Advance Acceptance Status Model for E-learning Based on University Academics and Students

Ayad Hameed Mousa¹, Seham Hameed Mousa², Sundus Hameed Mousa³, Hazim Allawi Obaid⁴

¹College of Science, University of Kerbala, Iraq, ayad.h@uokerbala.edu.iq
²College of Islamic Science, University of Kerbala, sehah.m@uokerbala.edu.iq
³Faculty of Administrative, University of Kufa, sundosh.alkatrani@uokufa.edu.iq
⁴College of Islamic Science, University of Kerbala, hazim.alawy@uokerbala.edu.iq

Abstract. E-learning provides students with the possibility of accessing, repeating, and using learning materials wherever and whenever they want. The philosophy of e-learning is not to replace the conventional learning process; it instead provides a new method and approach that offers opportunities for much faster delivery of knowledge. Teachers and students are the most significant actors in the process of educational transformation, and technology acceptance is measured by positive reactions from users based on their utilisation of technology to support those assignments designed for such purposes. In higher education institutions in Iraq, the use of e-learning has become compulsory and there is thus a critical need to study student and teacher behaviours in response to this. Accordingly, this paper undertakes an investigation based on the Technology Acceptance Model (TAM) to examine academics’ and students’ acceptance of and adoption of e-learning in university education in their roles as universities’ main actors. This paper focuses on teachers and students with no background in ICT, investigating their acceptance of e-learning as a learning method. A seven-point Likert scale questionnaire was systematically developed, validated, and used as a data collection instrument with 450 students and 75 university lecturers from two separate colleges. A clustering sampling method was used in the sampling selection process, and several hypotheses were proposed and tested via the paired T-test. The paper's outcomes can be classified into three categories: it helps to determine to what extent e-learning is accepted by non-expert users; it provides evidence of new factors that influence application of e-learning, extending the TAM model; and, finally, it provides meaningful recommendations for higher education institutions to utilise before adopting e-learning to maximise acceptance. In particular, the results indicate that academics’ and students’ intention to use e-learning is positively influenced by both perceived usefulness and perceived ease to use.

Keywords: Technology Acceptance Model, E-learning, Information, Clustering Sampling Method and Communication Technology.

1. Introduction

With the advent of the internet and increased interest in information and communication technologies (ICTs), several new trends are affecting higher education institutions in Iraq that provide a multitude of additional opportunities to learn alongside traditional face-to-face learning methods. E-learning is thus an outcome of the development of ICTs. Reviewing the relevant literature, many definitions of e-learning exist; in the context of this study, however, the definition offered by Jenkins was adopted: E-learning is to use the potential of information and communication technologies (ICTs) to support and facilitate the education process [1]. In line with this definition, the e-learning concept embraces the use of various ICTs (Internet services, personal computers, smartphones, and social media communication) to support the learning process [2] [3].

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
As ICTs have become an integral part of the personal and professional lives of users, they have had a large and generally positive influence on many sectors. The education sector has seen the wide and influential application of ICTs by various institutions, and this adoption of ICTs in higher education is seen as adding value to the learning process in various ways, including improving the effectiveness of the learning process by adding a new dimension to the process of learning that was not previously available [4][5][6].

E-learning has provided excellent opportunities for both the educational and business sectors, with the goal being to improve learning process performance. To promote ICTs, the use of these technologies is now frequently mandatory, yet acceptance and hence efficacy of application may still vary. One popular model used to measure technology acceptance is the technology acceptance model (TAM), developed in 1989 by Davis based on the Theory of Reasoned Action (TRA) [7]. TAM suggests that both perceived ease of use (PEU) and perceived usefulness (PU) can be used to predict of user attitudes towards using the intended technology. PEU also can influence the PU of the intended technology. Figure 1 illustrates the original version of TAM [8].

![Figure 1. Original TAM](image)

As clearly indicated in Figure 1, the basic TAM model consists of the following core ingredients:

i. **PU**-Perceived usefulness: The extent to which a technology’s users can enhance their business performance.

ii. **PEU**-Perceived Ease of Use: Users’ success in using the new technology to the fullest extent possible, determined by subjective perception.

iii. **Attitude**: Evaluation by the technology’s users of new technologies, whether positive or negative.

iv. **Behavioural intention**: Technology users’ desire and intent to use new technologies.

v. **Usage Behaviour**: Actual use behaviour.

2. **Problem Statement**

New technologies provide new ways for academics and students to communicate and learn, making learning process more attractive based on the adoption of e-learning alongside traditional face-to-face learning. The Ministry of Higher Education in Iraq has decided to require all universities and similar institutes in the country, both governmental and non-governmental, to adopt e-learning in support of traditional education; this makes it necessary to determine to what extent the acceptance of e-learning by students and academic staff is supported by this enforced use, as well as identifying any obstacles and developing recommendations to overcome these to find suitable ways to achieve the intended goal.

3. **Methodology**
This section outlines the step-by-step process by which the objectives of this research are achieved. Overall, a quantitative approach was followed, with a questionnaire used to evaluate the proposed design model. The following sub-sections offer further detail on the methodology used.

### 3.1. Research Model and Hypothesis

In the context of this study, academics’ and students’ acceptance of e-learning in Iraq higher education was investigated. The main model acting as a basis for the proposed e-learning model was the Technology Acceptance Model (TAM), with the proposed model extending to the TAM model to incorporate three external variables alongside the original variables. These external variables are IT background, application trust, and availability of IT infrastructure, which were thus evaluated alongside PU, PEU, and intention to use e-learning. Figure 2 illustrates the proposed model, and the following sub-paragraphs offer a brief description of each extending variable.

#### 3.1.1. IT Background

Familiarity and awareness with the IT background is a significant factor in achievement in e-learning, with the performance of both students and academics improved where they have solid IT backgrounds, and vice versa.

#### 3.1.2. Application Trust

A belief in the credibility of e-learning by both students and academics positively influences acceptance of e-learning as a new technology. With reference to this, it is difficult to provide and manage user trust in an application, and higher education institutions and their academic staff play an important role in this by providing responsible, trustworthy, and successful e-learning materials.

#### 3.1.3. IT Infrastructure

In Iraq, there are a gap in the enhancement, maintenance, and completion of smart IT infrastructure. The authors feel that smart IT infrastructure development in Iraq must include ICT implementation plans for the provision of hardware and software, as well as relevant tools and supporting accessories, in order to succeed. In particular, the availability of IT infrastructure has an influence on PU.

### 3.2. Research Hypotheses

In the context of this study, the following research hypotheses, adopted from the relevant literature, were investigated:

**H1.** IT Background has a significant effect on PEU (perceived easy to use).

**H2.** IT Background has a significant effect on PU (perceived usefulness).

This study examined students and academics from disciplines outside of the purview of information technology. The relevant research has shown that students and academics who have IT backgrounds perceive more positive usefulness and ease of use in e-learning systems. A significant body of research also found a positive impact from application trust on user’s behavioural intention to use technology, based on the factor of perceived ease of use [7][9]. Therefore, the following hypotheses were proposed:
H3. Application Trust has a significant effect on PU.
H4. Application Trust has a significant effect on PEU.

Based on the existing literature, IT Infrastructure (software, hardware, and relevant resources) also plays an important role as a critical success factor for e-learning [8, 9] due to its effects on e-learning acceptance levels among students and academics.

Previous researchers have indicated that providing an excellent IT Infrastructure has a positive effect on perceived ease of use [10]. Therefore, this study proposed the following hypotheses:

H5. IT Infrastructure has a significant effect on PEU.
H6. IT Infrastructure has a significant effect on PU.

In addition to the six hypotheses above, two related hypotheses required assessment:

H7. There is a positive relationship between PEU and PU.
H8. There is a positive relationship between PEU and Attitude Toward e-learning.

Figure 3 thus illustrates the extended TAM model and the relevant hypotheses.

3.3. Survey Instrument Development

To meet the research aim of this study, a survey questionnaire with six dimensions was developed and validated based on the adaptation of dimensions from previous relevant studies, and deductions from the conceptual explanations within the literature [10][11]. The questionnaires were divided into two phases: the first phase consisted of demographic questions, while the second phase examined six dimensions by means of several items spread over these dimensions. Each survey item used a Likert Scale for responses, ranging from 1 (very strongly disagree) to 7 (very strongly agree). A 7-point scale as shown in Figure 4 was used due to its ability to generate "curves of reliability" around the “zenith of validity” [15][16].

3.4. Sample Selection

The proposed instrument was administered to 525 selected respondents (academics and students with no ICT background) from two colleges using a cluster sampling method; of these, 500 responded, creating a response rate of 95.23%. IBM SPSS v.25 was used to analyse the collected data, with TAM used as the theoretical framework. A pilot test was conducted among some additional academic staff in order to test the comprehension and clarity of meaning of the proposed instrument. An introduction attached to each distributed questionnaire was also used to outline the purpose and objective of the study.
3.5. Validity and Reliability
Content validity was established based on the opinion of four experts in the area of e-learning and a pilot application of the questionnaire on a small sample. The collected feedback was used to eliminate or change some items in the questionnaire. A Cronbach's Alpha (α) test was then conducted to measure the reliability of the intended instrument (questionnaire), and further tests included factor analysis to verify the degree of significance of each item and which were most suitable in each dimension [12][13]. The criteria for accepting each item was based on utilising the Kaiser-Meyer-Olkin (KMO) test, Bartlett’s test of sphericity, the Measure of Sampling Adequacy (MSA), and Factor loading. Applying KMO is of significant value in factor analysis, and the results for this test were above 0.60 for all measures, as shown in Table 1:

| Variable           | Cronbach’s Alpha | KMO   | Bartlett’s test of Sphericity |
|--------------------|------------------|-------|-----------------------------|
| 1 IT Background    | 0.86             | 0.79  | 0.000                       |
| 2 Application Trust| 0.80             | 0.76  | 0.000                       |
| 3 IT Infrastructure | 0.79             | 0.72  | 0.000                       |
| 4 PU               | 0.78             | 0.69  | 0.000                       |
| 5 PEU              | 0.87             | 0.84  | 0.000                       |
| 6 Intentions to use| 0.80             | 0.83  | 0.000                       |
| 7 Attitude toward  | 0.79             | 0.75  | 0.000                       |
| Overall Average    | 0.81             | 0.76  | 0.000                       |

As clearly indicated in the table, the value of Cronbach’s Alpha of all variables was more than 0.7, indicating that all variables in this research are reliable. Bartlett’s test of sphericity also gave significant values of 0.000 for all constructs, suggesting that the second condition is also satisfied (significance value of $p \leq 0.05$). These data are thus deemed ready for factor loading analysis testing. The Cronbach’s alpha tests also demonstrated significance ($\alpha > 0.6$) [16].

The questionnaire was divided into seven dimensions (model variables) based on the study needs and several indicators spread over those variables were used. These variables and the number of applicable indicators are illustrated in Table 2.

| Variable          | Indicators (I) |
|-------------------|----------------|
| 1 IT Background   | 6              |
| 2 Application Trust| 5              |
| 3 IT Infrastructure| 6              |
| 4 PU              | 6              |
| 5 PEU             | 5              |
| 6 Intentions to use| 6              |
| 7 Attitude toward | 6              |

In order to develop an understanding of the data and present it in a meaningful manner, descriptive statistics (mean and standard deviation) were extracted; to ascertain accuracy and consistency, tests of
reliability were also conducted. The main tests were composite reliability ($\alpha$) and the variance extracted measure ($\rho$). The overall results of these tests are detailed in Table 3.

Table 3. Overall Testing Result

| Constructs               | Items     | Mean | STD  | Factor Loading | $\alpha/\rho$ |
|--------------------------|-----------|------|------|----------------|---------------|
| 1. PU                    | PU-I1     | 6.36 | 1.35 | 0.612          | 0.88/0.74     |
|                          | PU-I2     | 6.36 | 1.29 | 0.594          | 0.78/0.77     |
|                          | PU-I3     | 6.36 | 1.34 | 0.593          | 0.89/0.84     |
|                          | PU-I4     | 6.36 | 1.30 | 0.572          | 0.88/0.74     |
|                          | PU-I5     | 6.36 | 1.34 | 0.593          | 0.89/0.84     |
|                          | PU-I6     | 6.36 | 1.30 | 0.572          | 0.88/0.74     |
| 2. PEU                   | PEU-I1    | 6.36 | 1.29 | 0.600          | 0.68/0.64     |
|                          | PEU-I2    | 6.36 | 1.31 | 0.597          | 0.80/0.70     |
|                          | PEU-I3    | 6.36 | 1.30 | 0.593          | 0.88/0.74     |
|                          | PEU-I4    | 6.36 | 1.35 | 0.612          | 0.88/0.74     |
|                          | PEU-I5    | 6.36 | 1.30 | 0.594          | 0.78/0.77     |
| 3. IT Background (ITB)   | ITB-I1    | 6.36 | 1.34 | 0.590          | 0.79/0.77     |
|                          | ITB-I2    | 6.36 | 1.35 | 0.499          | 0.89/0.76     |
|                          | ITB-I3    | 6.36 | 1.30 | 0.603          | 0.83/0.73     |
|                          | ITB-I4    | 6.36 | 1.59 | 0.589          | 0.69/0.70     |
|                          | ITB-I5    | 6.36 | 1.35 | 0.499          | 0.89/0.76     |
|                          | ITB – I6  | 6.36 | 1.30 | 0.603          | 0.83/0.73     |
| 4. Application Trust (AT)| AT-I1     | 6.36 | 1.36 | 0.591          | 0.72/0.72     |
|                          | AT-I2     | 6.36 | 1.29 | 0.592          | 0.87/0.71     |
|                          | AT-I3     | 6.36 | 1.30 | 0.593          | 0.78/0.73     |
|                          | AT-I4     | 6.36 | 1.38 | 0.595          | 0.98/0.75     |
|                          | AT-I5     | 6.36 | 1.38 | 0.595          | 0.98/0.75     |
| 5. IT Infrastructure (ITI)| ITI-I1    | 6.36 | 1.36 | 0.592          | 0.99/0.75     |
|                          | ITI-I2    | 6.36 | 1.30 | 0.591          | 0.78/0.75     |
|                          | ITI-I3    | 6.36 | 1.29 | 0.596          | 0.88/0.75     |
|                          | ITI-I4    | 6.36 | 1.29 | 0.597          | 0.77/0.75     |
|                          | ITI-I5    | 6.36 | 1.31 | 0.594          | 0.79/0.75     |
|                          | ITI-I6    | 6.36 | 1.30 | 0.591          | 0.78/0.75     |
| 6. Intentions to Use (INTU)| INTU-I1   | 6.36 | 1.33 | 0.590          | 0.87/0.75     |
|                          | INTU-I2   | 6.36 | 1.36 | 0.587          | 0.89/0.75     |
|                          | INTU-I3   | 6.36 | 1.35 | 0.580          | 0.78/0.75     |
|                          | INTU-I4   | 6.36 | 1.33 | 0.590          | 0.87/0.75     |
As seen in Table 3, all items in the questionnaire were valid and usable in terms of representing their respective constructs. Factor loadings ≥ 0.50 are considered practically significant and well-defined in structure [14][15][16], though for safety, this study used scale loading values ≥ 0.7. To examine the simple bivariate relationships among variables in the model, a general structural model was utilised, and all hypotheses were examined within the context of the structural model. The justification for this was to obtain an interpretation of outcomes based on relationships between just two variables at a time while retaining other variables in the model.

### 3.6. Statistical Procedure

The collected data from the questionnaire was coded and tested in SPSS, which was also used to record data. To ensure coding accuracy, 5% of all data entered was checked. In order to better understand the data and present it in a meaningful manner, descriptive statistics (mean, standard deviation, and correlations) were implemented, and the validity of the proposed hypotheses based on evaluation of the structure model was examined by use of t-values; thus, 

- a) if \( t \)-value > t-table value (1.671), the hypothesis in question was not rejected, and 
- b) if \( t \)-value<= t-table value (1.671), the hypothesis in question was rejected [17] [18].

To detect the relationships between the potential of the proposed model's variables, the inner structure model (ISM) was used. The ISM testing process works "by calculating the t-value from the Lane’s coefficient and r-square value on significance level (Alpha) of 0.05 with two-tailed test"[20]. Table 4 shows the t-value results for corresponding lanes.

| Lane’s Coefficient | t-value | Explanation |
|--------------------|---------|-------------|
| 1. ITB → PU        | 0.287   | 2.056       | Significant |
| 2. ITB → PEU       | 0.277   | 2.106       | Significant |
| 3. ATB → PU        | 0.056   | 2.100       | Significant |
| 4. ATB → PEU       | 0.267   | 2.046       | Significant |
| 5. ITI → PU        | 0.271   | 2.023       | Significant |
| 6. ITI → PEU       | 0.288   | 2.036       | Significant |
| 7. PEU → PU        | 0.277   | 2.005       | Significant |
| 8. PEU → ATT       | 0.271   | 2.046       | Significant |

For all of the proposed model's endogenous variables (PU, PEU, ATT, and BIU), the \( R^2 \) values were also tested, and where such values > 0.20, the results were accepted, as illustrated in Table 5.

| Proposed Model Endogenous Variables | \( R^2 \) (R-SQUARE) Value |
|-------------------------------------|-----------------------------|
1. PU - Perceived usefulness 0.401
2. PEU - Perceived ease of use 0.334
3. BIU - Intention to use 0.455
4. ATT - Attitude towards 0.447

As mentioned earlier, the rejection or non-rejection of any hypothesis depended on the test results of the structural model. The T-values were thus calculated to test each hypothesis status, as shown in Table 6.

| Hypothesis | t-value | Hypothesis Status |
|------------|---------|-------------------|
| ITB → PU   | H1      | 2.056 Not rejected |
| ITB → PEU  | H2      | 2.106 Not rejected |
| ATB → PU   | H3      | 2.100 Not rejected |
| ATB → PEU  | H4      | 2.046 Not rejected |
| ITI → PU   | H5      | 2.023 Not rejected |
| ITI → PEU  | H6      | 2.036 Not rejected |
| PEU → PU   | H7      | 2.005 Not rejected |
| PEU → ATT  | H8      | 0.271 Not rejected |

4. Conclusion
The major objective of this study was to investigate the factors influencing the adoption of e-learning within Higher Education Institutes and to explore the relationships between these factors. An extension of TAM was thus proposed with the addition of three external variables (IT Background, Application trust, and IT Infrastructure) to measure academics’ and students’ acceptance of E-learning. The results confirmed a strong effect of IT Background among users on both PU and PEU. Generally, where academics and students possess good IT backgrounds this will enhance their perception of the usefulness and ease of use of technology (e-learning). Thus, users’ training should be slanted towards developing excellent IT backgrounds to support e-learning, as this leads to increased e-learning acceptance.

The results also demonstrated strong influence of application trust for users on both PU and PEU. Generally, where academics and students trust a new technology, this enhances their perceptions of both usefulness and ease of use of that technology (e-learning). Similarly, the results also confirm a strong influence of IT infrastructure on both PU and PEU. Generally, where institutes have the IT infrastructure required for using a new technology, this will enhance users’ perceptions of the usefulness and ease of use of that technology (e-learning).

5. Author’s Recommendation
Based on the study outcomes, the authors recommend that universities and their academic staff and students require support and sufficient tools to bolster the adoption of E-learning. A strong policy to support the processes and the mechanisms of applying e-learning in universities is thus required. Upgrading ICT devices in universities is suggested as a significant step towards meeting the increasing requirements for adopting e-learning in Iraqi universities.

Acknowledgments
The authors would like to thank the experts and survey participants consulted for their helpful comments that have improved this paper. The authors would also like to thank the College of Administration and Economics at Kufa University as well as the College of Islamic Sciences, Kerbala University, for their support and cooperation. Finally, special thanks go to everyone at the College of Science for their unlimited support.
References

[1] Bhuasiri W, Xaymoungkhoun O, Zo H, Rho J J and Ciganek A P 2012 Critical success factors for e-learning in developing countries: A comparative analysis between ICT experts and faculty Comput. Educ.

[2] Selwyn N 2007 The use of computer technology in university teaching and learning: A critical perspective J. Comput. Assist. Learn.

[3] Martins L L and Kellermanns F W 2011 A Model of Business School Students’ Acceptance of a Web-Based Course Management System. Acad. Manag. Learn. Educ.

[4] Edmunds R, Thorpe M and Conole G 2012 Student attitudes towards and use of ICT in course study, work and social activity: A technology acceptance model approach Br. J. Educ. Technol.

[5] Schaper L K and Pervan G P 2007 ICT and OTs: A model of information and communication technology acceptance and utilisation by occupational therapists Int. J. Med. Inform.

[6] Schaper L K and Pervan G P 2004 A Model of Information and Communication Technology Acceptance Utilisation by Occupational Therapists IFIP Int. Conf. Decis. Support Syst.

[7] Hill R J, Fishbein M and Ajzen I 1977 Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. Contemp. Sociol.

[8] Davis F D, Bagozzi R P and Warshaw P R 1989 User Acceptance of Computer Technology: A Comparison of Two Theoretical Models Manage. Sci.

[9] Fishbein M and Ajzen I 1975 Belief, Attitude, intention and behaviour

[10] Laurillard D 2005 E-learning in higher education Changing Higher Education: The Development of Learning and Teaching

[11] Lwoga E T and Komba M 2015 Antecedents of continued usage intentions of web-based learning management system in Tanzania Educ. Train.

[12] Bagozzi R P and Yi Y 1988 On the evaluation of structural equation models J. Acad. Mark. Sci.

[13] Ayad Hameed Mousa 2017 Data virtualization design model for near real time decision making in business intelligence environment (University Utara Malaysia)

[14] Schuenemeyer J H, Murtagh F and Heck A 2006 Multivariate Data Analysis Technometrics

[15] Beckett C, Eriksson L, Johansson E and Wikström C 2017 Multivariate Data Analysis (MVDA) Pharmaceutical Quality by Design: A Practical Approach

[16] Hair J F, Black W C, Babin B J and Anderson R E 2009 Multivariate data analysis: A global perspective

[17] Adhi Nugroho, Mahendra 2015 Impact of government support and competitor pressure on the readiness of SMEs in Indonesia in adopting the information technology Procedia Comput. Sci.

[18] Nugroho M A 2015 Impact of Government Support and Competitor Pressure on the Readiness of SMEs in Indonesia in Adopting the Information Technology Procedia Computer Science

[19] Subramanian G H 2007 A Replication of Perceived Usefulness and Perceived Ease of Use Measurement Decis. Sci.

[20] Taylor S and Todd P 2006 Assessing IT Usage: The Role of Prior Experience MIS Q.

[21] Davis, Fred D.Bagozzi, Richard P.Warshaw P R, Davis Richard P.Warshaw, Paul R. F D B and Davis, Fred D.Bagozzi, Richard P.Warshaw P R 1989 User Acceptance of Computer Technology: a Comparison of Two Theoretical Models. Manage. Sci.

[22] Agarwal R and Prasad J 1997 The Role of Innovation Characteristics and Perceived Voluntariness in the Acceptance of Information Technologies Decis. Sci.