

# Investigating University Student's Acceptance of Information and Communication Technology: Applying the Technology Acceptance Model

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## Abstract

Building on the technology acceptance model (TAM), this study examines university student's acceptance of information and communication technology (ICT) as a learning resource outside of the classroom. With the aim of looking more deeply into this subject, the study applied the technology acceptance model to recognize the effect of perceived usefulness on the student's actual use of ICT with the existence of perceived usefulness as a moderator variable. Data were collected from 376 students from Duhok Polytechnic University in the Kurdistan Region of Iraq using a questionnaire survey consisting of 15 items developed based on the related literature. The results support that both perceived ease of use and perceived usefulness are key determinants of student's actual use of ICT as a learning resource, and the relationship between perceived ease of use and actual use is moderated by perceived usefulness. Based on the findings, conclusions, implications, limitations, and an outlook for future studies were made. The originality of this study stems from the use of perceived usefulness as a moderator on the relationship between perceived ease of use and actual use of ICT among university students.

**Keywords:** Technology Acceptance Model, Perceived Ease of Use, Perceived Usefulness, Actual Use, ICT.

## 1. Introduction

Information and communication technology (ICT) dominates every aspect of our life and is a constantly evolving digital world from working to playing and from learning to socializing. Information and Communication Technology changes the way in which people communicate, access information, and learn. People are considering ICT as a change agent having its impact on accessing, monitoring and dissemination of information, teaching methods, learning approaches (Vaghela & Thaker, 2016).

In the higher education sector, the rapid growth of information and communication technology has made learning based on technology more convenient and effective for students. It has created a new learning environment that includes flexible access to information about courses anywhere, anytime, learning became student-centric, and students can rely on themselves to understand courses, in addition to introducing new learning methods. However, user acceptance is very important to the successful implementation of any new technology. In other words, in order to increase the level of technology usage, the emphasis on factors that can influence user acceptance should be raised (Taherdoost, 2019). Thus, it is of interest to investigate whether university students accept ICT as a learning resource or not. This question could be answered by looking at their perceived ease of use, perceived usefulness, and actual use of ICT. These components are the main constructs of the technology acceptance model (TAM) which was introduced for the first time by Fred Davis in 1986 based on the theory of reasoned action (TRA) by Fishbein and Ajzen (1975). In 1989, Davis used perceived ease of use and perceived usefulness to explain computer usage behavior, and as factors cause people to

accept or reject ICT (Masrom, 2007). Perceived ease of use is the degree to which an individual believes that using ICT would be free of effort. Perceived usefulness is the degree to which an individual believes that using ICT will enhance his /her performance (Ismael & Abbas, 2019).

TAM is considered to be the most important, famous, and widely applied tool for understanding the users' acceptance of specific technologies particularly in the workplace environment, both in an original model or modified model (Ismael & Abbas, 2019; Ahmad & Wajeeh, 2019). The main reasons for TAM's widespread acceptance stem from the fact the model is simple and easy to understand (Iqbal & Bhatti 2015; Ajibade, 2018).

TAM posits that a user's actual use of technology is predicated on the user's perceived ease of use and perceived usefulness of the specific technology, i.e., when a user perceives that a type of technology is easy to use and also useful, they will be willing to use it (Ismael & Abbas, 2019; Koul & Eydgahi, 2018; Ajibade, 2018). TAM also suggests that perceptions of usefulness and ease of use are mediated by external variables including individual differences, social influences, and facilitating conditions etc. (Portz et al., 2019).

TAM was updated many times by adding new variables to the original model or dropping variables from it (Farahat, 2012; Momani et al., 2017; Hanif et al., 2018). However, the most common usage of TAM has evolved to be the determinant of the relationship between perceived ease of use, perceived usefulness, and actual use of many emerging technologies (Horton et al., 2001; Ismael & Abbas, 2019). These three main constructs of TAM have been extensively used in the higher education context to determine the degree of how university student's perceived usefulness and student's perceived ease of use effect their actual use of a certain technology (Park, 2009; Sharma et al., 2014; Zogheib et al., 2015; Hanif et al., 2018). Accordingly, this study aims to contribute to the existing literature by exhibiting the moderator role of perceived usefulness on the relationship between perceived ease of use and actual use of ICT among university students, and TAM constructs were selected in order to investigate the university student's acceptance of ICT and to obtain answers for the following research questions:

- (1) To what extent does perceived ease of use effect the perceived usefulness of ICT among university students?
- (2) To what extent does perceived ease of use and perceived usefulness effect the actual use of ICT among university students?
- (3) Does perceived usefulness moderate the relationship between perceived ease of use and actual use of ICT among university students?

## 2. Literature Review and Hypotheses Development

There are many previous field studies that have relied on the TAM model to diagnose students' actual use usage of ICT as a learning resource. Roca and Gagne's (2008) study concluded that perceived ease of use is the most important factor that influences e-learning regarding continuance of actual use. Tingoy and Gulluoglu (2011) confirmed that students' initial dislike towards IT was greatly reduced at the end of an IT course. Edmunds et al. (2012) declared that usefulness and ease of use are key dimensions of students' attitudes towards using technology in course study. The results of a study conducted by Farahat (2012), found that students at Egyptian universities do not perceive ease of use and perceived usefulness of online learning, and they intend not to use online learning. Egle and Nijole's (2015) study concluded that the students' capability to use ICT tools is the only individual force that has a positive relationship with their attitude toward the employ of ICT as a learning resource at the university. Nazu (2016) indicated that university students possessed a generally high attitudinal acceptability level towards ICT as a learning resource. Joo, et al. (2016) investigated factors predicting online university students' actual usage of the mobile learning management system (m-LMS) in Korea and found that that perceived ease of use predicted perceived usefulness, but not predicted actual usage of m-LMS. TAM was used to study e-learning acceptance in Saudi Arabia by Al-Gahtani (2016). The results indicated that perceived usefulness was predicted by perceived ease of use. Similarly, the results of a study by Iqbal and Bhatti (2015) point out that the students' perceived ease of use and perceived usefulness of mobile-learning, positively influence their intention to use and usage behavior (actual use) of mobile-learning. According to the results of a study by Park et al. (2012) student's actual use of a technology system is influenced directly or indirectly by their perceived ease of use of the system. Furthermore, Akman and Turban (2017) concluded that perceived usefulness was a significant predictor of students' actual use of social learning systems. A study conducted by Duvince and Cheryl (2017) in private higher education institutions in the Philippines showed that both perceived ease of use and perceived usefulness were significant predictors of actual use. TAM was used to investigate students' acceptance of e-learning in Tunku Abdul Rahman University in Malaysia; a structural equation model was used to analyze the data; the results show that perceived ease of use significantly effects perceived usefulness, while perceived usefulness significantly effects actual use of e-learning (Ibrahim et al., 2017). A study was aimed to explore university students' intention to use mobile-learning management systems in higher education in Sweden based on the technology acceptance model (TAM). According to the results, support is found to the validation of the extended TAM for mobile-learning and demonstrates and moderately predicts students' intention to adopt mobile learning management systems in higher education in Sweden

(Saroia & Goa, 2019). Hanif et al. (2018) evaluated the factors affecting usage behavior of students toward using e-learning systems in universities to augment classroom learning; the results indicated that perceived usefulness and perceived ease of use have a significant positive influence on user behavior of the e-learning system.

Based on the TAM and the results of the above previous field studies, this study suggests the following two hypotheses: H1: Perceived ease of use has a positive effect on student's actual use of ICT as a learning resource outside of the classroom.

H2: Perceived usefulness has a positive effect on student's actual use of ICT as a learning resource outside of the classroom.

A review of the previous studies on TAM shows that most studies focused on the direct effect of perceived ease of use on the actual use of ICT, but the moderating role of perceived usefulness on such effect is still evolving. While we believe that perceived ease of use alone is not sufficient for the student to use information technology as a learning resource, rather it is coupled with his /her perceived usefulness of using it as a source to understand the information obtained in the course, as well as the perceived ease of use. Exposure to new technology is normal for university students because we are in the age of technology, as most university students have a high degree of perceived ease of use ICT, but they will nevertheless use it only if they realize that they will benefit from its use, so we believe that there is a moderating role of perceived usefulness in the relationship between perceived ease of use and the actual use of ICT by university students.

On the other hand, most previous studies focused on detecting students' actual use of ICT in the classroom, accordingly, the focus of this study is to reveal the students' actual use of ICT outside of the classroom as an additional tool to support learning courses, and the extent to which the actual use is effected by their perceived ease of use and their perceived usefulness of ICT as a learning resource. Therefore, we hypothesize that:

H3: Perceived usefulness moderates the effect of perceived ease of use on student's actual use of ICT as a learning resource outside of the classroom.

### **3. Methodology**

#### **3.1. Research Design**

This study used a descriptive analytical approach to investigate the relationship between perceived ease of use, perceived usefulness, and actual use of ICT among university students, as well as the moderator effect of perceived usefulness on the relationship between perceived ease of use and actual use of ICT among university students.

#### **3.2. Participants**

The study was conducted at the Technical College of Administration. This college was determined as the case study since it was the unique administrative technical college of Duhok Technical University, which is the unique technical university in the Governorate of Duhok in the Kurdistan Region of Iraq. It is characterized by the intensive use of ICT in its study courses.

The participants were chosen using simple random sampling from all stages of the four scientific departments of the college.

The survey was conducted during January - February, 2020. A total of 390 students participated in this study. However, due to the substantial amount of incomplete data, 376 questionnaires were valid (96%). The sample included 125 students from the Information Technology Management Department (33.2%), 108 students from the Business Administration Techniques Department (28.7%), 83 students from the Accounting and Financial Techniques Department (22.1%), and 60 students from the Electronic Journalism Department (16%). The sample consisted of 202 males (53.7%) and 174 females (46.3%). In terms of age, all respondents were between the ages of 19 and 26.

#### **3.3. Instrument**

The study utilized a modified questionnaire based on Davis' TAM (Davis, 1989) with a five-point Likert to collect data relevant for the study. The scale consists of three constructs of ITM: perceived ease of use, perceived usefulness, and actual use. Perceived ease of use was measured using 5 items. The items measure the extent to which using ICT by university students as a learning resource outside of the classroom would be free of effort. Sample items included "I find it easy for me to learn the skills of dealing with ICT". Perceived usefulness was measured using 5 items. The items measure the extent to which university students think that the use of ICT would enhance what they learn in the classroom. Sample items included "Using ICT for learning purposes reduces the time and effort required to learn courses". Actual use was measured using 5 items. The items measure the level of using ICT by university students as a learning resource outside of the classroom. Sample items included "I intend to use ICT to improve my academic achievement". Since TAM variations in most previous studies were all reliable, thus factor analysis was not carried out in this study. Instead, the Cronbach alpha coefficient test for all measurement scales separately was carried out. The results are reported in parentheses in Table 1, and according to the results, the reliability of all the variables is within the

range of 0.71 to 0.76 which shows the internal consistency of each item since the reliability coefficient values around (0.70) are acceptable (Kline, 2011).

### 3.4. Procedures

Data collection applications were administered in the classroom environment and lasted approximately 30 minutes. Before administration, the questionnaire was translated from its original version in English to Kurdish and Arabic languages. The purpose of the study was explained to the students, as well as they were instructed that the data would be used only for scientific research. It was also stressed that sincere and accurate responses for all items was very important for the reliability of the research results. The students were also asked to check for any missing responses before they returned their questionnaire forms.

## 4. Results

### 4.1. Descriptive Statistics and Correlation Matrix

Table 1 presents the descriptive statistics and Pearson correlation coefficient ( $r$ ) between the variables. According to the results in Table 1 participants highly agreed that they perceived ease of use of ICT for learning purpose ( $M=3.69$ ,  $SD=0.66$ ), they have a high level of perceived usefulness of using ICT for learning purposes ( $M=3.78$ ,  $SD=0.62$ ), and they also highly agreed that they have a high level of actual use of ICT for learning purposes ( $M=3.79$ ,  $SD=0.69$ ).

The results in Table 1 clarified that the three constructs of TAM were positively and significantly interrelated; perceived ease of use was correlated to perceived usefulness ( $r = 0.49$ ,  $P < 0.01$ ), and to actual use ( $r = 0.53$ ,  $P < 0.01$ ); perceived usefulness was correlated to actual use ( $r = 0.66$ ,  $P < 0.01$ ).

Table 1. Descriptive statistics and correlation matrix of constructs.

Variables	M	SD	1	2	3
Perceived ease of use (PEOU)	3.69	0.66	(0.73)		
Perceived usefulness (PU)	3.78	0.62	0.49**	(0.71)	
Actual use (AU)	3.79	0.69	0.53**	0.66**	(0.76)

\*\* $P < 0.01$

### 4.2. Test of Hypotheses

Before the application of linear regression to test the hypotheses, the normality of collected data was examined using Kolmogorov-Smirnov, kurtosis, and skewness. It was noted from the results in Table 2 that the data used for the purposes of this study were normally distributed since all Kolmogorov-Smirnov values were higher than 0.05, the maximum obtained value of kurtosis was (0.868), and skewness values ranged between (-0.958) for perceived usefulness and (-0.912) for perceived ease of use. In most studies, the acceptable values of kurtosis are (7) or below, and the acceptable values of skewness range between (-3) and (3) (Kline, 2011).

Table 2. Results of normal distribution.

Variables	Kolmogorov Smirnov	Skewness	Kurtosis
Perceived ease of use	0.08	-0.912	<b>0.514</b>
Perceived usefulness	0.11	-0.958	<b>0.868</b>
Actual use	<b>0.12</b>	<b>-0.947</b>	<b>0.373</b>

Multiple linear regression was used to test H1 and H2, and the results are presented in Table 3.

The results indicated that perceived ease of use has a significant positive impact on perceived usefulness ( $Beta=0.28$ ,  $t=6.53$ ,  $p=0.00$ ). It was also noted from the results that there is a significant positive impact of perceived ease of use on actual use of ICT ( $Beta = .533$ ,  $t = 12.188$ ,  $p = 0.000$ ). According to the results,  $R^2$  value was found to be 0.49. This result implies that perceived ease of use and perceived usefulness can explain 49% of the total differentiation in the level of the actual use of ICT, while 51% is explained by the other factors not examined. Therefore, Hypotheses 1 and 2 were confirmed.

Table 3. Multiple linear regression analysis between the variables of the study.

Model	B	Std. Error	B	t	R <sup>2</sup>	F	Sig.
Constant	.52	.18		2.95			<b>0.003</b>
PEOU	.29	.04	.28	6.53	.49	182	<b>0.000</b>
PU	.59	.05	.53	<b>12.43</b>			<b>0.000</b>

Dependent variable: AU

In H3, we expected that perceived usefulness would moderate the relationship between perceived ease of use and perceived usefulness. To examine this hypothesis, Model 1 in PROCESS macro by Hayes (2018) was selected to examine the role of perceived usefulness in moderating the relationship between perceived ease of use and actual use.

In order to minimize multi collinearity problems, the independent variables and moderating variables were centered before putting them in the regression analyses. The independent variable (perceived ease of use) was entered in the first step of the analysis. As Table 4 illustrates, perceived ease of use has a significant positive impact on the dependent variable (actual use) ( $\beta = .53, t = 12.19, p = 0.00$ ). The results also show that according to  $R^2$ , the percent of actual use that could be accounted for by perceived ease of use was 28.4%. The findings reveal that the first model was significant ( $\Delta R^2 = 284, F(1, 374) = 148.56, p < 0.01$ ). The moderator variable (perceived usefulness) was added to the model in step 2. The results indicate that perceived usefulness has a significant positive impact on actual use ( $\beta = 0.525, t = 12.429, p = 0.000$ ), and according to  $R^2$  values, the percentage of variability accounted for went up from 28.4% to 49.4%. The second model was significant ( $\Delta R^2 = 0.210, F(1, 273) = 154.47, p < 0.01$ ). The interaction term (perceived ease of use \* perceived usefulness) was entered into the last step of the analysis in order to test whether or not perceived usefulness moderated the impact of perceived ease of use on actual use. The results indicated that interactions between perceived ease of use and perceived usefulness were significantly and positively associated with actual use ( $\beta = -.762, t = 2.473, p = 0.01$ ). The coefficient of determination  $R^2$  is higher than in the other two steps at .502 indicating that with the interaction term included (50.2%) of the variation in actual use can be explained.

The overall strength of the model remains quite strong and statistically significant with the introduction of the interaction term ( $\Delta R^2 = 0.008, F(1, 372) = 6.116, P < 0.014$ ), thus, Hypothesis 3 was confirmed.

Table 4. Results of hierarchal multiple regression analysis for actual use.

Steps	Model variables	Constant	$\beta$	t	P- value
Step 1	Independent variable (PEOU)	1.735	.53	12.19	0.000
		$R^2 = .284^{**} \Delta R^2 = .284^{**}, F \text{ Change} = 148.56, df = 1,274$			
Step 2	Moderating variable (PU)	Constant	$\beta$	t	P- value
		.515	.525	12.429	0.000
$R^2 = .494^{**} \Delta R^2 = .210^{**}, F \text{ Change} = 154.47 df = 1,373$					
Step 3	Interaction (PEOU * PU)	Constant	$\beta$	t	P- value
		-1.109	-.762	-2.473	0.014
$R^2 = .502^{**} \Delta R^2 = .008^*, F \text{ Change} = 6.116 df = 1,272$					

Note. \* $P < .05$  \*\* $p < .01$

To confirm the above result and further examine whether the interaction effect exists, a graphical impact of the moderation effect was tested. Figure 1 illustrates the plotted graph of simple slopes for the association between perceived ease of use and actual use for low (-1 SD below the mean), moderate (mean), and high (+1 SD above the mean) levels of perceived usefulness. The interaction graphs revealed that the positive relationships between perceived ease of use and actual use were significantly stronger among respondents reporting higher levels of perceived usefulness than among those reporting lower levels of perceived usefulness.

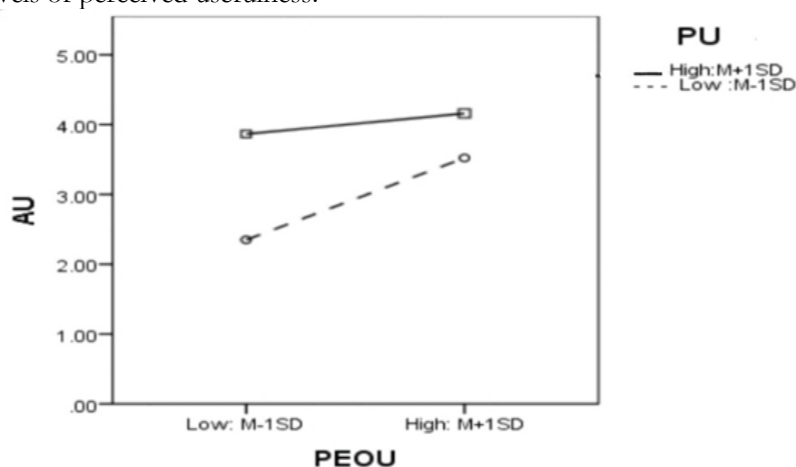


Figure 1. Moderating effect of perceived usefulness on perceived ease of use–actual use relationship.

## 5. Discussion

This study applied three constructs of TAM (perceived ease of use, perceived usefulness, and actual use) to examine the utility of TAM for investigating the degree to which students of the Technical College of Administration / Duhok Polytechnic University accepted ICT as a tool for learning purposes outside the classroom.

The results of the descriptive statistics show that most respondents have a high degree of perceived ease of use, perceived usefulness, and actual use of ICT. These results indicate that most respondents agree that ICT is a beneficial source of information about the courses to support the students in the classroom, and they actually use it and benefit from it free of effort. The study confirms that these results are normal for university students in the era of technology, and it's perfectly consistent with the view of Egle, and Nijole (2015) in that university students are exemplary agents of the so-called digital category, as they were born in the past decades of the 20th century and who playout their complete lives surrounded by the use of ICT. These results also are consistent with the study of Yea-Ru (2015) which showed that ICT instruments are admitted among students to strengthen their learning course.

A significant positive impact of perceived ease of use and perceived usefulness of ICT for learning purposes was found. This result is in line with the results of many previous studies conducted on adoption of TAM to investigate university students' acceptance of ICT which found a strong association between these two constructs (Park et al., 2012; Iqbal & Bahati, 2015; Al-Gahtani, 2016). The authors strongly agree with the view of Iqbal and Bahati (2015) whom state that ICT might not catch the attention of students if it is not easy to use.

Students' perceived ease of use has significant positive effect on their actual use of ICT. This mean that the high level of actual use of ICT as a learning resource is associated with students whom hold a high degree of perceived ease of use. This finding is similar to findings of Edmunds et al. (2012). The authors explain this result in that modern ICT (internet, computers, mobiles, smartphones, YouTube) are available in the Kurdistan Region of Iraq with a low cost therefore, perceived ease of use can lead to the acquisition of these technologies for use in many fields, including learning.

Perceived usefulness significantly affects students' actual use of ICT. This result is consistent with results of Edmunds (2012) which found that PERCIEVED USEFULLNESS is a key dimension of students' actual use of ICT in course study

## 6. Conclusion and Limitations

This paper proposes a revised TAM framework for enhancing our understanding of university student's acceptance ICT as a learning resource outside of the classroom. One of the conclusions of the study refers to the reliability of the instrument created for this study based on Davis' TAM to investigate student's acceptance of ICT as a learning resource outside of the classroom. The results of the study indicated that university students are interested in using ICT to support learning in the classroom. They hold a high degree of perceived ease of use, high degree of perceived usefulness, and they are already taking advantage of the information available to them as their actual use of ICT is at a high level.

Our revised TAM framework in the current study highlights the importance of perceived usefulness as a moderator in the relationship between perceived ease of use and actual use of ICT. This seems to be the key contribution of this research to the extant literature on the student's acceptance of ICT as a learning resource outside of the classroom. This study provides a good theoretical contribution to the previous literature of TAM as it has successfully investigated the role of perceived usefulness in the relationship between perceived ease of use and actual use of ICT, since the previous studies that focus on the moderator effects between TAM constructs are still evolving.

The practical implications of this research are relevant to university administration and faculty as well in addition to students to enhance the degree of perceived ease of use and perceived usefulness and actual use of ICT as a learning resource outside of the classroom through university administration encouraging students to make use of ICT as a learning resource, providing adequate computers, and modern programs in the laboratories of the university, so that sufficient time is available for all students to make use of it. In addition, the university should work to transform the university towards the application of e-learning and support all forms of learning electronically.

The current study has a number of limitations, and it is necessary to depict these limitations. First, the study is limited in terms of sample selection. The respondents from only one college of one university were selected using a non-random sampling technique. Future study could include other colleges or universities. The second limitation of this study is that external factors that may affect students perceived ease of use and perceived usefulness of ICT as a learning resource have not been considered. Future studies could include other external factors such as the demographic profile of students, social influence, facilitating conditions, and self-efficacy. Finally, this study is limited in terms of the common method bias. To reduce the common method bias, data can be collected to measure the variables in future studies from different sources.

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