European Journal of Educational Research
Volume 12, Issue 1, 467 - 480.
ISSN: 2165-8714
http://www.eu-jer.com/

Employing Fuzzy Delphi Techniques to Validate the Components and Contents of E-Learning Antecedents and Usage Behavior Towards E-Learning Performance

Mohamad Aidil Hasim
Universiti Teknikal Malaysia Melaka, MALAYSIA

Juhaini Jabar*
Universiti Teknikal Malaysia Melaka, MALAYSIA

Atirah Sufian
Universiti Teknikal Malaysia Melaka, MALAYSIA

Nor Fauziana Ibrahim
Multimedia University Malacca, MALAYSIA

Fararisha Abdul Khalid
Monash University, AUSTRALIA

Received: March 4, 2022 ▪ Revised: July 8, 2022 ▪ Accepted: January 11, 2023

Abstract: The primary objective of this study is to require the experts' unanimous agreement on the e-learning antecedents and usage behavior towards e-learning performance. This study used the Fuzzy Delphi Method (FDM) to gather answers and feedback using a 7-point Likert scale. The survey (items) was reviewed and approved by eight panel members or experts. It was analyzed using Fuzzy Delphi Logic (FUDELO 1.0) software. The data were evaluated using triangular fuzzy numbering and the position (ranking) of each variable was established through defuzzification. The findings revealed that all of the items received high levels of expert agreement, significantly greater α-cut defuzzification values >.5, the overall value of the threshold (d) is less than .2 and had to comply with the overall percentage of percent consensus, which must be greater than 75%. All 45 recommended items were retained adequately and acceptable for a large-scale survey in this study. Finally, each item was prioritized (ranked) based on the defuzzification value, and then some additional items were added, as recommended by experts.

Keywords: *E-learning antecedents, e-learning performance, Fuzzy Delphi techniques, usage Behavior.*

To cite this article: Hasim, M. A., Jabar, J., Sufian, A., Ibrahim, N. F., & Abdul Khalid, F. (2023). Employing fuzzy Delphi techniques to validate the components and contents of e-learning antecedents and usage behavior towards e-learning performance. *European Journal of Educational Research, 12*(1), 467-480. https://doi.org/10.12973/eu-jer.12.1.467

Introduction

The unprecedented growth of e-learning in the developed world has prompted Malaysia to jump on board by devoting a significant number of resources to investments in information technology and communication (ICT), propelling the nation into a knowledge-based economy (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2018). E-learning is recognized as an advanced learning approach in Higher Education Institutions (HEIs). It has grown worldwide as a form of instruction (Maatuk et al., 2022). The Internet's widespread availability and amplified attention to ICT have prompted various patterns influencing HEIs, offering a huge opportunity to engage in conventional face-to-face teaching and learning approaches (Mousa et al., 2020). The development of ICTs has resulted in e-learning. In previous scholarly theories, e-learning has been characterized from various angles, including educationally driven, technologically driven, delivery-system oriented, and communication-related, to name just a few of the approaches that have been taken (Coman et al., 2020). Furthermore, it represents a collection of models, processes, and mechanisms for gaining and utilizing knowledge that is solely dispersed and supported by electronic means (Caporarello & Sarchioni, 2014). Due to the diverse interpretations and definitions, Kot et al. (2017) offered an exclusive definition of e-learning can be defined as the process of transferring conventional educational practices, procedures, products, and outcomes into digital formats to make them more adaptable, user-friendly, and user-friendly interactive, communicative, and available to learners. This is done in order to facilitate the learning process. In accordance, e-learning encompasses the utilization of numerous ICT platforms such as smartphones, social media, and personal computers, which are used to facilitate teaching and learning (Mousa et al., 2020). Furthermore, e-learning also allows students to access, repeat, and utilize educational materials. E-learning aims to establish an innovative technology enabling more effective information delivery to students (Bączek et al., 2021). The use of technological aids and approaches in e-learning has the potential

* **Corresponding author:**
Juhaini Jabar, Universiti Teknikal Malaysia Melaka, Malaysia. ✉ juhaini@utem.edu.my

to improve education quality and performance by offering students learning resources and schemes that have been optimized to meet their specific needs and priorities (Dhawan, 2020; Kim et al., 2019). The occurrence of this phenomenon has stirred up the belief that traditional learning could be strengthened with the addition of e-learning. According to the method that can be understood through technological means, HEIs should capitalize on the advancement of e-learning as students' favorite teaching approach or an auxiliary technique to conventional face-to-face classes. Hence, digital native students are accustomed to these educational landscapes.

In response to the global pandemic caused by the coronavirus, higher education institutions (HEIs) have altered their approaches to the teaching and learning process. Because of this, the interaction between academics and students has significantly changed. These changes were brought about as a direct result of the epidemic. Many nations are influenced by the COVID-19 pandemic, an extremely contagious disease instigated by SARS-CoV-2 (Verawardina et al., 2020). As a consequence of the pandemic, this issue has led to the closure of universities, colleges and schools worldwide. Universities were compelled to conduct all interactions with students solely through the internet since this virus can be spread through human-to-human transmission (Abdullah et al., 2020). In response to school closures, universities were urged to opt for open distance learning (ODL) as a viable alternative for schools and academicians to reach students remotely and limit the interference in the educational process (Mustafa, 2020) and e-learning is gradually replacing traditional classroom lessons as the most common approach to education in the modern world. With the COVID-19 pandemic underway, many universities discovered that it is difficult to provide and use online learning resources within their e-learning systems initially because most of them are unable to switch the entire educational system simultaneously. In fact, most of them are not ready to face this issue (Alqahtani & Rajkhan, 2020). All of this is because students have diverse levels of digital abilities, varied levels of engagement, in addition to other attributes such as desire, attitudes, and self-assurance, in the utilization of e-learning for academic activities (Coman et al., 2020; Kim et al., 2019) thus, dissatisfaction correlates. Hence, this issue has led to mixed perceptions of using e-learning among students. To attain an elevated percentage of understanding and satisfaction among students, e-learning in HEIs should emphasize the utilization of digital technologies in developing educational resources in order to educate students and standardize the curriculum within the context of universities (Organization for Economic Co-operation and Development [OECD], 2020; Parkes et al., 2015). Moreover, it is recommended that educational institutions make it obligatory for students to make use of ICT, with the goal of encouraging students to do so on a regular basis in order to advance the widespread adoption of ICT. Therefore, this study intends to verify the components and contents of e-learning antecedents and usage behavior towards e-learning performance before embarking on extensive research through the Fuzzy Delphi techniques. This is to ensure students are confident in using this technology, and self-efficacy among students increases the usage of e-learning as a primary platform in their learning process.

Literature Review

In this study, the development of the proposed research model was adapted from the unified theory of acceptance and use of technology (UTAUT) model proposed by Venkatesh et al. (2003) and the task-technology fit (TTF) model proposed by Goodhue and Thompson (1995) as a main theoretical framework. Initially, the UTAUT model was developed with the objectives of forecasting the degree to which users would accept new technology, assisting with the explanation of users' intentions to utilize an information system, as well as the users' subsequent usage behavior, and predicting user acceptance of technology (Ayaz & Yanartaş, 2020) while the TTF model was utilized in order to quantify the efficiency of technology inside a system by analyzing the relationship between the task characteristics and technical characteristics, to provide support (Spies et al., 2020). However, Dwivedi et al. (2019) claimed that the UTAUT model ignored certain potentially significant associations and hypothesized others that may not be applicable in all cases, such as the UTAUT model theorized others that may not be applicable in all scenarios, such as (facilitating condition and behavior intention). In order to advance the theory and identify future research direction, this study attempted to conduct critical analysis and refinement of the original UTAUT model. Thus, eliminating these constructs, such as (facilitating condition and behavior intention) may help to explain the finding much more clearly. All of this is due to the fact that facilitating condition and behavior intention were found to be poor predictor and tend to be unstable, which could affect the proposed model in this study (Ajzen, 2020; Moghavvemi et al., 2013; Venkatesh et al., 2008; Wedlock & Trahan, 2019).

Although the UTAUT is universally acknowledged, this study has employed two variables from the TTF model: task characteristics and technology characteristics (Goodhue & Thompson, 1995). It also has been reported TTF model was one of the most influential models for analyzing information systems' adoption and usage behavior in the context of e-learning (D'Ambra et al., 2013; Elçi & Abubakar, 2021; Vongjaturapat, 2018). In the present investigation, the TTF model served as the basis for extending the application of technological aid to e-learning activities carried out during the COVID-19 pandemic. In fact, earlier research has demonstrated that the TTF model significantly impacted e-learning performance (Lee & Lehto, 2013; Yuce et al., 2019). These findings, which have gained empirical support and validation from the previous study and meta-analysis that revealed a positive connection with the TTF model, demonstrated that the TTF model had a significant impact on the e-learning performance (Isaac et al., 2019). Figure 1 presents the proposed research model utilized in this study.

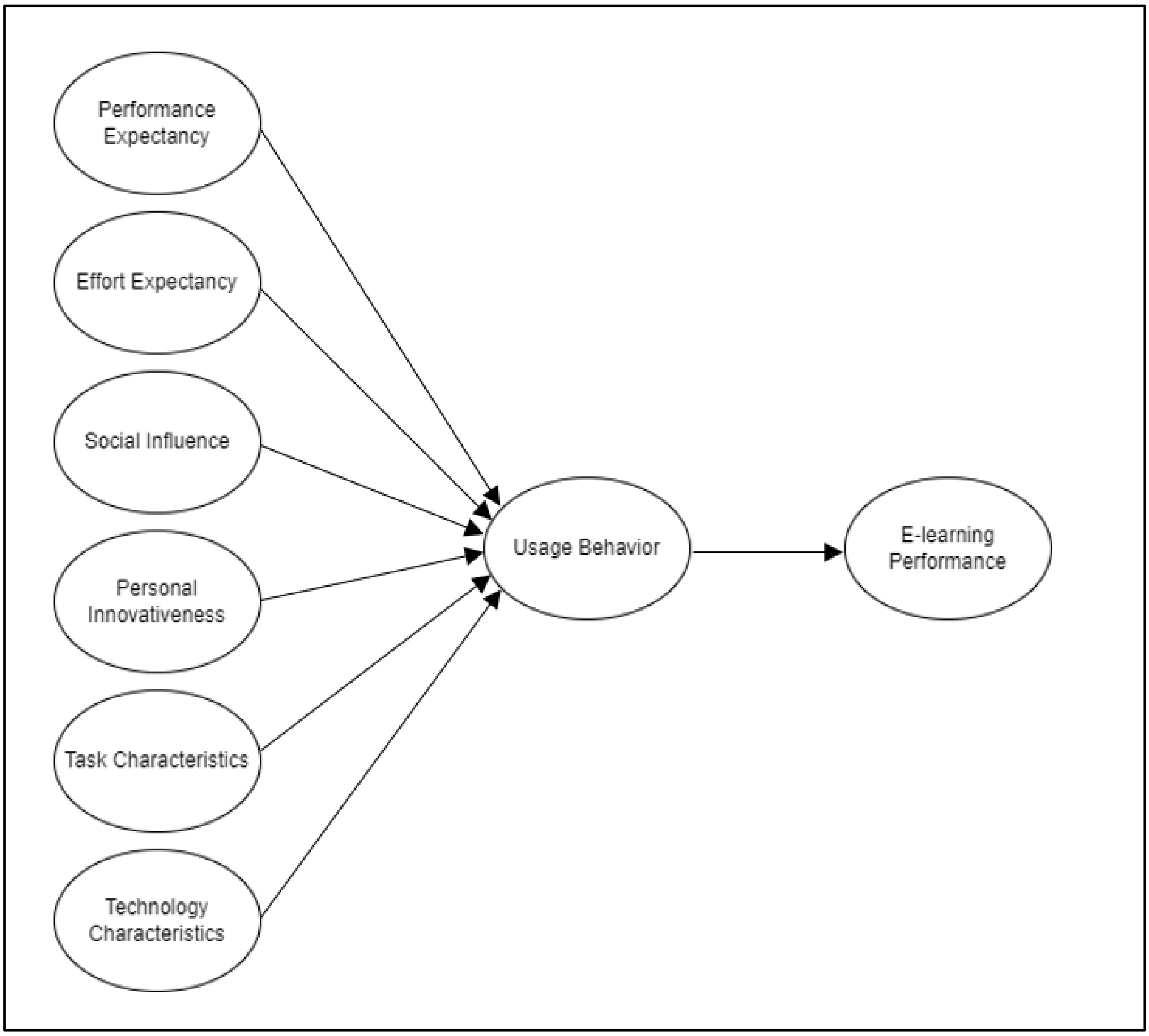


Figure 1. Proposed Research Model

Furthermore, a new construct, personal innovativeness, has been incorporated into this study. In the context of e-learning, more innovative learners are more likely to have favorable opinions of the benefits and utility of e-learning, which influences their intention to utilize it (Twum et al., 2021). Hence, personal innovativeness was used as a predictor of e-learning performance. All constructs were examined simultaneously for construct validation, and refinement purposes for the whole measurement model fit via path analysis in Covariance Based-Structural Equation Modeling (CB-SEM) to apply the model in an e-learning context. The combination of these theories enables the examination of e-learning antecedents and usage behavior as it relates to e-learning performance through a more comprehensive model lens. Lastly, these combinations may produce new perspectives on information systems and their subsequent usage behavior. Thus, the UTAUT and TTF models were utilized to explain the proposed research model's development further.

Methodology

The primary purpose of this investigation is to verify the components and contents of e-learning antecedents and usage behavior towards performance using the Fuzzy Delphi Method (FDM) via expert feedback. In order to determine a definite choice, this approach was taken to acquire the agreement of relevant experts (Mustapha et al., 2021). FDM provides several benefits, such as the capacity to acquire expert opinion, arrive at a consensus, ascertain whether or not it is feasible to adopt instructional interventions, forecast future trends, and establish connections with research subjects without being constrained by the constraints of time or location (Ciptono et al., 2019). Basically, FDM was used to determine the extent to which experts or lay people agree about a particular problem and with each other and to achieve a consensus opinion in areas where they disagree with one another. FDM was often conducted through survey questionnaires (Latif et al., 2017). When compared to the Delphi method, the FDM is preferable because it reduces the time and money spent on the management of surveys while simultaneously facilitating the experts' provision of consistent feedback (Yusoff et al., 2021). In this study, there are two stages in this method for developing the concrete questionnaire. In the first stage, the researcher adapted and modified the questionnaire based on previously validated studies (Abbad, 2021; Alkawsi et al., 2021; Baabdullah et al., 2022; Bere, 2018; Buabeng-Andoh & Baah, 2020; Devisakti

& Ramayah, 2019; Goodhue & Thompson, 1995; Venkatesh et al., 2003; Wijesundara & Xixiang, 2018), as demonstrated in appendix section. Then, the researcher used previously validated questionnaires to support the contents and measurement items of the questionnaire into a formatted survey within a seven-point Likert scale. In the second stage, after obtaining all the contents and measurement items, the researcher designed a survey and distributed it to eight experts with specific expertise. The findings were analyzed using the FDM technique through Fuzzy Delphi Logic (FUDELO 1.0) software.

Sample Expert Criteria and Sampling

In order to synchronize with the expert criteria, this study has employed purposive sampling techniques to select the experts by taking into account both their level of experience and their level of knowledge in the research. In FDM, purposive sampling was the most appropriate techniques to carry out the sampling (Mokhtar & Yasin, 2018). To evaluate the model, this researcher was used eight experts to evaluate the usability of the model. The experts had to have at least five years of experience and above, in addition to the need to be exact with their field of expertise and continually have experience teaching and managing (Mokhtar & Yasin, 2018). The Fuzzy Delphi Method (FDM) requires agreement and expert opinion, which entails building a model, as stated by Ismail et al. (2019). In expert selection, Yusoff et al. (2021) have stated that seven is the minimum number of experts required. This finding is supported by Mustapha et al. (2017) which reported that seven samples are adequate in the Fuzzy Delphi Method (FDM), if the experts are quite similar to one another (highly homogeneous). Thus, eight experts are sufficient to obtain information and expert consensus. The experts involved are summarized in Table 1.

Table 1. Experts List Using FDM

Expert	Designation of expert	Area expertise	Organization	Years of experience
Expert 1	Professor	Technology Management	Universiti Sains Malaysia (USM)	32
Expert 2	Professor	Management Information Systems	Universiti Teknologi MARA (UiTM)	22
Expert 3	Professor (Professional Technologies)	Organizational Behaviour	Universiti Malaysia Pahang (UMP)	20
Expert 4	Associate Professor	Technology Management & Management Information Systems	Universiti Malaysia Kelantan (UMK)	13
Expert 5	Associate Professor	Organizational Behaviour	Universiti Teknikal Malaysi Melaka (UTeM)	19
Expert 6	Associate Professor (Professional Technologies)	Organizational Behaviour (E-learning)	Universiti Malaysia Pahang (UMP)	21
Expert 7	Senior Lecturer (Professional Technologies)	Management Information Systems (E-learning)	Universiti Malaysia Sawarak (UNIMAS)	20
Expert 8	Senior Lecturer	Management Information Systems (E-learning)	Universiti Teknologi MARA (UiTM)	6

Fuzzy Scale in Instruments

The Fuzzy Delphi instrument was established based on a review of the literature. According to Yusoff et al. (2021) the researcher could design the elements of a questionnaire based on literature review, pilot experiments, and/ or previous experiences. Jamil et al. (2014) found that when developing a question for the Delphi's Fuzzy based on the highlights of the study, it is possible to conduct expert interviews using methods such as focus groups. Furthermore, a study done by Mokhtar and Yasin (2018) revealed that the development of items and content elements of a research should be made through the previous studies. After thoroughly reviewing the relevant literature and in-depth consultations with the experts, a series of expert questions are formulated using a seven-point Likert scale. In order to make it easier for the expert to respond to the questionnaire, the researcher substituted a scale ranging from one to seven for the fuzzy value, as shown in Table 2, for each of the seven linguistic scales that follow, while Table 3 depicts the data collection and formulation steps utilized in this study's Fuzzy Delphi Method (FDM).

Table 2. Level of Agreement and Fuzzy Scale (Adopted from Jamil et al., 2014)

Linguistic variables	**Fuzzy scale**
Strongly disagree	0.0. 0.0, 0.1
Disagree	0.0, 0.1, 0.3
Somewhat disagree	0.0, 0.3, 0.5
Neither agree nor disagree	0.3, 0.5, 0.7
Somewhat agree	0.5, 0.7, 0.9
Agree	0.7, 0.9, 1.0
Strongly agree	0.9, 1.0, 1.0

Table 3. Data Collection and Formulation Steps Utilized in FDM

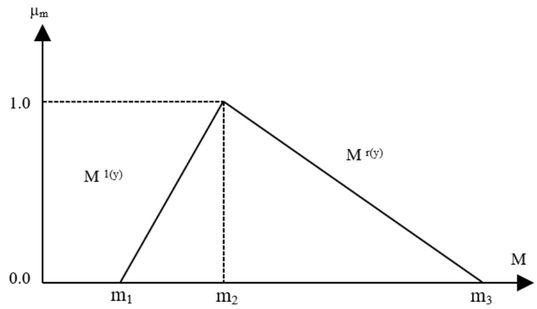
Step	**Formulation**
Step 1: Expert selection	For this investigation, eight experts were consulted to ascertain the significance of the evaluative criteria in connection to the variables that would be measured by linguistic variables, as seen in Table 2.
Step 2: Determining linguistic scale	The first step in this process is to transform all linguistic variables into a numerical system for fuzzy triangles (triangular fuzzy numbers). In this stage, linguistic variables were converted in conjunction with the incorporation of fuzzy numbers (Chang et al., 2011; Hsieh et al., 2004). The Triangular Fuzzy Number represented the values m1, m2, and m3 and was written as follows (m1, m2, m3). The value of m1 represents the smallest value feasible, and the value of m2 represents a value considered appropriate. The value of m3 represents the highest value that is possible. As can be seen in Figure 2, each response was given one of three fuzzy values that indicated expert opinion (fuzziness expert opinion).  Figure 2: Traingular fuzzy number (Adopted: Hsieh et al., 2004) Note: (M_1=smallest value; M_2=reasonable value; M_3=maximum value)
Step 3: Determination of linguistic variables and average responses	Once the researcher has obtained a response from the designated expert, the researcher must transform the entire Likert scale into the Fuzzy scale. In some circles, this is also called calculating each fuzzy number's average reaction (Benitez et al., 2007). This procedure is based on the equation: $$M = \frac{\sum_i^n = 1\text{mi}}{\text{n}}$$
Step 4: The determination of threshold value "d"	The threshold value is an essential factor in assessing the degree of consensus among the experts (Thomaidis et al., 2006). For example, to determine how far apart any fuzzy number m = (m1, m2, m3) and n = (n1, n2, n3) are from one another, the distance may be calculated with the help of the following formula: $$d\ (\overline{m},\overline{n}) = \sqrt{\frac{1}{3}\ [(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2]}$$
Step 5: Identify the alpha cut aggregate level of fuzzy assessment	When the experts have reached a consensus, a hazy score will be assigned to each item (Jamil et al., 2014). The following formula is used for both the calculation and determination of fuzzy values: Amax = (1) /4 (m1 + 2m2 + m3).

Table 3. Continued

Step	Formulation
Step 6: Defuzzification process	The defuzzification procedure was also carried out during the Fuzzy Delphi method devoted to data analysis. The process of identifying the position or rank of each item and the position of each variable or sub-variable is referred to as position analysis. In this process, Jamil et al. (2014) have formulated three potential formulas that can be utilized in this procedure. Therefore, the researchers have the option of selecting one of these formulas, which are as follows: 1) $A = 1/3^* (m_1 + m_2 + m_3)$ or; 2) $A = 1/4^* (m_1 + 2m_2 + m_3)$ or; 3) $A = 1/6^* (m_1 + 4m_2 + m_3)$. Following that, the α-cut value = the median value for "0" and "1," where α-cut = (0+1)/2 = (.5). If the value of A yielded is less than the α-cut value = (.5), the item will be rejected because the experts agree to reject the item; however, if the value of A exceeds the α-cut value = (.5), the item will be accepted because the experts agree to accept the item (Tang & Wu, 2010). The data were then tabulated to obtain the Fuzzy value (n1, n2, n3). The average Fuzzy value (m1, m2, m3) calculated the threshold value, the percentage of expert consensus, the defuzzification value, and the item ranking.
Step 7: *Ranking process*	Lastly, the ranking process. Saido et al. (2018) explain the model's ranking process or sub-phases process. The method of placement involves selecting the model element to be placed based on the defuzzification value according to the general agreement of the experts, and the position within the model is what determines the highest possible value that is considered to be the most important.

Findings / Results

In this section, the results of this research are based on the experts' general agreement regarding the guidelines for formulating steps involved in the Fuzzy Delphi Method (FDM). The information that was gathered was derived from the responses that were given to eight different experts in the relevant field. The following is a rundown of the findings from the study:

Table 4. Finding of Expert Consensus of Performance Expectancy

Performance Expectancy						
Expert	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**	**Item6**
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0
Statistics	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**	**Item6**
“d” value of every item	0.0	0.0	0.0	0.0	0.0	0.0
Average of “d” value						0.0
Item <0.2	8	8	8	8	8	8
% of item < 0.2	100%	100%	100%	100%	100%	100%
Average of % consensus						100
Defuzzification > 0.5	1.0	1.0	1.0	1.0	1.0	1.0
Ranking	1	1	1	1	1	1
Status	Accept	Accept	Accept	Accept	Accept	Accept

Table 5. Finding of Expert Consensus of Effort Expectancy

Effort Expectancy					
Expert	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**
1	0.0	0.0	0.0	0.02165	0.02165
2	0.0	0.0	0.0	0.02165	0.02165
3	0.0	0.0	0.0	0.15155	0.02165
4	0.0	0.0	0.0	0.02165	0.15155
5	0.0	0.0	0.0	0.02165	0.02165
6	0.0	0.0	0.0	0.02165	0.02165
7	0.0	0.0	0.0	0.02165	0.02165
8	0.0	0.0	0.0	0.02165	0.02165
Statistics	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**
"d" value of every item	0.0	0.0	0.0	0.03789	0.03789
Average of "d" value					0.01516
Item <0.2	8	8	8	8	8
% of item < 0.2	100%	100%	100%	100%	100%
Average of % consensus					100
Defuzzification > 0.5	1.0	1.0	1.0	0.9625	0.9625
Ranking	1	1	1	2	2
Status	Accept	Accept	Accept	Accept	Accept

Table 6. Finding of Expert Consensus of Social Influence

Social Influence					
Expert	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0
Statistics	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**
"d" value of every item	0.0	0.0	0.0	0.0	0.0
Average of "d" value					0.0
Item <0.2	8	8	8	8	8
% of item < 0.2	100%	100%	100%	100%	100%
Average of % consensus					100
Defuzzification > 0.5	1.0	1.0	1.0	1.0	1.0
Ranking	1	1	1	1	1
Status	Accept	Accept	Accept	Accept	Accept

Table 7. Finding of Expert Consensus of Personal Innovativeness

Personal Innovativeness						
Expert	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**	**Item6**
1	0.0	0.0	0.0	0.0	0.0	0.23094
2	0.0	0.0	0.0	0.0	0.0	0.11547
3	0.0	0.0	0.0	0.0	0.0	0.05774
4	0.0	0.0	0.0	0.0	0.0	0.05774
5	0.0	0.0	0.0	0.0	0.0	0.05774
6	0.0	0.0	0.0	0.0	0.0	0.05774
7	0.0	0.0	0.0	0.0	0.0	0.05774
8	0.0	0.0	0.0	0.0	0.0	0.05774

Table 7. Continued

Personal Innovativeness						
Statistics	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**	**Item6**
"d" value of every item	0.0	0.0	0.0	0.0	0.0	0.08661
Average of "d" value						0.01443
Item <0.2	8	8	8	8	8	7
% of item < 0.2	100%	100%	100%	100%	100%	87%
Average of % consensus						97
Defuzzification > 0.5	1.0	1.0	1.0	1.0	1.0	0.9
Ranking	1	1	1	1	1	2
Status	Accept	Accept	Accept	Accept	Accept	Accept

Table 8. Finding of Expert Consensus of Task Characteristics

Task Characteristics					
Expert	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**
1	0.02887	0.0	0.0	0.0	0.0
2	0.14434	0.0	0.0	0.0	0.0
3	0.02887	0.0	0.0	0.0	0.0
4	0.02887	0.0	0.0	0.0	0.0
5	0.02887	0.0	0.0	0.0	0.0
6	0.02887	0.0	0.0	0.0	0.0
7	0.02887	0.0	0.0	0.0	0.0
8	0.02887	0.0	0.0	0.0	0.0
Statistics	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**
"d" value of every item	0.04330	0.0	0.0	0.03789	0.03789
Average of "d" value					0.00866
Item <0.2	8	8	8	8	8
% of item < 0.2	100%	100%	100%	100%	100%
Average of % consensus					100
Defuzzification > 0.5	0.95	1.0	1.0	0.9625	0.9625
Ranking	2	1	1	2	2
Status	Accept	Accept	Accept	Accept	Accept

Table 9. Finding of Expert Consensus of Technology Characteristics

Technology Characteristics							
Expert	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**	**Item6**	**Item7**
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Statistics	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**	**Item6**	**Item7**
"d" value of every item	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average of "d" value							0.0
Item <0.2	8	8	8	8	8	8	8
% of item < 0.2	100%	100%	100%	100%	100%	100%	100%
Average of % consensus							100
Defuzzification > 0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Ranking	1	1	1	1	1	1	1
Status	Accept	Accept	Accept	Accept	Accept	Accept	Accept

Table 10. Finding of Expert Consensus of Usage Behavior

Usage Behavior					
Expert	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**
1	0.0	0.0	0.00722	0.02165	0.0
2	0.0	0.0	0.00722	0.02165	0.0
3	0.0	0.0	0.00722	0.02165	0.0
4	0.0	0.0	0.00722	0.02165	0.0
5	0.0	0.0	0.05052	0.15155	0.0
6	0.0	0.0	0.00722	0.02165	0.0
7	0.0	0.0	0.00722	0.02165	0.0
8	0.0	0.0	0.00722	0.02165	0.0
Statistics	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**
"d" value of every item	0.0	0.0	0.01263	0.03789	0.0
Average of "d" value					0.01010
Item <0.2	8	8	8	8	8
% of item < 0.2	100%	100%	100%	100%	100%
Average of % consensus					100
Defuzzification > 0.5	1.0	1.0	0.9875	0.9625	1.0
Ranking	1	1	2	3	2
Status	Accept	Accept	Accept	Accept	Accept

Table 11. Finding of Expert Consensus of E-learning Performance

E-learning Performance						
Expert	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**	**Item6**
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	0.0
Statistics	**Item1**	**Item2**	**Item3**	**Item4**	**Item5**	**Item6**
"d" value of every item	0.0	0.0	0.0	0.0	0.0	0.0
Average of "d" value						0.0
Item <0.2	8	8	8	8	8	8
% of item < 0.2	100%	100%	100%	100%	100%	100%
Average of % consensus						100%
Defuzzification > 0.5	1.0	1.0	1.0	1.0	1.0	1.0
Ranking	1	1	1	1	1	1
Status	Accept	Accept	Accept	Accept	Accept	Accept

As a consequence of the investigation of the analyses (refer to Table 4, 5, 6, 7, 8, 9, 10, and 11), the darkened threshold value is higher than .2, which shows that it is above the threshold value. It indicated that expert opinions differed or did not reach a consensus on certain issues. Although expert opinions differed, the average value of all items in (Table 4, 5, 6, 7, 8, 9, 10, and 11), reveals that the threshold value (d) is lower than .2, which shows that each of the components reached an adequate level of consensus among the experts (Chang et al., 2011; Mustapha et al., 2021; Rahayu & Wulandari, 2022). In addition, it posted evidence that the total percentage of percent consensus is higher than 75%, showing that the requirements for the existence of an expert consensus on these issues have been met (Yusoff et al., 2021). On a similar note, it was discovered that every single of the Alpha-Cut defuzzification value, also known as the average of fuzzy response, is higher than 0.5 for the α-cut threshold. In the circumstance that if the value of defuzzification is lower than α-cut => .5, then the item in this study would be rejected because it demonstrates that the experts agreed on rejecting the utilized items (Ismail et al., 2019). In this study, all alpha cut values are greater than .5. All the items utilized are reliable and appropriate to use in other settings. Lastly, the findings of this analysis show that all the items received high levels of expert agreement and have been categorized and ordered according to the priority (ranking), which can be found in Table (4, 5, 6, 7, 8, 9, 10, and 11) respectively.

Discussion

In this study, the UTAUT and TTF have been incorporated in order to develop a comprehensive framework model for examining the e-learning antecedents, usage behavior, and e-learning performance. This study has been accomplished by examining the relationship between the two theories. While the existing e-learning scales are widely used in different contexts and with various other variables, this study has empirically examined and validated the present questionnaire to fit in the study context via the feedback of subject matter experts throughout the Fuzzy Delphi Method (FDM). This approach was taken to ascertain knowledgeable individuals' agreement before making a final choice (Mustapha et al., 2021). The outcomes of the current study demonstrated that the items received high levels of expert agreement, significantly greater α-cut defuzzification values of >.5 (Ismail et al., 2019) and complied with the overall percentage of percent consensus, which must be greater than 75% (Yusoff et al., 2021). In this study, all 45 recommended items were retained adequately and acceptable for a large-scale survey to be utilized, which was conducive for data collection. Similarly, it also emphasizes the significance of a Fuzzy Delphi Method (FDM), which contributes to validating and comparing the expert consensus while handling the questionnaires. During the process, the experts can provide their views and understanding of the items utilized. Finally, all the comments and suggestions were considered for improvements.

Conclusion

In conducting the analysis via the Fuzzy Delphi Method (FDM), this study also considers all of the feedback and recommendations for advancement that field experts provided. The sentences were revised one more time after the components were reorganized according to their level of importance, and this research incorporated some new elements recommended by experts (solidified items). It has been concluded that all the constructs are reliable and appropriate to use based on the consensus of experts. As a result, this study has successfully established the validated research instruments and enhanced the research design for the substantive investigation has been improved. It demonstrates that all the constructs from the literature review are validated to be drivers of e-learning contexts. The purposes of the study were successfully attained, which was to address questions about areas of agreement among experts. As a result, the described items can be implemented successfully and are suitable for use in various environments.

Recommendations

The findings clearly show that Fuzzy Delphi Method (FDM) can be utilized to ascertain the consensus of experts on the elements used to develop or validate the questionnaires. Furthermore, it can be said that the FDM may be utilized once for screening purposes. A clear solution was also given for ending the rounds of FDM formulation steps. The validation of these items contributes to the expansion of the body of knowledge, which in turn contributes to the development of knowledge (literature) and practice in e-learning. This study was primarily based on highlights from the literature and expert consensus. As a result, future researchers might be able to conduct in-depth interviews with industry experts, which would allow them to evaluate and investigate the topic in greater detail, so that the components and contents of e-learning antecedents can be improved and studied further in various settings (Hasim et al., 2022). Hence, FDM is indispensable for future work.

Limitations

Several challenges were uncovered during this crucial phase of the Fuzzy Delphi Method (FDM), including concerns about the instruments' usefulness and transferability. Secondly, this study combined a number of validated questionnaires that were used in a variety of contexts. As a consequence of this, each of the instruments needs to go through the FDM validation once more. Lastly, this study was confined to the experts with a minimum of five years of experience, in addition to the need to be exact with their field of expertise and continually have experience teaching and managing. These requirements are based on highly tight selection standards.

Acknowledgements

We would like to express our thankfulness to the Universiti Teknikal Malaysia Melaka and the Centre for Technopreneurship Development for funding this project through INDUSTRI(IRMG)/YAPERTIB/2020/FPTT-CTED/I00043.

Authorship Contribution Statement

Hasim: Conceptualization, design, data analysis, writing. Jabar: Supervision, securing funding, final approval. Sufian: Design, supervision. Ibrahim: Material support. Abdul Khalid: Editing, proofreading.

References

Abbad, M. M. (2021). Using the UTAUT model to understand students' usage of E-learning systems in developing countries. *Education and Information Technologies*, *26*, 7505-7224. https://doi.org/10.1007/s10639-021-10573-5

Abdullah, J. M., Ismail, W. F. N. M. W., Mohamad, I., Ab Razak, A., Harun, A., Musa, K. I., & Lee, Y. Y. (2020). A critical appraisal of COVID-19 in Malaysia and beyond. *The Malaysian Journal of Medical Sciences*, *27*(2), 1-9. https://doi.org/10.21315/mjms2020.27.2.1

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, *2*(4), 314-324. https://doi.org/10.1002/hbe2.195

Alkawsi, G., Ali, N. A., & Baashar, Y. (2021). The moderating role of personal innovativeness and users experience in accepting the smart meter technology. *Applied Sciences*, *11*(8), Article 3297. https://doi.org/10.3390/app11083297

Alqahtani, A. Y., & Rajkhan, A. A. (2020). E-learning critical success factors during the covid-19 pandemic: A comprehensive analysis of E-learning managerial perspectives. *Education Sciences*, *10*(9), 1-16. https://doi.org/10.3390/educsci10090216

Ayaz, A., & Yanartaş, M. (2020). An analysis on the unified theory of acceptance and use of technology theory (UTAUT): Acceptance of electronic document management system (EDMS). *Computers in Human Behavior Reports*, *2*, Article 100032. https://doi.org/10.1016/j.chbr.2020.100032

Baabdullah, A. M., Alsulaimani, A. A., Allamnakhrah, A., Alalwan, A. A., Dwivedi, Y. K., & Rana, N. P. (2022). Usage of augmented reality (AR) and development of E-learning outcomes: An empirical evaluation of students' E-learning experience. *Computers & Education*, *177*, Article 104383. https://doi.org/10.1016/j.compedu.2021.104383

Bączek, M., Zagańczyk-Bączek, M., Szpringer, M., Jaroszyński, A., & Wożakowska-Kapłon, B. (2021). Students' perception of online learning during the covid-19 pandemic: A survey study of polish medical students. *Medicine*, *100*(7), Article e24821. https://doi.org/10.1097/MD.0000000000024821

Benitez, J. M., Martín, J. C., & Román, C. (2007). Using Fuzzy number for measuring quality of service in the hotel industry. *Tourism Management*, *28*(2), 544-555. https://doi.org/10.1016/j.tourman.2006.04.018

Bere, A. (2018). Applying an extended task-technology fit for establishing determinants of mobile learning: An instant messaging initiative. *Journal of Information Systems Education*, *29*(4), 239-252. https://aisel.aisnet.org/jise/vol29/iss4/4

Buabeng-Andoh, C., & Baah, C. (2020). Pre-service teachers' intention to use learning management system: An integration of UTAUT and TAM. *Interactive Technology and Smart Education*, *17*(4), 455-474. https://doi.org/10.1108/ITSE-02-2020-0028

Caporarello, L., & Sarchioni, G. (2014). E-learning: The recipe for success. *Journal of E-learning and Knowledge Society*, *10*(1), 117-128.

Chang, P. L., Hsu, C. W., & Chang, P. C. (2011). Fuzzy Delphi Method for evaluating hydrogen production technologies. *International Journal of Hydrogen Energy*, *36*(21), 14172-14179. https://doi.org/10.1016/j.ijhydene.2011.05.045

Ciptono, A., Setiyono, S., Nurhidayati, F., & Vikaliana, R. (2019). Fuzzy Delphi method in education: A mapping. *Journal of Physics: Conference Series, 1360*, Article 12029. https://doi.org/10.1088/1742-6596/1360/1/012029

Coman, C., Ţîru, L. G., Meseșan-Schmitz, L., Stanciu, C., & Bularca, M. C. (2020). Online teaching and learning in higher education during the coronavirus pandemic: Students' perspective. *Sustainability*, *12*(24), Article 10367. https://doi.org/10.3390/su122410367

D'Ambra, J., Wilson, C. S., & Akter, S. (2013). Application of the task-technology fit model to structure and evaluate the adoption of e-books by academics. *Journal of the American Society for Information Science and Technology*, *64*(1), 48-64. https://doi.org/10.1002/asi.22757

Devisakti, A., & Ramayah, T. (2019). E-learning usage outcomes among university learners: A pilot study. *Journal of Education and E-learning Research*, *6*(3), 149-155. https://doi.org/10.20448/journal.509.2019.63.149.155

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal Of Educational Technology Systems*, *49*(1), 5-22. https://doi.org/10.1177/0047239520934018

Dwivedi, Y. K., Rana, N. P., Jeyaraj, A., Clement, M., & Williams, M. D. (2019). Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model. *Information Systems Frontiers*, *21*(3), 719-734. https://doi.org/10.1007/s10796-017-9774-y

Elçi, A., & Abubakar, A. M. (2021). The configurational effects of task-technology fit, technology-induced engagement and motivation on learning performance during Covid-19 pandemic: An fsQCA approach. *Education and Information Technologies*, *26*(6), 7259-7277. https://doi.org/10.1007/s10639-021-10580-6

Goodhue, D. L., & Thompson, R. L. (1995). Task-Technology Fit and individual performance. *MIS Quarterly*, *19*(2), 213-236. https://doi.org/10.2307/249689

Hasim, M. A., Jabar, J., Sufian, A., & Ibrahim, N. F. (2022). Validating the component of e-learning antecedents, digital readiness and usage behavior towards e-learning performance: A pilot study. *International Journal of Learning, Teaching and Educational Research*, *21*(10), 178-194. https://doi.org/10.26803/ijlter.21.10.9

Hsieh, T. Y., Lu, S. T., & Tzeng, G. H. (2004). Fuzzy MCDM approach for planning and design tenders' selection in public office buildings. *International Journal of Project Management*, *22*(7), 573-584. http://doi.org/10.1016/j.ijproman.2004.01.002

Isaac, O., Aldholay, A., Abdullah, Z., & Ramayah, T. (2019). Online learning usage within Yemeni higher education: The role of compatibility and task-technology fit as mediating variables in the is success model. *Computers & Education*, *136*, 113-129. https://doi.org/10.1016/j.compedu.2019.02.012

Ismail, N. K., Mohamed, S., & Hamzah, M. I. (2019). The Application of the Fuzzy Delphi technique to the required aspect of parental involvement in the effort to inculcate positive attitude among preschool children. *Creative Education*, *10*(12), Article 2907. https://doi.org/10.4236/ce.2019.1012216

Jamil, M. M. R., Siraj, S., Hussin, Z., Noh, M. N., & Sapar, A. A. (2014). *Basic introduction to Fuzzy Delphi Method in research and development*. Minda Intelek.

Kim, H. J., Hong, A. J., & Song, H. D. (2019). The roles of academic engagement and digital readiness in students' achievements in university E-learning environments. *International Journal of Educational Technology in Higher Education*, *16*(1), Article 21. https://doi.org/10.1186/s41239-019-0152-3

Kot, S., Tan, M., & Dragolea, L. (2017). The use of social media supporting studying. *Economics and Sociology*, *10*(1), 169-180. https://doi.org/10.14254/2071-789X.2017/10-1/12

Latif, A. R., Dahlan, A., Mulud, Z. A., & Nor, M. Z. M. (2017). The Delphi technique as a method to obtain consensus in health care education research. *Education in Medicine Journal*, *9*(3), 89-102. https://doi.org/10.21315/eimj2017.9.3.10

Lee, D. Y., & Lehto, M. R. (2013). User acceptance of YouTube for procedural learning: An extension of the technology acceptance model. *Computers & Education*, *61*, 193-208. https://doi.org/10.1016/j.compedu.2012.10.001

Maatuk, A. M., Elberkawi, E. K., Aljawarneh, S., Rashaideh, H., & Alharbi, H. (2022). The COVID-19 pandemic and E-learning: Challenges and opportunities from the perspective of students and instructors. *Journal of Computing in Higher Education*, *34*(1), 21-38. https://doi.org/10.1007/s12528-021-09274-2

Moghavvemi, S., Salleh, N. A. M., & Abessi, M. (2013). Determinants of IT-related innovation acceptance and use behavior: Theoretical integration of unified theory of acceptance and use of technology and entrepreneurial potential model. *Social Technologies*, *3*(2), 243-260. https://doi.org/10.13165/ST-13-3-2-01

Mokhtar, S., & Yasin, R. M. (2018). Design of teaching influences the training transfer amongst TVET's instructors: Fuzzy Delphi technique. *International Journal of Academic Research in Business and Social Sciences*, *8*(6), 1083-1097. http://dx.doi.org/10.6007/IJARBSS/v8-i6/4303

Mousa, A. H., Mousa, S. H., Mousa, S. H., & Obaid, H. A. (2020). Advance acceptance status model for E-learning based on university academics and students. *IOP Conference Series: Materials Science and Engineering, 671*, Article 012031. https://doi.org/10.1088/1757-899X/671/1/012031

Mustafa, N. (2020). *Impact of the 2019-20 Coronavirus pandemic on education*. ResearchGate. https://doi.org/10.13140/RG.2.2.27946.98245

Mustapha, R., Hussin, Z., & Siraj, S. (2017). Analysis of factors causing academic dishonesty amongst students: Application of the Fuzzy Delphi technique. *Asia Pacific Journal of Curriculum & Teaching, 5*(2), 1-18. http://shorturl.at/dkmHJ

Mustapha, R., Jafar, M. F., Mohamad, A., Mahmud, M., Malkan, S. N. A., Hassan, S. H. M., & Ibrahim, R. A. (2021). Development of E-Xtvt guidelines in promoting active online learning in higher education: The Fuzzy Delphi approach. *Psychology and Education Journal*, *58*(1), 5681-5696. https://doi.org/10.17762/pae.v58i1.1972

Organization for Economic Co-operation and Development. (2020, July 24). *OECD policy responses to Coronavirus (COVID-19): The potential of online learning for adults: Early lessons from the COVID-19 crisis*. https://bit.ly/3ItOLg9

Parkes, M., Stein, S., & Reading, C. (2015). Student preparedness for university e-learning environments. *The Internet and Higher Education*, *25*, 1-10. https://doi.org/10.1016/j.iheduc.2014.10.002

Rahayu, P., & Wulandari, I. A. (2022). *Defining e-portfolio factor for competency certification using Fuzzy Delphi method*. *Procedia Computer Science*, *197*, 566-575. https://doi.org/10.1016/j.procs.2021.12.174

Saido, G. A. M., Siraj, S., Dewitt, D., & Al-Amedy, O. S. (2018). Development of an instructional model for higher order thinking in science among secondary school students: A Fuzzy Delphi approach. *International Journal of Science Education*, *40*(8), 847-866. https://doi.org/10.1080/09500693.2018.1452307

Spies, R., Grobbelaar, S., & Botha, A. (2020). *Lecture notes in computer science: Vol 12066. A scoping review of the application of the task-technology fit theory*. Springer. https://doi.org/10.1007/978-3-030-44999-5_33

Tang, C. W., & Wu, C. T. (2010). Obtaining a picture of undergraduate education quality: A voice from inside the university. *Higher Education*, *60*(3), 269-286. https://doi.org/10.1007/s10734-009-9299-5

Thomaidis, N. S., Nikitakos, N., & Dounias, G. D. (2006). The evaluation of information technology projects: A fuzzy multicriteria decision-making approach. *International Journal of Information Technology & Decision Making*, *5*(1), 89-122. https://doi.org/10.1142/S0219622006001897

Twum, K. K., Ofori, D., Keney, G., & Korang-Yeboah, B. (2021). Using the UTAUT, personal innovativeness and perceived financial cost to examine student's intention to use E-learning. *Journal of Science and Technology Policy Management*, *13*(3), 713-737. https://doi.org/10.1108/JSTPM-12-2020-0168

United Nations Educational, Scientific and Cultural Organization. (2018). *Issues and trends in education for sustainable development*. https://unesdoc.unesco.org/ark:/48223/pf0000261445

Venkatesh, V., Brown, S. A., Maruping, L. M., & Bala, H. (2008). Predicting different conceptualizations of system use: The competing roles of behavioral intention, facilitating conditions, and behavioral expectation. *MIS Quarterly*, *32*(2), 483-502. https://doi.org/10.2307/25148853

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

Verawardina, U., Asnur, L., Lubis, A. L., Hendriyani, Y., Ramadhani, D., Dewi, I. P., Darni, R., Betri, T. J., Susanti, W., & Sriwahyuni, T. (2020). Reviewing online learning facing the COVID-19 outbreak. *Journal of Talent Development and Excellence*, *12*, 385-392.

Vongjaturapat, S. (2018). Application of the task-technology fit model to structure and evaluation of the adoption of smartphones for online library systems. *Science and Technology Asia*, *23*(1), 39-56. https://l24.im/r4Duk

Wedlock, B. C., & Trahan, M. P. (2019). Revisiting the unified theory of acceptance and the use of technology (UTAUT) model and scale: An empirical evolution of educational technology. *Research Issues in Contemporary Education*, *4*(1), 6-20.

Wijesundara, T. R., & Xixiang, S. (2018). Social networking sites acceptance: The role of personal innovativeness in information technology. *International Journal of Business and Management*, *13*(8), 75-85. https://doi.org/10.5539/ijbm.v13n8p75

Yuce, A., Abubakar, A. M., & Ilkan, M. (2019). Intelligent tutoring systems and learning performance: Applying task-technology fit and IS success model. *Online Information Review*, *43*(4), 600-616. https://doi.org/10.1108/OIR-11-2017-0340

Yusoff, M. A. F., Hashim, A., Muhamad, N., & Wan Hamat, W. N. (2021). Application of Fuzzy Delphi technique to identify the elements for designing and developing the E-PBM PI-Poli module. *Asian Journal of University Education, 7*(1), 292-304. https://doi.org/10.24191/ajue.v17i1.12625

Appendix

	Items	Adapted from:
Performance Expectancy		
1	I believe that online learning is a valuable learning tool.	(Hasim et al., 2022; Venkatesh et al., 2003)
2	I know that the online learning helps me finish my learning tasks faster.	
3	I know that online learning helps me learn better.	
4	I am aware that online learning boosts my overall productivity.	
5	I am aware that online learning improves the quality of my education.	
6	I am aware that using online learning boosts my enthusiasm for learning.	
Effort Expectancy		
1	I know that the online learning is user-friendly.	(Hasim et al., 2022; Venkatesh et al., 2003)
2	I am aware that using online learning helps me improve my skills.	
3	I have achieved a high level of competence in utilizing the online learning.	
4	I am confident that the use of the online learning is clear.	
5	I am confident that my interactions with the online learning are understandable.	
Social Influence		
1	People that have influence over my decisions believe that I should take advantage of online learning.	(Buabeng-Andoh & Baah, 2020; Hasim et al., 2022; Venkatesh et al., 2003)
2	People that are important to me believe that I should use online learning.	
3	My instructors recommend that I should utilize the online learning.	
4	The administration of my department encourages us to use online learning.	
5	In general, the university has supported the use of the online learning.	
Personal Innovativeness		
1	I consider myself to be open to experimenting with various online learning.	(Alkawsi et al., 2021; Hasim et al., 2022; Wijesundara & Xixiang, 2018)
2	Typically, I am the first among my peers to utilize an online learning.	
3	I have no qualms about utilizing the online learning.	
4	I have a positive attitude toward experimenting with the online learning.	
5	During my studies, I prefer to employ creative learning strategies (such as online learning).	
6	I found out that the online learning is something I am interested in.	
Task Characteristics		
1	I am aware that online learning allows me to study anytime and whenever I wish.	(Bere, 2018; Goodhue & Thompson, 1995; Hasim et al., 2022)
2	I frequently seek advice from others on how to address my learning challenges more effectively.	
3	I often learn things by getting information from other people.	
4	In order to learn effectively, I frequently require social interaction.	
5	Throughout the entirety of the learning process, I frequently require timely feedback.	
Technology Characteristics		
1	I know online students engage in active learning.	(Bere, 2018; Goodhue & Thompson, 1995; Hasim et al., 2022)
2	online learning is convenient because I can study anytime, anywhere.	
3	online learning allows me to interact synchronously or asynchronously.	
4	I can always interact with the online learning through video, audio, or text.	
5	I am aware that the technological components of online learning are conducive to learning success.	
6	I understand that online learning can provide me with efficient folder-sharing and data syncing features.	
7	I am aware that online learning can provide me with access to files and information on several devices as well as the ability to navigate multiple operating systems.	
Usage Behavior		
1	I would classify myself as a frequent user of the online learning.	(Abbad, 2021; Devisakti & Ramayah, 2019; Hasim et al., 2022)
2	I complete most of my learning tasks using online learning.	
3	Whenever possible, I use the online learning.	
4	I often do my daily duties on the online learning.	
5	In the future, I aim to make extensive use of online learning.	
E-learning Performance		
1	Utilizing online learning my educational outcomes (such as CGPA).	(Baabdullah et al., 2022; Devisakti & Ramayah, 2019; Hasim et al., 2022)
2	online learning facilitates more effective problem-solving during my study.	
3	Online learning gives me the opportunity to boost my competitiveness during my study.	
4	Online learning gives me the ability to adapt more quickly to shifting circumstances.	
5	Online learning is a tool that helps me achieve my learning goals and objectives.	
6	In general, I find online learning to be advantageous for organizing my academic work.	