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Digital literacy, trust, and satisfaction in cloud-based academic systems adoption

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ABSTRACT

Cloud-based academic platforms have become essential components of digital transformation in higher education institutions. Despite their widespread implementation, maintaining students' continued engagement with these systems remains a major concern, particularly in vocational higher education settings. This study develops an extended unified theory of acceptance and use of technology (UTAUT) framework by incorporating digital literacy, trust, and satisfaction to explain students' post-adoption behavior toward cloud-based academic systems. Data were collected from 500 vocational higher education students in Indonesia using a cross-sectional survey design. The dataset was analyzed using exploratory factor analysis, multiple regression analysis, and conditional process analysis through PROCESS Macro 4.2. The findings indicate that digital literacy significantly strengthens trust and behavioral intention, while trust positively affects both satisfaction and continued system usage. Social influence was identified as the strongest determinant of digital literacy, suggesting that institutional and peer support remain important in digital learning environments. The results additionally demonstrate that experience and training reinforce the relationships among behavioral intention, satisfaction, and actual system use. The framework provides additional insight into post-adoption educational technology behavior by emphasizing the combined influence of digital competence, user perception, and environmental support in cloud-based learning environments.

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1. INTRODUCTION

Higher education institutions increasingly rely on cloud-based academic systems to support academic administration, communication, and learning activities in integrated digital environments. These systems allow institutions to centralize academic services, improve accessibility, and support real-time information exchange among students, lecturers, and administrators [1], [2]. The role of cloud-based academic systems is particularly significant in vocational higher education, where academic activities frequently require collaborative coordination, real-time accessibility, and continuous monitoring of practical coursework [3]. Although the unified theory of acceptance and use of technology (UTAUT) framework has been widely applied to investigate educational technology adoption, most previous studies primarily emphasize initial acceptance behavior rather than sustained post-adoption usage in cloud-based academic environments. Previous educational technology adoption research has predominantly emphasized core

UTAUT determinants, whereas the combined influence of digital competence, affective responses, and institutional support on continued system usage remains insufficiently explored [4]–[6].

Another limitation in prior research is the fragmented treatment of digital literacy, trust, and satisfaction. These variables are often examined independently or positioned only as supporting constructs, resulting in limited understanding of how cognitive capability and affective evaluation jointly influence post-adoption behavior [7], [8]. Furthermore, empirical evidence regarding the moderating roles of experience and training in educational cloud systems remains insufficient, particularly within vocational higher education institutions where students intensively interact with technology-supported academic activities [4], [9], [10].

Methodologically, many previous investigations rely on general higher education contexts and focus primarily on technology acceptance at the adoption stage. Consequently, limited evidence is available regarding sustained usage behavior in vocational learning environments characterized by practical and continuous interaction with cloud-based academic systems [3], [11]. Addressing these gaps, the present study develops an extended post-adoption UTAUT framework integrating digital literacy, trust, satisfaction, experience, and training to explain continued usage behavior in vocational higher education [12]. To address the limited understanding of post-adoption behavior in cloud-based academic environments, the present framework incorporates digital literacy, trust, and satisfaction into the UTAUT model to examine continued system utilization among vocational higher education students [13]. The framework further considers the roles of user experience and institutional training as contextual factors that may reinforce sustained engagement with academic cloud platforms [14]–[17].

The proposed framework broadens the application of UTAUT by emphasizing post-adoption perspectives rather than focusing solely on initial technology acceptance. By combining cognitive capability, affective evaluation, and contextual support, the model offers a more comprehensive explanation of continued interaction with cloud-based academic systems [11], [18], [19]. The framework also underlines the relevance of institutional facilitation and prior user familiarity in encouraging long-term educational technology utilization within vocational higher education contexts [19], [20]. The model assumes that cognitive perceptions influence user capability (digital literacy), which subsequently shapes belief (trust), leading to intention, satisfaction, and ultimately actual usage behavior.

Figure 1 illustrates the proposed extended UTAUT framework for explaining students' post-adoption behavior toward cloud-based academic systems. Performance expectancy, effort expectancy, and social influence are hypothesized to influence digital literacy and trust. Digital literacy is further expected to influence trust and behavioral intention, while trust is expected to influence behavioral intention and satisfaction. Behavioral intention and satisfaction are proposed to influence actual usage behavior. In addition, experience and training are incorporated as moderating variables to examine whether they strengthen the relationships between behavioral intention and satisfaction and between satisfaction and usage behavior, respectively.

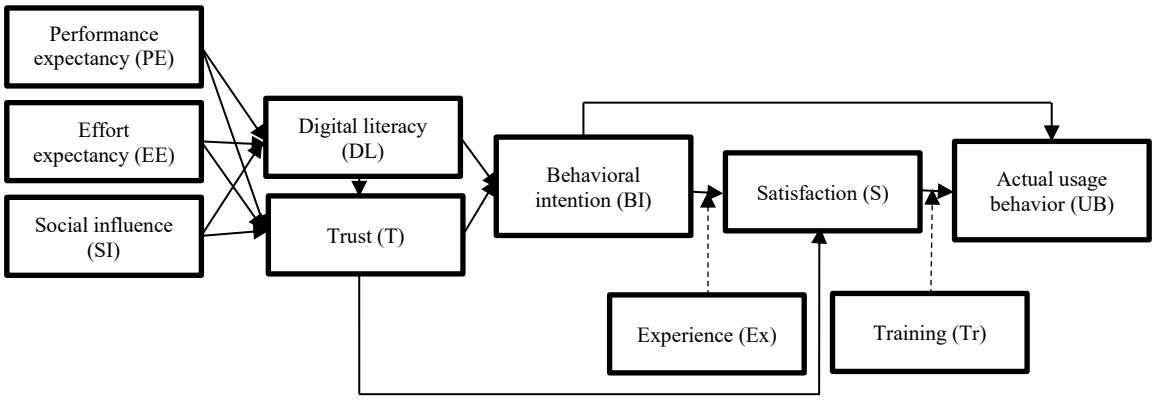


Figure 1. Conceptual framework digital literacy, trust, and satisfaction in cloud-based academic systems adoption

2. METHOD

2.1. Research design

Preliminary statistical examinations were conducted before hypothesis testing to ensure the robustness of the measurement model. Common method bias was evaluated using Harman's single-factor test, while multicollinearity was assessed through variance inflation factor (VIF) analysis [21], [22]. The results indicated that the data were free from serious measurement bias and multicollinearity concerns.

2.2. Participants

Participants were drawn from vocational higher education institutions in Indonesia, particularly students who had actively used cloud-based academic systems in their academic activities. A purposive sampling approach was employed to recruit respondents with relevant system usage experience [23]. A total of 500 valid responses were obtained, which was considered adequate for regression and conditional process analyses to achieve reliable statistical estimation.

2.3. Instruments

Data were gathered using a structured questionnaire designed from previously established technology adoption dimensions. The questionnaire included ten constructs associated with the adoption of cloud-based academic systems, including performance expectancy, effort expectancy, social influence, digital literacy, trust, behavioral intention, satisfaction, usage behavior, experience, and training. All items were evaluated using a 5-point Likert scale ranging from strongly disagree to strongly agree. To ensure contextual relevance, several indicators were adapted to suit vocational higher education settings and the characteristics of cloud-based academic platforms [7], [14], [24]. Table 1 summarizes the measurement constructs used in this study, including the number of items, operational descriptions, and corresponding sources.

Table 1. Measurement of constructs

Construct	Code	Items	Description	Source
Performance expectancy	PE	2	Perceived benefits gained from using the academic system	[5]
Effort expectancy	EE	3	Perceived level of convenience in operating the system	[5]
Social influence	SI	3	Perceived encouragement from surrounding social environment	[5]
Digital literacy	DL	3	Competency in interacting with digital technologies and platforms	[14]
Trust	T	3	Confidence in the reliability and security of the system	[7]
Behavioral intention	BI	3	Willingness to continue using the academic platform	[5]
Satisfaction	S	3	User satisfaction level	[25]
Usage behavior	UB	4	Actual usage behavior	[5]
Experience	Ex	3	Prior system experience	[13]
Training	Tr	3	Training received	[13]

2.4. Data analysis

Questionnaire responses were processed using IBM SPSS together with PROCESS Macro version 4.2. Initial analysis focused on descriptive statistics and regression procedures to explore the relationships among the proposed constructs. Conditional process analysis was then performed to investigate the moderating effects within the proposed research framework.

Measurement quality was evaluated through reliability and validity assessment procedures, including Cronbach's alpha, composite reliability, average variance extracted, and exploratory factor analysis. Factor extraction was conducted using principal axis factoring followed by Promax rotation to identify the underlying factor structure and assess indicator adequacy. The overall assessment demonstrated satisfactory measurement consistency and construct validity, indicating that the dataset was suitable for subsequent statistical analysis [26], [27]. Table 2 presents the results of the hypothesis testing, including the standardized path coefficients (β), t-values, p-values, and decisions for the fifteen proposed hypotheses. The results show that fourteen hypotheses were supported, whereas H4 was not supported because the relationship between effort expectancy and trust was not statistically significant.

Table 2. Hypothesis testing results

Hypothesis	Path	β	t-value	p-value	Decision
H1	Performance expectancy→ digital literacy	0.179	4.217	<0.001	Accepted
H2	Performance expectancy→ trust	0.076	2.269	0.024	Accepted
H3	Effort expectancy→ digital literacy	0.345	7.821	<0.001	Accepted
H4	Effort expectancy→ trust	-0.010	-0.266	0.790	Not accepted
H5	Social influence→ digital literacy	0.447	9.634	<0.001	Accepted
H6	Social influence→ trust	0.287	6.948	<0.001	Accepted
H7	Digital literacy → trust	0.587	12.316	<0.001	Accepted
H8	Digital literacy → behavioral intention	0.538	11.022	<0.001	Accepted
H9	Trust → behavioral intention	0.365	7.885	<0.001	Accepted
H10	Trust → satisfaction	0.763	17.446	<0.001	Accepted
H11	Behavioral intention→ satisfaction	0.162	3.991	<0.001	Accepted
H12	Behavioral intention→ usage behavior	0.630	14.217	<0.001	Accepted
H13	Satisfaction → usage behavior	0.345	8.102	<0.001	Accepted
H14	Behavioral intention × experience → satisfaction	0.118	3.026	0.003	Accepted
H15	Satisfaction × training → usage behavior	0.102	3.291	0.001	Accepted

2.5. Hypothesis development

Within the proposed framework, students' perceptions related to system usefulness, ease of interaction, and the influence of their social environment are expected to play an important role in shaping both digital literacy and trust in cloud-based academic systems. Digital literacy is expected to influence trust and behavioral intention, while trust is hypothesized to affect behavioral intention and satisfaction. Behavioral intention is proposed to influence satisfaction and usage behavior, and satisfaction is expected to influence usage behavior. Furthermore, experience and training are hypothesized to moderate key relationships in the model. The hypotheses were developed based on prior technology adoption literature suggesting that cognitive capability, trust, and contextual support influence post-adoption behavior [5], [7], [11].

2.5.1. Direct relationships

Based on the proposed relationships among the constructs, the following hypotheses were formulated to examine the direct effects of performance expectancy, effort expectancy, social influence, digital literacy, trust, behavioral intention, and satisfaction within the extended UTAUT framework:

- H1: performance expectancy is associated with higher levels of digital literacy.
- H2: performance expectancy contributes to stronger trust toward the system.
- H3: effort expectancy enhances students' digital literacy capability.
- H4: effort expectancy is expected to strengthen users' perceived trust in the system.
- H5: social influence strengthens students' digital literacy.
- H6: social influence contributes to greater trust toward cloud-based academic systems.
- H7: digital literacy increases users' trust in the system.
- H8: digital literacy strengthens behavioral intention toward system usage.
- H9: trust contributes to stronger behavioral intention.
- H10: trust enhances user satisfaction.
- H11: behavioral intention contributes to satisfaction with system usage.
- H12: behavioral intention strengthens actual usage behavior.
- H13: satisfaction contributes to continued usage behavior.

2.5.2. Moderating relationships

To examine the contextual effects of prior experience and institutional training on post-adoption behavior, the following hypotheses were formulated to assess their moderating effects:

- H14: experience is expected to enhance the extent to which behavioral intention translates into satisfaction outcomes.
- H15: training is hypothesized to strengthen the effect of satisfaction on actual system usage behavior.

3. RESULTS AND DISCUSSION

3.1. Exploratory factor analysis

Exploratory factor analysis was applied using principal axis factoring with Promax rotation to examine the underlying structure of the measurement model. Items that exhibited weak communalities or substantial cross-loadings were removed to improve construct clarity. Several indicators with low communalities and substantial cross-loadings were excluded from further analysis. The remaining items demonstrated satisfactory factor loading patterns, indicating acceptable convergent validity and adequate construct representation [28].

3.2. Direct effects analysis

Key determinants derived from the UTAUT model, namely perceived performance benefits, ease of system interaction, and social/environmental influence. Among these variables, social influence showed the strongest contribution, indicating that support from peers, lecturers, and institutional environments plays a substantial role in strengthening students' digital competencies. A collaborative academic environment may therefore facilitate students' readiness to adapt to digital learning ecosystems. Similar patterns have also been discussed in previous educational technology studies, which emphasized the importance of social interaction and environmental encouragement in shaping technology-related behavior [5], [9].

Digital literacy was further associated with higher levels of trust and behavioral intention. Students who possessed stronger digital skills tended to demonstrate greater confidence when interacting with cloud-based academic platforms and were more willing to continue using such systems [14], [15]. One possible explanation is that digitally capable users experience lower levels of uncertainty when navigating online academic services. In vocational higher education settings, where students regularly interact with integrated digital applications, digital literacy appears to function as an important enabling factor for sustained technology engagement.

The findings additionally showed that trust contributed positively to both behavioral intention and user satisfaction. Students who perceived academic platforms as dependable, secure, and institutionally supported were more likely to maintain favorable attitudes toward continued system usage. The proposed framework also demonstrated substantial explanatory power in predicting usage behavior, satisfaction, and trust. These results suggest that emotional assurance and perceptions of reliability remain important components in maintaining long-term engagement with cloud-based educational technologies [7], [17].

In contrast, effort expectancy did not demonstrate a significant relationship with trust. This outcome may indicate that ease of use is no longer the primary consideration for students who are already familiar with digital environments. Rather than focusing solely on usability aspects, students may place greater emphasis on system stability, information security, and institutional credibility when evaluating cloud-based academic systems. Such findings may reflect a gradual shift from usability-centered evaluation toward reliability-centered evaluation in contemporary higher education technology environments.

3.3. Moderation analysis

The moderating effect indicates that students with higher experience demonstrate a stronger translation of intention into satisfaction, suggesting that familiarity enhances expectation confirmation [29]. This confirms the importance of institutional support in digital system adoption [13]. Students' digital literacy was positively shaped by performance expectancy, effort expectancy, and social influence within the context of cloud-based academic systems. Social influence emerged as the strongest predictor, suggesting that peer and institutional encouragement play important roles in improving students' digital capability toward cloud-based academic systems. These findings are consistent with prior studies emphasizing the role of social and cognitive factors in educational technology adoption [4], [5].

The moderation results suggest that contextual support plays an important role in strengthening continued engagement with cloud-based academic systems. Students who possessed greater prior experience and received adequate institutional training were more capable of transforming positive perceptions into consistent system utilization. These findings imply that familiarity with digital platforms and structured institutional assistance contribute to more sustainable educational technology usage within higher education environments [13].

The interaction analysis using PROCESS Macro Model 1 further confirmed the moderating roles of experience and training within the proposed framework. Prior experience strengthened the relationship between behavioral intention and satisfaction, indicating that experienced users tended to evaluate system usage more positively. In addition, institutional training reinforced the relationship between satisfaction and actual usage behavior, suggesting that continuous training support may encourage students to maintain long-term engagement with cloud-based academic platforms.

3.4. Theoretical implications

The extended UTAUT framework demonstrates that post-adoption behavior in cloud-based academic systems is influenced not only by technological perceptions but also by cognitive and affective dimensions. Digital literacy functions as a cognitive capability that enables users to interact effectively with cloud-based platforms, while trust represents an affective belief that reduces uncertainty and strengthens user confidence toward system reliability. Incorporating digital literacy, trust, and satisfaction into the UTAUT framework provides a broader understanding of post-adoption behavior in cloud-based educational environments, particularly in explaining students' continued system utilization. The findings also reinforce the view that technology acceptance in higher education should be understood as a multidimensional process involving capability, perception, emotional evaluation, and contextual support simultaneously [4], [30].

3.5. Practical implications

Higher education institutions should prioritize continuous digital literacy enhancement programs to improve students' capability in utilizing cloud-based academic systems effectively. Institutional support in the form of technical assistance, user guidance, and structured training programs can strengthen students' confidence and encourage sustainable system usage behavior [31], [32]. In addition, improving cloud infrastructure reliability, data security, and service stability is essential for maintaining user trust and satisfaction. Vocational higher education institutions may also benefit from integrating practical digital competency development into academic activities to support long-term adoption of cloud-based educational technologies [14], [33], [34].

3.6. Discussion

The findings indicate that students' continued usage behavior is shaped by the interaction between technological perception, digital capability, and emotional evaluation toward cloud-based academic systems. Digital capability was found to play an important role in shaping students' trust and intention to continue

using cloud-based academic systems. Students who possessed stronger digital skills tended to demonstrate greater confidence and more favorable perceptions toward system utilization. In addition, the positive associations among trust, satisfaction, and actual usage behavior indicate that psychological assurance and perceived system dependability contribute substantially to sustained engagement in digital learning environments.

The insignificant effect of effort expectancy on trust indicates that system usability alone may not adequately influence users' confidence, particularly among students who are already familiar with digital technologies. Within cloud-based academic settings, factors such as platform reliability, data security, and institutional support appear to be more influential in shaping trust than ease-of-use considerations. This pattern may reflect a gradual shift in students' evaluation of educational technologies from functionality-oriented perceptions toward reliability- and credibility-oriented expectations. The relevance of these findings is particularly evident in vocational higher education settings, where students frequently engage with integrated digital systems for academic administration, communication, and practical learning activities. Continuous interaction with cloud-based platforms requires not only system accessibility but also sufficient digital capability and institutional support to ensure sustainable usage behavior.

4. CONCLUSION

An extended UTAUT framework integrating digital literacy, trust, and satisfaction was developed to explain post-adoption behavior toward cloud-based academic systems in vocational higher education. The findings demonstrate that digital literacy and trust play central roles in shaping behavioral intention, satisfaction, and sustained usage behavior. Social influence also emerged as an important factor influencing students' digital capability in cloud-based environments. Continued usage behavior was more evident among students with greater prior experience and training exposure, suggesting that institutional facilitation plays an important role in sustaining educational technology practices. The findings also broaden current perspectives on post-adoption behavior in cloud-based academic systems across vocational higher education contexts.

The study was limited to vocational higher education students in Indonesia and employed a cross-sectional design, which may restrict generalizability across educational contexts. The research employed a cross-sectional design and focused only on vocational higher education students in Indonesia, which may limit generalizability across different educational settings. Future research may apply longitudinal approaches and structural equation modeling techniques to further validate the proposed framework across broader educational contexts.

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Dinar Mutiara Kusumo Nugraheni					✓		✓			✓		✓		

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that there are no financial, professional, or personal relationships that could be considered as influencing the outcomes or interpretation of this study. All authors have read, reviewed, and approved the final manuscript and agree to its submission for publication.

INFORMED CONSENT

Participation in this study was entirely voluntary. All respondents were informed about the purpose and scope of the research prior to participation and provided their consent before completing the questionnaire.

ETHICAL APPROVAL

Ethical considerations were observed throughout the research process. Participation was voluntary, and all respondents were informed about the study objectives before data collection. No identifiable personal data were collected, and confidentiality was ensured.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy and confidentiality considerations of the respondents.

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