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Digital Learning Acceptance in Islamic Education: Validity and Reliability Testing of the Modified Technology Acceptance Model

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Abstract

Digital technologies (DT) have revolutionised various sectors, including education. In Islamic education, integrating DT can potentially enhance the teaching and learning processes. However, incorporating these technologies into Islamic education requires careful consideration due to the unique nature of the subject matter and cultural sensitivities. Thus, this pilot study assessed the validity and reliability of the TAMISE (Technology Acceptance Model in Islamic Education) through confirmatory factor and composite analyses. The TAMISE framework extended the Technology Acceptance Model (TAM) with perceived Islamic education compatibility to address the acceptance of digital technologies in Islamic education. The study employed a survey questionnaire administered to a sample (N = 65) of Islamic education students from Indonesia and Malaysia. The data collected were analysed using confirmatory factor analysis (CFA) and confirmatory composite analysis (CCA). The results indicated that the TAMISE model demonstrated adequate validity and reliability, thus supporting its applicability as a theoretical model for understanding digital technology adoptions in Islamic educational systems. Furthermore, the findings theoretically contribute to Islamic education and technology acceptance by providing insights into factors influencing students' adoption and use of digital technologies.

Keywords: Islamic Education, Digital Technology, Technology Acceptance, CFA, Higher Education, TAM, Digital Learning

Introduction

Digital technologies (DT) have fundamentally altered individuals' lifestyles, social interactions, professional endeavours, and educational experiences. Consequently, digital technology has seamlessly integrated itself into the field of education, especially within the realm of digital-based learning (Bygstad et al., 2022). Digital-based learning entails the utilisation of electronic systems and multimedia-related tools to facilitate the acquisition of knowledge (Alenezi, 2023). This approach is widespread across various educational settings, including those related to Islamic education- a form of religious teachings that

underscores Islamic principles, doctrines, and rituals (Waghid, 2014). Notably, in certain countries such as Indonesia and Saudi Arabia (Al-Harbi, 2019; Jamaluddin et al., 2019), there has been a recent embrace of DT within Islamic education to enrich the quality and accessibility of learning.

Islamic education prioritises the teachings found in the Quran and Prophet Muhammad's practices and traditions (Arjmand, 2018; Daun & Arjmand, 2021), intending to equip Muslims with the wisdom and abilities necessary for virtuous living and fulfilling societal demands (Daun & Arjmand, 2021). Recently, there has been a notable surge of interest in integrating technology into Islamic education (Subiyakto et al., 2022). Different technological tools, including online educational platforms, mobile applications, and multimedia resources, have emerged to streamline teaching-learning processes (Alsharbi et al., 2021). Incorporating DT in Islamic education promises to elevate educational standards and broaden its reach to a more extensive group of audiences (Shan-a-alahi & Huda, 2017). Thus, investigating DT acceptance in this unique context is paramount in modern digital times.

The acceptance of DT is pivotal for successfully fostering a digital learning culture. One widely applied framework for comprehending user behaviour regarding the acceptance of DT is the Technology Acceptance Model (TAM), introduced by Davis (1989). This theory posits that perceived ease of use and usefulness are the fundamental factors shaping a user's behaviour when adopting DT. Despite TAM's effectiveness in explaining individuals' acceptance of digital technology, it possesses specific weaknesses in illustrating the acceptance of digital technology in some contexts, such as Islamic education. For instance, TAM did not account for the compatibility of DT with the distinctive Islamic education's religious and cultural values. Islamic educational system boasts unique religious and cultural features that significantly impact the receptivity towards DT. Hence, a necessity arises to incorporate the notion of perceived compatibility with Islamic education into the TAM framework, thereby giving rise to a novel model, the Technology Acceptance Model in Islamic Education (TAMISE), suggested by a recent study (Abubakari & Zakaria, 2023). This adapted model aims to elucidate the acceptance of DT for digitally enhanced learning within the specific context of Islamic education.

Incorporating digital technology into diverse educational systems has witnessed a growing trend (Daniela, 2019; International Telecommunication Union [ITU] et al., 2020). Islamic education, which strongly emphasises Islamic tenets and values, can likewise reap advantages from the proficient use of digital tools. Nevertheless, the examination and embrace of digital technologies within the realm of Islamic education have received limited attention (Al-rahmi et al., 2017) and call for a dedicated theoretical model capable of deciphering the distinct elements affecting their adoption (Abubakari et al., 2023; Abubakari & Priyanto, 2021). The present study intends to verify the reliability and validity of the TAMISE model for comprehending the acceptance of digital technology in Islamic

education. This model is constructed on TAM but modified explicitly to Islamic education's unique requirements and attributes (Abubakari & Zakaria, 2023). Therefore, this work aims to verify the validity of the TAMISE model, and the following are the core objectives of the present pilot study:

1. To examine the reliability of the TAMISE model in explaining the acceptance of DT in Islamic educational settings.
2. To assess the validity of TAMISE in Islamic educational settings using confirmatory factor analysis.

Literature Review

Education and Digital Technologies

Digital technologies (DT) provide multiple advantages within the realm of education. To begin with, they enhance student engagement by utilising interactive and multimedia materials that captivate students' interest and accommodate diverse learning preferences (Alamri et al., 2020). Moreover, DTs facilitate the accessibility of extensive information and educational materials (Serin, 2022), broadening the scope of learning beyond conventional classrooms (Daniela, 2019), primarily through online educational platforms (Abubakari et al., 2022; Abubakari & Mashoedah, 2021). Lastly, educators also experience positive outcomes from DTs (United Nations Educational Scientific and Cultural Organization [UNESCO], 2021), as they can harness digital platforms and tools to facilitate tasks such as instructional preparation, evaluation, and collaborative work with peers.

Integrating DTs into educational settings has brought about a significant shift in teaching-learning methodologies. Incorporating interactive digital materials, like online-based textbooks, multimedia presentations, and educational-related applications, has infused a sense of greater engagement and interactivity into the learning process (Haleem et al., 2022). Additionally, digital technologies have made it possible to tailor learning experiences to individual students, allowing them to progress at their own pace and delve deeper into subjects of interest (Alshammari & Qtaish, 2019). Furthermore, these digital tools foster student collaboration, encouraging active involvement in the learning journey (Wheeler, 2012). Despite various digital resources within educational institutions, many individuals fail to fully harness their potential benefits (Abubakari et al., 2021; Islam et al., 2019). This fact calls for a special investigation into DT acceptance in different contexts of educational systems.

The limited exploration of the underutilisation of DT and the factors that affect their adoption, particularly within the context of Islamic education, is a relatively uncharted area in the existing literature. Consequently, examining the acceptance and utilisation of DT in diverse settings presents an intriguing and compelling research topic. Numerous

theories rooted in socio-technical and psychological factors have been developed to elucidate the situation of DT adoption across different contexts. One such theory is the Technology Acceptance Model (TAM), which this pilot study will adopt and tailor to align with the specific circumstances being investigated.

Overview of TAM and the TAMISE Model

The Technology Acceptance Model (TAM) is a theoretical framework designed to elucidate the potential elements that impact a user's willingness to accept and incorporate digital technologies. Developed by Davis in 1986, TAM drew inspiration from prior behavioural theories, notably the Theory of Planned Behaviour and the Theory of Reasoned Action (Davis, 1989). According to this prominent model, the primary driving forces behind the adoption of digital technologies are perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989). PU pertains to how much a user believes digital technology will enhance performance. At the same time, PEOU concerns the extent to which a user views digital technology as user-friendly. TAM suggests that if users perceive a particular technological innovation has some potential value and is easy to operate, they will be inclined to embrace it.

Despite TAM's widespread adoption in various contexts, limitations exist (Scherer & Teo, 2019), necessitating additional empirical research. Researchers emphasise the need for further studies to enhance the model's external validity (Dishaw & Strong, 1999) despite TAM's acclaim for its simplicity and capacity to elucidate DT adoption. Furthermore, the available literature underscores that most TAM studies have predominantly been conducted in Western environments (Teo & van Schaik, 2012), with scant exploration in non-Western settings, particularly in Islamic education. This highlights the imperative for conducting additional inquiries into TAM within diverse cultural and contextual backgrounds. Consequently, a recent conceptual study (Abubakari & Zakaria, 2023) proposed a modified TAM, incorporating appropriate religious and individual constructs to create the TAMISE model, and the goal of the current pilot study is to verify its reliability and validity.

The TAMISE model expands upon the original TAM by introducing two additional elements, digital self-efficacy (DSE) and perceived Islamic education compatibility (PIC), to account for the distinctive aspects of Islamic education. Initially, TAM proposed that PU and PEU mainly determine the acceptance of DT. Nevertheless, to better capture the specific context of Islamic education, this TAMISE model incorporates an extra unique variable: perceived Islamic education compatibility, encompassing compatibility with values and pedagogical requirements, thus contextualising the Islamic education environment. Figure 1 depicts the TAMISE model, which comprises five components: two external constructs (DSE and PIC) and four components derived from TAM. The subsequent section provides a theoretical elucidation of each of these

components.

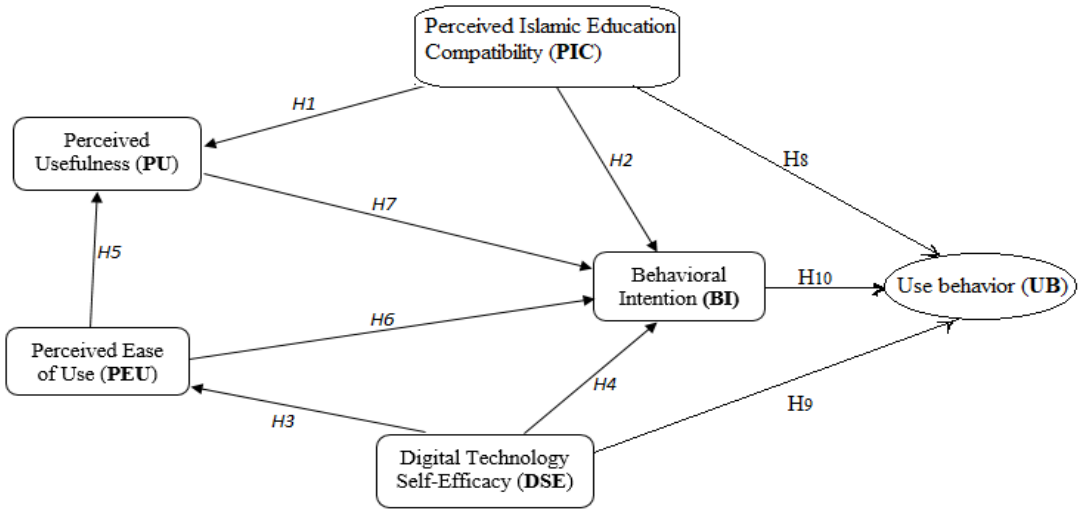

Figure 1: The TAMISE Model (Abubakari & Zakaria, 2023).

Perceived Ease of Use (PEU) and Usefulness (PU)

Perceived usefulness (PU) encompasses a person's conviction that a specific digital technological system offers benefits when utilised (Davis, 1989). PU is regarded as the foremost determinant for predicting and elucidating a person's inclination to adopt a specific digital system within the TAM framework (Davis, 1989). Following PU, perceived ease of use (PEU) is the second most dominant construct in explaining a user's intention to utilise DT according to the TAM theory (Davis et al., 1989; Scherer et al., 2019). PEU quantifies the extent to which an individual believes a given technology demands minimal effort and time during usage (Davis et al., 1989). Previous researchers (Davis, 1989; Davis et al., 1989) reasoned that even when people perceive technology as beneficial, they may still refrain from using it if they anticipate a significant investment of time and effort in its utilisation. Thus, PEU can mediate the impact of PU on a person's intention to adopt DT.

Digital Self-Efficacy (DSE)

Psychological studies (Bandura, 1977, 2001) focusing on cognition have underscored the significance of self-efficacy in forecasting human behaviour. Some scholars contend that subjective assessments of a person's digital skillset are as vital as objective abilities when effectively utilising DT (Peiffer et al., 2020). Digital technology-related self-efficacy pertains to an individual's confidence to engage with and adeptly employ a particular information technology (Compeau & Higgins, 1995). Consequently, an individual's self-efficacy in using digital systems plays a pivotal role in illustrating the

proficient utilisation of digital tools (Ulfert et al., 2022).

Perceived Islamic Education Compatibility (PIC)

Some studies have emphasised the significance of investigating DT adoption from the perspective of Muslims, considering contextualised religious factors (Al-rahmi et al., 2017). In the Innovation Diffusion Theory (IDT), compatibility refers to the degree to which a potential adopter believes a digital innovation aligns with their needs and preexisting values (Rogers, 1995). Drawing on the concept of compatibility based on the IDT (Rogers, 1995, 2003), a study (Abubakari & Zakaria, 2023) developed the construct of perceived Islamic education compatibility (PIC) tailored to the context of the Islamic educational system. In the current pilot study, PIC is defined as a Muslim's perception of how relevant and compatible the use of DT is within an Islamic educational setting. Therefore, this construct is proposed to gauge the feelings of probable users of digital technology regarding the alignment between technological innovation and the values upheld in Islamic education.

Behavioural Intention (BI) and Use Behaviour (UB)

Behavioural psychology studies (Ajzen & Fishbein, 1977; Fishbein & Ajzen, 1975) highlight that specific behaviour, like using DT, is determined by behavioural intention (BI). It's well-established that intention can firmly explain a person’s behaviour (Fishbein & Ajzen, 2015). Behavioural intention represents an individual's subjective likelihood of carrying out behaviour and is considered the underlying cause of specific usage behaviours (Yi et al., 2006). It's conceptualised as a motivating factor significantly influencing usage behaviour (UB), such as using DT. It expresses the extent to which a person is willing to invest effort in performing an action (Ajzen, 1991). Consequently, BI is a variable aimed at assessing the degree to which an individual is inclined to use DT in practical terms.

Related Works on DT Acceptance

Findings from earlier literature on technology acceptance, especially from an Islamic education perspective, have demonstrated the validity of the TAM model adaptation. To illustrate, a study in Malaysia expanded the TAM model to assess students’ BI to utilise e-learning (Rahman et al., 2022). The study added two constructs, including computer competency (CC), and observed that all reliability and validity criteria of the research framework were adequately established, including average variance extracted (AVE), discriminant validity, composite reliability (CR), and Cronbach’s alpha. However, one item of the CC construct was removed as its AVE’s loading was below the 0.5 threshold. Similarly, other studies have also found extended TAM valid and reliable in

their investigations (Ali et al., 2016; Haris et al., 2022; Ngabiyanto et al., 2021; Subiyakto et al., 2022). However, these studies have no consistency regarding the effects of some constructs of their research models. Despite previous related studies having comparable results in the reliability and validity of their adapted TAM models, there are discrepancies in some variables' effects, varying from one survey to another. Further, a recent work (Abubakari & Zakaria, 2023) proposed a conceptual model named TAMISE, but its validity is yet to be verified. Hence, the present pilot study validates the TAMISE model to verify its validity and reliability in Islamic education.

Methodology

Research Approach and Sampling

The pilot study implemented a quantitative approach based on an online survey using Google Forms for data gathering from students at Islamic education universities. Convenience sampling was used for data gathering and obtained a sample of Sixty-five (65) university students from Malaysia (11) and Indonesia (54), the majority of which were females (41), while males were twenty-four (24). Further, the education level of the majority was undergraduate (44), followed by postgraduate (12) and diploma (9). The age of many participants (46) ranged between 18 and 25 years, followed by 26-35 years (15); few were below eighteen years (2) and above 35 years (2). It is worth noting that this pilot study is part of an ongoing project.

Instrumentation and Analysis Approach

The survey instrument was developed based on the TAMISE framework in which four constructs were adapted from TAM's items (Davis, 1989), while DSE and PIC items were modified from previous research (Kuo et al., 2014; Moore & Benbasat, 1991; Xie et al., 2022). A five-point Likert scale (from 1: Strongly disagree to 5: Strongly agree) was used to measure every research item. Data analysis was done using Confirmatory Factor Analysis (CFA) through the JASP software (JASP Team, 2023) to assess the model fit, and Smart-PLS v4 (Ringle et al., 2022) was used for analysing the validity and reliability of TAMISE. Note that the whole research instrument scored 0.949 of Cronbach's alpha, suggesting high measurement reliability.

Results and Discussion

Multicollinearity and Multivariate Normality

Since the analysis is Multivariate, excess Kurtosis and Skewness were used to assess the data normality. The scores of Kurtoses of each item ranged from –0.87 to 2.97,

while that of Skewness was between –1.32 and 0.38, indicating that there was no severe violation of the Multivariate normality test whose scores should be between –3 and +3 (Kline, 2016). As for Multicollinearity, the variance inflation factor (VIF) values of individual items ranged from 1.3 to 4.3, and that of between construct relationships ranged from 1.0 to 2.2, fulfilling the required cut-off value of 5 (Hair, Black, et al., 2019; Kock, 2022), hence, no redundancy issues among indicators (Kline, 2016). Thus, this indicates no common method bias and Multicollinearity issues were observed in the model and survey design (Kock, 2022).

Model Fitting Results

Before testing the reliability and validity of the TAMISE model, the model fit was evaluated based on CFA using diagonally-weighted least squares (DWLS) for parameter estimation, as all data scores were ordinal (Forero et al., 2009). The results indicated that the chi-square test was significant (χ^2 = 452.654, df = 390, p < .05), suggesting that the proposed model did not fit the data perfectly. However, note that the chi-square test is susceptible to sample size, and therefore, alternative fit indices were examined to provide a more comprehensive assessment of the model fit (Hu & Bentler, 1999). Thus, six appropriate indices were selected to analyse the model's goodness-of-fit: root mean square error of approximation (RMSEA), goodness of fit index (GFI), comparative fit index (CFI), Tucker-Lewis Index (TLI); Normed Fit Index (NFI); and the Chi-square (χ^2) to its degree of freedom (*df*) ratio. Table 1 portrays the score of each fit index after running the CFA.

Table 1**:** Measurement model fit indices

Fit Index	Recommended Value	Measurement Model Value
RMSEA	< 0.08	0.05
GFI	> 0.95	0.979
CFI	> 0.95	0.997
TLI	> 0.95	0.996
NFI	> 0.95	0.976
χ^2	N/A	452.654 (P = 0.016)
df	N/A	390
χ^2/df	< 3.0	1.16

As Table 1 shows, all fit indices fulfilled the fitting criteria; the CFI, GFI, TLI and NFI scores are above the 0.95 minimum thresholds, indicating an acceptable fit to the data. Similarly, the χ^2/df ratio (1.16) is below 3, confirming an acceptable fit. Additionally, the RMSEA value was computed, resulting in a value of 0.05, indicating a reasonable fit to the

data (Hu & Bentler, 1999). Finally, note that the model was fitted without any modifications.

Measurement Model Analysis

Confirmatory composite analysis (CCA) was applied through the Smart-PLS software to examine the validity and reliability of the measurement model and the individual constructs. In addition, Cronbach's alpha (CA) and composite reliability (CR) were used to assess each construct's measurement reliability. The results revealed a high level of internal consistency for the constructs under investigation. As Table 2 portrays, the CA values ranged from 0.786 to 0.932, while that of CR ranged from 0.814 to 0.933, which are all above 0.7, indicating strong reliability (Hair, Risher, et al., 2019).

Both convergent and discriminant validity were examined to assess the validity of the measures used in the study. First, convergent validity was evaluated by examining each latent construct's average variance extracted (AVE) and indicator loadings (IL). Table 2 shows that all constructs demonstrated AVE values above the recommended threshold of 0.50, ranging from 0.582 to 0.830, and IL scores ranged from 0.477 to 0.928, indicating satisfactory convergent validity. Note that the strictest criteria for indicator loadings is a minimum of 0.7, as proposed by scholars, and the relaxed criterion is between 0.5 and 0.6 (Hair, Black, et al., 2019; Hair Jr et al., 2017). Therefore, as indicated in Table 2, four items (PEU1, PIC4, PU4, and DSE2) should be rephrased in future studies as their values are below 0.7. Nevertheless, scholars (Hair, Black, et al., 2019) argue that any value above 0.3 is still considered relevant for the model's structure interpretation.

Table 2: Convergent validity, item loadings, and reliability results

Construct	Item	IL	CA	CR	AVE
Perceived Ease of Use (PEU)	**PEU1**	**0.601**	0.786	0.814	0.615
	PEU2	0.879			
	PEU3	0.841			
	PEU4	0.788			
Digital Self-Efficacy (DSE)	DSE1	0.752	0.855	0.870	0.582
	DSE2	**0.606**			
	DSE3	0.767			
	DSE4	0.818			
	DSE5	0.802			
	DSE6	0.812			
Perceived Usefulness (PU)	PU1	0.853	0.839	0.865	0.677
	PU2	0.880			
	PU3	0.859			
	PU4	**0.682**			
Perceived Islamic Education Compatibility (PIC)	PIC1	0.843	0.869	0.907	0.602
	PIC**2**	0.899			
	PIC3	0.756			
	PIC4	**0.477**			
	PIC5	0.780			
	PIC6	0.827			
Behavioural Intention (BI)	BI1	0.900	0.932	0.933	0.830
	BI2	0.928			
	BI3	0.924			
	BI4	0.893			
Use Behaviour (UB)	UB1	0.739	0.914	0.923	0.702
	UB2	0.842			
	UB3	0.869			
	UB4	0.896			
	UB5	0.887			
	UB6	0.784			

Further, Discriminant validity was verified based on the Fornell-Larcker Criterion (FLC) and Heterotrait-Monotrait Ratio (HTMT). For FLC, the results (in Table 3) revealed that the square root of the AVE for each construct was bigger than the correlation coefficients between the construct and other constructs in the model (Hair, Risher, et al., 2019). The HTMT ratio provides a measure of discriminant validity by comparing the correlation between constructs to the correlation between constructs and their indicators. As shown in Table 3, the analysis revealed HTMT values (italicised in brackets) below the recommended threshold of 0.85, indicating satisfactory discriminant validity (Hair, Risher,

et al., 2019). This finding confirms the adequate discriminant validity of the constructs.

Table 3: Fornell-Larcker criterion and HTMT results

Construct	BI	DSE	PEU	PIC	PU	UB
Behavioural Intention (BI)	**0.911** *(0)*					
Digital Self-Efficacy (DSE)	0.614 *(0.672)*	**0.763** *(0)*				
Perceived Ease of Use (PEU)	0.592 *(0.697)*	0.675 *(0.797)*	**0.784** *(0)*			
Perceived Islamic Education Compatibility (PIC)	0.409 *(0.398)*	0.548 *(0.610)*	0.461 *(0.501)*	**0.776** *(0)*		
Perceived Usefulness (PU)	0.724 *(0.808)*	0.600 *(0.655)*	0.611 *(0.712)*	0.499 *(0.517)*	**0.823** *(0)*	
Use Behaviour (UB)	0.766 *(0.825)*	0.611 *(0.653)*	0.571 *(0.673)*	0.417 *(0.414)*	0.664 *(0.742)*	**0.838** *(0)*

The analysis results demonstrate the strong validity and reliability of the measurement model and individual constructs of the TAMISE model in this study. Overall, the model fit indices suggest an acceptable fit of the proposed model to the data. Moreover, the measures demonstrated satisfactory validity and reliability, indicating they are suitable for future research. The satisfactory validity and reliability of the modified TAM models were similarly observed in previous studies in Islamic education (Haris et al., 2022; Ngabiyanto et al., 2021; Nuryanna et al., 2021; Subiyakto et al., 2022).

Conclusion and Future Directions

This study contributes to the existing literature by providing empirical evidence for the reliability and validity of the TAMISE framework through confirmatory factor and composite analyses. The results confirm the importance of incorporating factors specific to Islamic education when assessing the acceptance and adoption of digital technologies. The validated TAMISE model offers insights into the factors influencing the acceptance of digital technologies in Islamic education and can guide future research and practice in this domain. The study is limited to pilot testing the validity and reliability of the TAMISE model due to sample size limitations. Thus, using adequate samples, future research should further validate the TAMISE model by testing various hypotheses based on the constructs' relationships to explore variables that might influence digital technology adoption in Islamic education. We propose future studies to implement structural equation modelling (SEM) for testing hypotheses based on the TAMISE model.

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