Extending technology acceptance model (TAM) to measure the students’ acceptance of using digital tools during open and distance learning (ODL)

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Abstract. Ever since the Covid-19 pandemic outbreak, we are taught to live in the new norm. Higher learning institutions are forced to adopt a new norm of open and distance learning (ODL) immediately. Since that, students are facing issues, especially in courses that need a conventional setting. During ODL, students and lecturers rely on digital tools, social media, pre-recorded video, and video conference to assist the learning process. However, there are unexplored topics on the students’ intention to use digital tools during ODL. A sample of 367 students who responded from different diploma and degree programs of Universiti Teknologi MARA (UiTM) Terengganu was collected via an online survey. Data collected are analysed on its correlation and coefficient determinant, regression, and analysis of actual use. Technology Acceptance Model (TAM) is expanded to include external factors of technology access and online learning skills to be measured with perceived usefulness, perceived ease of use, attitude, behaviour intention to use and actual system use. Findings on the study will help uncover significant understanding of students’ acceptance of ODL in using digital tools for a better decision-making and students’ support assistance. Hence, this study benefits us to foresee the possible future need for courses in conducting ODL successfully.

1. Introduction
The pandemic coronavirus 2019 (COVID-19) has become an international concern and affects all fields, including the education industry, as UNESCO stated [1]. On 30th January 2020, the World Health Organization (WHO) declared the permissibility of the COVID-19 virus as a general health risk and a worldwide pandemic on 11th March 2020. [2]. As in the education line, COVID-19 has caused severe problems for students, instructors, and educational institutions worldwide. [3]. Due to the pandemic, the Malaysian ministry of higher education had issued all academic activities to fully transform online [4]. Many higher learning courses are facing issues, especially the courses that need physical contact. According to UNESCO, this pandemic has impacted over 87% of the world’s student population in more than 160 countries [5].

As learning processes must continue, educational institutions’ services must continue to run even with the various situations and challenges amid the outbreak of a pandemic. UiTM had enforced open and distance learning (ODL) for online facilitation and other activities supporting education [6]. This situation illustrates how online learning delivery has allowed instructors and learners to incorporate flexibility into their lesson plans. However, there are unexplored topics on the students’ intention to use
digital tools during ODL. Thus, this study investigates students’ intent to use digital tools during ODL based on the Technology Acceptance Model theory (TAM). A random sample of 367 students who responded from different diploma and degree programs from UiTM Terengganu were collected via an online survey. Data collected are analysed on its reliability, correlation and coefficient determinant, regression, and analysis of actual use. Findings on the study will help understand students’ intention to use digital tools during ODL to improve decision-making and support assistance for students’ needs.

1.1. Technology Acceptance Model

The Technology Acceptance Model (TAM) is introduced by Davis in 1989 [7] to explain how user accepts and use technology. This model proposes that perceived usefulness and perceived ease of use of technology predict user attitude towards using the technology, subsequent behavioural intentions, and actual usage [8]. In TAM, perceived usefulness refers to the perception that using the technology will improve the user’s work performance. Perceived ease of use refers to how seamless the user perceives it to be. The user’s attitude towards using technology and the user’s preference for using the technology influence their intention to use it [9]. TAM has been applied in various studies, and many refer to TAM for technology acceptance [10]. Figure 1 illustrates the theoretical framework for this study, adapted based on TAM's original version [7]. TAM is expanded to include external factors, which are technology access (TA) and online learning skills (OLS) to be measured with perceived usefulness (PU), perceived ease of use (PEOU), attitude (ATT), behaviour intention to use (UI) and actual use. Technology access is defined as the program infrastructure, including the internet and wi-fi. The use of computers and the internet form a significant component of online learning. Online learning skill encompasses basic computer skills and techniques to engage in online education. Previous findings reveal that computer experience, skills and personal knowledge of Internet technology contribute to the students’ achievement in an online computer environment [11].

![Figure 1. Technology Acceptance Model (TAM) as a theoretical framework.](image)

1.2. Open and distance learning

The Malaysian Ministry of Higher Education (MoHE) decided to halt all face-to-face lectures as part of the covid-19 pandemic control measures and urged all higher education providers to prepare for open and distance learning (ODL). The majority of teaching is administered by someone remote and separated from their learner during ODL. The goal seeks to enable students to have a more comprehensive degree of flexibility and accommodations and its programme or other structure elements[12]. Distance learning also can be defined as a method of teaching and learning in different geographical location, either near or far, with the use of electronic media and devices as tools for enhancing the availability of training, communication, and interaction, and that helps in accepting novel ways of comprehending and the interaction and knowledge in establishing learning [5].

Distance education provides affordable educational options for those who would like to learn. Still, their circumstance cannot afford a formal university education since educators and students can replace
physical interaction with digital media [13]. In this time of deadly pandemics, online social media platforms that allow video conferencing, online discussions, and online lecture access are necessary. Internet connections must be good, enabling instant feedback on students’ progress from remote locations and can be used as an alternative to face-to-face classes [14]. The development of reliable and sufficient technology resources, such as digital learning tools and platforms and online courses, are essential for this situation [15].

1.3. Digital Tools
The use of distance learning in higher education institutions has expanded globally [16]. During distance learning, students and lecturers rely on technology to assist the learning process. Orlando and Attard stated that teaching with technology does not apply to everyone. Its implementation will depend on the technological resources available and the curricular needs of the students [17]. The study in Hong Kong University shows some of the aspects that affect technology usage for learning to have been students’ skill with computers, their attitude towards technology, learning styles, as well as teachers and peers’ support [18].

Distance learning using digital tools can be defined as “the use of electronic technology to deliver, support and enhance both learning and teaching and involves communication between learners and teachers utilising online content” [19]. Distance learning has the potential to facilitate the transition from a teacher-centred approach, where the student might be a passive observer at the hands of the teacher, to a student-centred approach where a student might be a vocal participant in their own education as well as with other students. Utilising digital tools in distance learning may help cope with the variability in learning environments and may provide individuals with self-paced learning and content [20], [21]. The digital educational tools are divided into eight major categories: Learning Management System (LMS), Massive Online Open Courses (MOOCs), Mind mapping, Interactive tools, Web conferencing, Infographics, Research visibility tools and Web-based Content Management Systems. A recent study among nursing students suggests that only one-third of them preferred distance learning using digital tools [22]. Moreover, it was found that students’ increased willingness to complete research work effectively was associated with digital platforms for education and learning [23]. Digital technology is advantageous to lesson study and learning, which has enabled rigorous collaboration, synchronous observations, ensuring better data management, leading to a more profound understanding of information [24].

2. Research Method
The study-in-progress investigated TAM as a basis for hypothesising the effects of proposed external variables in ODL, which are technology access and online learning skills. An attempt is made whether attitudinal belief such as perceived ease of use and perceived usefulness have a relationship and impact towards the ODL adoption and the suitability of the technology acceptance model in the study’s context. Convenience sampling is frequently used in quantitative research, where the researcher selects subjects that are more readily accessible. The questionnaires were distributed through an online survey among UiTM Terengganu students at three campuses located in Dungun, Bukit Besi and Kuala Terengganu. 370 students from various background participated in this study. The questionnaire developed was based on 6 constructs which consist of 30 items. The items in the construct of Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Attitude (ATT) and Use Intention (UI) were adopted from Shittu, Gambari and Sule, [25] while the items in the construct of Technology Access (TA) and Online Learning Skills (OLS) are adopted from Puspitasari and Listyarini [26].

The research model consists of seven (7) factors where four (4) factors are adopted from TAM and three (3) other factors identified from the literature are technology access (TA), online learning skills (OLS) and attitude (ATT). These three (3) additional factors are identified as the external variables. The hypotheses of this research are:

$H1$: PU is positively related to the intention to use (UI) digital tools among students for online learning.

$H2$: PU is positively related to the attitude (ATT) among students for online learning.
H3: PEOU is positively related to the PU to use digital tools among students for online learning.  
H4: PEOU is positively related to the attitude (ATT) among students for online learning.  
H5: ATT is positively related to the UI to use digital tools among students for online learning.
H6: TA is positively related to the PU to use digital tools among students for online learning.
H7: OLS is positively related to the PU to use digital tools among students for online learning.
H8: TA is positively related to the PEOU to use digital tools among students for online learning.
H9: OLS is positively related to the PEOU to use digital tools among students for online learning.

3. Results and discussions

3.1. Descriptive Analysis
A total of 370 participated in this study, where 36% of them are bachelor students and 64% are diploma students. 74.32% of the students are female, whereas 25.68% are male as shown in figure 2 and figure 3.

![Figure 2. Number of respondents by the level of education.](image1)

![Figure 3. Number of respondents by gender.](image2)

3.2. Reliability Analysis
Table 1 represents the reliability analysis from this study.

| Construct               | Number of Items | Cronbach’s Alpha |
|-------------------------|-----------------|------------------|
| Technology Access       | 3               | 0.782            |
| Online Learning Skills  | 8               | 0.875            |
| Attitude                | 3               | 0.925            |
| Perceived Ease of Use   | 6               | 0.940            |
| Perceived Usefulness    | 6               | 0.955            |
| Use Intention           | 4               | 0.931            |

Cronbach Alpha is a measure used to evaluate the reliability or the internal consistency of a scale or test item set. In other words, the reliability of any given measurement refers to the degree of consistency of an assumption measurement. One way to measure the strength of that consistency is Cronbach Alpha. According to Sekaran and Bougie [27], Cronbach Alpha of 0.6 is categorised as poor, 0.7 is good, 0.8 is considered very good and 0.9 is indicated as excellent. As can be seen in Table 1, the value for Cronbach Alpha for technology access (0.782) indicates good reliability, online learning skills (0.875) indicates very reliable whereas attitude (0.925), perceive ease of use (0.94), perceived usefulness (0.955) and use intention (0.931) shows excellent internal consistency.
3.3. Correlation and Coefficient of Determination Analysis

Correlation coefficient measures the strength of a relationship between two variables. Values ≤ 0.35 are generally considered as weak correlations, 0.36 to 0.67 represents moderate correlations and 0.68 to 1.0 shows strong correlations by Taylors [28]. The result in Table 2 shows that the relationship between PU -> UI (0.807), ATT -> UI (0.698), PEOU -> ATT (0.680), PU -> ATT (0.697) and PEOU -> PU (0.819) are strong positive relationship. OLS -> PU (0.636) and OLS -> PEOU (0.618) exhibit moderate positive relationship. On the contrary, TA -> PU (0.465) and TA -> PEOU (0.433) shows weak positive relationship. All of the relationships are significant (p-value <0.05).

R² determines the coefficient of determination. This value measures how much variation the independent variable explained the dependent variable. Table 2 shows that the variation in UI is explained by PU (66.0%) and ATT (46.7%). The variation in ATT is explained by PEOU (64.7%) and PU (47.4%). The variation in PU is explained by PEOU (67.8%), TA (20.8%) and OLS (38.0%), whereas the variation in PEOU is explained by TA (18.3%) and OLS (38%).

3.4. Regression Analysis

Regression analysis is used to estimate the relationships between a dependent variable and one or more independent variables. It is an analysis to see the impact of an independent variable on the dependent variable. Since all the relationship, as shown in Table 2, is significant (p-value <0.05), we can carry on the regression analysis.

As shown in Table 3, the impact of PU and ATT on UI are both significant (p-value <0.05). The B coefficient means that when PU and ATT increased by 1 unit, the UI will increase by 0.813 and 0.683, respectively.

**Table 2. Correlation and coefficient of determination analysis.**

| Hypothesis | Correlation | Sig. | Strength | R² |
|------------|-------------|------|----------|----|
| Perceived Usefulness -> Use Intention | 0.807** | 0 | Strong Positive | 0.660 |
| Attitude -> Use Intention | 0.698** | 0 | Strong Positive | 0.467 |
| Perceived Ease of Use -> Attitude | 0.680** | 0 | Strong Positive | 0.477 |
| Perceived Usefulness -> Attitude | 0.697** | 0 | Strong Positive | 0.474 |
| Perceived Ease of Use -> Perceived Usefulness | 0.819** | 0 | Strong Positive | 0.678 |
| Technology Access -> Perceived Usefulness | 0.465** | 0 | Weak Positive | 0.208 |
| Online Learning Skills -> Perceived Usefulness | 0.636** | 0 | Moderate Positive | 0.380 |
| Technology Access -> Perceived Ease of Use | 0.433** | 0 | Weak Positive | 0.183 |
| Online Learning Skills -> Perceived Ease of Use | 0.618** | 0 | Moderate Positive | 0.380 |

**Table 3. Regression analysis of independent variable vs use intention.**

| Model | Unstandardised Coefficients | Standardised Coefficients | t | Sig. |
|------|-----------------------------|---------------------------|---|------|
| Dependent Variable | Independent Variable | B | Std. Error | Beta | |
| (Constant) | | 0 | 0.031 | -0.006 | 0.995 |
| Perceived Usefulness | | 0.813 | 0.031 | 0.813 | 26.643 | 0 |
Table 4 shows that the impact of PU and PEOU towards ATT are both significant (p-value <0.05). The B coefficient means that when PU and PEOU increased by 1 unit, the ATT will increase by 0.688 and 0.691, respectively.

Table 5 shows that the impact of PEOU, TA and OLS towards PU are all significant (p-value <0.05). The B coefficient means that when PEOU, TA and OLS increased by 1 unit, the PU will increase by 0.823, 0.456 and 0.617, respectively.

Table 6 shows that the impact of TA and OLS towards PEOU are both significant (p-value <0.05). The B coefficient means that when TA and OLS increased by 1 unit, the PEOU will increase by 0.428 and 0.616, respectively.
Table 6. Regression analysis of independent variables vs perceived ease of use.

| Dependent Variable | Independent Variable | Unstandardised Coefficients | Standardised Coefficients |
|--------------------|----------------------|-----------------------------|---------------------------|
| Perceived Ease of Use | (Constant) | 9.07E-05 | 0.047 | 0.002 | 0.998 |
| Perceived Ease of Use | Technology Access | 0.428 | 0.047 | 0.428 | 9.057 | 0 |
| Perceived Ease of Use | (Constant) | 0 | 0.041 | 0.003 | 0.998 |
| Perceived Ease of Use | Online Learning Skills | 0.616 | 0.041 | 0.616 | 14.943 | 0 |

3.5. Descriptive Analysis of Actual Use

From figure 4, it is safe to say that majority of the respondents (62.10%) have been using digital tools between 2-3 years and most of the respondents (49.9%), according to figure 5, had been using digital tools daily. From figure 7, most of the respondents have experience using word processing documents (82.1%) followed by tablet and cell phone applications (75.1%), slide presentation software (72.9%), educational applications that can be found on the internet (69.6%) and electronic reference materials (55.6%). Summing up the regression analysis, the model established in this study as in figure 7.
4. Conclusions
The goal of this research, which is based on the TAM model, is to add new variables, namely technology access and online learning skills, as the external variables to the model and explore students’ intention to use digital technology in learning during ODL. The TAM model was extended in this study to investigate the university students’ digital tools usage and the factors influencing intention relating to its usage. Online learning skills means how well the student can operate a computer and their ability to use online tools, whereas technology access refers to the condition of the computer that they have, internet access and adequate software. The result proves that online learning skills exert a more substantial influence on perceived usefulness and perceived ease of use than technology access. Therefore, it is advisable to take measures to reinforce students’ technology access in terms of their computer condition, internet access and adequate software provided in assisting online and distance learning.

This study provided information that perceived ease of use and perceived usefulness towards attitude to use digital tools are encouraging. It implies that if the student thinks that using the digital tools will be easy, clear and understandable and that digital tools may enhance their performance, they will have a positive attitude towards using digital tools during ODL. This study also reveals that digital tools’ use intention was more affected by perceived usefulness than attitude, though both are significant contributor. It indicates that if the students feel that using digital tools would improve their efficacy and enhance their learning, they are more likely to use digital tools during ODL.

To conclude, this research showed that part of UiTM Terengganu students has a positive intention to use digital tools in their learning activities during ODL. Hence, it is safe to say that students are ready to use digital tools in online learning. However, there are some limitations to this study. The use of the convenience sampling technique limits the generalizability of the findings to all UiTM Terengganu students; therefore, the results should be interpreted with caution.

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