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Determinants Influencing Malaysian University Students' Continuance Intention to Adopt E-learning: A Structural Equation Modelling Approach

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Abstract

E-learning, powered by technology and the internet, has become a dominant mode of education in today's world. However, several factors influence students' continuance intention to adopt e-learning, including internet connectivity issues, low attendance rates, and inadequate instructor support. This study investigates the impact of these factors on university students' continuance intention to adopt e-learning, exploring the relationships between each determinant. A survey was administered to 210 undergraduate students at the Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia (UTHM), yielding 157 responses. Descriptive analysis and Partial Least Square Structural Equation Modeling (PLS-SEM) were used to analyze the data. The results revealed a strong influence of these factors on students' continuance intention to adopt e-learning. Specifically, perceived ease of use was positively correlated with perceived usefulness and continuance intention, while perceived enjoyment significantly affected perceived ease of use, perceived usefulness, and continuance intention. Perceived usefulness had a significant impact on continuance intention, and social influence also demonstrated a significant impact on continuance intention. This study contributes to the understanding of factors influencing e-learning adoption and provides an extended model that incorporates motivational elements, offering valuable insights for future research and practical recommendations for enhancing e-learning experiences.

1. Introduction

In the evolving education landscape, e-learning has emerged as the predominant mode of study, driven by technological advancements and the internet. As defined by Ismail et al. (2012), E-learning utilizes electronic-based teaching and learning methods facilitated through online or electronic means employing information technologies (Tamm, 2023). The proliferation of information and communication technologies (ICT) has significantly shaped the development of online learning, enabling students to engage in diverse activities across various virtual platforms, from video conference apps to Learning Management Systems (Ermilinda et al., 2024), such as university e-learning systems, Zoom, Google Classroom, Moodle, WebEx, Microsoft Teams, and

BigBlueButton. This approach offers substantial advantages for educators and learners, including cost efficiencies, improved learning processes, accommodating diverse learning styles, and delivering dynamic course content (Al-Rahmi et al., 2019). E-learning is widely recognized as the most effective method for delivering knowledge to meet contemporary academic needs (Ramasamy et al., 2023).

The global COVID-19 pandemic necessitated a widespread adoption of online learning or e-learning methods by educational institutions and organizations to sustain their operations (Alyoussef, 2023). Despite the pandemic's subsiding, many institutions embrace e-learning due to its manifold benefits. In Malaysia, e-learning has swiftly become the norm for most students who are progressively acclimatizing to its flexibility, convenience, and accessibility. Nevertheless, several critical factors influence university students' satisfaction with e-learning, encompassing system quality, service quality, content quality, learner perspective, instructor attitude, and supportive issues (Chan et al., 2022). These factors decisively shape the efficacy of online education and the overall learning experience. Despite the extensive uptake of e-learning, ICT competency levels among Malaysian students generally remain low, posing additional hurdles to its effective implementation. Addressing these challenges is pivotal for enhancing the quality and satisfaction of online education in Malaysia.

Given the challenges associated with e-learning, it is imperative to identify the determinants of students' intention to continue adopting e-learning to ensure its efficacy. Previous studies underscore that not all students derive equal benefits from e-learning, with those in rural areas particularly hindered by internet connectivity issues that impede their participation in crucial online activities such as video meetings (The Sun Daily, 2020). Moreover, research indicates inadequate attendance rates and low continuance intention among students engaged in online learning, often attributed to insufficient instructor support (Leong et al., 2020). Enhancing students' continuance intention requires making teaching methods and learning materials more engaging (Hariguna & Akmal, 2019). Factors such as effort expectancy and social influence have been identified as negatively impacting students' continuance intention towards e-learning (Chen et al., 2021). In contrast, perceived usefulness significantly influences the intention to persist with e-learning (Leong et al., 2020). Therefore, this study aims to assess the extent to which these determinants influence UTHM students' intention to continue using e-learning and explore their relationships within the Malaysian university context.

The determinants influencing students' e-learning continuance intention can be effectively evaluated using the Technology Acceptance Model (TAM) and motivation theory. TAM considers perceived ease of use and perceived usefulness as pivotal determinants, assessing users' perceptions of the ease of application use and its potential to enhance performance (Li et al., 2021). Additionally, motivation theory incorporates perceived enjoyment and social influence to gauge these determinants. Consequently, employing these theoretical frameworks will facilitate a comprehensive examination of the factors driving students' intentions to continue using e-learning, thereby contributing valuable insights to enhance educational practices in Malaysia.

2. Literature Review

2.1 Determinants of E-Learning Continuance Intention: TAM Theory

In 1986, the Technology Acceptance Model (TAM) was developed by Davis to identify the application of computer technology (Li et al., 2021). TAM describes the determinants of computer acceptance and determines technological system acceptance and usage (Davis et al., 1989a). The model incorporates three factors: Perceived Ease of Use, Perceived Usefulness, and Attitude Toward Use (Davis et al., 1989b). Previous studies have shown that TAM helps lecturers understand how to utilize technology and plays an essential role in integrating external components (Murillo et al., 2021). According to Li et al. (2021), perceived ease of use directly influences perceived usefulness, meaning that higher usage of information systems leads to improved job performance. Perceived ease of use and perceived usefulness have positively impacted technology acceptance and students' behavioral intentions during e-learning.

2.1.1 Perceived Ease of Use

According to Davis (1989b), perceived ease of use refers to the extent to which an individual perceives that utilizing a specific system would require minimal effort. This concept implies that the system is expected to be user-friendly and acceptable. Perceived ease of use plays a multifaceted role, as it not only measures user assessments of usability and learning but also influences user motivation when using Information Technology (Gefen & Straub, 2000). When an e-learning system is perceived as easy to use, users are more likely to regard the system as useful (Barz et al., 2024). A previous study by Shen & Chiou (2010), which examined internet service adoption with perceived ease of use, suggested that users are more likely to use a website if they perceive it as easy to use. Therefore, perceived ease of use significantly impacts user motivation to use a particular application.

2.1.2 Perceived Usefulness

Davis (1989b) proposed that perceived usefulness can be defined as the extent to which an individual believes using a specific system would improve their job performance. Additionally, perceived usefulness pertains to the quality of an information system that enables users to solve problems effectively through its use. This implies that when information is presented clearly and easily understandable, its quality is perceived as high, enhancing its usefulness to the user (Larcker & Lessig, 1980). Perceived usefulness is a strong predictor of continuance intention (Chen et al., 2023). Uzun et al. (2024) found that perceived usefulness moderately impacted continuance intention, while Jo (2022) revealed that it positively influences continuance intention. This underscores the role of perceived usefulness in influencing the adoption of e-learning.

2.2 Determinants of E-Learning Continuance Intention: Motivation Theory

According to Li et al. (2021), motivation theory describes the factors that lead to an activity being performed or repeated. Two main types of motivation theories exist: extrinsic and intrinsic (Reiss, 2012). Intrinsic motivation can be defined as engaging in activities purely because of personal interest or enjoyment, such as a child playing baseball simply because they enjoy it (Reiss, 2012). On the other hand, extrinsic motivation often involves external factors such as rewards, deadlines, or competition (Murillo et al., 2021). Previous studies have explored students' motivation for learning in traditional classrooms (Li et al., 2021).

2.2.1 Perceived Enjoyment

Perceived enjoyment is considered one of the intrinsic motivations (Murillo et al., 2021). It is defined as the degree to which the act of adopting a system is perceived as enjoyable and amusing, regardless of the performance outcomes expected from its use (Davis et al., 1992). Zhao et al. (2011) asserted that perceived enjoyment is the primary intrinsic motivation in IT adoption research. Previous studies have shown high perceived enjoyment of using Facebook, indicating strong technology usage and acceptance (Nasri & Charfeddine, 2012).

2.2.2 Social Influence

Chen et al. (2021) defined social influence as the degree to which an individual perceives that influential others (such as friends and family) should use the new system. The researchers also indicated that extrinsic and intrinsic motivations are equally important in influencing human behavior (Deci et al., 1999). However, extrinsic motivation primarily focuses on rewards and external demands. Therefore, social influence is categorized as one of the extrinsic motivations (Murillo et al., 2021), as it involves how individuals are influenced by the actions or behaviors of others (Li et al., 2021).

2.3 Continuance Intention

According to Cui (2021), continuance intention is the initial step students must take towards e-learning, significantly influencing their adoption of e-learning. Continuance intention can be defined as the individual's intention to use the technology, relying on three components: the user's satisfaction with the IT, the extent to which the user confirms their expectations, and post-adoption expectations (Chen et al., 2019). The student's intention to continue using online learning depends on their satisfaction. Furthermore, their intention to persist with online learning is influenced by their past experiences (Taghizadeh et al, 2021).

2.4 Conceptual Framework and Hypotheses Development

Fig. 1 illustrates the relationship between the determinants and the continuance intention of e-learning. The independent variables in this study are the factors influencing university students' intention to adopt e-learning for laboratory subjects, namely perceived ease of use, perceived enjoyment, perceived usefulness, social influence, and intention. The dependent variable in this research is the intention of university students. Seven hypotheses are proposed in this study, as shown in Fig. 1.

The first hypothesis, H1, is based on the Technology Acceptance Model (TAM), which asserts that perceived ease of use directly influences perceived usefulness. Nugroho et al. (2018) emphasize that both perceived usefulness and perceived ease of use are critical determinants of students' intention to continue using information systems. The results of Sumi et al. (2024) indicated that perceived ease of use has the most significant effect on perceived usefulness. Therefore, the hypothesis H1 is stated as follows:

H1: Perceived ease of use is positively related to the perceived usefulness of e-learning.

TAM asserts that perceived ease of use directly influences perceived usefulness. Consequently, perceived ease of use also affects students' intention to adopt e-learning (Baki et al., 2018). Additionally, perceived ease of use

reflects an individual's attitude toward using technology, which further influences their intention to adopt it (Sakarji et al., 2019). Based on these relationships, hypothesis H2 is proposed:
H2: Perceived ease of use is positively related to the intention to adopt e-learning.

Hypothesis H3 draws on research by Halim et al. (2021), which found that perceived usefulness positively affects behavioral intention in the context of e-learning. According to Ramasany et al. (2023), perceived usefulness positively predicts the intention to use e-learning, and when students perceive the usefulness of online learning technologies, they are more likely to adopt them (Wang et al., 2021). Hence, hypothesis H3 is formulated as follows:
H3: Perceived usefulness is positively related to the intention to adopt e-learning.

H4 is grounded in Thapa et al.'s (2021) study, which revealed that perceived enjoyment positively influences students' perceived ease of use when engaging with e-learning. Students who find e-learning enjoyable are more likely to experience greater ease of use. Therefore, hypothesis H4 is suggested:
H4: Perceived enjoyment is positively related to the perceived ease of use of e-learning.

Further building on the role of perceived enjoyment, H5 is supported by research by Humida et al. (2022), which suggests that students who find e-learning enjoyable are more likely to have stronger intentions toward learning. This implies that enjoyable e-learning experiences increase students' perceived usefulness of the platform. Hence, hypothesis H5 is proposed:
H5: Perceived enjoyment is positively related to the perceived usefulness of e-learning.

H6 stems from research by Al-Rahmi et al. (2019) and Hussein (2018), who found that the quality of the learning experience and the incorporation of technology systems enhance students' enjoyment and, consequently, their intention to adopt e-learning. Thus, hypothesis H6 is:
H6: Perceived enjoyment is positively related to the intention to adopt e-learning.

H6 is derived from research by Al-Rahmi et al. (2019) and Hussein (2018), who discovered that the quality of the learning experience and the integration of technology systems improve students' enjoyment, thereby increasing their intention to adopt e-learning. Therefore, hypothesis H7 is proposed as follows:
H7: Social influence is positively related to the intention to adopt e-learning.

These hypotheses collectively explore the relationships between various determinants and students' intentions regarding the adoption of e-learning for laboratory subjects, aiming to enhance understanding of the factors that shape e-learning adoption in higher education.

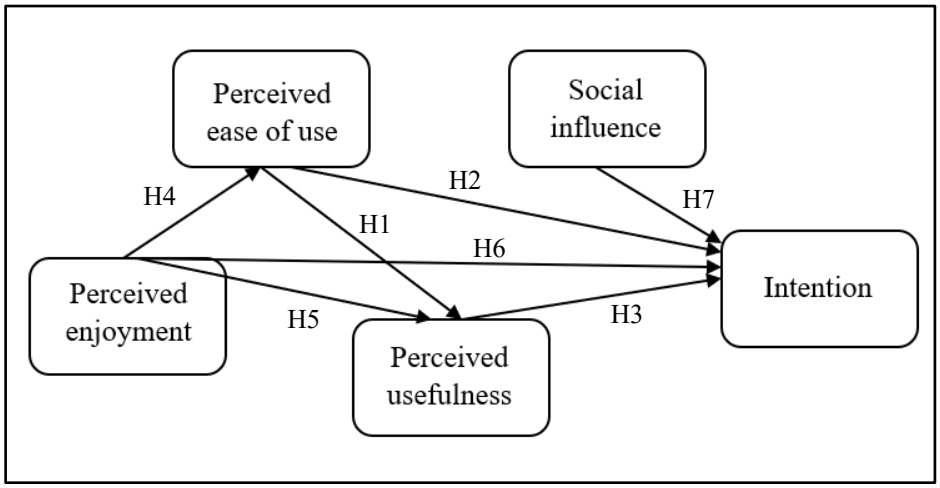

Fig. 1 *Conceptual framework*

3. Methods

3.1 Research Design

A research design serves as a blueprint for achieving research objectives (Schindler, 2022). According to Schindler (2022), Quantitative research, fundamental to statistical studies, emphasizes the measurement of the quantity,

frequency, or magnitude of phenomena and depends on the accuracy and reliability of measurement instruments utilized in observations, surveys, and experimental tests. This research aims to identify the extent of the determinants influencing UTHM students' continuance intention to apply e-learning. The second objective is to study the relationships between these determinants. Therefore, the researcher used the quantitative method for this study. The research analyzed descriptive statistics such as mean, percentage, standard deviation, and frequency. After collecting the data, confirmatory analysis was used to test the validity and reliability of the measures. Finally, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to study the relationships between the variables.

3.2 Sample

The target population can be defined as a specific, conceptually limited group of potential participants to whom the researcher may have access and who represent the nature of the population of interest (Casteel & Bridier, 2021). The population of respondents was drawn from students in the Faculty of Technology Management and Business at Universiti Tun Hussein Onn Malaysia (UTHM). This population consists of 463 students from five courses. In this research, a simple random sampling method was utilized. According to Schindler (2022), simple random sampling is one of the probability sampling techniques in which each element in the population has an equal chance of being chosen. In this study, only third-year students were randomly selected because they have three years of experience using e-learning for laboratory subjects (such as Industrial Automation and Product Development). According to Krejcie and Morgan (1970), the required sample size is 210. A total of 210 questionnaires were distributed to the students, but only 157 responses were received, resulting in a response rate of 74.76%.

3.3 Research Instrument

A research instrument encompassing various types, such as survey questionnaires, interview guides, group discussion guides, and observation checklists, is used to collect data on a study's variables. (Schindler, 2022). In this research, an online questionnaire via Google Forms is utilized. A self-administered questionnaire was used to collect primary data from the respondents, adopting questions from previous studies. There are four types of questionnaires: open-ended questions, closed-ended questions, dichotomous questions, Likert scale questions, and multiple-choice questions. The researcher used Likert scale questions to obtain the results in this study. The questionnaire is divided into six sections: Section A, Demographic Information, identified using multiple-choice questions; Section B, Perceived Ease of Use, identified using a 7-point Likert scale; Section C, Perceived Usefulness, identified using a 7-point Likert scale; Section D, Social Influence, identified using a 7-point Likert scale; Section E, Perceived Enjoyment, identified using a 7-point Likert scale; and Section F, Intention, identified using a 7-point Likert scale.

According to Schindler (2022), The content validity of a research instrument refers to the extent to which it adequately covers the investigative questions guiding the study. Before distributing the questionnaire, the researcher asked four experts to review the questionnaire items and provide suggestions. All the experts are lecturers at UTHM, specializing in studies on online learning. After the researcher obtained suggestions from the four experts, amendments were made accordingly.

Pilot testing is conducted to identify experimental design errors and ensure proper control of extraneous variables and environmental conditions (Schindler, 2022). The researcher conducted a pilot test in this study by distributing the questionnaire to 30 respondents. Subsequently, Cronbach's Alpha was computed to assess internal consistency reliability. Cronbach's Alpha, also known as Coefficient Alpha or Cα, measures the internal consistency reliability of questionnaire items by summing the total item scores (Schindler, 2022). Therefore, the pilot test aimed to examine the reliability of the data.

For the pilot test, the researcher collected 30 responses from UTHM students, and the reliability of the data was assessed using SPSS 26.0. The results indicate that all factors exceeded the acceptable threshold. Continuance Intention (CI) achieved a high Cronbach's Alpha of 0.891, followed by Perceived Ease of Use (PEOU) with 0.853, indicating good data reliability. Perceived Enjoyment (PE) and Perceived Usefulness (PU) also demonstrated good reliability, scoring 0.851 and 0.816, respectively. Social Influence (SI) achieved an acceptable Cronbach's Alpha of 0.743. All items were deemed acceptable as their Cronbach's Alpha exceeded 0.70 (Statistics Solutions, 2024).

3.4 Data Analysis

The researcher used IBM Statistical Package for the Social Sciences (SPSS) Statistics version 26.0 and SmartPLS version 3.2.9 to analyze the data quantitatively. According to Berg (2024), SPSS was first launched in 1968 and acquired by IBM in 2009. SPSS is used to edit and analyze data from various sources such as scientific research, customer databases, Google Analytics, or website server logs. It can handle file formats like spreadsheets, plain text files, and relational (SQL) databases. SmartPLS is essential software for conducting Partial Least Squares

Structural Equation Modeling (PLS-SEM), path analysis, and Confirmatory Factor Analysis (CFA). The collected data underwent descriptive analysis using SPSS 26.0 for the first research question. The second research question was analyzed using SmartPLS 3.2.9 for Exploratory Factor Analysis (EFA) and PLS-SEM.

Descriptive analysis is a method that allows researchers to compute variables and numbers on a small scale. This analysis enables researchers to calculate mean, sum, standard deviation, range, variance, min/max, skewness, and kurtosis. The purpose of descriptive analysis is to quickly identify errors and coding issues in data. It also presents data in a concise and compact tabular form (Hunt, 2021). The results can be analyzed with reference to Table 1, which presents the Intervals of Application Degrees (Arora et al., 2019).

Table 1 *Intervals of application degrees*

Ranges	Degree of level
1.00 - 1.80	Very low
>1.80 – 2.60	Low
>2.60 – 3.40	Moderate
>3.40 – 4.20	High
>4.20 – 5.00	Very high

Partial Least Squares Structural Equation Modeling (PLS-SEM) is a path modeling method developed in 1989 and refined in 1992. Unlike the historically more common covariance-based Structural Equation Modeling (CB-SEM), PLS-SEM offers a distinct approach (Hair & Alamer, 2022). In recent years, PLS-SEM has gained popularity across various disciplines, particularly due to its suitability for non-normal data, small sample sizes, and the incorporation of formative indicators (Hair et al., 2014). It is primarily used for studying cause-and-effect relationships among latent variables. The advantages of using Partial Least Squares include its ability to operate with smaller sample sizes and its facilitation of testing moderating relationships (Shackman, 2013). Therefore, the researcher employed PLS-SEM to explore the relationships between the determinants.

4. Findings

4.1 Descriptive Data Analysis

Descriptive analysis was utilized in this study to examine the extent of the determinants influencing UTHM students' continuance intention to apply e-learning. The researcher calculated each construct's mean, minimum, maximum, and standard deviation. The five main variables analyzed descriptively are Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Social Influence (SI), Perceived Enjoyment (PE), and Continuance Intention (CI). Table 2 illustrates the average mean score of determinants of UTHM students' continuance intention to apply e-learning.

Table 2 *Average mean score of determinants of UTHM students' continuance intention to apply e-learning*

Determinants	Average Mean Score
Perceived Ease of Use	4.58
Perceived Usefulness	4.67
Social Influence	4.72
Perceived Enjoyment	4.77

4.2 Measurement Model

The measurement validity test for this study was conducted on all the variables using SmartPLS 3.2.9. All the reflective indicators were run to calculate the PLS Algorithm. Table 3 presents a summary of the construct's reliability for each dimension. The results show that the factor loading for each construct is above 0.70, and no items need to be deleted as the factor loadings are all above this threshold.

Composite reliability (CR) Composite reliability is a preferred method over Cronbach's alpha for assessing convergent validity in a reflective model (Garson, 2016). A CR higher than 0.7 is considered a stronger consistency value (Hair et al., 2014). According to Table 3, the CR values range from 0.937 (CI) to 0.955 (PEOU), all exceeding the agreed threshold of 0.7. The CR values for PU, SI, and PE are 0.948, 0.947, and 0.946, respectively.

The average variance extracted (AVE) is a metric that compares the amount of variance captured by a construct to the amount of variance due to measurement error. Typically, AVE represents the average level of commonality for each latent factor in a reflective model (Garson, 2016). AVE values of at least 0.50 are recommended. A value

below 0.50 indicates that the items contain substantial error variance (Garson, 2016). Table 3 shows that all items in this study have AVE values ranging from 0.749 to 0.809.

Table 3 *Summary of the constructs reliability*

Variables	Items	Factor Loading (>0.7)	AVE (>0.5)	Composite Reliability (CR) (>0.7)
Perceived Ease of Use	PEOU1	0.884	0.809	0.955
	PEOU2	0.921		
	PEOU3	0.906		
	PEOU4	0.915		
	PEOU5	0.870		
Perceived Usefulness	PU1	0.889	0.784	0.948
	PU2	0.879		
	PU3	0.887		
	PU4	0.897		
	PU5	0.875		
Social Influence	SI1	0.867	0.783	0.947
	SI2	0.931		
	SI3	0.894		
	SI4	0.875		
	SI5	0.856		
Perceived Enjoyment	PE1	0.899	0.777	0.946
	PE2	0.866		
	PE3	0.879		
	PE4	0.883		
	PE5	0.880		
Continuance Intention	CI1	0.866	0.749	0.937
	CI2	0.855		
	CI3	0.894		
	CI4	0.847		
	CI5	0.864		

Discriminant validity determines whether constructs that should not be related are indeed unrelated. It is a type of construct validity that measures how well constructs are designed. Discriminant validity is achieved when each measurement item shows a weak correlation with all other constructs except those to which it is conceptually related (Nikolopoulou, 2022). According to the Fornell-Larcker criterion, discriminant validity is confirmed if each latent variable's Average Variance Extracted (AVE) is greater than the squared correlation with any other latent variable. This means that the square root of the AVE should be larger than the correlation between each pair of constructs (Andleeb, 2021). Table 4 demonstrates that the AVE values satisfy these criteria, indicating sufficient discriminant validity as they exceed the squared correlations in each variable set.

Table 4 *Variable correlation-root square of AVE (Fornel and Larcker result)*

	Continuance Intention	Perceived Ease of Use	Perceived Enjoyment	Perceived Usefulness	Social Influence
Continuance Intention	0.865				
Perceived Ease of Use	0.837	0.899			
Perceived Enjoyment	0.906	0.792	0.881		
Perceived Usefulness	0.863	0.864	0.801	0.885	
Social Influence	0.870	0.773	0.821	0.818	0.885

The Heterotrait-Monotrait Ratio (HTMT) was used to confirm discriminant validity. According to Table 5, the results show that the values meet the threshold of 0.85, confirming good discriminant validity for the items (Garson, 2016).

Table 5 *Heterotrait-Monotrait ratio (HTMT)*

	Continuance Intention	Perceived Ease of Use	Perceived Enjoyment	Perceived Usefulness	Social Influence
Continuance Intention					
Perceived Ease of Use	0.901				
Perceived Enjoyment	0.982	0.847			
Perceived Usefulness	0.934	0.923	0.861		
Social Influence	0.941	0.826	0.884	0.879	

4.3 Structural Model

After assessing the measurement model's statistical significance, the researcher evaluated the structural model using SEM SmartPLS. The goodness of fit (GoF) has been developed to measure model fit for PLS-SEM. In SmartPLS, there are five criteria to measure the goodness of fit: Standardized Root Mean Square Residual (SRMR), Exact Model Fit Tests, Normal Fit Index (NFI), Chi^2 and Degrees of Freedom, and RMS theta (Ramayah et al., 2018). The researcher used Standardized Root Mean Square Residual (SRMR) and Normal Fit Index (NFI) to measure the overall model. The SRMR tests the differences between the observed correlation and the model implied correlation matrix. It is considered a good fit model if the value of SRMR is less than 0.10 or 0.08 (Hu & Bentler, 1999). For NFI, it calculates Chi^2 of the model and then compares it. The model fit is acceptable if the NFI is above 0.9 (Ramayah et al., 2018). Table 5 shows the fit value of the model.

Table 6 indicates that the SRMR is 0.039 and 0.049 for the measurement and structural models, respectively. This demonstrates that the model of constructs is a good fit, as the SRMR value is below 0.08. Additionally, the NFI results confirm that the model is acceptable, with values of 0.839 and 0.834 for the measurement and structural models, respectively, approaching the suggested threshold of 0.9.

Table 6 *Model fit value*

Criterion	SRMR	NFI
Measurement model	0.039	0.839
Structural model	0.049	0.834
Suggested value	≤ 0.08	> 0.90

The hypotheses of this study are tested using the PLS Algorithm and bootstrapping technique. The relationship between each variable is determined through path coefficients, t-values, and p-values. Therefore, Table 7 and Fig. 2 display the structural model results. Additionally, the hypotheses are tested by running 1000 bootstrap samples in SmartPLS 3.2.9.

The results for H1 (Perceived Ease of Use to Perceived Usefulness) are supported with $\beta = 0.617$, t-value = 9.865, $p = 0.000$. This indicates that perceived ease of use significantly influences perceived usefulness. The data collected from UTHM students shows a positive and significant relationship between perceived ease of use and the intention to adopt e-learning.

The result for H2 (Perceived Ease of Use to Continuance Intention) is supported with $\beta = 0.116$, t-value = 1.662, $p = 0.048$. It suggests a positive relationship between perceived ease of use and continuance intention. Thus, H2 is supported, indicating a positive and significant relationship between perceived ease of use and UTHM students' intention to adopt e-learning.

The results of H3 (Perceived Usefulness to Continuance Intention) indicate support with $\beta = 0.200$, t-value = 2.264, $p = 0.012$. This confirms a positive relationship between perceived usefulness and continuance intention among UTHM students in adopting e-learning.

The results for H4 (Perceived Enjoyment to Perceived Ease of Use) are supported with $\beta = 0.792$, t-value = 21.595, $p = 0.000$. They demonstrate a significant positive relationship between perceived enjoyment and perceived ease of use. Therefore, UTHM students perceive that the ease of using online learning impacts their enjoyment of it.

H5 (Perceived Enjoyment to Perceived Usefulness) shows that perceived enjoyment has an impact on perceived usefulness with $\beta = 0.312$, t-value = 4.934, $p = 0.000$. This indicates a positive significant relationship between perceived enjoyment and perceived usefulness, supporting H5.

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The result for H6 (Perceived Enjoyment to Continuance Intention) is supported with β = 0.453, t-value = 6.422, p = 0.000. It reveals a positive relationship between perceived enjoyment and continuance intention, showing that enjoyment influences UTHM students' intention to continue using e-learning.

H7 (Social Influence to Continuance Intention) shows that social influence impacts continuance intention with β = 0.245, t-value = 4.285, p = 0.000. This demonstrates a positive significant relationship between social influence and continuance intention, supporting H7.

Table 7 *Results of structural model and hypothesis testing*

	Hypothesis	β	t-value	P	Decision
H_1	PEOU → PU	0.617	9.867	0.000	Supported
H_2	PEOU → CI	0.116	1.662	0.048	Supported
H_3	PU → CI	0.200	2.264	0.012	Supported
H_4	PE → PEOU	0.792	21.595	0.000	Supported
H_5	PE → PU	0.312	4.934	0.000	Supported
H_6	PE → CI	0.453	6.422	0.000	Supported
H_7	SI → CI	0.245	4.185	0.000	Supported

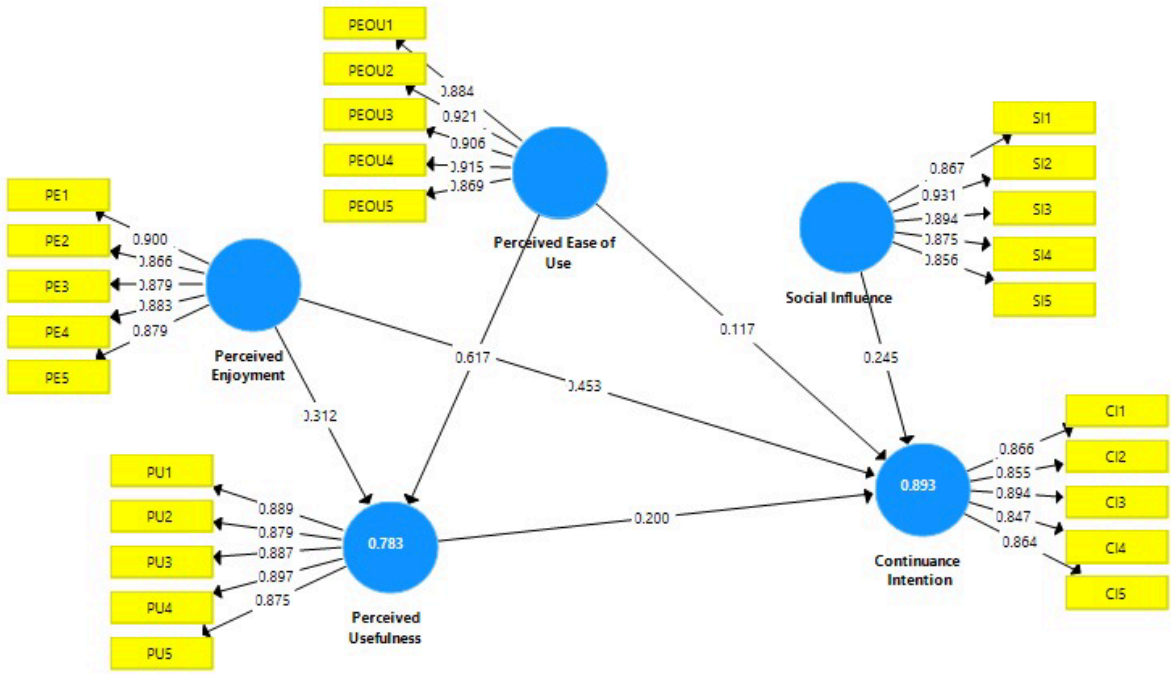

Fig. 2 *Structural model*

5. Discussions

5.1 The Extent Level of the Determinants Influencing UTHM Students' Continuance Intention to Apply E-learning

The first research objective of this study is to identify the determinants of UTHM students' continuance intention to apply e-learning based on their perceptions. The average mean scores of the four determinants influencing UTHM students' continuance intention to apply e-learning—Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Social Influence (SI), and Perceived Enjoyment (PE)—were computed. The highest average mean score for Perceived Enjoyment (PE) is 4.77. This is because perceived enjoyment is recognized as a principal intrinsic motivation that encourages students to adopt e-learning. Therefore, it is an important determinant influencing UTHM students' continuance intention to adopt online learning.

The second highest mean score is for Social Influence (SI) at 4.72. The study by Venkatesh et al. (2003) stated that social influence is an extrinsic motivation with a positive and significant relationship with the continuance intention to adopt information technology. Hence, social influence is one of the determinants used to measure the continuance intention of students to adopt e-learning. This is followed by Perceived Usefulness (PU) with an

average mean score of 4.67. Perceived Usefulness is used to identify the productivity and effectiveness of the e-learning system and to understand the benefits of the system (Tahar et al., 2020). Therefore, PU is significant in testing the continuance intention of students to adopt e-learning.

The lowest average mean score compared to the other determinants is Perceived Ease of Use (PEOU), with an average mean score of 4.58. According to the study by Huang (2021), students trust effective teaching that introduces knowledge and skills. The ease of use of learning tools is a key factor in determining whether they can learn successfully or not. According to Arora et al. (2019), the overall results indicate a high degree of influence of determinants on UTHM students' continuance intention to adopt e-learning.

5.2 The Relationship Between Determinants of E-Learning Continuance Intention

The second research objective discussed the relationships between each determinant to identify their interconnections. Seven subsections cover the hypotheses of the constructs examined in this study. These subsections include Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Social Influence (SI), and Perceived Enjoyment (PE), based on hypotheses H1, H2, H3, H4, H5, H6, and H7.

The first hypothesis revealed that Perceived Ease of Use (PEOU) is positively associated with the Perceived Usefulness (PU) of e-learning, consistent with prior research (Li et al., 2021). A system that is easy to navigate and operate enhances students' perception that the technology is efficient and effective in meeting their learning needs. Additionally, when students find it effortless to use e-learning platforms, they are more likely to explore its functionalities and discover its practical benefits, reinforcing their perception of its usefulness.

The second hypothesis posited that Perceived Ease of Use (PEOU) is positively related to Continuance Intention (CI) among UTHM students, aligning with previous findings (Li et al., 2021). Students who perceive an e-learning system as easy to use develop a sense of comfort and familiarity. This positive experience can increase their confidence in using the system regularly, leading to a higher intention to continue using it over time. Additionally, ease of use reduces barriers to accessing learning materials and interacting with course content, which may enhance students' commitment to persist with e-learning as a preferred mode of education.

Regarding the third hypothesis, the results indicated that Perceived Usefulness (PU) is positively related to Continuance Intention (CI) among UTHM students, supported by studies by Jo (2022) and Uzun et al. (2024), in which perceived usefulness emerged as a direct determinant of the intention to continue using the e-learning system. When students perceive that e-learning systems offer tangible benefits such as improving learning efficiency, flexibility in accessing resources or enhancing academic performance, they are more likely to continue using these systems. In other words, students are more likely to continue using e-learning if they perceive benefits such as improved learning efficiency, flexible resource access, or enhanced academic performance.

The fourth hypothesis findings showed that Perceived Enjoyment (PE) is positively related to Perceived Ease of Use (PEOU) of e-learning among UTHM students, supported by Li et al. (2021) and Humida et al. (2022). When students find the e-learning system enjoyable, they are more likely to perceive it as easy to use because enjoyment often reduces perceived barriers and increases motivation to interact with the platform effortlessly. In other words, enjoyment enhances the perception of ease of use by reducing perceived barriers and increasing motivation to interact with the platform effortlessly.

The study found in the fifth hypothesis that Perceived Enjoyment (PE) is positively related to Perceived Usefulness (PU) among UTHM students, consistent with findings by Abdullah et al. (2016) indicating that enjoyment enhances engagement and motivation, improving perceptions of e-learning tools' effectiveness and practical benefits. When students find using e-learning enjoyable, they are more likely to perceive it as useful because enjoyment enhances their overall satisfaction with the learning experience.

The sixth hypothesis indicated that Perceived Enjoyment (PE) significantly influences Continuance Intention (CI), consistent with prior research (Li et al., 2021). Students' intention to adopt e-learning increases if they find the process enjoyable (Li et al., 2022). Therefore, university students are more likely to adopt e-learning if it provides an enjoyable and pleasurable learning environment.

Finally, the seventh hypothesis demonstrated that Social Influence (SI) is positively related to Continuance Intention (CI) among UTHM students, as indicated in studies by Maldonado et al. (2011) and Li et al. (2021). This shows that social influence plays a significant role in influencing students to adopt online learning. Positive feedback from friends, classmates, instructors, or university management can increase the adoption rate of e-learning among university students.

6. Conclusion, Implications and Recommendations

In conclusion, the objectives of this research have been achieved: (i) determining the extent to which determinants influence UTHM students' continuance intention to adopt e-learning and (ii) exploring the relationships between these determinants. For the first research objective, the findings reveal a big influence of determinants on UTHM students' continuance intention to adopt e-learning. Regarding the second objective, it was found that perceived ease of use positively correlates with perceived usefulness and students' continuance intention to adopt e-

learning. Additionally, perceived enjoyment significantly affected perceived ease of use, perceived usefulness, and continuance intention. Moreover, perceived usefulness demonstrated a notable impact on continuance intention, while social influence also significantly affected continuance intention.

In terms of theoretical implications, this study provides valuable insights for university management and students. It enhances understanding of undergraduate students' intention to continue using online learning by applying the Technology Acceptance Model (TAM) and incorporating extrinsic motivation factors. The findings highlight that intrinsic factors like Perceived Enjoyment and extrinsic factors such as Social Influence are crucial in assessing students' commitment to adopting e-learning, alongside traditional TAM constructs like Perceived Ease of Use and Perceived Usefulness. The validated extended TAM model can serve as a theoretical foundation for future research on technology adoption in educational contexts.

Regarding practical implications, the study findings demonstrate that Perceived Ease of Use (PEOU) significantly correlates with Perceived Usefulness (PU) and Continuance Intention (CI). This indicates that the ease of using e-learning platforms enhances students' likelihood to use and continue adopting e-learning. Consequently, providing comprehensive training on e-learning usage is crucial for university management. For instance, guidelines on submitting assignments through online platforms should be provided to students to enhance their understanding and utilization of e-learning benefits, such as flexibility in learning time and location.

Additionally, the study supports the positive relationship between Social Influence (SI) and Continuance Intention (CI). This underscores the role of university management, parents, friends, and classmates in influencing students' adoption of e-learning. Therefore, university management should offer timely support and guidance to students encountering challenges with e-learning implementation. Ensuring prompt feedback and maintaining open communication with students can facilitate a smoother transition to and successful adoption of e-learning.

Furthermore, considering that Perceived Enjoyment (PE) positively correlates with Perceived Ease of Use (PEOU), Perceived Usefulness (PU), and Continuance Intention (CI), lecturers can enhance student engagement by offering meaningful online content. Incorporating interactive elements such as quizzes and Kahoot can make the e-learning experience more enjoyable for students, thereby increasing their willingness to adopt and engage with online learning platforms.

Several recommendations have been proposed for this study. Firstly, expanding the target population is advised for future research. This entails extending the scope beyond a single university to encompass multiple institutions. The current study focused exclusively on third-year students from the Faculty of Technology Management and Business at UTHM, suggesting that future researchers should include students from various universities to increase sample diversity. Additionally, it is recommended that future research physically distribute questionnaires to target respondents. The present study utilized an online distribution method, which proved time-consuming for data collection. Therefore, distributing questionnaires physically is suggested to ensure the accuracy and reliability of the data obtained. Moreover, this study was limited to five constructs and did not incorporate all potential variables. Thus, future research is encouraged to expand the scope by including additional determinants such as self-efficacy, perceived convenience, and behavioral aspects within the constructs.

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Conflict of Interest

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

Author Contribution

The authors confirm their contribution to the paper as follows: ***study conception and design:*** *Shiau Wei Chan;* ***data collection:*** *Alice Lee Ke Jia;* ***analysis and interpretation of results:*** *Alice Lee Ke Jia;* ***draft manuscript preparation:*** *Shafie Mohamed Zabri, and Fadillah Ismail; All authors reviewed the results and approved the final version of the manuscript.*

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