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Towards an integrated model: Task-technology fit in Unified Theory of Acceptance and Use of Technology 2 in education contexts

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Keywords

Task-Technology Fit (TTF);
technology acceptance;
Unified Theory of Acceptance and Use of Technology 2 (UTAUT2).

Abstract

The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model has been widely used to study new technological systems. It has proven to be a robust theoretical framework for predicting users' intentional use. Although UTAUT2 was intended for commercial use, many later studies have focused on educational technologies like e-learning, learning management systems, mobile learning, e-books and instructional tools. This paper reviews previous work done on the model and proposes a new research model by integrating the Task-technology Fit theory with UTAUT2 to study educational technology acceptance.

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Introduction

The Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003) model is a popular and reliable technology acceptance model that has been widely adopted by researchers and practitioners alike. Since its inception, the Unified Theory of Acceptance and Use of Technology (UTAUT) has served as a base model in research to study various technologies, even in educational contexts. There have been many applications and adoption of the entire UTAUT model or part of the model. Among these past UTAUT studies, researchers added new constructs to expand the scope of the model. Venkatesh et al. (2012) extended their original UTAUT model with additional constructs to study the acceptance and use of technology in consumer contexts. The extended model, known as The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), added three additional constructs: hedonic motivation, price value and habit. Compared to the original model, the extensions proposed in UTAUT2 significantly improved the variance explained in behavioural intention from 56% to 74% and technology use from 40 % to 52%. These represent significant improvements in variance explained compared to the original model.

In the systematic review of 650 UTAUT2 studies by Tamilmani et al. (2017), it was revealed that the model was gaining popularity among researchers as findings revealed a proportionate increase in its utilisation. While 503 (77.4%) studies cited UTAUT2 for general purposes, 134 (20.6%) studies revealed insightful results. In the meta-analysis by Yee and Abdullah (2021), UTAUT2 studies accounted for 12.82% of the total between 2007 and 2020. This finding was not surprising as Venkatesh et al. (2012) found a significant increase in variance explained compared to the original model. For instance, the variance in behavioural intention explained by the original model with direct effects was 35%, while UTAUT2 yielded better outcomes with the direct effects explained at 44%. Tamilmani et al. (2017) explained that the increase in UTAUT2 utilisation resulted from information technologies permeating around us in every aspect of society and giving rise to individual uses in various contexts. UTAUT2 was utilised by not only information technology and information system researchers but also academics. These findings were also echoed by Taneja and Bharti (2021), who conducted a structured literature review analysis using a bibliometric approach to synthesise the research on the Unified Theory of Acceptance and Use of Technology 2. This paper reviews previous work on the model and proposes a new research model by integrating the Task-technology Fit theory with the Unified Theory of Acceptance and Use of Technology 2 to study educational technology acceptance.

Literature review

Unified Theory of Acceptance and Use of Technology

In the original Unified Theory of Acceptance and Use of Technology model, four constructs play a significant role as direct determinants of user acceptance and usage behaviour: performance expectancy, effort expectancy, social influence; and facilitating conditions. In the original model, attitude toward using technology, self-efficacy and anxiety are not direct determinants of behavioural intention. A diagrammatic representation of the UTAUT model is shown in Figure 1.

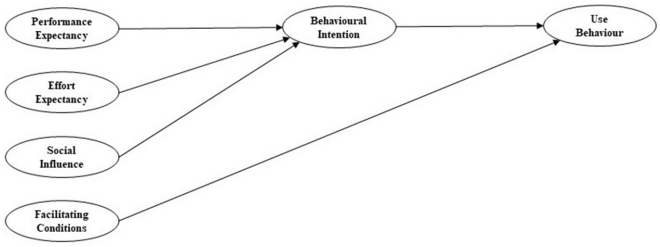

Figure 1: Unified Theory of Acceptance and Use of Technology. Note: Adapted from Venkatesh et al. (2003).

In the Unified Theory of Acceptance and Use of Technology, performance expectancy is the degree to which an individual believes that using a system will benefit him or her in terms of job performance. Effort expectancy is the ease with which users can adopt the system (Venkatesh et al., 2003). Social influence is the extent to which an individual perceives that 'important others' consider that he or she should use the system (Venkatesh et al., 2003). Facilitating conditions are the extent to which an individual believes that there is an existing organisational and technical infrastructure to support the use of the system (Venkatesh et al., 2003). Behavioural intention is the individual's intention to use the technology.

With respect to the importance of these factors for predicting behavioural intention and use behaviour, performance expectancy, effort expectancy, and social influence are all proposed to be predictors of behavioural intention, and via behavioural intention as a mediator, of use behaviour. Conversely, facilitating conditions are not theorised to operate via behavioural intention but more directly on use behaviour unless other predictors in the model are not present. Specifically, Venkatesh et al. (2003) pointed out that if effort expectancy is not included as a predictor of behavioural intention, facilitating conditions will act as a significant predictor of behavioural intention. However, in the presence of both performance expectancy and effort expectancy, facilitating conditions will not be a significant predictor of behavioural intention.

Unified Theory of Acceptance and Use of Technology 2

The Unified Theory of Acceptance and Use of Technology 2 was developed to tailor to the context of consumer acceptance and use of technology. There were three key features in UTAUT2: (1) the introduction of hedonic motivation, price value and habit as critical factors in the adoption of consumer product and technology use; (2) some existing relationships were changed in the original model; and (3) new relationships introduced (Venkatesh et al., 2012) (Figure 2). According to Venkatesh et al. (2012), the impact of hedonic motivation on behavioural intention is moderated by age, gender, and experience. The effect of

price value on behavioural intention is moderated by age and gender. Habit has both direct and mediated effects on use behaviour, and individual differences moderate these effects.

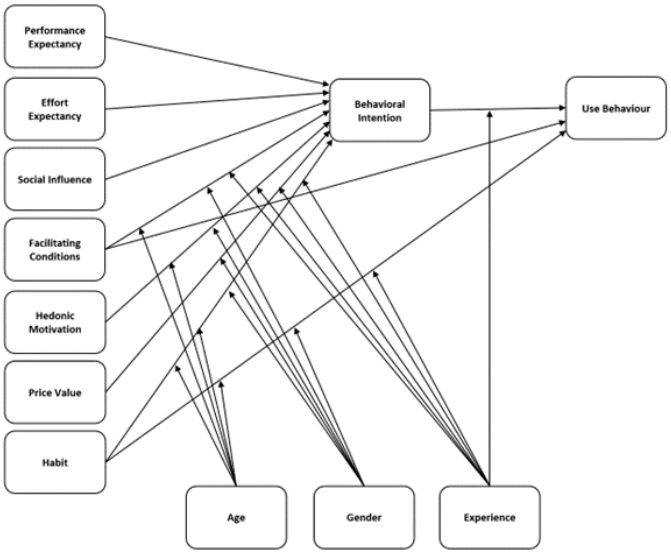

Figure 2: Unified Theory of Acceptance and Use of Technology 2. Note: Adapted from Venkatesh et al. (2012).

Empirical research using Unified Theory of Acceptance and Use of Technology 2

Unified Theory of Acceptance and Use of Technology 2 is considered the most comprehensive model in the field of information systems and information technology adoption research (Tamilmani et al., 2017). It has been used in numerous empirical studies to examine factors influencing the acceptance of different technologies. For example, Azizi et al. (2020) utilised the Unified Theory of Acceptance and Use of Technology 2 model to examine factors affecting the acceptance of blended learning in medical education. Raman and Don (2013) explored pre-service teachers' acceptance of learning management software using the Unified Theory of Acceptance and Use of Technology 2 model. In some of these studies, the model was used in its original form as Venkatesh et al. (2012) had introduced it (Almahri et al., 2020, Azizi et al., 2020, Bervell et al., 2021; Kumar & Bervell, 2019; Raman & Don, 2013, Tseng et al., 2019). In other studies, the Unified Theory of Acceptance and Use of Technology 2 was either extended with additional variables or integrated with another theoretical model. For instance, Ain et al. (2016) extended the model with learning value to study its influence on learning management system use, while Gengfu and Chotiyaputta (2019) integrated the Task-Technology Fit model to examine the acceptance and use of e-books.

Based on the literature from 2013 to 2022 summarised in Table 1, UTAUT2 has been a popular technology acceptance model in empirical research. The plausible reason could be that UTAUT2 has higher predictive power than its already competent predecessor. As Venkatesh et al. (2012) pointed out, the variance explained in behavioural intention (74%) was relatively higher compared to the original model (56%).

Table 1: UTAUT in educational contexts.

Technology	Author(s)	Construct	Additional Construct(s)
e-Learning	Azizi et al. (2020)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention; use behaviour	-
	El-Masri & Tarhini (2017)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention	Trust
	Meet et al. (2022)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention	Language Competency; Teacher Influence
	Osei et al. (2022)	Performance; expectancy effort expectancy; facilitating conditions; price value; habit; behavioural intention	Personality Trait; Perceived Relatedness; Perceived Autonomy; Perceived Competence
	Prasetyo et al. (2021)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention	Learning Value; Instructor Characteristics
	Raman & Thannimalai (2021)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention	-
	Rudhumbu (2022)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention	Blended Learning Acceptance
	Tseng et al. (2019)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; behavioural intention; use behaviour	-
	Zacharis & Nikolopoulou (2022)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention; use behaviour	Learning Value; Empowerment in Learning
Learning Management System (LMS)	Ain et al. (2016)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention; use behaviour	Learning Value
	Raman & Don (2013)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention; use behaviour	-
	Sharif et al. (2019)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention	Task Characteristics; Technology Characteristics; Task Technology Fit; Learning Value

Technology	Author(s)	Construct	Additional Construct(s)
	Widjaja et al. (2019)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention; use behaviour	Trust
	Zwain (2019)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention; use behaviour	Learning Value; Technological Innovativeness; Information Quality
	Zwain & Haboobi (2019)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention; use behaviour	Learning Value
Mobile Learning	Arain et al. (2018)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention	Ubiquity; Personal Innovativeness
	Arain et al. (2019)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention	Ubiquity, Information Quality; System Quality; Appearance Quality; Satisfaction
	Hu et al. (2020)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention; use behaviour	-
	Moorthy et al. (2020)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention; use behaviour	-
e-Books	Bhimasta & Suprapto (2016)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention	Use Adoption; Task Characteristics; Technology Characteristics; Task Technology Fit; Learning Value
	Gengfu & Chotiyaputta (2019)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention	Adoption to Use; Technological Task Fit; Technology Characteristic; Task Characteristic; User Satisfaction
	Gunawan et al. (2019)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention	Personal Innovativeness; Perceived Cost; Environment Consciousness
Instructional Tools	Almahri et al. (2020)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; habit; behavioural intention	-
	Bervell et al. (2021)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention; use behaviour	-
	Faqih & Jaradat (2021)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention	Task Characteristics; Technology Characteristics; Task Technology Fit
	Farooq et al. (2017)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention; use behaviour	Personal Innovativeness
	Jung & Lee (2020)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention	-
	Kumar & Bervell (2019)	Performance; expectancy effort expectancy; social influence; facilitating conditions; hedonic motivation; price value; habit; behavioural intention; use behaviour	-

Empirical results on the prediction of the Unified Theory of Acceptance and Use of Technology 2 Model

Performance expectancy as a predictor of behavioural intention

As in the original model, Venkatesh et al. (2012) posited that performance expectancy was a predictor of behavioural intention. The proposition remains constant in later empirical studies utilising the Unified Theory of Acceptance and Use of Technology 2. For example, Raman & Don (2013) adopted the model in its original form and found in their study with 288 Malaysian pre-service teachers on the acceptance of the learning management system that performance expectancy remained a predictor of behavioural intention. Similarly, Tseng et al. (2019) found that performance expectancy was a predictor of behavioural intention in their study with 166 Taiwanese teachers on their acceptance of Massive Open Online Courses using the Unified Theory of Acceptance and Use of Technology 2. In studies where the model was extended with additional constructs, performance expectancy remained a predictor of behavioural intention. For example, when El-Masri and Tarhini (2017) and Widjaja et al. (2019) extended the model with the construct of trust in their research models, performance expectancy remained a predictor of behavioural intention in both studies. In the studies on the acceptance of learning management systems using the Unified Theory of Acceptance and Use of Technology 2 model, Ain et al. (2016) and Zwain et al. (2019) added the construct of learning value to their studies and performance expectancy again emerged as an influencing factor.

Effort expectancy as a predictor of behavioural intention

Similar to the Unified Theory of Acceptance and Use of Technology findings, the empirical results from Unified

Theory of Acceptance and Use of Technology 2 studies with effort expectancy as a predictor of behavioural intention have been inconsistent. Some studies which adopted the UTAUT2 model by Venkatesh et al. (2012) showed that effort expectancy did not have a significant effect on behavioural intention. For example, Kumar and Bervell (2019) discovered in their study with 206 undergraduates on the acceptance of Google Classroom that effort expectancy was not a predictor of behavioural intention. In a similar research on the acceptance of Google Classroom, Bervell et al. (2021) conducted a study with 163 students; effort expectancy was found to have a significant effect on social influence instead of behavioural intention. Hu et al. (2020), in their study with 638 Chinese academics on the acceptance of mobile learning, found that effort expectancy had no significant effect on behavioural intention.

Empirical studies that extended Unified Theory of Acceptance and Use of Technology 2 with additional constructs also reported similar findings. Arain et al. (2019) included additional constructs like ubiquity, information quality, system quality, appearance quality and satisfaction with the model in a study with 730 Pakistani students to examine the acceptance of mobile learning in higher education. The findings revealed that effort expectancy was a predictor of performance expectancy instead of behavioural intention. Prasetyo et al. (2021) found that effort expectancy bore no significant effect on behavioural intention in their study with 360 Filipino students on the acceptance of e-learning during the COVID-19 pandemic. In their study, the researchers added learning value and instructor characteristics as additional constructs to the UTAUT2 model.

However, effort expectancy appeared to have a significant effect on behavioural intention when UTAUT2 was integrated with another theoretical framework like the Task-Technology Fit theory. For instance, in the mobile learning acceptance study by Bhimasta and Suprapto (2016), where the Task-Technology Fit theory was integrated with the Unified Theory of Acceptance and Use of Technology 2, effort expectancy was a predictor of behavioural intention. Effort expectancy was found again to have a significant effect on behavioural intention when Faqih and Jaradat (2021) integrated the Task-Technology Fit theory with the Unified Theory of Acceptance and Use of Technology 2 in their study on the adoption of augmented reality with 281 students in Jordan.

Social influence as a predictor of behavioural intention

Based on the literature, social influence was posited to be a predictor of behavioural intention. In studies where the Unified Theory of Acceptance and Use of Technology 2 was adopted in its original form, social influence was found to have a significant effect on behavioural intention (Aziz et al., 2020; Raman & Don, 2013; Tseng et al., 2019). When extended with additional constructs, social influence remained a predictor of behavioural intention in most cases. For example, when the UTAUT2 was extended with additional constructs like learning value and empowerment in the study with 314 Greek university students by Zacharis and Nikolopoulou (2022) to explore the factors that predict behavioural intentions on e-learning, social influence showed a significant effect on behavioural intention. Similarly, in the study by Rudhumbu (2022) with 431 university students in Zimbabwe to predict the acceptance of blended learning, social influence remained a predictor of behavioural intention. When integrated with another theory like the Task-Technology Fit theory, findings showed that social influence significantly affected behavioural intention (Bhimasta & Suprapto, 2016; Faqih & Jaradat, 2021; Gengfu & Chotiyaputta, 2019).

Facilitating conditions as a predictor of behavioural intention and use behaviour

One of the key features of UTAUT2 is the change of some existing relationships from the original model (Venkatesh et al., 2012). In the original Unified Theory of Acceptance and Use of Technology model, facilitating conditions are posited to predict use behaviour (Venkatesh et al., 2003). However, in the UTAUT2 model, facilitating conditions are posited to predict both behavioural intention and use behaviour (Venkatesh et al., 2012). In general, irrespective of whether the model was tested in the Unified Theory of Acceptance and Use of Technology 2 original form, an extended form of the model, or integrated with another theory, facilitating conditions remained a predictor of behavioural intention (Arain et al., 2018; Azizi et al., 2020; Bhimasta & Suprapto, 2016; El-Masri & Tarhini, 2017; Faqih & Jaradat, 2021; Farooq et al., 2017; Gengfu & Chotiyaputta, 2019; Gunawan et al., 2019; Hu et al., 2020; Meet et al., 2022; Raman & Don, 2013; Rudhumbu, 2022; Sharif et al., 2019; Tseng et al., 2019; Widjaja et al., 2020; Zacharis & Nikolopoulou, 2022). The discussion on facilitating conditions as a predictor of use behaviour is sometimes not straightforward as in many studies. Use behaviour was often omitted in many Unified Theory of Acceptance and Use of Technology 2 empirical studies (Arain et al., 2018; Bhimasta & Suprapto, 2016; El-Masri & Tarhini, 2017; Faqih & Jaradat, 2021; Gengfu & Chotiyaputta, 2019; Gunawan et al., 2019; Meet et al., 2022; Rudhumbu, 2022; Sharif et al., 2019). For studies that included use behaviour as a construct, in most cases, findings revealed that facilitating conditions were a predictor of use behaviour (Ain et al., 2016; Bhimasta & Suprapto, 2016; Hu et al., 2020; Raman & Don, 2013; Tseng et al., 2019; Widjaja et al., 2020; Zawain, 2019; Zawin & Haboobi, 2019).

Hedonic motivation as a predictor of behavioural intention

Hedonic motivation is the fun or pleasure derived from using a device, system, software or technology (Brown & Venkatesh, 2005). It has been included as a critical predictor in many past consumer behaviour research and prior information system research in the consumer technology use context (Brown & Venkatesh, 2005; Holbrook & Hirschman, 1982). In information system research, hedonic motivation has been found to influence technology acceptance and use (Childers et al., 2001; Thong et al., 2006; Van der Heijden, 2004). From the literature, hedonic motivation is generally a predictor of behavioural intention, a finding that is aligned with what was proposed by Venkatesh et al. (2012) (Arain et al., 2018, Arain et al., 2019, Azizi et al., 2020, Bervell et al., 2021; Faqih et al.,

2021; Farooq et al., 2017; Gengfu et al., 2019; Gunawan et al., 2019; Hu et al., 2020; Kumar & Bervell, 2019; Meet et al., 2022; Moorthy et al., 2019; Raman & Don, 2013; Rudhumbu, 2022; Sharif et al., 2019; Widjaja et al., 2020). However, when Tamilmani et al. (2019) conducted a meta-analysis of 79 UTAUT2 studies, the researchers found that only 46 (58%) of the studies utilised hedonic motivation as a construct, while 33 studies (42%) omitted the construct. In the same study, Tamilmani et al. (2019) also discovered a new relationship between the Unified Theory of Acceptance and Use of Technology 2 constructs where hedonic motivation had a significant effect on effort expectancy.

Past Unified Theory of Acceptance and Use of Technology 2 research has examined the hedonic motivational differences in technology acceptance across users and cultural contexts. In the study by Zwain (2019) that examined the predictors of faculty members' and students' acceptance of the learning management system, the findings showed that hedonic motivation was a predictor of behavioural intention for both groups of users. Zawin & Haboobi (2019) confirmed the findings by conducting the same study with separate faculty and student groups. When El-Masri and Tarhini (2017) compared the factors affecting the adoption of e-learning systems between users in Qatar and the United States, they found no difference across the two countries.

Price value as a predictor of behavioural intention

Venkatesh et al. (2012) extended the original UTAUT to examine the use of information technology in consumer contexts. Hence, price value is crucial in the model as consumers have to bear the costs associated with purchasing devices and services. Past consumer behaviour research has included cost-related constructs to explain consumers' actions (Dodds et al., 1991). In marketing research, price value was conceptualised together with the quality of products and services to determine their perceived value (Zeithaml, 1988).

While adding price value as a construct may set UTAUT2 apart from the original model, many later studies did not include it as part of the latter model. Tamilmani et al. (2018a) conducted a meta-analysis on 79 UTAUT2 empirical studies and found that only 32 studies (41%) utilised price value while 47 studies (59%) omitted the construct from their research models. The main argument for excluding price value as a construct in their UTAUT2 models was that the technology involved in the studies was free of costs, like mobile applications and social networking sites. Among the 47 studies examined, only four were in the educational contexts examining learning management systems, informal learning and podcasting (Lai et al., 2016; Lin et al., 2013; Raman & Don, 2013). The researchers recommended price value to be a key predictor of individual technology adoption with the Unified Theory of Acceptance and Use of Technology 2. In other words, for utilising the Unified Theory of Acceptance and Use of Technology 2 model for studies, price value should be one of the essential constructs in future research. For some studies that included price value as a construct, it has been found that price value was a predictor of behavioural intention (Azizi et al., 2020; Farooq et al., 2017; Gengfu & Chotiyaputta, 2019; Meet et al., 2022; Moorthy et al., 2019; Sharif et al., 2019; Tseng et al., 2019).

Habit as a predictor of behavioural intention and use behaviour

Habit is a critical factor in predicting technology use (Kim & Malhotra, 2005; Kim et al., 2005; Limayem et al., 2007). It is defined as the extent to which people tend to perform behaviours automatically because of learning (Limayem et al., 2007), while Kim et al. (2005) equate habit with automaticity. In other words, habit is viewed as prior behaviour measured as the extent to which an individual believes the behaviour to be automatic (Kim & Malhotra 2005; Limayem et al. 2007). Tamilmani et al. (2018b) discovered in their systematic review that out of 66 empirical studies that utilised UTAUT2, only 23 (35%) utilised habit as a construct. They recommended that researchers studying the initial stages of technology adoption in mandatory user settings should refrain from using habit as a construct. On the other hand, using habit as a construct is encouraged in research to examine established technologies driven by intrinsic consumer motivation.

Implications for the application of UTAUT2 across different forms of technology

Like the original model, the Unified Theory of Acceptance and Use of Technology 2 has been found to have a high level of applicability. Constructs in the model can significantly predict user intentions and behaviours across various user groups, situations, and forms of technology. The following sections summarise some of the research that has been conducted using the Unified Theory of Acceptance and Use of Technology 2 model across different forms of technology use within educational contexts. These applications have indicated different relationships between the constructs depending on the studied technology. Various studies have incorporated extensions to the model depending on the educational technology under study. Among these, e-learning is the most prevalent among the various forms of technologies in the educational context.

Unified Theory of Acceptance and Use of Technology 2 and e-learning

E-learning is learning supported by digital electronic tools and media (Hoppe et al., 2003). The UTAUT2 model has been utilised in numerous studies on the acceptance of e-learning. These included studies on students' acceptance of e-learning across seven countries. For instance, Azizi et al. (2020) conducted a study with 230 students in Iran to examine the factors affecting the acceptance of blended learning in medical education. Meet et al. (2022) explored with 483 Indian students the factors affecting the adoption of MOOCs using an extended UTAUT2 model. Rudhumbu (2022) applied the model to predict the acceptance of blended learning by 432 students in Zimbabwe. Some of these studies took place during the COVID pandemic. For example, Raman and Thannimalai (2021) studied the factors that impacted the students' behavioural intention to use

e-learning in Malaysian higher education amid the pandemic. In the same year, Prasetyo et al. (2021) examined the factors affecting the acceptance of medical education e-learning in the Philippines with 360 students. Osei et al. (2022), in their study with 1306 African tertiary education students, integrated variables like personal traits and motivation in the model to understand e-learning adoption during the COVID-19 pandemic. In Greece, Zacharis and Nikolopoulou (2022) used the model to predict 314 university students' behavioural intention to use e-learning platforms in the post-pandemic normal. While most UTAUT2 research was conducted to examine students' acceptance of e-learning, one particular study by Tseng et al. (2019) in Taiwan investigated 166 teachers' adoption of MOOCs.

From these studies, when UTAUT2 is utilised as a model to examine e-learning, performance expectancy, effort expectancy, facilitating conditions, social influence, habit, hedonic motivation and price value had a significant effect on behavioural intention, and behavioural intention had a significant effect on use behaviour (Azizi et al., 2020; El-Masri & Tarhini, 2017; Meet et al., 2022; Prasetyo et al., 2021; Raman & Thannimalai, 2021; Rudhumbu, 2022; Tseng et al., 2019; Zacharis & Nikolopoulou, 2022). Researchers also extended the model with variables like trust, language competency, teacher influence, personality trait, perceived relatedness, perceived autonomy, perceived competence, learning value, instructor characteristics and empowerment in learning (El-Masri & Tarhini, 2017; Meet et al., 2022; Osei et al., 2022; Prasetyo et al., 2021; Zacharis & Nikolopoulou, 2022). Learning value, in particular, was often included in the extended Unified Theory of Acceptance and Use of Technology 2 model (Prasetyo et al., 2021; Zacharis & Nikolopoulou, 2022). Learning value refers to the learner's perception that the time and effort invested in learning represents a good value (Ain et al., 2016). In these studies, learning value significantly affected behavioural intention (Prasetyo et al., 2021; Zacharis & Nikolopoulou, 2022).

Unified Theory of Acceptance and Use of Technology 2 and Learning Management Systems

A learning management system is an online application that presents and manages educational content and determines and evaluates educational objects (Forouzesh & Darvish, 2012). The Unified Theory of Acceptance and Use of Technology 2 model has been utilised to study students' and teachers' learning management system acceptance. Raman and Don (2013) applied the model to study the acceptance of the learning management system with 288 pre-service teachers in Malaysia. In a study with 100 teachers in Indonesia, Widjaja et al. (2019) integrated the Unified Theory of Acceptance and Use of Technology 2 and Trust models to examine the factors influencing lecturers' acceptance of the learning management system. Sharif et al. (2019) integrated the Task-technology Fit theory with the Unified Theory of Acceptance and Use of Technology 2 model to examine students' acceptance of the learning management system in Pakistan. Zwain and Haboobi (2019) investigated the determinants of the learning management system acceptance with 113 faculty members and 184 students in Iraq.

In the UTAUT2 studies on learning management systems, performance expectancy, facilitating conditions, social influence, habit and hedonic motivation were generally found to have a significant effect on behavioural intention, while facilitating conditions and behavioural intention were predictors of use behaviour. However, effort expectancy was found not to be a predictor of behavioural intention. Similar findings were reported in the original UTAUT studies on learning management systems (Or & Chapman, 2021). In these studies on learning management systems, the UTAUT2 model was extended with constructs like learning value, technological innovativeness, information quality, task characteristics, technology characteristics, task-technology fit and trust (Ain et al., 2016; Sharif et al., 2019; Widjaja et al., 2019; Zwain, 2019; Zwain & Haboobi, 2019). Like in the studies in e-learning, learning value was often included as an additional construct and was found to be a predictor of behavioural intention. As for price value, it was often omitted in studies on learning management systems. Even when price value was included in such studies, it was found not to have a significant effect on behavioural intention (Widajaja et al., 2020).

UTAUT2 and mobile learning

Mobile learning refers to learning mediated with handheld devices and is made available anytime, anywhere (Barzegar, 2016). The UTAUT2 model was utilised to study mobile learning acceptance across three countries. In Pakistan, Arain et al. (2018) extended the model with ubiquity and personal innovativeness as additional constructs to examine the factors influencing the acceptance of mobile learning by 731 higher education students. In another study by Arain et al. (2019) with 730 students, the extended model that included constructs like ubiquity, information quality, system quality, appearance quality and satisfaction was utilised to examine the acceptance of mobile learning in higher education. Moorthy et al. (2019) discovered that habit and hedonic motivation were the strongest influences on mobile learning behaviours when the researchers conducted a study with 358 Malaysian higher education students. In China, Hu et al. (2020) explored the Unified Theory of Acceptance and Use of Technology 2 factors that affected the adoption of mobile learning with 638 academics.

Based on the past findings from the Unified Theory of Acceptance and Use of Technology 2 studies on mobile learning, performance expectancy, facilitating conditions, habit, and hedonic motivation had a significant effect on behavioural intention, while effort expectancy and social influence were found to have no significant effect on behavioural intention. One crucial observation in the studies on mobile learning was that moderators were often included in the research. For instance, moderators like gender, age, teaching years and discipline were included in the study by Hu et al. (2020), while gender was added as a moderator in the study by Moorthy et al. (2019).

UTAUT2 and e-books

An e-book is an electronic format of a particular book that can be read on a dedicated device, computer screen, or internet (Gengfu & Chotiyaputta, 2019). Most research that utilised the UTAUT2 model was often integrated with the Task-technology Fit (TTF) theory or extended with additional constructs. For instance, Bhimasta and Suprapto (2016) integrated TTF with the UTAUT2 model in a study with 326 Indonesian students to examine the adoption of mobile e-textbooks. Learning value was also included as an additional construct in the research framework of that study. In a similar study, Gengfu and Chotiyaputta (2019) integrated the Task-technology Fit theory with the UTAUT2 model to study the acceptance and use of e-books in China with 257 university students. On the other hand, Gunawan et al. (2019) extended the model with constructs like personal innovativeness, perceived cost and environmental consciousness to study millennials' acceptance of e-Books. In the e-Book context, performance expectancy, social influence, facilitating conditions and habit are generally predictors of behavioural intention, while effort expectancy and price value are not found to be predictors of behavioural intention (Bhimasta & Suprapto, 2016; Gengfu & Chotiyaputta, 2019).

UTAUT2 and instructional tools

There were various UTAUT2 studies on the acceptance of instructional tools in education. These included technologies like chatbots, augmented reality, lecture capture systems, Google Classroom and open educational resource systems (Almahri et al., 2020; Bervell et al., 2021, Faqih & Jaradat, 2021; Farooq, 2017; Jung & Lee, 2020; Kumar & Bervell, 2019). In the contexts of instructional tools, performance expectancy, effort expectancy, social influence, facilitating conditions, habit and hedonic motivation were generally found to have a significant effect on behavioural intention, and behavioural intention had a significant effect on usage behaviour (Almahri et al., 2020; Bervell et al., 2021; Faqih & Jaradat, 2021; Farooq, 2017; Jung & Lee, 2020; Kumar & Bervell, 2019). Some UTAUT2 models were extended or integrated with another theoretical framework. For instance, Farooq et al. (2017) extended the UTAUT2 with the construct of personal innovativeness, while Faqih et al. (2021) integrated the Task-technology Fit theory. While many studies on instructional tools included price value in their research frameworks, it was found that it did not have a significant effect on behavioural intention (Faqih & Jaradat, 2021; Jung & Lee, 2020).

The proposed research model

Venkatesh et al. (2016) classified research that integrated part of or the complete UTAUT with at least one other theory with theoretical significance as its research model as integration studies. The Task-technology Fit theory is one of the frequent candidates in this aspect. For instance, Bhimasta and Suprapto (2016) empirically investigated student adoption of mobile e-textbook using an integrated UTAUT2-TFT framework. Sharif et al. (2019) studied the acceptance of the learning management system by university students using an integrating framework of modified UTAUT2 and TFT theories. Gengfu and Chotiyaputta (2019) similarly used a UTAUT2-TFT integrated model to study the acceptance and use of e-books in Chinese universities. Faqih and Jaradat (2021) integrated the TFT to investigate the adoption of augmented reality technology in education. Based on the past empirical studies that utilised both TFT and the UTAUT2, the research model in Figure 3 is proposed to study factors influencing users' adoption of technology, particularly in the educational contexts.

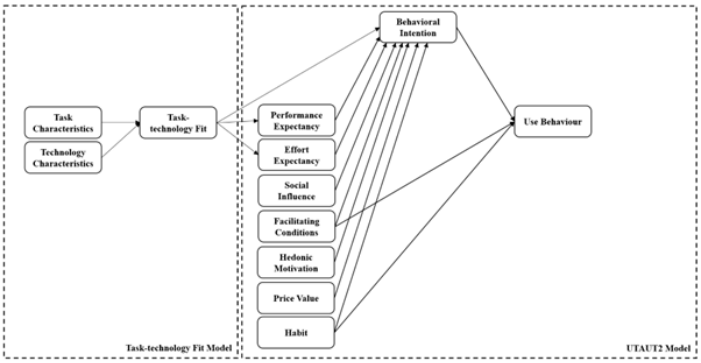

Figure 3: Proposed research model. Note: Adapted from Venkatesh et al. (2012); Goodhue & Thompson (1995).

In the proposed research model, constructs from the Task-technology Fit theory, task characteristics, technology characteristics and task-technology fit are integrated into the Unified Theory of Acceptance and Use of Technology 2 model. Tasks are the totality of individuals' physical and/or cognitive actions and processes in a given environment (Goodhue & Thompson, 1995; Spies et al., 2020). They are defined broadly as the actions carried out by individuals to turn inputs into outputs. Task characteristics are defined as those that an individual might perceive the fit of information technology tool to undertake or those that might move a user to rely more heavily on specific aspects of the information technology (Goodhue & Thompson, 1995). It has been posited that task characteristics have a significant effect on task-technology fit. This proposition is evident in the empirical study with 223 South African university students by Bere (2018) to examine the determinants of mobile learning acceptance. From the findings, it was found that task characteristics had a significant effect on task-technology fit.

Technologies are viewed as tools used by individuals to carry out their tasks (Goodhue & Thompson, 1995). In the context of information systems research, technology refers to computer systems (i.e. hardware, software, and data) and user support services (i.e. training and helpdesk) provided to assist users in their tasks. Technology characteristics refer to the device attributes used to carry out their tasks, considering the situation it is used in and the responsibilities it seeks to support (Goodhue & Thompson, 1995; Hidayat et al., 2021). According to Goodhue and Thompson (1995), technology characteristics are posited to have a significant effect on task-technology fit. In a study with 206 Malaysian students to examine the factors affecting academic performance in higher education using the Task-technology Fit model, it was found that technology characteristics have a significant

effect on task-technology fit (Al-Rahmi et al., 2020).

Task-technology fit is the extent to which technology assists an individual in performing his or her portfolio of tasks. More specifically, task-technology fit is the correspondence between task requirements, individual abilities, and the functionality of the technology (Goodhue & Thompson, 1995). It relates to how technology helps an individual perform a set of tasks and is consequently influenced by the relationship between the task's characteristics and the technology's purposes (Hidayat et al., 2021). These outcomes proposed by Goodhue and Thompson (1995) were still relevant in recent studies. For example, the study by Navarro et al. (2021) with 1011 Filipino engineering students that examined factors affecting learning management system acceptance during the COVID-19 pandemic showed that task and technology characteristics significantly influenced task-technology fit.

There were prior studies that extended the original Unified Technology Acceptance and Use of Technology with the Task-technology Fit theory. In the study by Kissi et al. (2018) with 400 high school students on their acceptance of video-based instruction in flipped learning, task-technology fit was found to have a positive influence on behavioural intention. Wan et al. (2020) integrated task-technology fit into their Unified Technology Acceptance and Use of Technology research model. In the study with 464 students on their continued intention to use Massive Open Online Courses, it was found that task-technology fit was positively related to performance expectancy. Several studies were also conducted to incorporate the Task-technology Fit theory into the Unified Technology Acceptance and Use of Technology 2 model. For instance, in the study by Sharif et al. (2019) on the acceptance of the learning management system with 178 students in Pakistan, it was found that task-technology fit had significant effects on performance expectancy, effort expectancy and behavioural intention. It was explained that task-technology fit not only encouraged students to select but also influenced user-friendliness and performance. Students using technology based on the fit between technology features and task requirement improved their performance expectancy and effort expectancy. The results were similar to the findings by Faqih and Jaradat (2021) in their study on the adoption of augmented reality technology with 281 Jordanian students. Task-technology fit was found to have a strong positive on both performance expectancy and effort expectancy, while task-technology fit provided an indirect effect on behavioural intention through the mediating role of performance expectancy.

While the Task-technology fit theory originated from information systems studies, many researchers found its relevance in educational contexts. For example, McGill and Klobas (2009) examined the role of task-technology fit in the learning management system implementation with 267 Australian university students. Two constructs, task-technology fit and utilisation, were included in the research model. The findings showed that task-technology fit influenced perceived impact on learning directly and indirectly via utilisation. It also showed that while task-technology fit had a strong influence on the perceived impact of the learning management system on learning, it had a weak impact on outcomes in terms of student grades. Isaac et al. (2019) extended the DeLone and Maclean Model of Information System Success model with two constructs, task-technology fit and performance impact. The study with 448 university students in Yemen revealed that user satisfaction influenced task-technology fit, and task-technology fit influenced performance impact. It was also found that task-technology fit mediated the relationships between user satisfaction, actual usage and performance impact. Vanduhe et al. (2020) extended the Technology Acceptance Model with the task-technology fit variables to study instructors' continued intentions to use gamification for training in higher education. The study with 374 instructors from Cyprus International University showed that task-technology fit positively influenced instructors' perceived ease of use. Alyoussef (2021) combined the Task-technology Fit and Technology Acceptance Model theories to study the adoption of Massive Open Online Courses with 277 public university students. The findings revealed that perceived ease of use had a positive and significant effect on perceived enjoyment, perceived usefulness, and social influence, which in turn had a positive and significant effect on task-technology fit and MOOCs use. Task-technology fit also had a positive and significant effect on MOOCs use. The findings also showed that task-technology fit and MOOCs use positively and significantly affected student satisfaction and academic performance.

Conclusions

Past studies have revealed that when examining technologies that were free of charge, price value had no significant effect on behavioural intention (Buettner, 2016; Baptista et al., 2017). The recommendation would be to utilise the original UTAUT model or extend it with added constructs instead of citing it as UTAUT2 research. One may argue that many past studies were cited as UTAUT2 research but excluded price value (Ain et al., 2016; Almahri et al., 2020; Arain et al., 2019; Arain et al., 2018; Prasetyo et al., 2021, Raman & Don, 2013; Zacharis & Nikolopoulou, 2022). However, some of these UTAUT2 study findings showed that the outcomes were similar to those from a UTAUT model. For instance, Ain et al. (2016) named their study UTAUT2 extension research with an added construct, but price value was omitted. In their findings, performance expectancy and social influence were found to be a predictor of behavioural intention, while behavioural intention was a predictor of use behaviour. While included in the UTAUT2 model, habit and hedonic motivation had no significant effect on behavioural intention. The results were the outcomes of the original UTAUT model. Similarly, in the study by Prasetyo et al. (2021), price value was omitted, and habit and hedonic motivation were found not to have a significant effect on behavioural intention. In other words, without including price value as one of the constructs, it is recommended that the model should not be cited as a UTAUT2 model but remain as UTAUT or its extended model.

In much UTAUT2 research in the educational contexts, learning value was a frequent construct that was included in studies that examined user acceptance of e-learning and learning management systems (Sharif et al., 2019; Zacharis &

Nikolopoulou, 2022; Zwain, 2019; Zwain & Haboobi, 2019). Based on the findings, as the inclusion of learning value as a construct in the UTAUT2 models was only prevalent in technologies like e-learning and learning management systems, it is recommended that it will not be included in the proposed extended UTAUT2 model in general. However, future research using the proposed extended UTAUT2 model to examine educational technologies like e-learning and learning management systems should consider including learning value as a construct, as past research has shown that it was a strong predictor of behavioural intention in those contexts (Sharif et al., 2019; Zacharis & Nikolopoulou, 2022; Zwain, 2019; Zwain & Haboobi, 2019).

From the literature, both the UTAUT2 and Task-technology Fit models are widely applied for both industry and education, in different environments and with new technologies (Spies et al., 2020; Tamilmani et al., 2007). In summary, as evident in past empirical studies, the Task-technology Fit theory is a compatible candidate to be integrated with the Unified Theory of Acceptance and Use of Technology 2 model, especially in educational contexts. There is great potential in such an integrated model that utilises both theories to study technology acceptance in educational contexts. Future research is needed to validate the utility of the integrated model by comparing this with the original Task-technology Fit theory and Unified Theory of Acceptance and Use of Technology 2 model to determine which of these has the highest explanatory power in the different educational contexts. The next plausible step in the near future is developing and validating an instrument based on the integrated Unified Theory of Acceptance and Use of Technology 2- Task-technology Fit model.

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