DRIVERS OF STUDENTS' LMS CONTINUANCE: USEFULNESS, EASE OF USE, ENGAGEMENT, AND SATISFACTION

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ABSTRACT

This study examines factors that drive students' continuance intention to use a learning management system (LMS) in higher education by integrating Technology Acceptance Model (TAM) variables (perceived usefulness and perceived ease of use), student engagement, and learning satisfaction. Data were collected from 286 university students (280 provided complete demographic information) and analyzed using PLS-SEM with bootstrapping (5,000 subsamples). The results show that perceived usefulness significantly increases both learning satisfaction and continuance intention. Perceived ease of use significantly enhances learning satisfaction but does not directly influence continuance intention. Student engagement positively affects learning satisfaction and continuance intention, indicating that sustained LMS use is shaped not only by system perceptions but also by students' learning involvement. Learning satisfaction significantly increases continuance intention. Overall, the model demonstrates strong explanatory power for learning satisfaction and continuance intention. These findings imply that universities should prioritize LMS features that deliver tangible learning benefits, reduce friction in use, and support engaging learning activities to foster students' long-term willingness to continue using LMS-based learning.

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INTRODUCTIONS

Digital learning systems, including learning management systems (LMS), have become integral to university education as blended and online delivery expands. However, many students reduce or discontinue their use once course requirements lessen, which can undermine learning outcomes and institutional investment (Alraimi et al., 2015; Goh & Yang, 2021; Lee, 2010; Roca et al., 2006).

In the classroom context, an LMS is expected to help students access materials, submit assignments, communicate with instructors, and monitor learning progress. When students experience the platform as useful, easy to use, and supportive of learning activities, they are more likely to feel satisfied and continue using it (Davis, 1989; DeLone & McLean, 2003; Sun et al., 2008).

Prior continuance research highlights the importance of post-adoption evaluations such as satisfaction and the perceived benefits of continued use. Expectation-confirmation theory and the Expectation-Confirmation Model (ECM) explain continuance through confirmation, perceived usefulness, and satisfaction, while the Technology Acceptance Model (TAM) emphasizes perceived usefulness and perceived ease of use as key beliefs shaping intention (Bhattacherjee, 2001; Davis, 1989; Lee, 2010; Roca et al., 2006).

Beyond system beliefs, student engagement adds an experiential dimension because active participation, emotional involvement, and cognitive effort can influence satisfaction and sustained system use (Fredricks et al., 2004; Kahu, 2013). Despite extensive LMS acceptance studies, gaps remain in integrating engagement with TAM beliefs to explain students' continuance intention in a unified model. Therefore, this study tests a model linking perceived usefulness, perceived ease of use, student engagement, learning satisfaction, and continuance intention among university students, and offers implications for improving sustained LMS usage in coursework (Goh & Yang, 2021; Roca et al., 2006; Uzun et al., 2024).

Theoretical Basis

This study draws on the Technology Acceptance Model (TAM) and continuance-focused perspectives to explain students' post-adoption behavior in using an LMS. TAM highlights perceived usefulness and perceived ease of use as core beliefs shaping technology-related intentions (Davis, 1989), while continuance research emphasizes post-adoption evaluation and satisfaction as key drivers of continued use (Bhattacherjee, 2001; Lee, 2010; Roca et al., 2006). Broader technology-acceptance research such as UTAUT similarly emphasizes performance-related and effort-related beliefs in explaining intention (Venkatesh et al., 2003). Student engagement is incorporated to capture learners' behavioral, emotional, and cognitive investment in learning activities (Fredricks et al., 2004; Kahu, 2013).

Perceived Usefulness

Perceived usefulness refers to the extent to which students believe that using the LMS improves their learning performance and productivity (Davis, 1989). In TAM, usefulness is a key utilitarian belief that drives intention, and in continuance research it remains influential after initial adoption when students evaluate whether continued use still provides value (Bhattacherjee, 2001; Lee, 2010; Roca et al., 2006).

Perceived Ease of Use

Perceived ease of use reflects how effortless students perceive the LMS to be for completing learning tasks (Davis, 1989). An LMS that is easy to understand and operate can reduce cognitive burden, support smoother learning activities, and indirectly encourage continued use through more positive evaluations and satisfaction (Lee, 2010; Roca et al., 2006; Sun et al., 2008).

Student Engagement

Student engagement captures students' active involvement in learning activities, including behavioral participation, emotional interest, and cognitive effort (Fredricks et al., 2004; Kahu, 2013). In LMS-supported learning, engagement can be reinforced through interactive activities, timely feedback, and collaborative tasks, and higher engagement has been linked to more positive learning experiences and outcomes (Dubey et al., 2023; Goh & Yang, 2021).

Learning Satisfaction

Learning satisfaction represents students' overall positive evaluation of their learning experience with the LMS and whether it meets expectations in supporting learning. Within continuance frameworks, satisfaction reflects users' affective evaluation after use and is a central mechanism linking beliefs and experiences to continued use (Bhattacherjee, 2001; DeLone & McLean, 2003; Sun et al., 2008).

Continuance Intention

Continuance intention refers to a student's willingness to keep using the LMS regularly in the future and to increase usage frequency. It reflects post-adoption commitment and is commonly explained by perceived usefulness and satisfaction in continuance models of information systems and e-learning (Bhattacherjee, 2001; Roca et al., 2006).

Hypothesis Development

Based on TAM and continuance perspectives, this study proposes seven hypotheses linking perceived usefulness (PU), perceived ease of use (PEOU), and student engagement (SE) to learning satisfaction (LS) and continuance intention (CI). The conceptual model is presented in Figure 1.
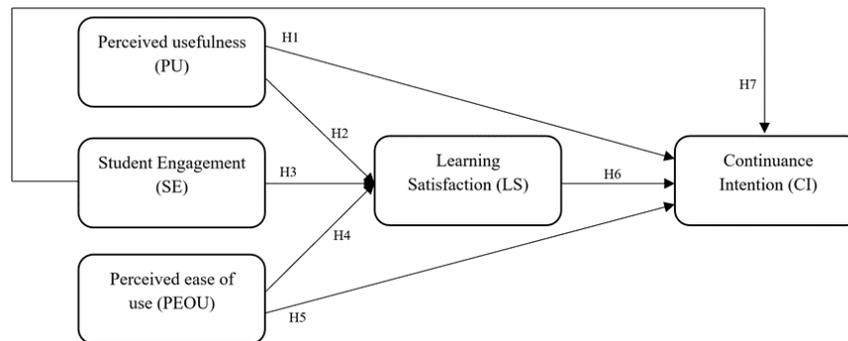
Figure 1. Proposed research model
Source: Authors' Illustration.

Perceived Usefulness and Continuance Intention

TAM posits that perceived usefulness strengthens users' intention because they expect performance benefits from system use (Davis, 1989). In post-adoption contexts, usefulness remains salient as students evaluate whether continuing to use the LMS still adds value to their learning. Empirical studies on e-learning continuance report perceived usefulness as a predictor of continuance intention (Jung & Jo, 2025; Uzun et al., 2024).

H1: Perceived usefulness positively influences continuance intention.

Perceived Usefulness and Learning Satisfaction

When students perceive that the LMS helps them learn effectively and complete course tasks more productively, they are more likely to feel satisfied with the system. Continuance research suggests that usefulness contributes to satisfaction by shaping users' overall evaluation of system performance after adoption (Bhattacherjee, 2001). Recent findings also report a positive relationship between perceived usefulness and satisfaction (Jung & Jo, 2025; Uzun et al., 2024).

H2: Perceived usefulness positively influences learning satisfaction.

Student Engagement and Learning Satisfaction

Engaged students tend to interact more frequently with learning resources, participate in activities, and invest cognitive effort, which can enhance their learning experience. As engagement increases, students are more likely to perceive learning activities as meaningful and enjoyable, leading to higher satisfaction with the LMS-supported learning process. Empirical work in education technology reports that learner engagement can be associated with satisfaction (Zhang et al., 2025).

H3: Student engagement positively influences learning satisfaction.

Perceived Ease of Use and Learning Satisfaction

A user-friendly LMS can reduce frustration and cognitive burden, making it easier for students to access materials and complete assignments. Ease of use can therefore contribute to a smoother learning experience and higher satisfaction. Studies integrating TAM and continuance perspectives often find perceived ease of use to be positively related to satisfaction in educational settings (Uzun et al., 2024; Zhang et al., 2025).

H4: Perceived ease of use positively influences learning satisfaction.

Perceived Ease of Use and Continuance Intention

An LMS that students perceive as easy to operate may strengthen their willingness to keep using it, because continued use requires repeated interaction across courses and tasks. Empirical evidence is mixed: some studies report a significant positive effect of perceived ease of use on continuance intention, while others find that its influence

becomes less salient once users are familiar with the system. This study re-tests the direct relationship in the context of coursework LMS use.

H5: Perceived ease of use positively influences continuance intention.

Learning Satisfaction and Continuance Intention

Continuance research highlights satisfaction as a primary driver of continuance intention because satisfied users are more likely to maintain usage behavior (Bhattacherjee, 2001). In LMS contexts, satisfaction reflects whether the system meets learning needs and expectations, which can translate into continued use. Recent e-learning studies consistently show satisfaction as a strong predictor of continuance intention (Jung & Jo, 2025; Uzun et al., 2024).

H6: Learning satisfaction positively influences continuance intention.

Student Engagement and Continuance Intention

Engagement can motivate students to keep using the LMS because engaged learners are more likely to rely on learning resources, interactions, and activities provided in the system. Empirical evidence suggests engagement can be linked to sustained technology use in learning environments (Goh & Yang, 2021; Zhang et al., 2025).

H7: Student engagement positively influences continuance intention.

RESEARCH METHODS

Research Design

This study uses a quantitative explanatory design with a cross-sectional survey to test the proposed hypotheses. The unit of analysis is individual undergraduate students who use an LMS/e-learning system as part of their coursework.

Population and Sample

The population consists of undergraduate students who use an LMS/e-learning system as part of their coursework during the current or most recent semester. Respondents are recruited using purposive sampling with the following criteria: (1) currently enrolled as a student, (2) have used the LMS in at least one course, and (3) have accessed the LMS within the last four weeks.

Regarding sample size, we applied a two-step justification. First, following PLS-SEM guidance (Sarstedt et al., 2021), we used the 10-times rule based on the maximum number of structural paths pointing to an endogenous construct. In the proposed model, continuance intention has four predictors (PU, PEOU, learning satisfaction, and student engagement), yielding a minimum requirement of $4 \times 10 = 40$ observations. Second, to provide a more rigorous justification, we performed an a priori statistical power assessment for multiple regression using the same maximum number of predictors (k = 4) and a conservative small-to-medium overall effect size ($f2 = 0.05$) at $\alpha = 0.05$. Under these assumptions, the minimum sample size required to achieve 0.80 power is approximately N = 244. Therefore, the final dataset (N = 286) exceeds both criteria and provides adequate statistical power (approximately 0.87) for estimating the model.

Measurement Instrument

All constructs are measured using reflective indicators on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Perceived usefulness and perceived ease of use are adapted from (Goh & Yang, 2021). Student engagement is measured using behavioral, emotional, and cognitive engagement indicators adapted from (Dubey et al., 2023). Learning satisfaction and continuance intention are adapted from (Herzallah et al., 2025). In total, the questionnaire contains 28 items. Items are translated and contextualized for Indonesian university students, and the wording is refined to ensure clarity and relevance to LMS use in coursework.

Data Collection Procedure

Data were collected using an online questionnaire (Google Forms) distributed through course groups and institutional communication channels. Participation is voluntary and anonymous. The main survey was administered

until 286 valid responses were obtained for analysis (N = 286). Of these, 280 respondents provided complete demographic information; therefore, demographic percentages are reported based on available data. Informed consent was obtained electronically at the start of the questionnaire.

Common Method Bias

Common method bias (CMB) was considered because the study uses a single-source, self-reported questionnaire. As procedural remedies, participation was voluntary and anonymous, and informed consent was obtained electronically at the start of the survey. Statistically, we applied Harman's single-factor test using an unrotated one-factor exploratory factor analysis of all measurement items. The single-factor solution accounted for 49.79% of the total variance, which is below the 50% threshold commonly used as an indication of problematic CMB. As an additional diagnostic, full-collinearity VIF values based on construct scores ranged approximately from 2.10 to 3.67, indicating no severe collinearity; nevertheless, common method effects cannot be entirely eliminated in cross-sectional self-report designs.

Data Analysis

The model is analyzed using PLS-SEM. Measurement model assessment includes indicator loadings, internal consistency reliability (Cronbach's alpha & composite reliability), convergent validity (AVE), and discriminant validity (HTMT). Structural model assessment includes collinearity (VIF), bootstrapped path coefficients (5,000 subsamples), explanatory power (R^2), effect sizes (f^2), and predictive relevance (Q^2).

Table 1. Operational definition of variables and indicators

Variable	Dimension	Code	Measurement items	Source
Perceived Ease of Use		PEOU1	I find the use of the LMS/e-learning system clear and easy to understand.	Goh & Yang (2021)
		PEOU2	I find the LMS/e-learning system easy to use.	
		PEOU3	I do not need to put much mental effort into using the LMS/e-learning system.	
Perceived Usefulness		PU1	The LMS/e-learning system helps me learn more effectively.	
		PU2	The LMS/e-learning system helps me complete academic tasks more efficiently.	
		PU3	Overall, I find the LMS/e-learning system useful for my studies.	
Student Engagement	Behavioral	BE1	I pay close attention during lectures.	Dubey et al. (2023)
		BE2	I follow the rules applied during the learning process.	
		BE3	I usually submit my assignments on time.	
		BE4	When I do not understand the material, I ask questions or participate in class discussions.	
		BE5	I actively contribute when working on group assignments.	
	Emotional	EE1	I feel proud of my academic achievements.	

Variable	Dimension	Code	Measurement items	Source
		EE2	I feel enthusiastic about participating in academic activities and completing coursework.	
		EE3	I feel comfortable with my learning environment.	
		EE4	I am interested in participating in learning activities.	
		EE5	I find classroom learning activities to be interesting.	
	Cognitive	CE1	When studying, I check whether I truly understand the material.	
		CE2	I often discuss course materials with people outside the university.	
		CE3	When the material is difficult, I seek help (e.g., asking questions or discussing with others) to understand it.	
		CE4	I try to apply what I learn to solve new academic tasks or problems.	
		CE5	I often connect content from different courses.	
Learning Satisfaction		LS1	I am satisfied with the LMS/e-learning system that I use.	Herzallah et al. (2025)
		LS2	My experience using the LMS/e-learning system is pleasant.	
		LS3	The LMS/e-learning system meets my expectations.	
Continuance Intention		CI1	I intend to continue using the LMS/e-learning system for learning purposes.	Herzallah et al. (2025)
		CI2	In the future, I plan to use the LMS/e-learning system regularly.	
		CI3	I intend to increase my frequency of using the LMS/e-learning system.	
		CI4	I would recommend the LMS/e-learning system to other students.	

Note: The measurement items were adapted and translated to fit the student context and the use of an LMS/e-learning system in coursework. Source: Processed survey data.

RESULTS AND DISCUSSION

This section will report respondent characteristics and the measurement and structural model assessment.

Respondent Characteristics

A total of 280 respondents provided complete demographic information. Most respondents were female (74.6%). By study program, the largest group was Hospital Administration (43.9%), followed by Nursing (26.4%) and Midwifery (19.6%). The majority were first-semester students (65.4%). Demographic items were not fully completed by all respondents; thus, percentages are based on available demographic data (n = 280).

Table 2. Demographic characteristics of respondents

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	71	25.4
	Female	209	74.6
	Hospital Administration	123	43.9
	Nursing	74	26.4
	Midwifery	55	19.6
Study Program	Informatics	13	4.6
	Law	9	3.2
	Management	4	1.4
	Others	2	0.7
	Semester 1	183	65.4
	Semester 2	1	0.4
Semester Level	Semester 3	63	22.5
	Semester 4	24	8.6
	Others	9	3.2

Note: Percentages may not total 100% due to rounding. Source: Processed survey data.

Measurement Model Assessment

Indicator loadings, internal consistency reliability (Cronbach's alpha & composite reliability), convergent validity (AVE), and discriminant validity (HTMT) were evaluated. Most indicator loadings were above 0.708; three student engagement indicators were slightly below the threshold (BE3 = 0.697; EE1 = 0.681; CE2 = 0.671) and were retained to preserve content coverage, given strong construct reliability and AVE.

Table 3. Indicator loadings

Construct	Indicator	Loading
CI	CI1	0.899
CI	CI2	0.936
CI	CI3	0.939
CI	CI4	0.900
LS	LS1	0.937
LS	LS2	0.948
LS	LS3	0.929
PEOU	PEOU1	0.884
PEOU	PEOU2	0.874
PEOU	PEOU3	0.827
PU	PU1	0.872
PU	PU2	0.863
PU	PU3	0.858
SE	BE1	0.747

Construct	Indicator	Loading
SE	BE2	0.747
SE	BE3	0.697
SE	BE4	0.737
SE	BE5	0.741
SE	CE1	0.732
SE	CE2	0.671
SE	CE3	0.759
SE	CE4	0.732
SE	CE5	0.715
SE	EE1	0.681
SE	EE2	0.820
SE	EE3	0.741
SE	EE4	0.784
SE	EE5	0.745

Source: Processed survey data.

Table 4. Internal consistency reliability and convergent validity

Construct	Total items	Cronbach's alpha	Composite reliability	AVE
PEOU	3	0.825	0.897	0.743
PU	3	0.830	0.898	0.746
SE	15	0.939	0.947	0.544
LS	3	0.932	0.957	0.880
CI	4	0.937	0.956	0.844

Source: Processed survey data.

Discriminant validity was assessed using the heterotrait-monotrait ratio (HTMT) and HTMT inference via bootstrapping. Most HTMT values were below 0.90. The highest HTMT was observed between perceived ease of use and perceived usefulness (HTMT = 0.946), which is expected given their conceptual proximity as TAM belief constructs. To strengthen inference, we bootstrapped the HTMT statistic (5,000 resamples) and found that the 90% confidence interval did not include 1.00 (CI90%: 0.897–0.992), supporting discriminant validity by inference. Therefore, despite the high association, the two constructs were retained as theoretically distinct beliefs that remain empirically distinguishable.

Table 5. Discriminant validity (HTMT)

Construct	PEOU	PU	SE	LS	CI
PEOU	1.000	0.946	0.721	0.893	0.815
PU	0.946	1.000	0.748	0.866	0.865
SE	0.721	0.748	1.000	0.728	0.697
LS	0.893	0.866	0.728	1.000	0.833
CI	0.815	0.865	0.697	0.833	1.000

Source: Processed survey data.

Structural Model Assessment

Collinearity was examined using VIF values and showed no severe issues (all VIFs < 5). Bootstrapping with 5,000 subsamples was performed to test the significance of the path coefficients. The model demonstrated substantial explanatory power with $R^2 = 0.698$ for learning satisfaction and $R^2 = 0.687$ for continuance intention. Predictive relevance assessed via blindfolding indicated Q^2 values greater than zero for both endogenous constructs.

Table 6. Collinearity assessment (VIF)

Endogenous construct	Predictor	VIF
LS	PU	2.928
LS	PEOU	2.765
LS	SE	1.897
CI	PU	3.199
CI	PEOU	3.332
CI	SE	2.070
CI	LS	3.310

Source: Processed survey data.

Table 7. Bootstrapped path coefficients

Hypothesis	Path	Beta	t	p	CI (2.5%)	CI (97.5%)	Decision
H1	PU → CI	0.343	4.843	<0.001	0.210	0.485	Supported
H2	PU → LS	0.311	4.467	<0.001	0.173	0.446	Supported
H3	SE → LS	0.291	4.384	<0.001	0.165	0.428	Supported
H4	PEOU → LS	0.451	7.035	<0.001	0.319	0.571	Supported
H5	PEOU → CI	0.096	1.370	0.171	-0.044	0.231	Not supported
H6	LS → CI	0.367	4.813	<0.001	0.216	0.514	Supported
H7	SE → CI	0.160	2.380	0.017	0.033	0.294	Supported

Source: Processed survey data.

Table 8. Explanatory power (R^2) and predictive relevance (Q^2)

Endogenous construct	R^2	Q^2
Learning Satisfaction (LS)	0.698	0.191
Continuance intention (CI)	0.687	0.182

Source: Processed survey data.

Table 9. Effect sizes (f^2)

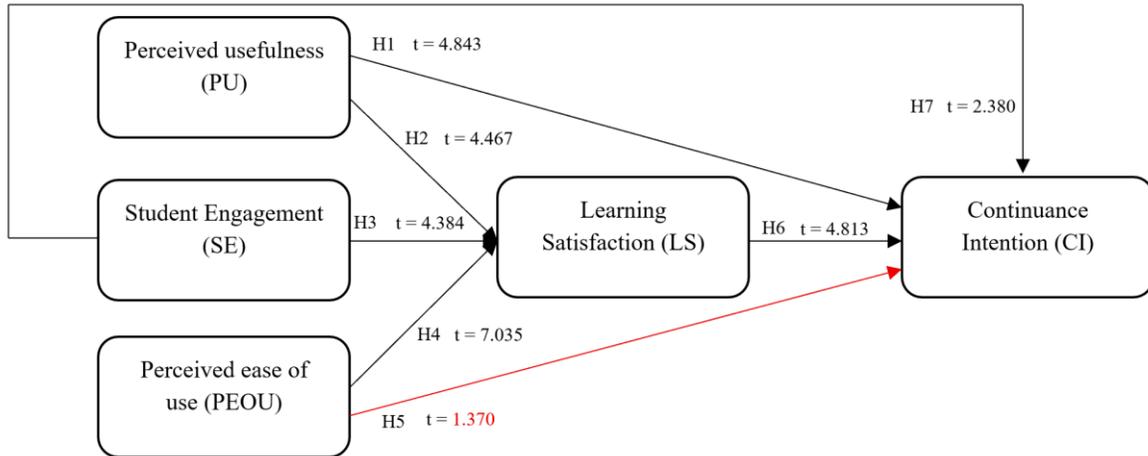| Path	f^2
LS → CI	0.135
PEOU → CI	0.008
PEOU → LS	0.205
PU → CI	0.104
PU → LS	0.093
SE → CI	0.025
SE → LS	0.091

Source: Processed survey data.

Discussion

Figure 2. Structural Model Results (PLS-SEM Path Model with Bootstrapping t-values)
Source: Authors' illustration.

In general, the findings suggest that students' continuance intention to use the LMS is shaped more by perceived value and the quality of their learning experience than by usability alone. This pattern is consistent with continuance research that highlights satisfaction as an important determinant of continued use (Bhattacherjee, 2001), while TAM positions perceived usefulness as a central determinant of intention (Davis, 1989).

Perceived usefulness is positively associated with continuance intention, indicating that students keep returning to the LMS when it helps them study more effectively such as by making materials easier to access, assignments easier to manage, and learning progress easier to track. This aligns with evidence that usefulness is a persistent driver of e-learning continuance during and after periods of intensive online learning (Uzun et al., 2024) and in emerging digital-learning contexts (Yan et al., 2024).

Perceived usefulness also strengthens satisfaction. When students feel the LMS genuinely supports their academic tasks and reduces unnecessary effort, their overall evaluation becomes more positive. This supports post-adoption logic in which performance benefits influence satisfaction and, in turn, long-term usage decisions (Bhattacherjee, 2001). Prior studies similarly report that usefulness contributes to satisfaction in learning technology settings (Jung & Jo, 2025; Uzun et al., 2024).

Student engagement is positively related to learning satisfaction and continuance intention. In everyday classroom reality, students tend to feel more satisfied and are more willing to keep using the LMS when they are actively involved, paying attention, participating in discussions, feeling interested, and investing cognitive effort. This finding resonates with work emphasizing the role of engagement-related experiences (e.g., e-engagement & flow) in sustaining LMS use beyond initial adoption (Goh & Yang, 2021), and with evidence that engagement-oriented learning experiences can shape post-adoption outcomes in educational technologies (Jung & Jo, 2025).

Perceived ease of use shows a positive association with learning satisfaction, suggesting that a user-friendly LMS reduces frustration and cognitive burden during study activities. However, ease of use does not directly predict continuance intention. This indicates that, once students are already familiar with the LMS, usability may be treated as a "basic requirement" rather than a deciding factor. Continued use depends more on whether the LMS feels valuable and satisfying, which is consistent with continuance perspectives that emphasize experience-based evaluations after adoption (Bhattacherjee, 2001) and with empirical findings that the importance of ease of use may diminish after initial adoption (Yan et al., 2024).

Satisfaction itself strongly predicts continuance intention, reinforcing that post-adoption decisions are largely experience-based. For students, satisfaction reflects simple but meaningful realities: the LMS is reliable, tasks are clear, materials are complete, deadlines and feedback are visible, and the platform supports communication with lecturers and classmates. When these expectations are met, students are more willing to use the LMS consistently and to recommend it to peers (Bhattacherjee, 2001; Uzun et al., 2024).

Overall, the results show that perceived usefulness, student engagement, and learning satisfaction jointly explain continuance intention, while perceived ease of use primarily contributes to learning satisfaction.

CONCLUSION

This study investigated factors influencing students' continuance intention to use an LMS in coursework by integrating TAM beliefs (perceived usefulness & perceived ease of use), student engagement, and satisfaction. The findings show that perceived usefulness, student engagement, and satisfaction are key drivers of continuance intention. Perceived usefulness, perceived ease of use, and student engagement are also positively associated with higher learning satisfaction.

An important insight is that perceived ease of use supports satisfaction but does not directly encourage continuance intention. This suggests that, after initial adoption, students may take usability for granted and base their continued-use decision more on whether the LMS is helpful for academic tasks and whether it supports an engaging and satisfying learning process.

Implications

Theoretically, the results support combining TAM with continuance-focused perspectives by demonstrating that perceived usefulness remains central in post-adoption contexts and that learning satisfaction is an important determinant of continued use (Davis, 1989; Bhattacherjee, 2001). The study also highlights the added role of student engagement beyond utilitarian beliefs, suggesting that continuance intention in LMS use is shaped not only by system beliefs but also by how learning activities are experienced inside the platform (Goh & Yang, 2021).

Practically, universities should strengthen the LMS's perceived usefulness by ensuring course materials are complete and well-structured, assignment processes are clear, and key learning functions, like submission, announcements, progress tracking, and feedback work reliably. Lecturers can cultivate engagement and satisfaction by designing interactive learning routines inside the LMS (e.g., guided discussions, short formative quizzes, peer collaboration, & timely feedback) so students experience the platform as a meaningful part of learning rather than a place to upload files (Goh & Yang, 2021).

From a system management perspective, improving ease of use still matters because it supports satisfaction. Practical steps include simplifying navigation, standardizing course layouts across courses, providing clear guidance for common tasks, and offering responsive technical support. Together, these actions can help institutions sustain student LMS use across semesters.

Limitations

This study has limitations. First, its cross-sectional design captures perceptions at one point in time and cannot observe changes in continuance behavior across semesters. Second, purposive sampling may limit generalizability to other universities or student populations. Third, although Harman's single-factor test and collinearity diagnostics suggest that common method bias is unlikely to be severe, the use of cross-sectional self-reported measures may still introduce shared-method effects. Future research could use longitudinal designs, broaden sampling contexts, and combine survey responses with LMS usage-log data to strengthen inference.

Recommendations

Future studies may extend this model by incorporating additional post-adoption variables such as confirmation of expectations, habit, system quality, and instructor support. Researchers may also test whether specific LMS-based

engagement interventions (e.g., feedback speed, collaborative features, or gamified activities) strengthen satisfaction and continuance intention over time, and compare results across disciplines and different LMS platforms.

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