes essential for improving learning effectiveness in digital learning environments.

From a theoretical perspective, this study contributes to the literature by integrating student engagement, learning motivation, academic performance, and student satisfaction into a single structural framework within the context of digital higher education. The findings provide empirical evidence that learning motivation plays a mediating role in translating student engagement into both academic outcomes and learning satisfaction.

From a practical perspective, the findings suggest that higher education institutions and educators should design digital learning environments that not only encourage student participation but also support students' intrinsic motivation. Strategies such as interactive learning activities, meaningful feedback, and supportive learning environments may help foster both engagement and motivation, ultimately improving students' academic performance and satisfaction.

Study Limitations and Future Research, This study has several limitations that should be acknowledged. First, the sample was limited to students from a single university, which may restrict the generalizability of the findings to other higher education contexts. Future research may involve larger and more diverse samples from multiple universities to provide broader insights into students' experiences in digital learning environments.

Second, the study employed a cross-sectional research design, which limits the ability to draw strong causal conclusions regarding the relationships among the variables. Longitudinal studies may provide a deeper understanding of how student engagement and motivation evolve over time in digital learning contexts. Third, the explanatory power of the model suggests that additional factors may influence students' motivation, academic performance, and satisfaction. Variables such as digital literacy, perceived instructor support, learning environment design, and self-regulated learning may also play important roles in shaping students' academic experiences in digital learning environments. Future research may therefore expand the model by incorporating these variables to develop a more comprehensive understanding of student learning in digital higher education.

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