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Determinants of E-Learning Acceptance in Indonesia Post-COVID-19 and Its Impact on Students' Technopreneurship

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ABSTRACT

Objective: This research aims to address the gaps in country-specific e-learning studies by examining the key factors influencing e-learning adoption in Indonesia. Grounded in a comprehensive literature review on flow theory, service quality, and technology acceptance models, the study develops a research model that includes four independent variables (instructor characteristics, teaching materials, content design, and enjoyment), two belief variables (perceived usefulness and perceived ease of use), and one dependent variable (intention to use e-learning). **Method:** Data were collected from 404 respondents, comprising students and lecturers at state Islamic universities in Indonesia, using convenience sampling. The study employed SEM-PLS for data analysis, validating the research instrument's reliability and validity. **Results:** The results offer insights into the managerial implications and suggest directions for future research in e-learning adoption. Its results confirm six hypotheses. **Novelty:** This study fills a gap in e-learning adoption research by focusing on Indonesia and integrating flow theory, service quality, and technology acceptance models. It highlights the roles of perceived playfulness, ease of use, and instructional content design in influencing e-learning adoption while challenging the expected impact of instructor characteristics. This research provides fresh insights into technology-driven learning in the context of developing countries.

INTRODUCTION

One of the most notable educational shifts during the information age has been the move from teacher-centered to learner-centered approaches. In addition to entering the information age, the COVID-19 pandemic has significantly altered human behavior and lifestyles across various sectors, including education (Gadi et al., 2022). Electronic learning (e-learning) has further accelerated the adoption of learner-centered education and transformed educational practices. E-learning has gained considerable attention from educational institutions, software developers, and businesses due to its potential benefits in education and cost efficiency (Dumbiri & Nwadiani, 2020; Giannakos et al., 2022; Madni et al., 2022; Qashou, 2022; Shurygin et al., 2021). These advantages include lower education costs, consistent and timely content delivery, flexible access, and convenience. Moreover, educational value can be enhanced by tailoring content to meet learners' needs.

Numerous universities have incorporated technology into their teaching and learning processes using Learning Management Systems (LMS), particularly following the COVID-19 pandemic (Syafrizal et al., 2023). They claim that online training saves training costs and increases learning effectiveness by providing high-quality training services. The success of e-learning largely depends on applying educational models that meet the needs of learners and educational goals. Designing a good e-learning service is a complex

task and requires a multidisciplinary approach. While several studies have investigated the success factors and benefits of e-learning, there is still a lack of empirical.nstudies that focus on the relationship between e-learning service factors and student acceptance.

Many educational institutions now offer innovative online degree programs, breaking down the barriers of time and space and enhancing traditional classroom learning with web-based tools. E-learning enables higher education institutions to consistently carry out teaching and learning activities during the COVID-19 pandemic (Ermilinda et al., 2024). Non-profit organizations are increasingly replacing traditional in-person job training with online programs, citing cost savings and improved learning outcomes due to the high quality of online training services. Technology-based education has significantly advanced in alignment with the strategic plans of the education systems in several developing countries (Abdelfattah et al., 2023). The effectiveness of e-learning hinges on implementing educational models that align with learner needs and educational objectives, making the design of effective e-learning services a complex, multidisciplinary task (Aditya, 2021; Alamri et al., 2021; Kerimbayev et al., 2023; Meng et al., 2023; Rof et al., 2022; Shehata et al., 2024). While numerous studies have explored the success factors and benefits of e-learning, there is a notable lack of empirical research on the relationship between e-learning service factors and student acceptance. In addition, adopting e-learning still faces challenges, as many teachers and students need help with using and implementing it effectively (Batmetan et al., 2023).

In Indonesia, the development of e-learning is closely tied to the COVID-19 pandemic and the rapid shift of industries toward e-commerce. E-learning adoption in state Islamic universities has become necessary, expanding rapidly, yet remains underexplored in international e-learning literature. As e-learning becomes a crucial method in the internationalization of higher education, the Indonesian government's policies on independent learning suggest that e-learning will likely become integral to future higher education curricula. Research on the abrupt transition to online learning during the COVID-19 pandemic is limited, especially regarding how students' experiences with online learning during the pandemic have influenced their intention to use e-learning in the post-COVID-19 period (Rahman et al., 2023). This underscores the importance of promoting research on e-learning at the individual country level in a global context. By examining e-learning adoption in Indonesia from a student perspective, this study aims to address a gap in country-specific e-learning research.

While integrating e-learning into higher education has been widely discussed, there still needs to be a significant gap in understanding how various factors influence its adoption, particularly in developing countries like Indonesia. The current study seeks to bridge this gap by investigating the key factors that drive the adoption of e-learning in Islamic universities. By incorporating flow theory, service quality, and technology acceptance models, this research aims to provide a nuanced understanding of e-learning adoption, focusing on specific variables such as instructor characteristics, teaching materials, content design, and enjoyment. This investigation will offer insights into the Indonesian context and contribute to the broader discourse on e-learning adoption in higher education.

RESEARCH METHOD

Based on the literature review, this research aims to assess students' intentions to use e-learning during and after the COVID-19 pandemic. The proposed model includes six independent variables—both internal factors (beliefs) and external factors—and one

dependent variable. The independent variables are perceived usefulness, ease of use, playfulness, teaching materials, student/instructor characteristics, and attitudes toward e-learning. Instructor characteristics are defined by the degree of care, support, and accommodation provided to students while teaching materials are evaluated based on their suitability for e-learning. The belief variables include perceived usefulness (the belief that e-learning will enhance learning performance), perceived ease of use (the belief that e-learning requires minimal effort), and perceived playfulness (the belief that e-learning provides an enjoyable experience). The dependent variable is the intention to use e-learning.

The research was conducted at Universitas Islam Negeri (UIN) Salatiga in Central Java, Indonesia, with 404 students and lecturers participating via a Google Form questionnaire. Respondents, chosen through convenience sampling, come from various majors and disciplines. The population size was not determined, but Central Java was selected due to its large number of state Islamic universities. Respondents used e-learning during the pandemic, contrasting with the traditional face-to-face learning methods, which included mandatory attendance, textbooks, and scheduled class times. E-learning support was provided synchronously (e.g., chat, video conferencing) and asynchronously (e.g., online notes, quizzes, announcements). Most respondents were aged 18 to 30 (81%), with most lecturers aged 31 to 50 (17.36%). The sample was balanced in gender, with 57.5% female and 42.5% male respondents. The questionnaire consisted of 26 statements and questions regarding respondent data. Out of 600 distributed questionnaires, 404 were completed, yielding a response rate of 60%.

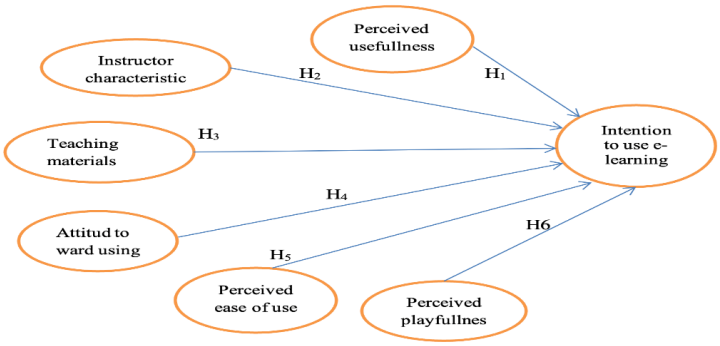

Figure 1. Research model.

This study proposes the following hypotheses:

1. Hypothesis 1: Instructor and student characteristics positively influence students' perceptions of the usefulness of e-learning.
2. Hypothesis 2: Teaching materials positively affect students' perceived usefulness of e-learning.
3. Hypothesis 3: Students and lecturers' perceived ease of use positively impacts their intention to use e-learning.
4. Hypothesis 4: Perceived usefulness positively influences the intention of students and lecturers to use e-learning.
5. Hypothesis 5: Attitudes toward e-learning adoption positively affect the intention of students and lecturers to use e-learning services.
6. Hypothesis 6: Perceived playfulness experienced by students and lecturers positively affects their intention to use e-learning.

Data analysis used Structural Equation Modeling (SEM) with a Partial Least Square (PLS) approach, employing SmartPLS 3.0 software. PLS was chosen because it does not require assumptions about the distribution of parameter estimates, eliminating the need for parametric testing. The evaluation model in PLS includes two components: (1) measurement models (outer models) with reflective indicators and (2) structural models (inner models).

Table 1. Definition and operational research variables.

Variables	Dimension	Number of Indicators and Reference	Scale
Instructor characteristics	Helpful, Caring, Accommodating	Lee et al., 2009. 5 item	Likert
Teaching materials	Suitable for e-learning Content of courses designed for e-learning	Lee et al., 2009. 3 item 6 item	Likert
Playfulness	Students and lecturers enjoy e-learning	Lee et al., 2009. 4 item	Likert
Intention to use e-learning	Students and lecturers have an interest in participating in e-learning	Lee et al., 2009. 4 item	Likert
Perceived usefulness	Students and lecturers believe that e-learning will improve learning outcomes.	Lee et al., 2009. 2 item	Likert
Perceived ease of use	Students and lecturers believe that e-learning will be easy to apply.	Lee et al., 2009. 3 item	Likert

RESULTS AND DISCUSSION

Results

The data analysis of this research uses Structural Equation Modeling (SEM) analysis of variance-based or component-based approaches with the partial least squares (PLS) analysis method and SmartPLS 3.0 software. The evaluation model in PLS is based on non-parametric predictive measurements. The evaluation of the research model includes (1) measurement or outer models with reflexive indicators and (2) Structural models or Inner Models.

Measurement Models or Outer Models

Convergent Validity

The outer model's convergence validity with reflexive indicators is seen from the correlation between the item or component score and the construct score calculated by PLS. The individual reflective measure is considered high if it correlates more than 0.70 with the construct to be measured. However, the loading value between 0.50 and 0.60 is still acceptable at the scale development stage.

Table 2. Outer Loading

	ATUM	BIUM	ICM	PEUM	PPM	PUM
(ATUM1)	0.691					
(ATUM2)	0.807					
(ATUM3)	0.843					

(ATUM4)	0.837		
(ATUM5)	0.741		
(BIUM1)		0.880	
(BIUM2)		0.816	
(BIUM3)		0.826	
(ICM1)			0.882

Based on the outer loading in the table above, no indicator should be dropped or removed from the model because it has a loading value of more than 0.50. Therefore, the indicators for each variableare as in Table 3.

Table 3. Variable indicator.

Variables	Indicator type	Indicator Code
Behavioral Intention to Use	Reflective	BIU1, BIU2, BIU3
Teaching Material	Reflective	TM1, TM2 , TM3
Perceived Usefulness	Reflective	PU1, PU2, PU3, PU4
Perceived ease of use	Reflective	EU1, EU2, EU3, EU4
Perceived playfulness	Reflective	PP1, PP2, PP3, PP4, PP5
Attitude toward using	Reflective	ATU1, ATU2, ATU3, ATU4, ATU5
Instructor / Student characteristic	Reflective	IC1, IC2, IC3, IC4, IC5

Discriminant Validity

The discriminant validity of the measurement model with reflective indicators is assessed based on the cross-loading between indicators and their constructs. Apart from the cross-loading, discriminant validity can be determined by comparing the roots of the average variance extracted for each construct with the correlation between the construct and other constructs in the model. As seen from the outer loading results in Table 4.26 above, it can be concluded that all indicators in this study have met the convergent validity standard because all the results of the value loading on each indicator are above > 0.60.

Table 4. Average variance extracted (AVE).

Variables	Average VarianceExtracted (AVE)	√AVE
Attitude toward using **(ATUM)**	0.618	0.786
Behavioral Intention to Use **(BIUM)**	0.707	0.840
Instructor / Student characteristic **(ICM)**	0.612	0.782
Perceived ease of use **(PEUM)**	0.715	0.845
Perceived playfulness **(PPM)**	0.617	0.785
Perceived usefulness **(PUM)**	0.615	0.784

Then, when viewed from the AVE value, each construct (Attitude toward using, Instructor, Student Characteristics, Perceived ease of use, Perceived playfulness, Perceived Usefulness, and Behavioral Intention to Use) is more significant than 0.50, so the discriminantvalidity criteria are met.

Composite Reliability

Reliability testing is measured by composite reliability and Cronbach Alpha of the indicator block that measures the construct. The construct is reliable if the composite reliability and Cronbach Alpha values exceed 0.70.

Table 5. Composite reliability and Cronbach's alpha.

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
ATUM	0.844	0.852	0.889	0.618
BIUM	0.792	0.794	0.879	0.707
ICM	0.833	0.870	0.884	0.612
PEUM	0.867	0.872	0.909	0.715
PPM	0.846	0.857	0.889	0.617

The output results are in Table 5,. The composite reliability and Cronbach alpha values for each construct are above 0.70., which suggests very good reliability.

Structural Measurement Model or Inner Model

The Inner model is evaluated by looking at the percentage of variance, namely, by looking at the R2 value for the dependent latent construct, using the size of the Stone-Geisser Q-square test, and seeing the magnitude of the structural path coefficient using the t-statistical test obtained from the bootstrapping. Figure 2 shows the research's structural model after passing the outer model test.

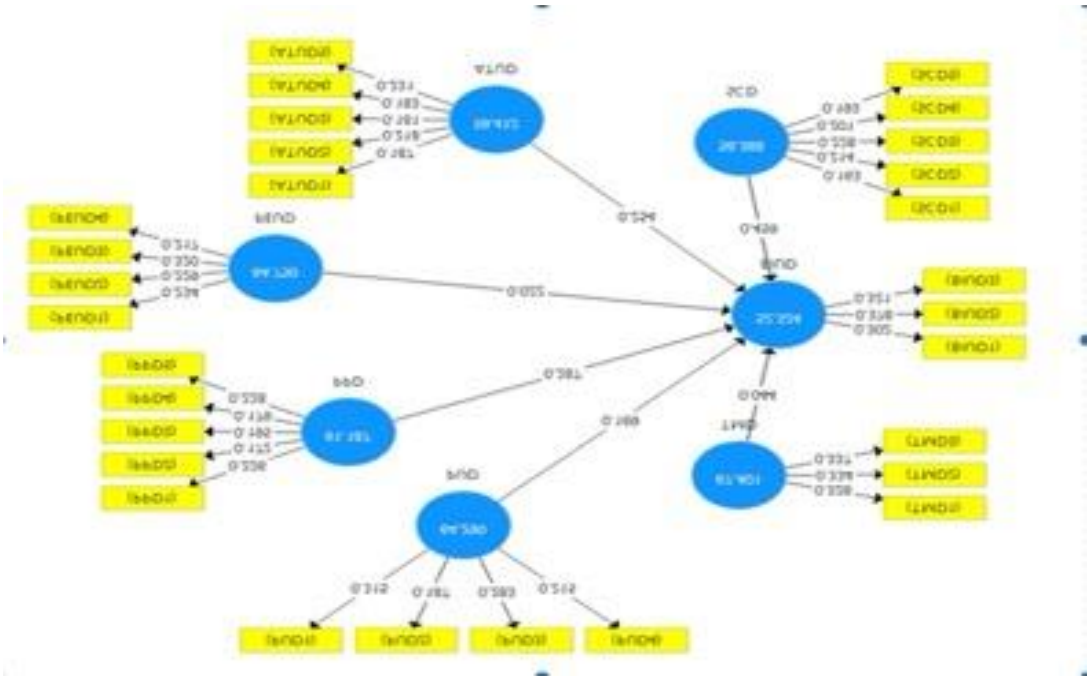

Figure 2. Inner research model.

Although Structural Equation Modeling (SEM) offers advantages over traditional statistical techniques like regression, researchers generally should collect at least 100 cases for models with two to four factors, with 200 cases being preferable. Another guideline from Stevens (1996) suggests having at least 15 cases per variable or indicator.

Given that the sample size in this study is smaller than recommended for SEM, a regression model was used instead to test the hypotheses. Parameter estimation in the inner or structural model was conducted by examining the R-square (R^2) value, a criterion for the model's goodness of fit. The following section presents the R^2 value output, reflecting the model's goodness of fit.

Table 6. R square.

Variable	R Square	R Square Adjusted
BIUM	0.839	0.932

The table shows that the model, which examines the influence of constructs such as Attitude Toward Using, Instructor/Student Characteristics, Perceived Ease of Use, Perceived Playfulness, and Perceived Usefulness on the Behavioral Intention to Use, has an R-square value of 0.932. This indicates that 93.2% of the variability in the Behavioral Intention to Use construct can be explained by the variability in these five constructs. In comparison, the remaining 6.8% is attributed to other variables not included in the study.

According to the R-square estimation results (for both lecturers and students), the R-square value of the endogenous construct (Behavioral Intention to Use) exceeds 0.67, which meets the criteria for a good model. Therefore, it can be concluded that the structural model used in this research is robust. Moreover, the significance of the relationships between the constructs can be assessed by examining the parameter coefficients and the statistical significance (t-values) obtained from the bootstrapping process. These results will provide further insights into the strength and significance of the pathways in the model.

Table 7. Path coefficient.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
ATUM -> BIUM	0.349	0.346	0.057	6.089	0.000
ICM -> BIUM	0.035	0.036	0.047	0.749	0.454
PEUM -> BIUM	-0.113	-0.113	0.053	2.138	0.033
PPM -> BIUM	0.148	0.152	0.072	2.073	0.039
PUM -> BIUM	0.383	0.385	0.063	6.127	0.000

From the table, the following conclusions can be drawn: (1) The Attitude Toward Using construct significantly influences the Behavioral Intention to Use construct, with a parameter of 0.349, which is statistically significant at the 0.01 level ($p = 0.000$), thereby supporting Hypothesis 1. (2) The Perceived Ease of Use construct also impacts the Behavioral Intention to Use construct, though negatively, with a parameter of -0.113, which is significant at the 0.05 level ($p = 0.033$), thus supporting Hypothesis 3. (3) The Perceived Playfulness construct positively influences the Behavioral Intention to Use construct, with a parameter of 0.148, which is significant at the 0.05 level ($p = 0.039$), supporting Hypothesis 6. (4) The Perceived Usefulness construct has a significant positive impact on the Behavioral Intention to Use construct, with a parameter of 0.383, significant at the 0.05 level ($p = 0.000$), supporting Hypothesis 4. (5) However, the Instructor Characteristic construct does not significantly influence the Behavioral

Intention to Use construct, with a parameter of 0.035 and a p-value of 0.454, leading to the rejection of this part of Hypothesis 1.

Discussion

This empirical study examines the acceptance of e-learning services among students and lecturers in Indonesia. It analyzes the relationships between six key constructs: student/instructor characteristics, perceived ease of use, perceived usefulness, perceived playfulness, teaching materials, and attitude toward the intention to use e-learning. The findings reveal that instructor characteristics and teaching materials are positively related to perceived benefits and that a positive attitude toward using e-learning is linked to a greater intention to use these services (Indrawati & Kuncoro, 2021; F. Li et al., 2021; Pölzl-Stefanec et al., 2024; Prahani et al., 2022; Saxena et al., 2020; Singh et al., 2021). These results suggest that as e-learning services improve, students and lecturers are likely to develop more favorable attitudes toward e-learning. Compared to traditional offline education, e-learning shows strong potential for future growth. As web technology advances, e-learning providers can enhance their services without incurring additional costs, leading to greater student and faculty adoption.

Among the variables studied, perceived usefulness and attitude toward using e-learning emerge as the strongest predictors of the intention to use e-learning. The findings indicate that the easier e-learning is to use, the more useful it is perceived to be, positively influencing the intention to use it. To ensure continued use of e-learning, it must be designed to provide value while remaining user-friendly. Enhancing usability without increasing complexity is critical to maintaining engagement. Furthermore, habitual use of technology in education can foster a spirit of technopreneurship among students, encouraging independent attitudes and technological proficiency to drive entrepreneurial growth. Perceived playfulness also has a positive effect on the intention to use e-learning (Gurban & Almogren, 2022; Humida et al., 2022; Kashive & Mohite, 2023; Nguyen et al., 2020; Su & Chiu, 2021). A current trend in educational services is to improve outcomes by incorporating entertainment, or "edutainment," into learning. This presents a challenge for instructors who may need more computer skills, highlighting the need for educational institutions to provide sufficient resources and training. The online gaming industry offers various entertainment tools that can be adapted for educational use, and regular surveys and assessments of new tools seem beneficial.

Most of these findings align with recent studies in the Technology Acceptance Model (TAM) conducted in various countries. For instance, perceived ease of use significantly influences perceived usefulness, and perceived usefulness positively affects the intention to use e-learning (Chen & Aklikokou, 2020; Farooq et al., 2020; Hariyanto et al., 2022; C. Li et al., 2021; Rawashdeh et al., 2021). The design of learning content impacts perceived ease of use, and teaching materials influence the effectiveness of e-learning. E-learning enjoyment also positively affects students' intention to use e-learning. However, enjoyment of e-learning did not impact the intention to use e-learning among Mediterranean educators, while it did among Nordic educators, suggesting cultural differences may influence these relationships. While this study focused on e-learning service quality constructs, other studies have explored learner characteristics like computer anxiety and self-efficacy. Pitch and Lee (2006) found no significant relationship between self-efficacy and the perceived usefulness or intention to use e-learning. Future research should explore how student characteristics interact with service quality constructs to enhance or diminish the intention to use e-learning.

CONCLUSION

Fundamental Finding: The study reveals that perceived usefulness, perceived playfulness, perceived ease of use, teaching materials, and attitude toward e-learning are significant predictors of the intention to use e-learning among students and lecturers in Indonesia, with perceived playfulness having the weakest impact. Interestingly, student/instructor characteristics did not significantly influence the intention to use e-learning. These findings align with similar studies in other countries, suggesting a universal pattern in learners' perceptions and behaviors toward e-learning. **Implication:** The implications of this research emphasize the importance of improving e-learning service quality, particularly by enhancing usability, content engagement, and overall utility, to encourage greater adoption. As e-learning continues to grow, driven by technological advancements, educational institutions, and businesses can leverage these opportunities to reduce costs and expand access to education. **Limitation:** The implications of this research emphasize the importance of improving e-learning service quality, particularly by enhancing usability, content engagement, and overall utility, to encourage greater adoption. As e-learning continues to grow, driven by technological advancements, educational institutions, and businesses can leverage these opportunities to reduce costs and expand access to education. **Future Research:** Future research should aim to include these additional service factors to develop a more comprehensive model and explore e-learning adoption across different environments, such as academic and business settings. Moreover, as globalization continues to impact education, cross-cultural studies on e-learning adoption could provide valuable insights into this rapidly evolving field.

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