Integrating Technology Acceptance Model With Innovation Diffusion Theory: An Empirical Investigation on Students' Intention to Use E-Learning Systems

WALEED MUGAHED AL-RAHMI[1], **NORAFFANDY YAHAYA**[1], **AHMED A. ALDRAIWEESH**[2], **MAHDI M. ALAMRI**[3], **NADA ALI ALJARBOA**[4], **UTHMAN ALTURKI**[2], **AND ABDULMAJEED A. ALJERAIWI**[5]

[1]Faculty of Education, Universiti Teknologi Malaysia, Johor Bahru 81310, Malaysia
[2]Educational Technology Department, College of Education, King Saud University, Riyadh 11362, Saudi Arabia
[3]Education Technology Department, Faculty of Education, King Faisal University, Alahsa 31982, Saudi Arabia
[4]Psychology Department, College of Education, Taif University, Taif 26571, Saudi Arabia
[5]Self-Development Skills Department, Common First Year, King Saud University, Riyadh 11362, Saudi Arabia

Corresponding authors: Waleed Mugahed Al-Rahmi (waleed.alrahmi@yahoo.com) and Noraffandy Yahaya (p-afandy@utm.my)

ABSTRACT This paper aims to explore and investigate the potential factors influencing students' behavioral intentions to use the e-learning system. This paper proposes an extended technology acceptance model (TAM) that has been tested and examined through the use of both innovation diffusion theory (IDT) and integrating TAM. This paper was conducted on 1286 students utilizing systems of e-learning in Malaysia. The findings were obtained via a quantitative research method. The findings illustrate that six perceptions of innovation characteristics, in particular, have impacts on students' e-learning system behavioral intention. The influences of the relative advantages, observability, trialability, perceived compatibility, complexity, and perceived enjoyment on the perceived ease of use is noteworthy. Moreover, the effects of the relative advantages, complexity, trialability, observability, perceived compatibility, and perceived enjoyment on the perceived usefulness have a strong impact. Therefore, the empirical results provide strong backing to the integrative approach between TAM and IDT. The findings suggest an extended model of TAM with IDT for the acceptance of the e-learning system used to improve the students' learning performance, which can help decision makers in higher education, universities, as well as colleges to evaluate, plan and execute the use of e-learning systems.

INDEX TERMS Technology acceptance model (TAM), innovation diffusion, theory (IDT), E-learning system, structural equation modeling, system adoption, end-students' perception.

I. INTRODUCTION

The term E-learning is used to refer to the online learning which is basically a type of training and tuition that is based on technology. In such learning, students are involved in various activities within a virtual environment. This training includes activities such as audiovisual interaction and investigation with different subjects. Through e-learning, both

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teachers and students get the opportunity to communicate with one another. It is believed that education institutions including the higher education ones should make it easy for individuals to access these virtual courses for e-learning [1]. The concept of e-Learning is known as utilizing Information and communications technology (ICT) in a way to provide students with the various resources of knowledge and information challenging geographic and time limitations [2]. The idea of e-learning is based on merging both online resources and online resources in a way to deliver communication,

information and education online [3]. Several benefits such as cost savings, learning process improvement, various learning styles accommodation, an increase in access to instructors for students, dynamic course content, and a quality training that can be structured or unstructured can be utilized by the organizations that make use of e-learning. Higher and primary education and corporate training as well as government employees training are some areas which witness the use and the application of e-learning [4], [5]. This implies that there is a difference between traditional and online types of learning. Through e-learning, students are encouraged to study at their homes individually and not in groups as in traditional learning where there are classes and study groups. It also gives the students the chance to manage their time based on their preferences as they attend the online course individually in their homes. They also have the freedom to choose any online course they feel useful to them and their needs.

The advantages of e-learning and its applications have been addressed in previous related literature [4], [6]. In spite of the increased usage of e-learning, still there is a lack of utilizing this technology which poses a problem in itself [4], [6]. The problem is represented by the fact that the full benefits of such learning cannot be achieved unless students and learners are able to utilize these e-learning systems [7], [8]. Both experts and researchers have been trying to investigate this problem through exploring the decisions of students and learners embracing the e-learning systems which can get them many benefits [1], [9], [10].

The improvement of students' competencies, skills, and knowledge are seen as the main benefits of the organizational level for e-learning [11]. Both the user satisfaction and behavioral intention to use thereof are the determining factors of the success of E-Learning [12], [13]. The instant antecedent of usage behavior is known as the Behavioral intention which determines the readiness of users to carry on certain behavior [14]. The actual usage can be precisely indicated by measuring the behavioral intention [14], [15]. The area of antecedents of technology adoption intention has been addressed in literature and most of the studies in this regard report that it can be highly predicted by users' attitudes [14], [16].

The individuals' satisfaction with e-learning received much attention be researchers who used a number of different theoretical models to assess this satisfaction but there was a lack of models to assess usefulness [2], [11], [17]. The gap also extends to the understanding of e-learning and its use including its influence on learning performance in higher education [3]. In an attempt to bridge this gap, the current study explores the relationship between the TAM variables and innovation diffusion theory in the same model. Through the use of IDT as a background theory, this study explores the motivational determinants' influence on TAM constructs which is seen as a fruitful addition to the existing knowledge in this regard. In particular, six factors are under investigation in the current study namely: trialability, complexity, relative

advantages, observability, perceived compatibility and perceived enjoyment as factors determining the perceived usefulness, perceived ease of use and behavioral intention to use e-learning system. The importance of the current study stems from the fact that it can develop and test theories in relation for the understanding of the designing strategies and those which can promote e-learning systems. Such theories are the ones in relation to e-learning system acceptance and to specialists. The contribution of this study extends to the policymakers at universities who can gain deeper insights and understandings of the students' acceptance of e-learning technology leading to a better developed e-learning policy.

II. THEORETICAL MODEL AND HYPOTHESES

Innovation adaptation research, that primarily deal with acceptance of information technology and information systems (i.e IT and IS), has formed variety of complementary and competing models to study adoption. According to Rogers' [18] and Davis' [19] Diffusion of Innovations (DOI) and Technology Acceptance Model (TAM) represent the most powerful theoretical emphasis to innovation adaptation literature, also, being extensively utilized by scholars to explore a variety of technological innovations adoption [20]. A review on IT adoption study shows that the features of innovations mostly belong to IT adoption literatures [20], [21]. Both TAM and DOI share similar premise that adopters assess innovations on the perception of their characteristics, or postulates that innovations having favorable features are likely to be more adopted [18], [19]. In addition, value-oriented aspects including perceived usefulness and relative advantage [18], [19], effort-oriented features for example perceived ease to use and complexity [18], [19], compatibility [18] are repeatedly been observed as major reasons manipulating adoption of inventions [22]. This is considered a significant theoretical contribution to previous Technology Acceptance Model (TAM) with Innovation Diffusion Theory (IDT) in the educational context [23], [24]. Therefore, the adoption of IS/IT is assessed by the two IDT and TAM which are described as alike in some constructs complementing each other. It has been reported by researchers that the TAM employed constructs are basically a subsection of perceived innovation characteristics. This means that stronger model can be created through combining these two theories [25], [26]. Looking at the existing literature, it is noticed that studies reported satisfactory results when combining both of these theories [9], [26]. Based on this background, TAM [18], [27], IDT [19], [28] and the two major theories employed in this study. The current study starts by studying the existing works on technology acceptance followed by a synthesis of the major theories and the previous related research. As the outcome of this study, a model of the key constructs of intention to use the E-learning systems and E-learning system acceptance is presented at the end of this study. Both of the diffusion of innovations theory and technology acceptance model are integrating in this research
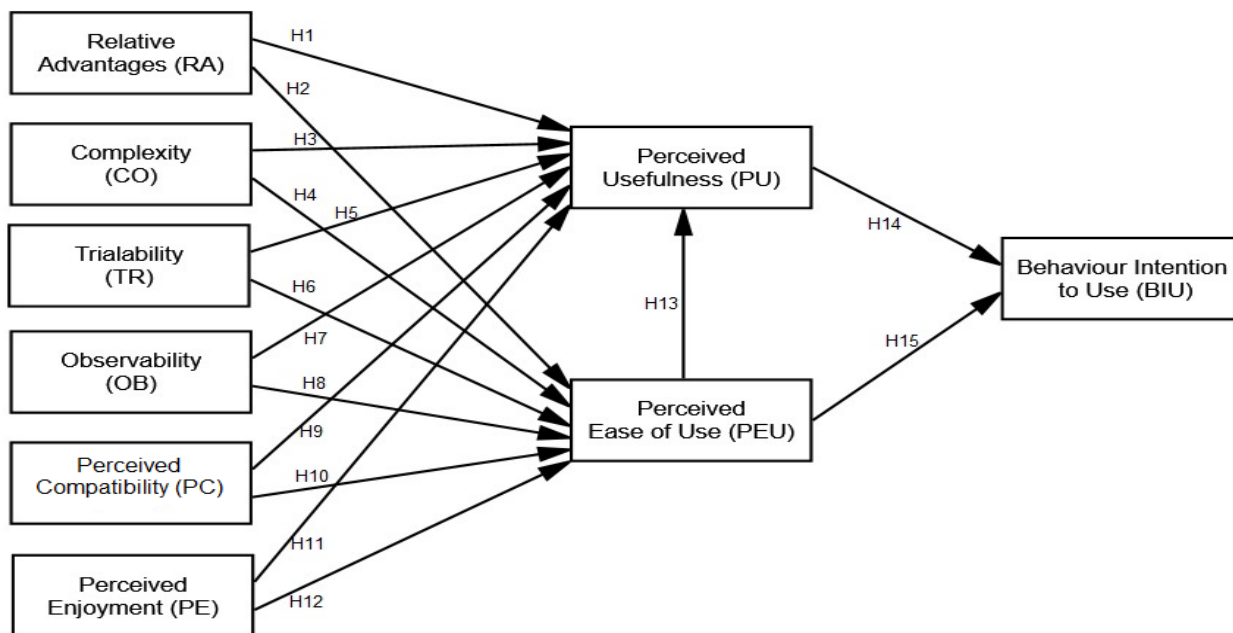
FIGURE 1. Research model and hypotheses.

to develop a model to measure Students' Intention to use E-Learning Systems. See Figure 1.

Both of the innovation diffusion theory and technology acceptance model are combined in this research for the purpose of supporting students' intention to use e-learning systems. The factors of TAM namely perceived ease of use (PEU), perceived usefulness (PU), perceived enjoyment (PE), and behavioral intention to use (BIU) e-learning system), the factors of IDT (relative advantages (RA), complexity (CO), trialability (TR), observability (OB), and perceived compatibility (PC) are examined in this study. The following sections illustrate the different research theories:

A. INNOVATION DIFFUSION THEORY (IDT)

IDT is defined as the "innovations that offer advantages, perceived compatibility with existing practices and beliefs, low complexity, potential triablity, and observability will have a more widespread and rapid rate of diffusion" [29]. Thus, a positive behavioral intention to use e-learning is expressed by the students' perceiving of E-learning as a beneficial tool, compatible with their current activities, and easy to use.

A relative advantage is defined as the level to which people assume that the new innovative is better than the old traditional one. Thus, this term is used in the current study to refer to the degree where learners believe that the use E-learning system can enhance their learning performance. The finding that intention to use the E-Learning system is positively influenced by the perceived relative advantages has been frequently reported in the related literature [9], [30]. The relationships among relative advantages, perceived ease of use, perceived usefulness and perceived enjoyment within TAM and IDT research has received little attention by researchers

and the only study done in this regard found out that students' perceived higher relative advantages means that they would perceive a higher level of usefulness of the E-Learning systems.

Complexity is defined as the level of difficulty in understanding innovations and their ease of use that is perceived by the end-user. Based on this definition, the current study uses these terms to refer to extent of difficulty viewed by the learner that affects his/her learning performance. It has been found in previous research that when the end users perceive the e-learning system as being complex, they tend to have a low intention to use the system [31]. Moreover, Hardgrave *et al.* [32] revealed that complexity has a negative relationship with the perceived usefulness. Other empirical studies such as the ones by [30] and [33]; highlighted the behavioral intention to use is negatively influenced by the complexity of E-Learning system.

Observability is defined as the level in which "the outcome of the innovation is noticeable by others". It is assumed that friends and neighbors of an adopter frequently ask him/her of a feedback. Visibility is seen as a factor that stimulates peer discussion of new ideas. Based on these points, the acceptability viewed by students of the use of E-learning system that has an impact on their learning performance defines the term trialability. The relation between the intention to use the system and trialability has been addressed in several studies [9], [30]. These studies found out that the intention to use the system is positively influenced by trialability. However, there is a lack of research in this area in terms of investigating the relation between perceived ease of use, trialability, perceived enjoyment, perceived usefulness and behavioral intentions to use the systems. The few attempts

in this regard found out that the higher trialability expressed by individuals lead to higher levels of usefulness, and ease of use of the system [9], [34].

Trialability refers to the extent to which people think that they need to experience the innovation before talking the decision of adopt it or not. The trialable innovation tends to have less uncertainty perceived by individuals who consider adopting it and those individuals tend to learn through this experience. As for the current study, this concept refers to how a student views his/her use E-learning system having a significant impact on their learning performance. It has been found by research done on different populations, through the use of methodologies, that the users' attitude towards using the system and their intentions intention to do so is highly influenced by observability [30]. Research done in the area of TAM and IDT has found out that there is a significant effect of the perceived use of the systems on the observability by the students [34], [35]. This observability has also a positive impact on other dimensions such as perceived ease of use, behavioral intention to use the e-learning system and perceived usefulness [9].

Perceived compatibility refers to the fact in which learners feel that the innovation is compatible with their standards, previous involvements and the desires of the probable adopters. Moore and Benbasat [28] were also of the same view stating that if the e-learning system goes in line with the learners' values, needs and experiences, then the level of perceived compatibility is considered to be high. This research uses this term to refer to the learners' perspectives on the benefit they can get by using the E-learning system. Previous literature regarding information systems adoption has often used Perceived compatibility as an indicator of the students' behavioral intention to use [10]. It has been found that perceived compatibility had a positive relation only with perceived usefulness as reported by [36]. Other researchers such as Wu and Wang [25] and Chang and Tung [37] reported the significant relationship between behavioral intention and perceived usefulness. The behavioral intention to use, perceived usefulness, and perceived ease of use were also strongly affected by perceived compatibility [9], [32]. The relation between similar technologies and prior experience was positively connected to the ease of use of technology innovation was reported as positive by [38].

B. TECHNOLOGY ACCEPTANCE MODEL (TAM)

Perceived enjoyment refers to how learners perceive the different activity or services to be enjoyable in them regardless of any consequences that may be predicted [39]. Thus, learners' enjoyment resulting from the use of E-learning system in a way that enriches their learning experiences is considered as perceived enjoyment in the current study.

Perceived usefulness is a term that is used to reflect the learners' opinions on whether they feel that a certain system can enhance their learning performance [18]. Behavioral

intention to use E-learning was found to the highly influenced by the factor named as perceived usefulness [4], [40], [41].

Perceived ease of use is a term referring to the learners' impression that a certain system is easy or effortless to handle [18]. In this study, this term is used to refer to the students' perspectives on the use of this system which can enhance their learning experiences and performance. Other researchers highlighted that this term is defined in terms of the efforts exerted in the use of a certain system [18], [42], [43].

Behavioral intention to use is known as the learners' choice whether to continue using the technology or not and this term is seen as a factor determining the use of a technology [44]. Thus, it is assumed, in this study, that behavioral intention to use in relation to E-learning system is able to improve the learning performance of the students. The use of E-learning system in this work is deemed important as it is an integral part for the building of technology utilization models [10], [18]. The basic principles of TRA, which consider that social media use is the function of the attitude by individual behaviors and subjective norms, are considered the origin of all of these theories and models. TRA was enhanced to include perceived control and hence TPB [45]. High levels of user satisfaction and continuance intention were found to be the most likely products of both perceived ease of use and perceived usefulness [46]. It has also been found that a high-level interaction with the system as well as a high level of behavior social media use are expressed by learners as they enjoy social media use [47].

III. RESEARCH METHODOLOGY

Two experts were consulted for the evaluated the questionnaire's content. Prior to data collection, a permit for this purpose was obtained from Universiti Teknologi Malaysia (UTM). Regarding the population and sampling, the study was conducted on undergraduate and postgraduate students who were users of E-learning system. The items in the questionnaire on Technology Acceptance Model (TAM), Innovation Diffusion Theory (IDT) were rated by students based on a 5-point Likert scale. The students, who manually received the questionnaires, were asked to fill in their details and provide their perspectives of E-learning systems and its impact on their learning performance. The Statistical Package for the Social Sciences (SPSS) was used for data analysis obtained from questionnaires. In particular, Structural Equation Modeling (SEM- Amos) was used as the main tool of data analysis. The process of using SEM- Amos was of two main stages: assessing the construct validity, the convergent validity, and the discriminant validity of the measurements; and analyzing the structural model. These two steps followed the recommendations by [48] and [49].

A. SAMPLE CHARACTERISTICS AND DATA COLLECTION

1432 questionnaires were manually distributed and only 1362 forming 94.7% of them were returned to the researchers. After excluding 26 incomplete questionnaires, 1336 were

analyzed using SPSS. Additional 50 questionnaires were excluded: 23 were of missing data and 27 were outliners. The total number of the valid questionnaire was 1286 after this exclusion. This step of exclusion is supported by Venkatesh *et al.* [44] who highlighted that this process is important to be carried out since the existence of outliers might be a reason for imprecise outcomes. In terms of the demographic details of the respondents: 612 (47.6%) were males, 674 (52.4%) were females, 93 (7.2%) were in the age range of 18-20, 203 (15.8%) were in the age range of 21-24, 468 (36.4%) were in the age range of 25-29 and 522 (40.6%) were above 30 years of age. In terms of the level of study: 166 (12.9%) were undergraduate students, level one, 157 (12.2%) respondents were undergraduate students, level two, 164 (12.8%) respondents were undergraduate students three, whereas 152 (11.8) respondents were in undergraduate students' level four, 404 (31.4%) respondents were in postgraduate students' master level, and 243 (18.9) respondents were in postgraduate students' PhD level. Regarding the demographic factors of specialization, 283 (22.0%) of the respondents from social science, 427 (33.2%) of the respondents from engineering, and 576 of the respondents from science and technology with the percentages of (44.8). Majority of the respondents 1203 (93.5%) used E-Learning system for learning, and the remaining 83 (6.5%) did not do so.

B. MEASUREMENT INSTRUMENTS

The items of the constructs were adapted to meet the purpose of ensuring content validity. The survey is mainly of three parts. The first section is on the respondents' demographic details such as age, gender, educational level. The second section consists of items assessing students' perspectives of perceived ease of use, perceived enjoyment, perceived usefulness and behavioral intention to use e-learning system in the TAM model. The second section contains 24 items adapted from the measurement by Chen *et al.* [26] and Venkatesh and Davis [43]. The third and final sections, which are designed based on IDT, includes 18 items adapted from the previous studies [18], [28], [50]. The third section includes items on relative advantages, complexity, trialability, observability and perceived compatibility.

IV. RESULT AND ANALYSIS

The result of Cronbach's Alpha reliability coefficient was 0.911 of the factors under TAM and IDT which have an influence on students' behavioral intention to use E-Learning system for the purpose of learning in the environment of higher education. The evaluation of discriminant validity (DV) was conducted through the use of three criteria namely: index among variables which should be below 0.80 [49], the AVE value of each construct that needs to be equal to or above 0.50, and square of (AVE) of each construct that has be above, in value, than the inter construct correlations (IC) connected with the factor [49].

Moreover, the crematory factor analysis (CFA) results with factor loading (FL) should be 0.70 or over while the results of Cronbach's Alpha (CA) are agreed to be ≥ 0.70 [44]. The researchers also add that composite reliability (CR) should be ≥ 0.70

A. MODEL ANALYSIS

The current study used AMOS 23 for data analysis. In particular, both structural equation modeling (SEM) and confirmatory factor analysis (CFA) were used as the major tools of analysis. Uni-dimensionality, reliability, convergent validity and discriminant validity were used to assess the measurement model. Byrne [51], Hair *et al.* [49], and Kline [52] emphasized that goodness-of-fit guidelines, like the normed chi-square, chi-square/degree of freedom, normed fit index (NFI), relative fit index (RFI), Tucker-Lewis coefficient (TLI) comparative fit index (CFI), incremental fit index (IFI), the parsimonious goodness of fit index (PGFI), the root mean square error of approximation (RMSEA) and the root mean-square residual (RMR) are all tools that can are used as the procedures to assess the model estimation. The measurement model of students' behavioral intention to use E-Learning system for learning was evaluated by the goodness-of-fit indices and illustrated in Table 1 while Figure 2 illustrates measurement technology acceptance model (TAM) and innovation diffusion theory (IDT) of students' behavioral intention to use E-Learning system for learning. See Table 1 & Figure 2.

B. MEASUREMENT MODEL

This type of validity is normally used to determine the size of the difference between a concept and its indicators with other concepts [48]. Based on the analysis in this regard, discriminant validity proved to be positive for all concepts since the values were above 0.50 (cut-off value) with $p = 0.001$ via Fornell and Larcker [54]. According to Hair *et al.* [49], correlations of items in any two given constructs should not exceed the square root of the average variance shared by them in one construct.

The resulting values of composite reliability (CR) and those of Cronbach's Alpha (CA) were around 0.70 and above while the results of the average variance extracted (AVE) were around 0.50 and above which indicates that the whole factor loadings (FL) were significant as they meet the conventions of such assessment [49], [51]. The sections below expand more on the findings on the measurement model. The results of validity and reliability as well as those of the average variance extracted (AVE), composite reliability (CR) and Cronbach's Alpha (CA) all were accepted are also illustrated establishing the discriminant validity. It is observed that all the values of (CR) are ranging between 0.837 and 0.915 which means that they are above the cut-off value of 0.70. The (CA) resulting values are also ranging between 0.841 and 0.920 exceeding the cut-off value of 0.70.

TABLE 1. Summary of goodness fit indices for the measurement model (IDT and TAM).

Type of measure	Acceptable level of fit	Values
Chi–square (χ2)	≤ 3.5 to 0 (perfect fit) and (ρ > .01)	4123.605/783
Normed Chi–square (χ2)	Value should be greater than1.0 and less than 5.0	5.266
Root-Mean Residual (RMR)	Close to 0 (perfect fit)	.035
Normed Fit Index (NFI)	Value should be equal to or greater than 0.90.	.949
Relative Fit Index (RFI)	Value should be equal to or greater than 0.90.	.948
Incremental Fit Index (IFI)	Value should be equal to or greater than 0.90.	.958
Tucker Lewis Index (TLI)	Value should be equal to or greater than 0.90.	.962
Comparative Fit Index (CFI)	Value should be equal to or greater than 0.90.	.963
Root-Mean Square Error of Approximation (RMSEA)	Value below 0.10 indicates a good fit and below 0.05 is deemed a very good fit.	.042

FIGURE 2. Measurement model (IDT and TAM).

The (AVE) are also above 0.50 ranging between 0.570 and 0.656. All of these results are positive and indicating significant (FLs) and they meet the conventional assessment guidelines [49], [54]. See Table 2.

Factors of TAM (Perceived Ease of Use (PEU), Perceived Usefulness (PU), Perceived Enjoyment (PE), and Behavioral Intention to Use (BIU) e-learning system), and examines the factors of IDT (Relative Advantages (RA),

TABLE 2. Validity and reliability for the model (IDT and TAM).

|	RA	CO	TR	OB	PC	PE	PU	PEU	BIU	CR	AVE	CA
RA	0.932									0.907	0.611	0.899
CO	0.502	0.901								0.888	0.598	0.841
TR	0.440	0.499	0.810							0.893	0.631	0.920
OB	0.390	0.482	0.437	0.890						0.837	0.656	0.885
PC	0.411	0.430	0.450	0.530	0.881					0.825	0.570	0.884
PE	0.501	0.493	0.441	0.486	0.433	0.905				0.905	0.634	0.906
PU	0.408	0.506	0.598	0.406	0.494	0.543	0.886			0.901	0.591	0.907
PEU	0.538	0.384	0.427	0.396	0.520	0.489	0.581	0.911		0.894	0.639	0.846
BIU	0.431	0.472	0.452	0.487	0.551	0.389	0.432	0.479	0.856	0.915	0.605	0.899
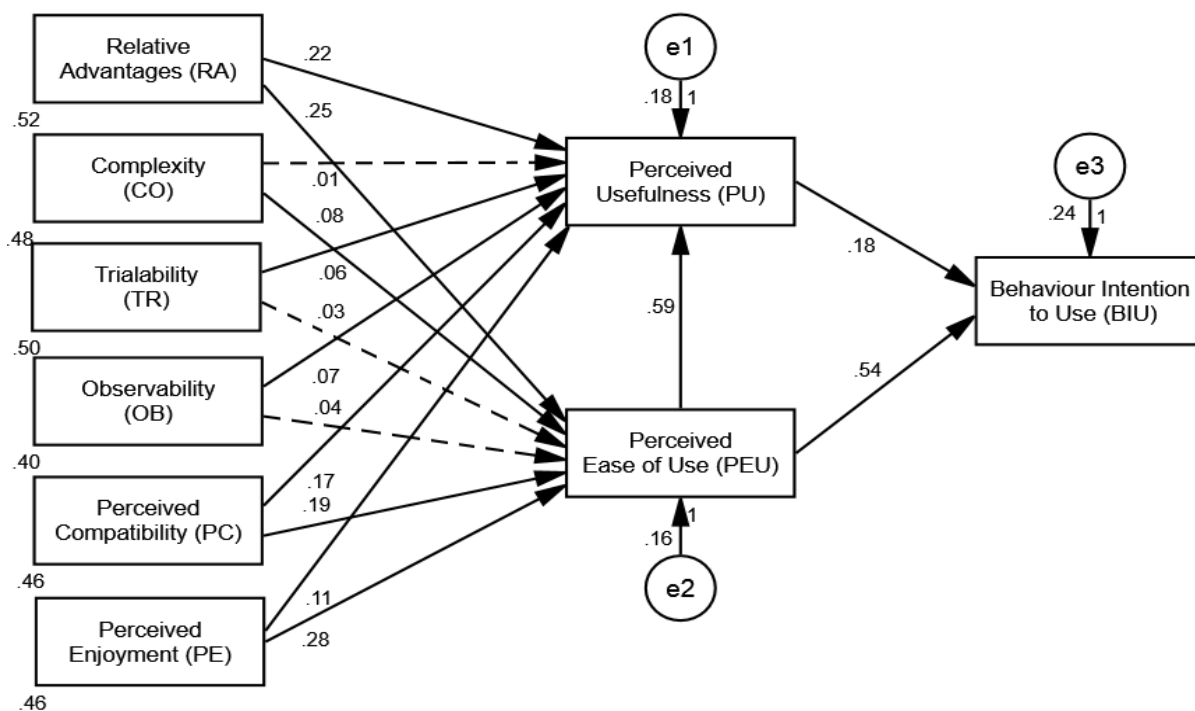
FIGURE 3. Results for the proposed model for E-Learning system.

Complexity (CO), Trialability (TR), Observability (OB), and Perceived Compatibility (PC)).

C. STRUCTURAL MODEL ANALYSIS

The path modeling analysis was used in this study to investigate the influence of students' learning within higher education through TAM and IDT factors on their behavioral intention to use E-Learning system of the different groups (male and female). Based on the E-learning system, the results are presented and compared in the discussion of hypothesis testing. Later, being the second phase, factor analysis (CFA) was carried out on the structural equation modeling (SEM) to test the proposed hypotheses as illustrated in Figure 3.

Figure 3 above illustrates that twelve hypotheses were accepted and only three were rejected based on the results

of this study. Table 3 below indicates that the main statistics of the model are good, indicating model validity and the hypotheses testing results through illustrating the values of unstandardized coefficients and standard errors of the structural model.

1) INNOVATION DIFFUSION THEORY (IDT) HYPOTHESES

The first direct ten assumptions are where the innovation diffusion theory (IDT) is addressed. According to Figure 3 and Table 3, the relationship between relative advantages and perceived usefulness has a significant with ($\beta = .112$, $t = 4.149$, $p < 0.001$) indicating that the first hypothesis (H1) proposed a positive and significant relationship. In other words, the current model shows that all students use E-Learning system advantages and its utility for learning. The next hypothesis that proposes a direct effect of relative

TABLE 3. Hypothesis testing results of structural model.

H	Independent	Relationship	Dependent	Estimate	S.E.	C.R.	P	Result
H1	RA	⟶	PU	.112	.027	4.149	.000	Supported
H2	RA	⟶	PEU	.282	.024	11.703	.000	Supported
H3	CO	⟶	PU	.014	.026	0.528	.598	Unsupported
H4	CO	⟶	PEU	.079	.025	3.219	.001	Supported
H5	TR	⟶	PU	.061	.025	2.452	.014	Supported
H6	TR	⟶	PEU	.027	.023	1.138	.225	Unsupported
H7	OB	⟶	PU	.073	.033	2.234	.025	Supported
H8	OB	⟶	PEU	.044	.031	1.438	.150	Unsupported
H9	PC	⟶	PU	.173	.029	5.863	.000	Supported
H10	PC	⟶	PEU	.187	.027	6.898	.000	Supported
H11	PE	⟶	PU	.112	.027	4.149	.000	Supported
H12	PE	⟶	PEU	.282	.024	11.703	.000	Supported
H13	PEU	⟶	PU	.593	.030	19.911	.000	Supported
H14	PU	⟶	BIU	.180	.030	5.913	.000	Supported
H15	PEU	⟶	BIU	.537	.034	15.693	.000	Supported

Note: SE: Standard Error, C.R.: Critical Ratio or t-value and P: P-value.

advantages has a significant relationship with perceived ease of use E-Learning ($\beta = .282$, t $= 11.703$, p < 0.001) indicating that the 2th hypothesis (H2) proposed a positive and significant relationship. In other words, the current model shows that all students use the system of E-Learning is advantages and its ease of use for learning.

Added to the above results, a negative relationship between complexity and perceived usefulness was indicated with ($\beta = .014$, $t = 0.528$, $p < 0.001$) signifying that the 3th hypothesis (H3) proposed a negative impact. In other words, in the current model show that all students got complexity of using E-Learning system and therefore less usefulness of E-Learning system. The next hypothesis direct effect is complexity has a positive and significant with perceived ease of use E-Learning ($\beta = .079$, $t = 3.219$, $p < 0.001$) indicating that the 4th hypothesis (H4) proposed a significant relationship, in other words, in the current model show that all students use E-Learning system is not' complexity and its ease of use for learning.

The relationship between trialability and perceived usefulness was positive and significant with ($\beta = .061$, $t = 2.452$, $p < 0.001$) indicating that the 5th hypothesis (H5) proposed a positive and significant relationship. In other words, the current model shows that all students have trial ability to use E-Learning system thus, its usefulness for learning. Nevertheless, next direct effect is a negative relationship between trialability and perceived ease of use E-Learning ($\beta = .027$, $t = 1.138$, $p < 0.001$) indicating that the 6th hypothesis (H6) proposed a negative impact. In other words, in the current model show that all students not trialability of perceived ease of use E-Learning system. Moving on to the hypothesis number seven, it proposed a significant relationship between observability and perceived usefulness ($\beta = .073$, $t = 2.234$, $p < 0.001$) indicating that the 7th hypothesis (H7) proposed a positive and significant relationship. In other

words, in the current model show that all students have observability of use E-Learning system thus, its usefulness for learning. Nonetheless, next direct effect it's a negative relationship between observability and perceived ease of use E-Learning ($\beta = .044$, $t = 1.438$, $p < 0.001$) indicating that the 8th hypothesis (H8) proposed a negative impact, In other words, in the current model show that all students haven't observability of perceived ease of use E-Learning system.

The relationship between perceived compatibility and perceived usefulness has a significant with ($\beta = .173$, $t = 5.863$, $p < 0.001$) indicating that the 9th hypothesis (H9) proposed a positive and significant relationship, In other words, in the current model show that all students compatibility of use E-Learning system and its usefulness for learning. The next hypothesis direct effect is perceived compatibility has a positive and significant with perceived ease of use E-Learning ($\beta = .187$, $t = 6.898$, $p < 0.001$) indicating that the 10th hypothesis (H10) proposed a positive and significant relationship, In other words, in the current model show that all students compatibility on E-Learning system used and its ease of use for learning. This is consistent with previous studies [4], [15], [25], [32], [35], [37], [55]–[57].

2) TECHNOLOGY ACCEPTANCE MODEL (TAM) HYPOTHESES

The second direct six assumptions are the TAM Model addressed. Based to Figure 3 and Table 3, the relationship between perceived enjoyment and perceived usefulness has a positive and significant with ($\beta = .112$, $t = 4.149$, $p < 0.001$) indicating that the 11th hypothesis (H11) is supported, In other words, in the current model show that all students enjoyment of use E-Learning system and its usefulness for learning. The next hypothesis direct effect is perceived enjoyment has a positive and significant with perceived ease of use E-Learning ($\beta = .282$, $t = 11.703$,

p < 0.001) indicating that the 12th hypothesis (H12) proposed a positive and significant relationship, In other words, in the current model show that all students enjoyment on E-Learning system used thus, its ease of use for learning.

Furthermore, the hypothesis number thirteen (H13) proposed that perceived ease of use and perceived usefulness has a significant relationship of (β = .593, *t* = 19.911, *p* < 0.001) which indicates that the 13th hypothesis is supported, In other words, in the current model show that all students perceived ease of use E-Learning system and its usefulness for learning. Similarly, next hypothesis direct effect is perceived usefulness has a positive and significant with students' behavioral intention to use E-Learning with (β = .180, *t* = 5.913, *p* < 0.001) indicating that the 14th hypothesis is supported, In other words, in the current model show that all students perceived usefulness of use E-Learning system and they have intention to use E-Learning for learning. The last hypothesis on the connection between perceived ease of use and students' behavioral intention to use E-Learning with (β = .537, *t* = 15.693, *p* < 0.001) indicating that the 15th hypothesis is supported, in other words, in the current model show that all students perceived ease of use E-Learning system and they have intention to use E-Learning for learning. In sum, the entire TAM hypotheses are supported by the results of this research, which consistent the majority of the prior studies that reported the perceived enjoyment, perceived usefulness and perceived ease of use E-Learning increases behavioral intention to E-Learning for learning which in turn increases students' academic performance [2], [4], [9], [10], [18], [30], [40], [41], [45], [58], [59].

D. DISCUSSION AND IMPLICATIONS

The development of a new hybrid technology acceptance model by combining TAM with IDT was the grand aim of this study to explore the influencing elements on the students' behavioral intentions in terms of using the e-learning systems usage in universities. This study is stepping a step forward by applying IDT into a TAM model. Through the use of the proposed model, this study investigated how the perceived usefulness, perceived enjoyment and the perceived ease of use with students' behavioral intention are linked to the five innovative characteristics. Both of the hypotheses and the research model were confirmed based on the findings. This study which examined the students' behavioral intention to use E-Learning system and the connection with their perceived enjoyment, perceived usefulness, and perceived ease of use provided many insights into the Technology Acceptance Model (TAM). The study also examined several factors namely: Innovation Diffusion Theory (IDT); relative advantages, complexity, trialability, observability, and perceived compatibility in turn affect students' behavioral intention to use E-Learning system. The current study found out that perceived usefulness and perceived ease of use are positively influenced by relative advantages, complexity, trialability,

observability, perceived enjoyment, and perceived compatibility. This finding goes in line with previous related literature. This indicates that students first check whether the e-learning systems could meet their study needs or be relevant to their study before talking the decision of using such technology. Students are noticed to perceive the e-learning systems to be more useful only after they realize that such technology is better than the traditional learning that does not involve E-Learning [9], [11], [25], [37], [60]. It is also noticed that students' intentions to use E-Learning is strongly influenced by both perceived usefulness and perceived ease of use. This can be understood through the popularity of these systems within universities.

Based on the analysis and as illustrated in tables and figures, it seems that only 3 hypotheses of all the study hypotheses were rejected. For example, the first hypothesis (H3) the relationship between complexity of E-Learning system and perceived usefulness of using E-Learning system. At the same time, Lee [30] and Hardgrave *et al.* [32] the use of E-Learning system can be negatively affected by the complexity of E-Learning system which goes against the findings of this study stating that perceived usefulness can be badly influenced by E-Learning system complexity. Regardless of the difficulty faced by students using E-Learning systems, they reported that such modern learning helped them to improve. On the other hand, students who don't consider that the use of e-learning can be fruitful for them might be of the ones who consider this technology as simple and easy to handle. Such contradicting results necessitate more research in order to explore and investigate these two factors.

As for the second hypothesis which is (H6), the results indicated that perceived ease of use of E-Learning system is negatively affected by trialability. In particular, a high level of perceived ease of use comes with a low level of trialability. This result does not go in line with some previous related studies [9], [35]. Due to all of these contradictions, this study recommends future research to be conducted to investigate the nature of such a relation. Concerning the third hypothesis (H8), the results showed that the factor named observability did not have any significant influence on the perceived ease of use leading to inconsistent results with previous related studies [9], [34], [35]. One of the reasons behind might be that while the users of e-learning can observe other learners' use of E-Learning systems and had an impression of how to operate them, they considered the E-Learning systems to be easier to use and simplifying their study learning. Thus, further rigorous follow-up studies should be conducted to investigate the precise role of observability in this case.

Perceived ease of use E-Learning systems' perceived ease of use was not affected by Observability and trialability which was in line with [4], [11], [60]. However, this result was not in line with the findings from Yang [34] and Huang [35]. Based on these contradicting results, more research is needed to explore the influence of specific such characteristics of

E-Learning systems' perceived ease of use in various contexts of E-Learning systems.

The current research suggests that information system (IS) department staff should pay more attention to the area of improving the usefulness of the system while investing on its ease of use. This can be explained by the important path coefficient of the perceived usefulness as it can speed up their readiness in arousing their intents. The study found out that perceived usefulness is positively influenced by observability and trialability and supports the hypothesis saying that perceived usefulness can be negatively influenced by complexity. These results go in line with other findings [9], [32], [34].

Bases to TAM, the students' behavioral intention to use the E-Learning systems was largely affected by perceived enjoyment, perceived ease of use and perceived usefulness. This was similar in the current study; it is believed that higher perceived usefulness lead to a higher level of behavioral intention in terms of using the systems of E-Learning. This study also proved that perceived usefulness was directly influences by the perceived ease of use. Such results are in line with Venkatesh and Davis [43] found in their study.

It was found that when E-Learning is perceived as complex and difficult by students, students tend to perceive the E-Learning systems with discomfort. This means that when students have the feeling that E-Learning system could promote their study performances, this drives them to find E-Learning systems as easy. Also, the more chances students have to try E-Learning systems make them feel that such technology is easy to use. Thus, this study suggests that E-Learning system developers should design the systems to be user-friendly and relevant to the students' study so that students have a better the perception of ease to use of E-Learning.

In short, the findings about the system characteristics suggest that the needs and values of system users should be considered by the developers, designers, and institutional purchasers of E-Learning systems to ensure that these systems effectively meet these demands. Such perceived compatibility between system features and user requirements has been found to enhance E-Learning adoption. Also, Students' behavioral intention to use E-Learning system can be influenced by other factors such as relative advantages; complexity, trialability and observability in turn affect students [8], [18], [28]. These claims are in line with recent findings for E-Learning systems [4], [15], [61], [62].

This study has a number of implications based on the model as well as the findings. The first implication is related to importance of the belief constructs. In particular, the positive relation between perceived ease of use perceived usefulness of the E-Learning system is a key issue in the prediction of E-Learning system use. When it is possible, Faculty needs to illustrate the use of the technology supplying students with instructional materials that can ease their learning of the technology taking in consideration that e-learning is perceived as both easy to use and useful. Students should be educated on the many benefits of using the technology and they should be

provided with the content of the course or attain other goals in relation to learning. Learners who believe that the E-Learning system would help them learn expressed a greater intent to use the E-Learning system.

Students' behavioral intention to use E-Learning system was supported by the findings of the current research. The findings indicated that students' behavioral intention to use E-Learning system for learning are largely influenced by a number of factors such as perceived enjoyment, perceived usefulness and perceived ease of use E-Learning system which in turn increases students' behavioral intention to use E-Learning system for learning. Similarly, students' behavioral intention to use E-Learning system is also positively influenced by advantages, complexity, trialability, observability, and perceived compatibility. The study also confirmed the findings on students' behavioral intention to use E-Learning system for learning and that it speeds their learning performance in higher education.

Although this study is considered important in area of e-learning, it has some limitations. One of the limitations is related to the sample size which makes it hard for the research findings to be generalized to additional areas such as private armies, universities, or school educators. Additional limitation revolves around the type of data. In particular, the current did not include qualitative data looking and soliciting the perspectives of teachers and students. Thus, other studies are strongly recommended to be conducted in dissimilar cultures and take these limitations into consider.

Three empirical pieces of evidence were provided in this study. These evidence were empirical evidence of E-Learning through the perceived ease of use perceived usefulness; empirical evidence of students' behavioral intention to use E-Learning system through perceived enjoyment, perceived usefulness and perceived ease of use E-Learning system that can improve students' academic performance in higher education; and empirical evidence of perceived usefulness and perceived ease of use E-Learning system through relative advantages, complexity, trialability, observability, and perceived compatibility that can affect students' behavioral intention to use E-Learning system. This is considered a significant theoretical contribution to previous Technology Acceptance Model (TAM) with Innovation Diffusion Theory (IDT) in the educational context [4], [9], [18], [30], [62]. Three implications based on the result of this research are presented below:

- Students' performance in higher education can be enhanced by utilizing E-Learning system for learning. Moreover, lecturers and supervisors carry the responsibility of helping the students in this regard by attending to their questions and be effective in sharing knowledge. Such role by the teachers can enhance the students' learning performance develop their research skills.
- Students who are able to use E-Learning system should be attracted and encouraged but not forced by Educational institutions to learn such courses. Through this encouragement, all the components and tools of using

E-Learning system can be combined for the purpose of enhancing students' learning performance.

- As for the behavioral intention to use E-Learning, Technology and resource are key issues that need to be taken into consideration. This implies that students should seize the opportunity of having a plenty of technological resources due to the fact that this can positively influence their learning performance.

V. CONCLUSION AND FUTURE WORK

In the current study, Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT) were validated in the educational context providing more insights into the students' potential perceptions about the use of E-Learning systems. The input that this study might have to the area of E-Learning acceptance was stated and discussed. More insights into users' acceptance and adoption of E-Learning systems were provided in this study through the results obtained in this respect. The study highlights that the integration of both TAM and IDT can positively influence the outcome of the study. The study found that several stakeholders such as system designers, developers, and institutional customers of E-Learning systems sensibly take into consideration the needs of the students and ensure that the particular systems efficiently meet their demands. The users' adoption of E-Learning systems can be largely determined by the five advanced features with e-learning systems. This study recommends more research to be conducted investigating the relationships between the complexity of E-Learning system and perceived usefulness. Follow-up studies are also need to explore the exact roles played by observability and trialability in E-learning especially they were reported as of an insignificant impact on the perceived ease of using E-Learning.

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WALEED MUGAHED AL-RAHMI received the Ph.D. degree from the Faculty of Computing and Information Systems, Universiti Teknologi Malaysia (UTM). He has eight years of teaching experience at the Department of Computer Science, Hodeidah University. He was a Teaching Assistant with the Faculty of Computing, UTM, for 2.5 years. He holds a Postdoctoral position with the Faculty of Information and Communication Technology, International Islamic University Malaysia, and with the Faculty of Science, UTM. He holds a Postdoctoral position with the Faculty of Education, UTM. His research interests include information system management, information technology management, human–computer interaction, implementation process, technology acceptance model, communication and constructivism theories, impact of social media networks, collaborative learning, e-learning, knowledge management, massive open online courses, and statistical data analysis (IBM SPSS, AMOS, NVIVO, and SmartPLS). He received the Best Student Award for excellent academic achievement in conjunction with the 56nd Convocation Ceremony, UTM, in 2016.

NORAFFANDY YAHAYA received the Ph.D. degree in computer-based learning from the University of Leeds, U.K. He was the Head of the Department of Educational Science, Mathematics and Creative Multimedia for nine years. He has been an Associate Professor with the Faculty of Education, Universiti Teknologi Malaysia, since 2013. He has conducted studies on students' interaction in online learning environment, learning analytics, and massive open online courses. He has published more than 70 papers in journals and conferences proceedings in the research areas of online learning, ICT in education, and the use of technology in teaching and learning. He has been a Supervisor for more than 25 completed master's degree students and seven completed Ph.D. students in the areas of educational technology, online learning, and ICT in education. He had been appointed as an external examiner for universities in Malaysia and Australia for doctoral theses and an assessor for master's dissertation for university in New Zealand. His research interests include multimedia in education, online learning, and ICT in education.

AHMED A. ALDRAIWEESH was the Head of the Educational Technology Department, College of Education, for two years. He is currently an Associate Professor with the Educational Technology Department, College of Education, King Saud University, Saudi Arabia. He is also the Vice Dean of scientific research for development and quality. His research interests include educational technology, e-learning, educational technology for special education, and educational computing.

MAHDI M. ALAMRI received the bachelor's degree in special education-gifted and talented students' education and the master's degree in education technology from King Saud University, Saudi Arabia, in 2001 and 2005, respectively, and the Ph.D. degree in education technology from LaTrobe University, Australia, in 2014. He is currently an Assistant Professor with the Educational Technology Department and the Vice Dean of the Scientific Research Deanship, King Faisal University, Alahsa, Saudi Arabia. His research interests include blended learning, online learning, flipped classroom, social media networks, thinking development skills, problem-based learning, and special education programs.

NADA ALI ALJARBOA received the bachelor's degree in mathematics from the Education College, Taif University, Saudi Arabia, in 2004, and the master's degree in education psychology from Jordan University, Jordan, in 2006. She is currently pursuing the Ph.D. degree with the Psychology Department, Umm Al-Qura University, Makkah, Saudi Arabia. She is also a Lecturer with the Psychology Department, Education College, Taif University. Her research interests include generations conflict, school bullying, and mathematical abilities.

UTHMAN ALTURKI received the Ph.D. degree from Kansas State University, in 2004. He was a full-time Consultant for three years at the National Center for E-learning and Distance Learning. He was the Head of the Computer Department at a teachers' college for two years. He was the Dean and the Deputy Dean for four years in the Ministry of Education. He is currently a Full Professor with the Educational Technology Department, College of Education, King Saud University, Saudi Arabia. The relationship between the performance and the perceived benefits of using an electronic performance support system. Innovations in Education and Teaching International, 41, 343–364. His research interests include learning technology, e-learning and distance learning, massive open online courses and cloud computing, evaluating the design and use of new technology, and learning analytics.

ABDULMAJEED A. ALJERAIWI was the Vice Dean for Academic Affairs for five years. He was the Head of the Educational Technology Department at a teachers' college for two years. He is currently an Assistant Professor with the Self-Development Skills Department, Deanship of Common First Year, King Saud University, Saudi Arabia. He is also the Dean of Common First Year. His research interests include educational technology, e-learning, and educational computing.

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