Exploring The Factors Influencing Universiti Teknologi Malaysia (UTM) Undergraduate Students' Intention to Adopt Smart Classrooms

Muhammad Aiman Darwisy Bin Rulhisam[1*], Sabrinah Binti Adam[2]
[1*,2] Faculty of Management, Universiti Teknologi Malaysia, Johor Bahru, Malaysia
*Corresponding author: muhammmadaimandarwisy@graduate.utm.my

ABSTRACT

The deployment of smart classroom technologies has come to be regarded as a crucial factor in higher education institutions that are trying to improve and speed up the learning process through the usage of new technologies. Even though there are many benefits of having smart classrooms, the usage by students of this kind of technology varies. This study tried to identify the factors that influence the acceptance of smart classrooms by undergraduate students at Universiti Teknologi Malaysia (UTM). The study is based on the Technology Acceptance Model (TAM), expanded to determines the connection between the intention to adopt, perceived ease of use, perceived usefulness, trust, and perceived value. A structured questionnaire was the main tool used to collect data from 380 full-time undergraduate students over various UTM faculties, which was being part of a quantitative research method. The data was analysed using IBM SPSS Statistics version 29, which included reliability analysis, descriptive statistics, correlation analysis, and multiple regression analysis. It has been found that all four factors positively and significantly impacted students' intentions to use smart classrooms. The strongest predictor was perceived value, followed by perceived usefulness, perceived ease of use, and trust. The implication of these findings is that when the students perceive the technology to provide meaningful academic benefits, ease of interaction, system reliability, and overall value, they are more likely to actively adopt smart classroom technologies. This study provides empirical evidence for the technology adoption literature in higher education in a Malaysian context and gives practical insights for universities on how to improve the implementation and acceptance of smart classroom technologies.

Keywords
Smart Classroom; Technology Acceptance Model; Perceived Value; Trust; Higher Education

Introduction

The rapid advancement of digital technologies has transformed higher education worldwide, encouraging universities to integrate innovative learning technologies into teaching and learning environments (Pinto & Leite, 2020). Oksana Varhata et al. (2025) emphasize that universities across the globe are increasingly integrating advanced technologies into their learning environments to enhance educational quality and effectiveness. One of the global outcomes of these technologies is the smart classroom, which is considered a technology-integrated learning environment that uses digital tools and interactive systems to provide a more interactive and flexible learning experience (Nguyen et al., 2022). These classrooms are aimed at promoting active learning, improving the accessibility of learning resources, and motivating students to participate, thus meeting the increasing need for education that is technology-based.

Focusing on the Malaysia context, the Higher Education 4.0 initiative emphasizes the integration of advanced technologies in universities to prepare graduates for the demands of the Fourth Industrial Revolution (Bujang et al., 2020). Even though smart classroom technologies are becoming more prevalent in Malaysian higher education institutions, a critical problem remains substantial structural investments do not automatically translate to high student utilization rates. The presence of technology alone does not guarantee effective utilization; therefore, it is crucial to articulate what specifically influences students' adoption intentions, as recent studies have noted fluctuating usage globally (Nguyen et al., 2022).

This study justifies its focus on Universiti Teknologi Malaysia (UTM) because smart classroom technology has been progressively introduced across all its faculties (UTM CDex, 2024), representing a significant institutional shift. A unique problem in UTM's context is that while physical attendance in these smart classrooms may be mandatory, the active, voluntary engagement with their interactive digital features is not. If usage is perceived merely as an enforced requirement, measuring only satisfaction is insufficient; therefore, evaluating intention to adopt remains vital because it captures a student's genuine willingness to voluntarily utilize the advanced tools to their full potential.

Research on the topic of technology adoption in education normally cites the Technology Acceptance Model (TAM) to describe the adoption process (Granić, 2022). This model takes into account perceived ease of use and perceived usefulness as the primary variables that define the intention to adopt a new technology. However, traditional TAM often fails in the context of UTM and Malaysian smart classrooms because these environments represent complex ecosystems of hardware and software, rather than straightforward applications. Consequently, recent studies suggest that supplementary aspects like trust and perceived value are essential. Students may hesitate to adopt modern smart classrooms if they perceive the infrastructure as unreliable or insecure, or if the interactive features offer limited academic value relative to the effort required. Understanding these factors is important because intention is a key predictor of future technology acceptance and use, and empirical evidence regarding UTM undergraduates remains limited. The findings may assist UTM and higher education institutions in designing and implementing smart classroom initiatives that better meet students' needs and expectations. Therefore, to examine the factors influencing UTM undergraduate students' intention to adopt smart classrooms, the study is directed by the following research objectives:

(i) To examine the influence of perceived ease of use and perceived usefulness on undergraduate students' intention to adopt smart classrooms at UTM.
(ii) To evaluate the effect of trust on undergraduate students' intention to adopt smart classrooms at UTM.
(iii) To investigate the role of perceived value in influencing undergraduate students' intention to adopt smart classrooms at UTM.

Literature Review

Factors Influencing Smart Classroom Adoption

Research on educational technology and information systems has extensively studied the implementation of smart classrooms in higher education. To improve student learning and teaching efficacy, smart classrooms incorporate interactive technologies and digital resources (Kim et al., 2018; Fu, 2022). Previous research indicates that perceived usefulness, perceived value, perceived ease of use, and trust are the main factors influencing adoption decisions (Hsu & Lin, 2016; Sneesl et al., 2022). Firstly, perceived ease of use refers to the degree to which a system is perceived as easy to learn and operate, while perceived usefulness reflects beliefs about its ability to enhance learning performance and efficiency (Davis, 1989). User-friendly smart classroom systems reduce learning barriers and encourage student engagement (Kim et al., 2018; Fu, 2022).

Beyond these fundamental elements of the Technology Acceptance Model (TAM), trust has been found to be an important variable in the adoption of technology. Importantly, trusting an isolated application or technology Service is vastly different from trusting a smart classroom. In a smart classroom context, trust involves the student's confidence that the integrated physical and digital systems will not fail during critical tasks (like exams or presentations), and that continuous monitoring and data collection respect their privacy (Vorm & Combs, 2022). In addition, perceived value captures students' overall evaluation of the benefits gained from smart classroom technologies relative to the effort required. When students perceive high academic and experiential value, their intention to adopt such technologies increases (Xie et al., 2021; Sneesl et al., 2022).

Rather than merely listing these variables, Table 1 compares prior findings to highlight a crucial research gap. While Kim et al. (2018) and Fu (2022) found that fundamental TAM factors positively drive learning effectiveness, Hsu & Lin (2016) and Nguyen et al. (2024) demonstrated that usability alone is insufficient without trust in system reliability. Sneesl et al. (2022) further emphasized perceived value over mere utility. However, the literature remains thin on how these overlapping variables operate simultaneously within fully integrated physical smart classrooms in Malaysian universities, validating the need for this research at UTM.

Table 1 Summary of Key Factors Examined in Smart Classroom and Educational Technology

AUTHORS	*STUDY CONTEXT*	*KEY FACTORS EXAMINED*	*MAIN FINDINGS*
Kim et al. (2018)	Higher education	Perceived ease of use, perceived usefulness	Both factors positively influenced adoption intention
Hsu & Lin (2016)	Technology services	Perceived usefulness, trust	Trust and usefulness significantly affected adoption
Fu (2022)	Smart learning environment	Perceived usefulness	Smart technologies enhanced learning effectiveness

Sneesl et al. (2022)	Smart campus adoption	Perceived ease of use, perceived value	Perceived value increased technology acceptance
Nguyen et al. (2024)	Educational technology	Perceived ease of use, trust	User-friendly and reliable systems improved adoption

Intention to Adopt Smart Classrooms

In educational technology adoption studies, intention to use smart classrooms is commonly used as the dependent variable. According to Venkatesh et al. (2003) and Tarhini et al. (2017), behavioral intention is a powerful predictor of actual system usage and indicates a person's readiness and willingness to use a specific technology.

Table 2 provides an overview of outcome variables in prior studies, allowing for a comparative analysis. Studies like Tarhini et al. (2017) and Eraslan Yalcin & Kutlu (2019) have consistently shown that intention strongly predicts actual use in software-based e-learning systems. Building on this, Kim et al. (2018), Xie et al. (2021), and Vorm & Combs (2022) expanded the context to smart environments and intelligent systems, concluding that perceived value and trust are mandatory to strengthen user acceptance. Identifying these outcomes highlights the gap this study addresses: measuring adoption intention specifically for physical smart classrooms equipped with intelligent systems.

Table 2 Summary of Outcome Variables Used in Educational Technology Adoption Studies

AUTHORS	*RESEARCH FOCUS*	*OUTCOME VARIABLE*	*KEY CONCLUSION*
Kim et al. (2018)	Smart classroom usage	Adoption intention	Positive intention increased technology usage
Tarhini et al. (2017)	E-learning adoption	Behavioural intention	Intention strongly predicted actual use
Eraslan Yalcin & Kutlu (2019)	Learning management systems	Intention to use	Acceptance factors influenced intention
Xie et al. (2021)	Digital platforms	Adoption intention	Perceived value strengthened intention
Vorm & Combs (2022)	Intelligent systems	User acceptance	Trust significantly influenced adoption

Conceptual Research Framework

The suggested conceptual research framework illustrates the theoretical connections between students' intention to adopt smart classrooms and perceived usefulness, perceived value, perceived ease of use, and trust.

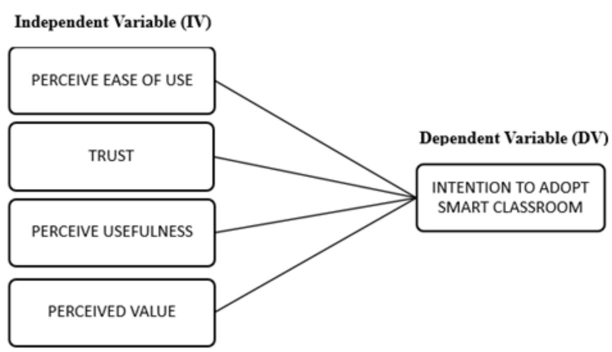

Figure 1. Conceptual Framework for the Study

Hypothesis

According to the Technology Acceptance Model (TAM), people's desire to accept new technologies is largely determined by their perceptions of its usefulness and simplicity of use (Davis, 1989). In the context of smart classrooms, students are more likely to adopt technologies that are easy to manage and require minimal effort, as user-friendly systems reduce learning barriers and enhance engagement (Kim et al., 2018). Accordingly, the following hypothesis is proposed:
H1: Perceived ease of use significantly influences students’ intention to adopt smart classrooms.

Perceived usefulness reflects students’ beliefs that smart classroom technologies improve learning effectiveness, academic performance, and overall learning outcomes. Previous research repeatedly shows that adoption intention in

educational technology contexts is positively impacted by perceived usefulness (Davis, 1989; Fu, 2022). Therefore, the following hypothesis is proposed:
H2: Perceived usefulness significantly influences students' intention to adopt smart classrooms.

The adoption of digital learning systems has been found to depend critically on trust in addition to usability and utility. By boosting students' confidence in system dependability, security, and data integrity, trust reduces the perceived risk of using technology (Hsu & Lin, 2016; Vorm & Combs, 2022). Hence, the following hypothesis is proposed:
H3: Trust significantly influences students' intention to adopt smart classrooms.

Perceived value represents students' overall evaluation of the benefits gained from using smart classroom technologies relative to the effort required. According to earlier research, adoption intention is strongly predicted by perceived value, especially when users believe there are significant academic and experiential benefits (Xie et al., 2021; Sneesl et al., 2022). Therefore, the following hypothesis is proposed:
H4: Perceived value significantly influences students' intention to adopt smart classrooms.

Methods

Research Design

This study employed a quantitative research approach to examine the factors influencing Universiti Teknologi Malaysia (UTM) undergraduate students' propensity to embrace smart classrooms. A survey-based approach was adopted as it is appropriate for testing relationships between variables and validating hypotheses in technology adoption research (Creswell & Creswell, 2018). According to Sekaran and Bougie (2016), quantitative approaches make it possible to gather numerical data and make statistical analysis easier to find significant correlations between independent and dependent variables.

Population and Sample

The target population of this study comprised full-time undergraduate students at Universiti Teknologi Malaysia (UTM) who had been exposed to smart classroom technologies during their learning activities. According to Facts and Figures of UTM (2023), the total undergraduate student population at UTM is approximately 21,036 students, consisting of 16,036 full-time and more than 5,000 part-time undergraduate students. To ensure consistency and relevance within the scope of the study, only full-time undergraduate students were considered.

To determine an appropriate sample size, the Krejcie and Morgan (1970) sample size determination table was used. Based on the population size, a minimum sample of 376 respondents was required to achieve adequate statistical representation and statistical reliability (Saunders et al., 2023). The chosen sampling method was a non-probability sampling technique, more specifically convenience sampling, since it was the most pragmatic and suitable for obtaining data from a huge student population in a short period of time.

Data Collection Procedure

The data was collected by distributing the structured questionnaire directly to undergraduate students at UTM via both digital and physical methods. The online survey form was distributed using university-based WhatsApp groups and official student communication channels, while concurrent in-person distribution took place across various faculty campuses to ensure a comprehensive reach. Participation in the data collection was anonymous and voluntary, and it took place over a predetermined time frame. IBM SPSS Statistics version 29 was used to code and analyze completed replies after they had been verified for completeness.

Research Instrument

Data were collected using a structured questionnaire adapted from established and validated instruments used in prior technology adoption studies (Davis, 1989; Venkatesh et al., 2003; Tarhini et al., 2017). The questionnaire consisted of six sections, as summarised in Table 3. Respondents' demographic information was gathered in the first part of the survey, and the rest of the sections assessed the study variables, such as perceived ease of use, perceived usefulness, trust, perceived value, and intention to adopt smart classrooms.

Each assessment item was assessed using a five-point Likert scale, where 1 represented "strongly disagree" and 5 represented "strongly agree." The use of a Likert scale is appropriate for capturing respondents' perceptions and attitudes toward technology adoption (Sekaran & Bougie, 2016). An online survey platform was used to deliver the questionnaire, and participation was anonymous and voluntary.

Table 3 Questionnaire Design

SECTION	*ASPECT*	*TYPE OF SCALE*	*TOTAL QUESTIONS*
1	Demographic Information	Choices Questions	7
2	Perceive Ease of Use	Likert Scale	5
3	Trust	Likert Scale	5
4	Perceive Usefulness	Likert Scale	5
5	Perceived value	Likert Scale	5
6	Intention to Adopt Smart Classrooms	Likert Scale	5
	TOTAL QUESTIONS		**32**

Data Analysis

To analyze the collected data, the Statistical Package for the Social Sciences (SPSS) was employed. Cronbach's alpha reliability analysis was used to evaluate the measurement scales' internal consistency. Descriptive statistics summarized the respondents' demographic traits and main variables. Multiple regression analysis examined the hypotheses proposed and determined the influence of perceived value, perceived usefulness, perceived ease of use, and trust on students' intention to adopt smart classrooms. Pearson correlation analysis was applied to explore the associations between variables.

Results

Respondent Demographic Profile

In all, 380 valid responses were gathered and examined for this study. The respondents' demographic profile is shown in Table 4. The bulk of responses were between the ages of 20 and 21 (33.9%) and 22 and 23 (30.0%), indicating that most respondents were within the typical undergraduate age range. There were 50% male and 50% female responders, making the gender distribution evenly balanced. The participants were chosen from a variety of Universiti Teknologi Malaysia faculties, with the Faculty of Management providing the largest percentage (30.0%), followed by the Faculty of Built Environment and Surveying (11.6%) and the Faculty of Science (9.7%). All respondents were full-time undergraduate students.

Regarding prior exposure to smart classroom environments, 91.3% of respondents reported having previous experience with smart classrooms. In addition, a high level of familiarity with smart classroom technologies was observed, with 78.4% of respondents indicating a familiarity level of 4 or 5 on a five-point scale. Overall, the demographic profile suggests that the respondents possessed sufficient exposure and familiarity with smart classroom technologies, making them suitable participants for examining adoption intention.

Table 4 Respondent Demographic Profile

		FREQUENCY	*PERCENTAGE (%)*
AGE			
18–19 years old		48	12.6
20–21 years old		129	33.9
22–23 years old		114	30
24–25 years old		78	20.5
26 years old and above		11	2.9
	Total	**380**	**100**
GENDER			
Male		190	50
Female		190	50
	Total	**380**	**100**
FACULTY			
Faculty of Civil Engineering		23	6.1
Faculty of Mechanical Engineering		18	4.7

Faculty of Chemical & Energy Engineering	24	6.3
Faculty of Electrical Engineering	20	5.3
Faculty of Computing	33	8.7
Faculty of Built Environment & Surveying	44	11.6
Faculty of Management	114	30
Faculty of Science	37	9.7
Faculty of Social Sciences & Humanities	33	8.7
Faculty of Educational Sciences and Technology	25	6.6
Faculty of Artificial Intelligence	4	1.1
Azman Hashim International Business School	5	1.3
Total	**380**	**100**
YEAR OF STUDY		
Year 1	59	15.5
Year 2	88	23.2
Year 3	143	37.6
Year 4 and above	90	23.7
Total	**380**	**100**
PREVIOUS EXPERIENCE WITH SMART CLASSROOMS		
Yes	347	91.3
No	33	8.7
Total	**380**	**100**
Familiarity with Smart Classroom Technologies (1=Very Unfamiliar, 5= Very Familiar)		
1	6	1.6
2	23	6.1
3	53	13.9
4	130	34.2
5	168	44.2
Total	**380**	**100**

Reliability Analysis

Before the primary data collection, a pilot study involving 30 undergraduate students was carried out. All constructs achieved Cronbach's alpha values ranging from 0.823 to 0.939, exceeding the suggested threshold of 0.70 (see Table 5). Following the completion of the pilot study, reliability analysis was performed on the actual study data (n = 380). Results show that each construct maintained strong reliability, with Cronbach's alpha scores ranging from 0.850 to 0.897

Table 5 Cronbach's Alpha Reliabiltiy

VARIABLES	*NO. OF ITEMS*	*PILOT TEST (N=30)*	*ACTUAL STUDY RESULT (N=380)*
		CRONBACH'S ALPHA	**CRONBACH'S ALPHA**
Intention to Adopt Smart Classroom	5	0.913	0.874
Perceive Ease of Use	5	0.922	0.897
Trust	5	0.823	0.850
Perceive Usefulness	5	0.939	0.890
Perceive Value	5	0.881	0.877

Descriptive Statistics

The results indicate generally high mean scores across all variables. The highest mean value (M = 4.4037, SD = 0.54292) for the intention to adopt smart classrooms reflected the students' great willingness to embrace smart classroom systems. Perceived value (M = 4.3721) and perceived usefulness (M = 4.3921) showed the students were conscious of the overall worth and educational benefits (see Table 6). Perceived ease of use (M = 4.3089) and trust (M = 4.2811) recorded slightly lower but still high mean values.

Table 6 Descriptive Analysis

VARIABLES	*N*	*MEAN*	*STD. DEVIATION*
Intention to Adopt Smart Classroom	380	4.4037	0.54292
Perceive Ease of Use	380	4.3089	0.64323
Trust	380	4.2811	0.59635
Perceive Usefulness	380	4.3921	0.59447
Perceive Value	380	4.3721	0.59599

Correlation Analysis

The correlation analysis investigated the relationships between the independent variables and students' intention to adopt smart classrooms. The results show significant positive relationships between all independent variables and students' adoption intention, suggesting that higher levels of these factors are associated with stronger willingness to adopt (see Table 7).

Table 7 Pearson Correlation Analysis

	Intention to Adopt Smart Classroom	*Perceive Ease of Use*	*Trust*	*Perceive Usefulness*	*Perceive Value*
Intention to Adopt Smart Classroom	1				
Perceive Ease of Use	.617**	1			
Trust	.644**	.670**	1		
Perceive Usefulness	.676**	.633**	.724**	1	
Perceive Value	.697**	.597**	.694**	.766**	1

*(Note: N=380 for all metrics. ** Correlation is significant at the 0.01 level, 2-tailed).*

Furthermore, the correlations between the independent variables fall within acceptable limits, indicating that multicollinearity is not a problem.

Multiple Regression Analysis

The impact of the independent variables on students' inclination to adopt smart classrooms was investigated using multiple regression analysis. Table 8 has been retitled to properly reflect its contents.

Table 8 Multiple Regression Analysis Results

MODEL	*UNSTANDARDIZED COEFFICIENTS*		*STANDARDIZED COEFFICIENTS*	*T*	*SIG.*
	B	**STD. ERROR**	**BETA**		
(Constant)	1.029	0.151		6.820	<0.001
Perceive Ease of Use	0.174	0.040	0.206	4.321	<0.001
Trust	0.125	0.050	0.137	2.499	0.013
Perceive Usefulness	0.174	0.054	0.191	3.259	0.001
Perceive Value	0.304	0.050	0.333	6.012	<0.001

The regression results indicate that the model is statistically significant and explains a substantial proportion of the variance in students' intention to adopt smart classrooms. All four independent variables exhibit positive and significant effects on adoption intention ($p < 0.05$), thereby supporting all proposed hypotheses.

With $\beta = 0.333$ and $p < 0.001$, perceived value was found to be the best predictor of adoption intention. Perceived usefulness ($\beta = 0.191$, $p = 0.001$) and perceived ease of use ($\beta = 0.206$, $p < 0.001$) follow, alongside trust ($\beta = 0.137$, $p = 0.013$), emphasizing the significance of user confidence and system dependability.

Hypothesis Validity

Regression analysis results showed that all hypotheses of this study were accepted (see Table 9).

Table 9 Summary of Hypothesis Validity

HYPOTHESIS	*STATEMENT*	*RESULT*	*RANK*
H1	Perceived Ease of Use significantly influences students' intention to adopt smart classrooms	Supported	3
H2	Trust significantly influences students' intention to adopt smart classrooms	Supported	4
H3	Perceived Usefulness significantly influences students' intention to adopt smart classrooms	Supported	2
H4	Perceived Value significantly influences students' intention to adopt smart classrooms	Supported	1

Discussions

The first research objective was to examine how undergraduate students' intention to adopt smart classrooms at UTM is influenced by their perceptions of usefulness and ease of use. The findings indicate that both perceived ease of use and perceived usefulness have positive and significant effects, supporting the fundamental assumptions of TAM (Davis, 1989; Venkatesh et al., 2003). In the specific context of UTM, where students from diverse faculties utilize these systems daily as it is intuitive and easy-to-navigate smart classroom environments. In addition, they also believe that smart classroom directly reduces learning barriers and enhance confidence. When UTM students perceive that smart classrooms contribute positively to their academic outcomes, their willingness to actively engage with the technology increases.

The second research objective focused on evaluating the effect of trust on students' intention to adopt smart classrooms at UTM. The findings indicate that trust positively and significantly impacts the intention to adopt. Because UTM's smart classrooms increasingly rely on interconnected digital platforms, high-speed networks, and data-driven monitoring, building students' trust in the security and reliability of these physical spaces is essential. Trust reduces the perceived risks of catastrophic technological failure during vital coursework, aligning with prior studies on advanced digital technologies (Vorm & Combs, 2022).

The third research objective was to investigate the role of perceived value, which emerged as the strongest predictor of students' adoption intention. This reveals a crucial dynamic within Malaysian higher education: UTM students meticulously evaluate technologies based on the overall return on investment regarding their time and effort. If the smart classroom provides robust experiential benefits, such as seamless access to resources that directly improve grades. Students are highly motivated to voluntarily adopt these systems rather than simply attending out of obligation (Xie et al., 2021; Sneesl et al., 2022).

Implications

The findings provide clear practical and theoretical implications for higher education institutions in Malaysia. Practically, university administrators and IT departments must prioritize the procurement of highly reliable systems to build foundational trust, while educators must design curricula that explicitly demonstrate the academic value of smart classroom tools. Theoretically, this study validates that while traditional TAM variables remain relevant, they are insufficient on their own; modern technology adoption models for integrated physical-digital learning spaces must explicitly incorporate trust and perceived value.

Conclusion

This study built on the Technology Acceptance Model and incorporated trust and perceived value to examine the elements that affected the intention of Universiti Teknologi Malaysia (UTM) undergraduate students to adopt smart classrooms. The findings demonstrate that the perceived value, perceived usefulness, perceived ease of use, and trust are critical determinants of the propensity of students to embrace the use of smart classrooms, with perceived value emerging as the most significant. These results add to the existing literature on technology application in higher education and provide contextualized insights for Malaysian universities.

Limitations and Future Studies

This study has a number of limitations. First, the study used a cross-sectional research approach and relied on self-reported data, which might not accurately reflect how students' perspectives have changed over time. Second, the sample was limited to undergraduate students from a single public institution. Future research should adopt a longitudinal research design to examine behavioral changes over time and expand the sample to include multiple universities to enhance generalisability. In addition, exploring variables such as facilitating conditions or social influence may provide deeper insights.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

References

Bujang, S. D. A., Selamat, A., Krejcar, O., Maresova, P., & Nguyen, N. T. (2020). Digital learning demand for future education 4.0: Case studies at Malaysia education institutions. *Informatics, 7*(2), Article 13. https://doi.org/10.3390/informatics7020013

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Fu, Q. (2022). Smart classroom technologies and their impact on students' learning performance in higher education. *Education and Information Technologies, 27*(4), 4821–4840. https://doi.org/10.1007/s10639-021-10741-3

Granić, A. (2022). Educational technology adoption: A systematic review. *Education and Information Technologies, 27*, 9725–9744. https://doi.org/10.1007/s10639-022-10951-7

Hsu, C. L., & Lin, J. C. C. (2016). Effect of perceived value and social influences on mobile app stickiness and in-app purchase intention. *Technological Forecasting and Social Change, 108*, 42–53. https://doi.org/10.1016/j.techfore.2016.04.012

Kim, T., Cho, J. Y., & Lee, B. G. (2018). Evolution to smart learning environment: From smart classroom to smart learning environment. *International Journal of Smart Learning Environments, 5*(1), 1–14. https://doi.org/10.1186/s40561-018-0072-8

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607–610. https://doi.org/10.1177/001316447003000308

Mondal, A., Chakraborty, S., & Pal, S. (2019). Online survey-based research in higher education: Methods and challenges. *Education and Information Technologies, 24*(1), 721–739. https://doi.org/10.1007/s10639-018-9793-0

Nguyen, L. T., Kanjug, I., Lowatcharin, G., Manakul, T., Poonpon, K., Sarakorn, W., Somabut, A., Srisawasdi, N., Traiyarach, S., & Tuamsuk, K. (2022). How teachers manage their classroom in the digital learning environment: Experiences from the University Smart Learning Project. *Heliyon, 8*(10), e10817. https://doi.org/10.1016/j.heliyon.2022.e10817

Pinto, M., & Leite, C. (2020). Digital technologies in support of students' learning in higher education: Literature review. *Digital Education Review, 37*, 343–360. https://doi.org/10.1344/der.2020.37.343-360

Saunders, M., Lewis, P., & Thornhill, A. (2023). *Research methods for business students* (9th ed.). Pearson.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill-building approach* (7th ed.). Wiley.

Sneesl, R., Dhir, A., & Talwar, S. (2022). Understanding students' adoption of digital learning technologies: The role of perceived value and trust. *Computers & Education, 179*, Article 104399. https://doi.org/10.1016/j.compedu.2021.104399

Tarhini, A., Hone, K., & Liu, X. (2017). Factors affecting students' acceptance of e-learning systems: A structural equation modeling approach. *Journal of Educational Technology & Society, 20*(2), 134–148.

Universiti Teknologi Malaysia. (2023). *Facts and figures of UTM*. Universiti Teknologi Malaysia. https://www.utm.my

UTM CDex. (2024). *UTM CDex: Center for Advancement in Digital and Flexible Education*. https://utmcdex.utm.my/

Varhata, O., Udodova, O., Ardelian, O., Apalat, H., & Vykhrystiuk, A. (2025). Advancing higher education through technology and innovation. *Multidisciplinary Reviews, 9*(1), 2026037. https://doi.org/10.31893/multirev.2026037

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

Vorm, E. S., & Combs, G. M. (2022). Trust in digital learning environments: A systematic review. *Computers & Education Open, 3*, Article 100073. https://doi.org/10.1016/j.caeo.2022.100073

Xie, C., Siau, K., & Nah, F. F. H. (2021). The impact of perceived value on students' adoption of smart learning technologies. *Journal of Computer Information Systems, 61*(4), 356–365. https://doi.org/10.1080/08874417.2019.1709226