Predictive Modeling of Information Systems Success in Higher Education: A WarpPLS-SEM Analysis of User-Centered Portals

Coravil Joy C. Avila
College of Information Technology Education, North Eastern Mindanao State University, 8300 Tandag City, Philippines
cjcavila@nemsu.edu.ph

Keywords: UTAUT, ISSM, User Satisfaction, Continuance Intention, Self-Efficacy, Higher Education, Enrollment Portal.

Abstract: This study evaluates the success of a university enrollment web portal through a predictive modeling approach that integrates the Unified Theory of Acceptance and Use of Technology (UTAUT) and the DeLone and McLean Information Systems Success Model (ISSM). Although higher education institutions increasingly deploy digital portals to support academic services, technical availability alone does not ensure user satisfaction, sustained use, or perceived institutional benefits. This study therefore examined the factors influencing user satisfaction, continuance intention, and net benefits in the context of the NEMSU enrollment portal. A mixed-methods design was employed, with quantitative data gathered from 176 students, faculty, and staff and analyzed using Structural Equation Modeling through WarpPLS 8.0. Qualitative inputs were used to contextualize users' experiences and support the interpretation of the quantitative findings. The results showed that system quality did not significantly influence user satisfaction, whereas information quality and service quality were strong predictors. User satisfaction significantly influenced continuance intention, while facilitating conditions and self-efficacy emerged as important drivers of sustained portal use. Mediation analysis further confirmed that continuance intention mediated the relationship between user satisfaction and net benefits. The findings suggest that university ICT administrators should prioritize accurate and timely enrollment information, responsive support services, reliable facilitating conditions, and user training to strengthen self-efficacy. The study contributes to the predictive validation of a hybrid UTAUT-ISSM model and provides practical guidance for improving sustainability, continuance adoption, and success of user-centered portals in higher education.

1 INTRODUCTION

University information systems now carry much of the routine work that students, faculty, and administrative staff previously handled through counter-based transactions. At NEMSU, the enrollment portal forms part of this shift because it supports enrollment-related access, coordination, and information retrieval. The rapid digital turn during and after COVID-19 made such systems necessary, but the more important question for universities is whether users will still rely on them once emergency adoption has passed. For this reason, system effectiveness in this study is treated as more than system availability; it includes continued use, user satisfaction, and perceived performance during actual portal transactions [1] - [3].

Enrollment portals in higher education are expected to simplify institutional services, but they do not become successful simply because they are online. Their value depends on how users experience the system while completing tasks such as checking information, following enrollment procedures, or requesting assistance. UTAUT-based studies show that continued educational technology use is affected by performance expectancy, effort expectancy, and facilitating conditions [1], [4], [5]. Evidence from online examination portal research also indicates that students' intention and actual use are shaped by perceived usefulness, ease of use, and institutional support, showing that portal success involves both system design and the resources surrounding its use [6].

The ISSM perspective provides another basis for evaluating the NEMSU enrollment portal because it connects user satisfaction with the quality of the

system, the quality of information, and the quality of service support [7] - [11]. Previous studies do not assign equal weight to these dimensions. In student information systems and educational technology settings, some users respond more strongly to system/interface quality, while others judge the system through the accuracy of information or the responsiveness of support services. This variation supports the need for a predictive model that is tested within the specific institutional setting rather than assumed from another university context [8], [9], [12].

For this paper, information system success refers to the practical value produced by the NEMSU enrollment portal after users interact with it, not merely the fact that the portal has been deployed [13]. The model therefore includes system quality, information quality, service quality, performance expectancy, effort expectancy, facilitating conditions, self-efficacy, user satisfaction, continuance intention, and net benefits. The ISSM side of the model links the three quality dimensions to user satisfaction, while the UTAUT side accounts for behavioral and support-related factors that may influence continued use [4], [13]. This distinction is important in the NEMSU context because students normally use the portal as part of required enrollment procedures, whereas faculty and administrative staff use it in relation to advising, coordination, verification, and support functions. Thus, satisfaction and continuance intention are interpreted as context-sensitive indicators of whether the portal remains useful, dependable, and worth sustaining over time [14] - [16].

Satisfaction is especially important in this study because it connects the user's immediate experience with the likelihood of future portal use. When users find the portal helpful during enrollment periods, their intention to continue using it becomes a stronger indicator of successful design and support. Prior higher education studies consistently position satisfaction as a predictor of continuance intention in digital learning and portal environments [7], [17]. In addition, studies using integrated acceptance and success models show that UTAUT and ISSM can be combined to explain how users move from initial acceptance to continued engagement [4], [18], [19].

The study therefore tests a user-centered predictive model for the NEMSU enrollment portal. It asks which quality factors predict user satisfaction, which user and support factors predict continuance intention, and how satisfaction and continuance intention explain net benefits. The measures used in the analysis were aligned with higher education research on satisfaction and continuance intention [6], [7], [12], [20] while the interpretation was anchored on broader work on user experience, sustained use, and system outcomes [21], [22]. The expected contribution is practical: the results can guide portal redesign, user assistance, training, and support planning during enrollment periods [1], [17].

2 RELATED LITERATURE

The DeLone and McLean Information Systems Success Model is widely used to evaluate higher education portals because it links system quality, information quality, and service quality with satisfaction and perceived benefits [13] - [15]. In practice, however, these relationships differ across portal settings. Some studies report stronger effects for system or interface design, while others emphasize service responsiveness or information accuracy [9], [14], [15]. For the NEMSU enrollment portal, this means that the analysis must identify the factors that matter most to its own users rather than rely on a general assumption that all quality dimensions contribute equally [23].

Continuance intention extends portal evaluation beyond first-time acceptance. Evidence from student portal studies suggests that system quality can affect satisfaction and future use when the system supports actual tasks through clear information presentation, functionality, ease of use, and perceived performance [17]. Related e-learning acceptance research also shows that system quality may influence acceptance through perceived usefulness and intention to use [24]. These findings support a user-centered interpretation of portal success: users are more likely to remain engaged when the portal structure helps them finish enrollment-related tasks with less confusion and more confidence [14], [17], [24].

PLS-SEM is frequently applied in portal and educational technology studies because it allows researchers to estimate relationships among quality variables, satisfaction, use, success, and perceived benefits. Recent studies further show that success determinants and facilitating conditions may shift depending on system context, user needs, and institutional readiness [14] - [16]. This is relevant to NEMSU because student users, academic personnel, and administrative personnel encounter the portal from different roles. A local predictive model is therefore more appropriate than directly transferring results from other platforms or populations [15], [16], [23].

Overall, the literature supports the view that portal success is shaped by user experience, perceived quality, satisfaction, continuance intention, and perceived benefits [13] - [15], [23]. This paper builds on that body of work by applying a combined ISSM-UTAUT model to one institutional enrollment portal and by examining how the model behaves among users who interact with the system during enrollment support and processing.

3 CONCEPTUAL FRAMEWORK

The conceptual framework integrates UTAUT and ISSM because the NEMSU enrollment portal must be evaluated from both adoption and system-success perspectives. UTAUT explains continued use through constructs such as performance expectancy, effort expectancy, and facilitating conditions [4]. ISSM, on the other hand, focuses on the quality of the system, the quality of the information it provides, the quality-of-service support, and the satisfaction and benefits that follow [13]. Combining the two models allows the study to examine both what users think the portal can help them do and how well the portal performs as an institutional information system.

In the ISSM portion of the framework, system quality covers the portal's functional and technical characteristics, including navigation, structure, availability, and user-friendliness. Information quality refers to whether enrollment-related content is complete, clear, organized, useful, and timely. Service quality refers to the assistance provided by support personnel, including responsiveness, competence, and availability. These three quality dimensions are expected to shape user satisfaction, or the user's overall judgment of the portal experience [7], [9], [13].

The UTAUT portion explains why users may continue or discontinue portal use after initial exposure. Performance expectancy refers to the perceived usefulness of the portal in completing enrollment-related tasks. Effort expectancy concerns how easy the portal is to learn and navigate. Facilitating conditions describe the resources, connectivity, device compatibility, and support structures available to users. Self-efficacy represents the user's confidence in completing portal tasks independently. Within the proposed model, user satisfaction also contributes to continuance intention, and both satisfaction and continuance intention are linked to net benefits [1], [4], [20].

The framework also accounts for differences among NEMSU user groups. Student users are treated as mandatory users because portal access is normally tied to enrollment requirements. Faculty members, program coordinators, college secretaries, and administrative staff may use the system in a more task-specific or semi-voluntary manner, depending on advising, coordination, or processing responsibilities. Their continued use may therefore depend more on support availability, task efficiency, and perceived benefits than on compliance alone. This distinction helps explain why the same success factors may not operate in the same way for all portal users [14] - [16]. The integrated relationships among these constructs are presented in Figure 1.

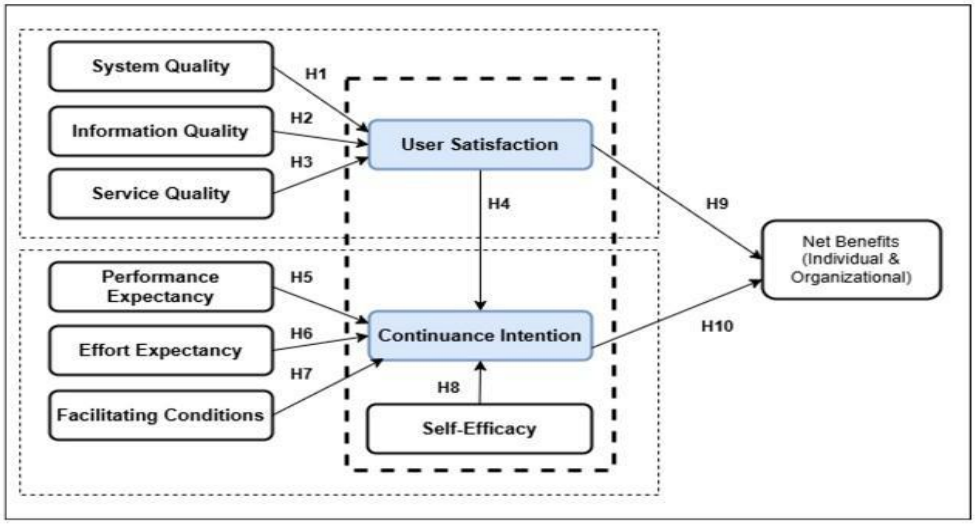

Figure 1: Proposed hybrid UTAUT-ISSM model.

4 METHODOLOGY

4.1 Research Design

The study used a mixed-methods design to examine the NEMSU enrollment portal from both measurement-based and user-experience perspectives. The quantitative component gathered survey responses on portal quality, satisfaction, continuance intention, self-efficacy, and perceived benefits. The qualitative component used exploratory interviews and focus group discussions to document user-reported difficulties, enrollment-related concerns, and suggested improvements. These qualitative inputs were not analyzed as a separate thematic-results section; they were used to support the interpretation of the SEM findings and to keep the discussion grounded in actual portal use. In this way, the numerical model was read alongside practical concerns raised by students and support personnel.

4.2 Flow of the Study

The study began with a review of literature on UTAUT, ISSM, portal success, satisfaction, and continued use. After the framework was established, survey questionnaires and interview guides were prepared for users involved in the NEMSU enrollment process. Data collection was conducted among students, faculty, and staff who interacted with the university information system. The survey was distributed through Google Forms within the main campus of Northeastern Mindanao State University.

After data collection, the responses were organized for quantitative analysis and checked against the intended research objectives. The analysis focused on identifying which portal quality and user-related factors should be prioritized for improvement. The qualitative inputs were used to clarify how users experienced the portal during enrollment-related activities. The process ended with recommendations for improving the NEMSU enrollment portal. Figure 2 summarizes the input-process-output flow followed in the study.

4.3 Research Variables and Evaluation Criteria

To make the evaluation criteria explicit, the study measured ten latent constructs from the hybrid UTAUT-ISSM model. The constructs were measured using Likert-scale indicators and interpreted through descriptive statistics and SEM path testing. Table 1 identifies each variable, its role in the model, and the basis used to evaluate it in relation to the NEMSU enrollment portal.

4.4 Participants

The respondents represented the main user groups of the NEMSU enrollment portal. Students were included as primary users, while administrative staff, college secretaries, program coordinators, and registrar personnel were included because they support student-facing enrollment processes [9], [11], [12]. This study employed a convenience sampling in that the target respondents were already within the university and had experiences directly with using the portal. These approaches are common in the studies of higher education portal [12] and e-learning portals [11], [14]; that collected data from the available population (typical end-users) via a campus-based or online method. This resulted in 176 valid responses which were used for the SEM estimation after screening of the dataset.

4.5 Analysis of Data

A total of 233 responses were collected from the original dataset. Data were also screened prior to model estimation for incomplete entries, inconsistent responding, outlying cases, and straight-lining. An approach of using a standard deviation cut-off, 0.00 to 0.25 was used to identify straight-lining [25], [26]. This left us with 176 valid cases after cleaning, removing fifty-seven responses.

The sample adequacy was examined by running a priori power analysis for F-test of multiple regression. The computation was based on nine predictors, an effect size of $f^2 = 0.15$, $\alpha = 0.05$, and power $(1 - \beta) = 0.95$. The sample size of 166 was required, yet the final dataset entry comprised a total of 176 valid respondents. So the retained sample was above the minimum requirement and sufficient for SEM testing [1], [20]. Table 2 presents the power-analysis parameters used to justify the sample size.

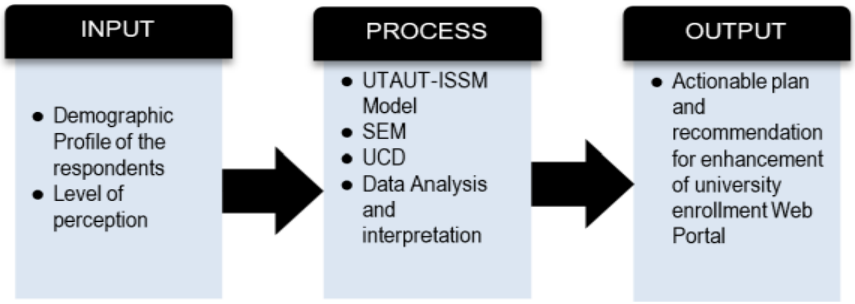

Figure 2: Flow of the study.

Table 1: Research variables and evaluation criteria.

Variable	Model Role	Evaluation Basis
System Quality	ISSM antecedent of user satisfaction	Navigation, user-friendliness, structure, reliability, and availability.
Information Quality	ISSM antecedent of user satisfaction	Completeness, clarity, organization, usefulness, timeliness, and decision support.
Service Quality	ISSM antecedent of user satisfaction	Responsiveness, competence, support availability, instructions, and training.
User Satisfaction	Central success construct	Overall experience, expectation fulfilment, efficiency, effectiveness, and contentment.
Performance Expectancy	UTAUT predictor of continuance intention	Perceived usefulness, productivity, task support, and time savings.
Effort Expectancy	UTAUT predictor of continuance intention	Ease of learning, clarity of interaction, navigation, and mobile convenience.
Facilitating Conditions	UTAUT predictor of continuance intention	Resources, knowledge, internet access, support team availability, and device compatibility.
Self-Efficacy	Extended user capability construct	Confidence in independent use and completion of portal tasks.
Continuance Intention	Post-adoption behavioral construct	Intention to continue, regular future use, preference, and sustained use.
Net Benefits	ISSM outcome construct	Time savings, decision support, resource reduction, data access, and administrative control.

Table 2: Distribution of respondents using G*power sample size estimation.

Parameter	Value
Test Family	F tests
Statistical Test	Linear multiple regression: Fixed model, R^2 deviation from zero
Type of Power Analysis	A priori: Compute required sample size
Effect size (f^2)	0.15
α error probability	0.05
Power (1 - β error probability)	0.95
Number of predictors	9
Noncentrality parameter (λ)	24.9000000
Critical F	1.9403478
Numerator degrees of freedom (df)	9
Denominator degrees of freedom (df)	156
Total sample size required	166
Actual Respondents	176
Actual Power	0.9500973

5 RESULTS

5.1 Hypothesis Testing

The WarpPLS-SEM analysis showed which paths in the proposed model were statistically supported. Information quality and service quality had significant effects on user satisfaction, while system quality did not. Among the satisfaction predictors, service quality produced the strongest coefficient, indicating that users responded strongly to the availability and responsiveness of assistance during enrollment-related transactions. Table 3 presents the path coefficients, probability values, effect sizes, and decisions for the hypothesized relationships.

User satisfaction had a significant positive effect on continuance intention, meaning that users who evaluated the portal experience more favorably were more likely to express future use. Continuance intention also had a significant effect on net benefits, indicating that the value of the NEMSU enrollment portal depends partly on sustained use rather than one-time access. These results show that satisfaction contributes to long-term use and to the realization of individual and institutional benefits. Figure 3 presents the corresponding structural model with beta coefficients.

Performance expectancy and effort expectancy were not significant predictors of continuance intention in this dataset. In the NEMSU setting, this may reflect the mandatory nature of enrollment-related portal use: students may continue using the portal because it is required, even when perceived usefulness or ease of use is not the strongest driver. In contrast, facilitating conditions and self-efficacy were significant predictors. Users were more likely to intend continued use when they had sufficient resources, support, and confidence to complete portal tasks independently.

Table 3 Results of hypothesis testing.

Hypothesis	Path	β	P-value	f^2	Decision
1	SysQ → US	-0.013	0.432	0.007	Not Supported
2	IQ → US	0.282	<0.001	0.180	Supported
3	ServQ → US	0.484	<0.001	0.333	Supported
4	US → CI	0.263	<0.001	0.170	Supported
5	PE → CI	0.056	0.228	0.016	Not Supported
6	EE → CI	0.064	0.196	0.024	Not Supported
7	FC → CI	0.184	0.006	0.097	Supported
8	SE → CI	0.422	<0.001	0.304	Supported
9	US → NB	0.271	<0.001	0.143	Supported
10	CI → NB	0.419	<0.001	0.245	Supported
11	US → CI → NB	0.110	0.018	0.058	Supported

Note: SysQ = System Quality; IQ = Information Quality; ServQ = Service Quality; US = User Satisfaction; PE = Performance Expectancy; EE = Effort Expectancy; FC = Facilitating Conditions; CI = Continuance Intention; SE = Self-Efficacy; NB = Net Benefits; $f^2 \geq 0.02$ = small effect; $f^2 \geq 0.15$ = medium effect; $f^2 \geq 0.35$ = large effect.

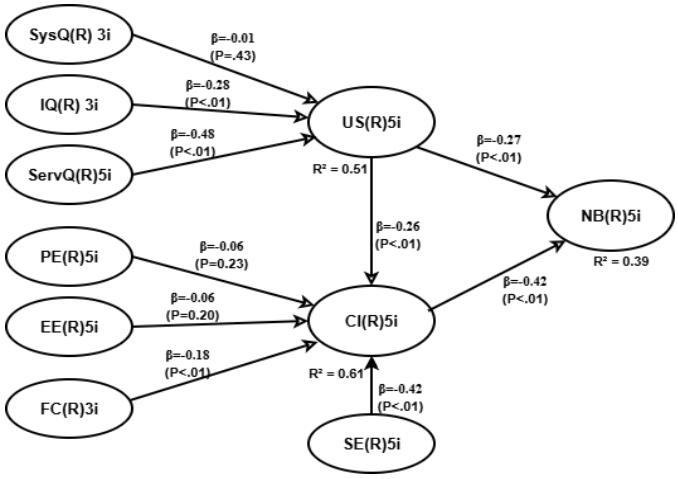

Figure 3: Structural model with beta coefficients.

Table 4: Coefficient of determination, full collinearity VIF, and Q^2.

Endogenous Construct	R^2	Full Collinearity VIF	Q^2
User Satisfaction	0.507	2.598	0.507
Continuance Intention	0.612	2.417	0.614
Net Benefits	0.388	2.112	0.395

Note: R^2 = coefficient of determination; Q^2 = Stone-Geisser's predictive relevance value.

5.2 Coefficient of Determination and Predictive Relevance

The model showed acceptable explanatory and predictive performance for the endogenous constructs. As shown in Table 4, the R^2 values for user satisfaction, continuance intention, and net benefits were all above zero, indicating that the model explained meaningful variation in these outcomes. The positive Q^2 values further indicate that the model had predictive relevance.

For NEMSU, the results point to practical improvements that should be prioritized during enrollment periods. The portal should provide accurate and timely information, while support personnel should be available to assist users who encounter access, navigation, or transaction-related problems. The hybrid UTAUT-ISSM model therefore offers guidance not only for predicting portal use but also for improving the support conditions that make continued use possible.

5.3 Integrated Interpretation of Success Factors

The strongest success factors in the NEMSU enrollment portal context were information quality, service quality, facilitating conditions, and self-efficacy. Information quality and service quality predicted satisfaction more strongly than system quality, suggesting that users placed greater value on accurate enrollment information and responsive assistance than on technical features alone. Facilitating conditions and self-efficacy also mattered for continuance intention, indicating that sustained use depends on resources, institutional support, and user confidence.

The findings also indicate that portal success should be interpreted differently for each user group. Students may continue using the portal because enrollment procedures require it, but their satisfaction still depends on whether information is clear and support is accessible. Faculty and administrative personnel use the portal in relation to advise, coordination, verification, and processing tasks; therefore, they may judge success through efficiency, support availability, and work-related benefits. A successful NEMSU enrollment portal must therefore combine reliable technical operation with human support that responds to the needs of different users.

6 CONCLUSIONS

This study confirms the suitability of hybrid UTAUT-ISSM model for explaining the success in using NEMSU enrollment portal. The results indicated that for the hypothesized relationships, information quality and service quality affected user satisfaction to a significant extent; Moreover, user satisfaction considerably influenced continuance intention and net benefits in the context of WarpPLS-SEM. It concludes that user satisfaction is not only a short-term reaction to the portal experience but also serves as an essential prerequisite for sustained usage of the information portals.

Supporting factors and self-efficacy were also important for continued portal use. In practical terms, people were more likely to remain engaged with the NEMSU enrollment portal when they had resources available to them and a belief that they would successfully be able to do what needs doing on the portal. The findings also indicate that students, faculty, and administrative staff may assess the portal from different roles and expectations. Enrollment needs drive students more so than usefulness and support quality, as well as benefits to faculty members' work processes for administrative staff.

The model's explanatory ability, the R^2 values for user satisfaction, continuance intention, and net benefits, shows that the integrated framework can explain both adoption-related and sustained-use outcomes. For NEMSU, the model can guide decisions on portal support, information management, training, and future system improvement. The integration of UTAUT and ISSM therefore provides a structured basis for evaluating educational portal success.

Several limitations should be considered. The first was that the data were obtained from users of the NEMSU enrollment portal and, as such, the findings may be less applicable to institutions with different

infrastructure, level of digital maturity or support arrangements. Second, the study involved students, faculty and administrative staff but was heavily weighted toward student users whose responses may have driven the overall pattern. Third, using a cross-sectional design in the present study means user perceptions were assessed at a single point and cannot reveal how satisfaction, self-efficacy or continuance intention may change as a function of repeated portal use. Future research could examine the trans-campus/institutional hierarchies of the hybrid UTAUT-ISSM model, employ longitudinal methodologies, and investigate further factors like system trust, perceived institutional support, digital literacy skills and user group classification. Such extensions may clarify how satisfaction develops into continuance use and meaningful organizational outcomes.

REFERENCES

[1] E. Marandu, I. Mathew, T. Svotwa, R. Machera, and O. Jaiyeoba, "Predicting students' intention to continue online learning post-COVID-19 pandemic: Extension of the unified theory of acceptance and usage technology," J. Appl. Res. High. Educ., vol. 15, no. 3, pp. 681-697, 2022, [Online]. Available: https://doi.org/10.1108/jarhe-02-2022-0061.

[2] K. Vasuthevan, S. Vaithilingam, and J. Ng, "Academics' continuance intention to use learning technologies during COVID-19 and beyond," PLoS One, vol. 19, no. 1, art. no. e0295746, 2024, [Online]. Available: https://doi.org/10.1371/journal.pone.0295746.

[3] S. Nikou, "Web-based videoconferencing in online teaching during the COVID-19 pandemic: University students' perspectives," in Proc. IEEE Int. Conf. Adv. Learn. Technol. (ICALT), 2021, pp. 431-435, [Online]. Available: https://doi.org/10.1109/ICALT52272.2021.00137.

[4] Y. Li and M. Zhao, "A study on the influencing factors of continued intention to use MOOCs: UTAUT model and CCC moderating effect," Front. Psychol., vol. 12, art. no. 528259, 2021, [Online]. Available: https://doi.org/10.3389/fpsyg.2021.528259.

[5] C. Gan, Y. Bong, G. Goh, and T. Liew, "Supporting student-centred learning with mobile technology: UTAUT and Hofstede's dimensions of culture," Cult. Educ., vol. 37, no. 1, pp. 268-300, 2025, [Online]. Available: https://doi.org/10.1177/11356405251316068.

[6] S. Shirolkar and R. Kadam, "Determinants of adoption and usage of the online examination portal (OEP) in Indian universities," Educ. + Training, vol. 65, no. 6/7, pp. 827-847, 2023, [Online]. Available: https://doi.org/10.1108/ET-09-2022-0360.

[7] M. Salim, L. Alfansi, A. Sularsih, F. Saputra, and C. Afandy, "The role of perceived usefulness in moderating the relationship between the DeLone and McLean model and user satisfaction," Uncertain Supply Chain Manage., vol. 9, no. 3, pp. 755-766, 2021, [Online]. Available: https://doi.org/10.5267/j.uscm.2021.4.002.

[8] K. Çelik and A. Ayaz, "Validation of the DeLone and McLean information systems success model: A study on student information system," Education and Information Technologies, 2022, [Online]. Available: https://doi.org/10.1007/s10639-021-10798-4.

[9] P. E. Ramírez-Correa, F. J. Rondán-Cataluña, and J. Arenas-Gaitán, "Student information system satisfaction in higher education: The role of visual aesthetics," Kybernetes, vol. 47, no. 8, pp. 1604-1622, 2018, [Online]. Available: https://doi.org/10.1108/K-08-2017-0297.

[10] D. Al-Fraihat, M. Joy, R. Masa'deh, and J. Sinclair, "Evaluating e-learning systems success: An empirical study," Computers in Human Behavior, vol. 102, pp. 67-86, 2020, [Online]. Available: https://doi.org/10.1016/j.chb.2019.08.004.

[11] M. Shams, M. Niazi, H. Gul, T. Mei, and K. Khan, "E-learning adoption in higher education institutions during the COVID-19 pandemic: A multigroup analysis," Front. Educ., vol. 6, 2022, [Online]. Available: https://doi.org/10.3389/feduc.2021.783087.

[12] A. Shahzad, R. Hassan, A. Aremu, A. Hussain, and R. Lodhi, "Effects of COVID-19 in e-learning on higher education institution students: The group comparison between male and female," Qual. Quant., vol. 55, no. 3, pp. 805-826, 2020, [Online]. Available: https://doi.org/10.1007/s11135-020-01028-z.

[13] W. H. DeLone and E. R. McLean, "The DeLone and McLean model of information systems success: A ten-year update," J. Manage. Inf. Syst., vol. 19, no. 4, pp. 9-30, 2003.

[14] W. A. Cidral, T. Oliveira, M. Di Felice, and M. Aparicio, "E-learning success determinants: Brazilian empirical study," Computers & Education, vol. 122, pp. 273-290, 2018, [Online]. Available: https://doi.org/10.1016/j.compedu.2017.12.001.

[15] B. Bervell, D. O. Mireku, and D. Agyapong, "Modelling the antecedents of students' satisfaction and continuous use intentions of an electronic appraisal portal system in higher education," Computers in Human Behavior Reports, vol. 15, art. no. 100431, 2024, [Online]. Available: https://doi.org/10.1016/j.chbr.2024.100431.

[16] M. A. Almaiah, A. Al-Khasawneh, and A. Althunibat, "Exploring the critical challenges and factors influencing the e-learning system usage during COVID-19 pandemic," Education and Information Technologies, vol. 25, no. 6, pp. 5261-5280, 2020, [Online]. Available: https://doi.org/10.1007/s10639-020-10219-y.

[17] B. Bervell et al., "Modelling distance education students' satisfaction and continuous use intention of students' portal: An importance-performance map analysis," Inf. Dev., vol. 42, no. 1, pp. 104-124, 2023, [Online]. Available: https://doi.org/10.1177/02666669231206774.

[18] A. AL-Hawamleh, "Exploring the satisfaction and continuance intention to use e-learning systems," Int. J. Electr. Comput. Eng. Syst., vol. 15, no. 2, pp. 201-214, 2024, [Online]. Available: https://doi.org/10.32985/ijeces.15.2.8.

[19] D. Kala and D. Chaubey, "Cryptocurrency adoption and continuance intention among Indians: Moderating role of perceived government control," Digit. Policy Regul. Gov., vol. 25, no. 3, pp. 288-304, 2023, [Online]. Available: https://doi.org/10.1108/DPRG-09-2022-0108.

[20] S. Masrani, M. Amin, V. Sivakumaran, and S. Piaralal, "Important factors in measuring learners' satisfaction and continuance intention in open and distance learning (ODL) institutions," High. Educ. Ski. Work-Based Learn., vol. 13, no. 3, pp. 587-608, 2023, [Online]. Available: https://doi.org/10.1108/HESWBL-12-2022-0274.

[21] A. Siyal, H. Chen, G. Chen, M. Memon, and Z. Binte, "Structural equation modeling and artificial neural networks approach to predict continued use of mobile taxi booking apps: The mediating role of hedonic motivation," Data Technol. Appl., vol. 55, no. 3, pp. 372-399, 2020, [Online]. Available: https://doi.org/10.1108/DTA-03-2020-0066.

[22] K. Tang et al., "Predicting continuance intention and use of mobile shopping apps with PLS-SEM and necessary condition analysis in tandem," J. Appl. Struct. Equ. Model., vol. 8, no. 1, pp. 1-27, 2024, [Online]. Available: https://doi.org/10.47263/jasem.8(1)02.

[23] E. Tetteh, Z. Qin, and B. Kwofie, "Computer-mediated communication portal implementation framework: A higher education institutional perspective," Int. J. Emerg. Technol. Learn., vol. 15, no. 3, p. 180, 2020, [Online]. Available: https://doi.org/10.3991/ijet.v15i03.11641.

[24] M. I. Alkhawaja, M. S. Abd Halim, M. S. S. Abumandil, and A. S. Al-Adwan, "System quality and student's acceptance of the e-learning system: The serial mediation of perceived usefulness and intention to use," Contemporary Educational Technology, vol. 14, no. 2, art. no. ep350, 2022, [Online]. Available: https://doi.org/10.30935/cedtech/11525.

[25] S. Gautam and V. Singh, "Adaptive discretization using golden section to aid outlier detection for software development effort estimation," IEEE Access, vol. 10, pp. 90369-90387, 2022, [Online]. Available: https://doi.org/10.1109/ACCESS.2022.3200149.

[26] J. Karch, "Outliers may not be automatically removed," J. Exp. Psychol. Gen., vol. 152, no. 6, pp. 1735-1753, 2023, [Online]. Available: https://doi.org/10.1037/xge0001357.