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## Measuring the Effect of E-Learning Information Quality on Student's Satisfaction Using the Technology Acceptance Model

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**Abstract**—This study analyses a blended e-learning system's information resources. Their quality is assessed based on learners' perceptions using a modified version of the Technology Acceptance Model (TAM). To enable flexible learning and enhance understanding during the COVID-19 epidemic, most Iraqi universities have lately embraced Google Classroom and Moodle in addition to face-to-face (F2F) courses. Based on TAM, individual differences and perspectives were investigated concerning correlations between student satisfaction and technology adoption. There were 270 undergraduate students in the research sample who were enrolled in academic courses at Middle Technical University's (MTU) /Technical College of Management (TCM). A survey was used for data collection. The research was done after developing the model's essential and external variables and selecting their components. Partial least squares structural equation modelling (PLS-SEM) examined path-connected dependent and independent components. The study's results showed how "E-Learning Information Quality" (EIQ) positively impacted students' adoption of e-learning. That is demonstrated by the internal variables' positive correlation, which includes perceived usefulness (PU) and perceived ease of use (PEOU), which can be seen in H1 and H2 by the values of ( $\beta = 0.204$ ,  $\beta = 0.715$ ), and which both positively influence attitudes toward use (ATU), which can be seen in H5 were value ( $\beta = 0.643$ ), and behavioral intention (BIU), which can be seen in H4 was value ( $\beta = 0.300$ ). Therefore, e-Learning information sources must have value and meaning for students. However, more research is required to evaluate the system's quality. Furthermore, the acceptability of e-learning may change as pedagogies change.

**Keywords** — TAM; e-learning; structural equation modeling; PLS-SEM.

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### I. INTRODUCTION

The subject of how to use modern information and communication technology for learning objectives is significant in educational institutions (such as high schools, universities, etc.) and the workplace. In its broadest definition, e-learning refers to any learning made possible by technology. Many believe online learning has considerably improved teaching and learning [1], [2]. The use of technology in educational settings to improve academic performance is referred to as "e-learning." [3].

Physical classrooms are, therefore, still the norm, regardless of their size, location, or time constraints [4]. However, to get beyond the issues mentioned above and profit from online learning, blended learning has become increasingly popular as a compromise between traditional and digital approaches. It is "the intentional mixing of face-to-face classroom learning experiences with online learning activities" [5], [6]. Online, blended learning has been

observed to maximize the advantages of traditional learning methods with online learning materials [7].

The Republic of Iraq is the subject of this study's attention, focusing on the local situation and advancing our general knowledge of students' attitudes toward e-learning tools. Even while e-learning has advantages, especially in unusual circumstances, its success mainly rests on the acceptance and willingness of the students [8], [9]. In 1999, the Technical College of Management (MTU) was founded. It delivers courses and supports to students by utilizing online course management systems like Moodle and Google Classroom to enhance educational outcomes in a globalized and dynamic educational environment. The definition of these platforms is "an intranet-based e-learning environment that enables professors and students to participate in the design of education" [10]. As a result, the professors could administer and offer their courses in various methods so that students could access them at any time and from any location, proving that e-learning is a widely used method [11]–[13].

However, little empirical research has examined students' attitudes toward using e-learning information sources through platforms. E-learning has received much attention to enhance traditional teaching methods at universities. Analyzing students' attitudes toward e-learning is essential to the performance and development of higher education institutions since they view students as their primary focus. To complete the academic year 2020–2021 for higher education institutions, Iraq was one of the nations that turned to online learning amid the Corona pandemic. However, due to its status as a developing country, Iraq lacks an e-learning infrastructure [14], [15].

As a result, empirical research is required in this paper to investigate the extent to which TAM variables and other external factors increase or lessen students' relationships with these e-learning sources in Iraqi institutions. This study aims to create a comprehensive model that connects the TAM model's aspects and the external factor in measuring students' satisfaction and retention when using e-learning information quality through the platforms. Our model, in particular, aims to understand the nature of interactions between the e-learning information quality external components (EIQ). They also included TAM components as independent variables, including perceived usefulness (PU) and perceived ease of use (PEOU). Adopting e-learning and staying on it for a long time in Iraq is the main focus. However, to get the most out of e-learning, we must secure the quality of information between students and teachers to improve university education.

In this paper, several studies have examined the impact of e-learning and blended learning on higher education. In addition, several researchers have looked at how students behave when using an e-learning platform using the technology acceptance model (TAM) [16], [17]; the TAM Theory explains how learners accept and use new technologies. TAM asserts that two things influence customers' decisions to employ new technology when they encounter it—Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) [18]. Most research has also been assessed and reviewed using the smart PLS Software [19].

As integrated e-learning is increasingly used in the educational system, one study analyzed the alternatives proposed as answers to the most significant barriers to achieving excellence in educational institutions. The study suggested e-cooperative education and said that obstacles to e-learning included a lack of an electronic environment and inadequate equipment [20].

To improve students' levels by giving them high-quality electronic courses, other researchers focus on setting standards for the quality of service provided by Egyptian Universities through online courses [21]. Studies on the function of e-learning in improving educational quality in India's higher education institutions have indicated that the suggested technique is effective. Given the country's expanding population and limited resources, e-learning is a strategy to expand education in India. According to research, e-learning is most effective when students are interested in and introduced to new technology [22]. Considering the available study findings, the Technology Acceptance Model and external variables measure students' intentions regarding online learning. The moderator of the model is Task Technology Fit. Though accuracy and self-efficacy were less

significant, students loved e-learning [23]. The other study's results showed that (Perceived Ease of Use) plays a clear role in accepting e-learning and positively affects the acceptance rate (Perceived Usefulness), confirming that an information system can easily meet students' needs and convenience will be helpful for the student [24]. Since students frequently require a hassle-free educational system, it was discovered that (Perceived Ease of Use) impacts student satisfaction [25]. In Korea's elementary schools, the researcher found that (Perceived Ease of Use) had no discernible effect on (Behavioral Intention to Use) [26]. Investigations showed that perceived usefulness and perceived ease of use had an equal impact on this result (Behavioral Intention to Use). Perceived usefulness (PU) and perceived ease of use (PEOU) are two essential elements of the behavioral intention to use (BIU) technology [27]–[29]. Using the TPB and TAM models as a foundation. In one of the studies, researchers looked at factors of online learning satisfaction such as perceived usefulness, convenience of use, behavioral attitude, and behavioral intention. They were using the TAM paradigm. The findings revealed that perceived usability is higher than expected (Perceived usefulness). This could be due to how students need to understand the concept of usefulness correctly [30]. University students from four campuses in Greater Jakarta, Indonesia, participated in this study by answering a standardized questionnaire. Using SEM LISREL, they assessed their objectives and performance as well as the usability, usefulness, and satisfaction of the e-learning process. Perceived ease of use (PEOU) and service quality improved e-learning satisfaction [31]. Using the Technology Acceptance Model, the willingness of university students in Indonesia to adopt e-learning was investigated (TAM). The system's quality and the atmosphere for online learning were considered external factors. Data analysis was done using SEM and SMART PLS 3.0. The information demonstrated that the proposed model adequately captured how university students used e-learning during the epidemic [32].

Since numerous research have effectively expanded the application of TAM in e-learning technologies, the primary goal of this study is to assess the factors influencing acceptance (EIQ) using the TAM model by undergrad students in the Technical College of Management (TCM).

## II. MATERIALS AND METHOD

### A. The technology acceptance model (TAM)

Users' perceptions of an information system and how well it meets their requirements determine how well it is accepted by users [33]. This model was chosen to assess a range of applications and systems in hundreds of tests, and it has subsequently grown in popularity as a model for determining user acceptance and usage. For example, the TAM model has significantly increased the use and acceptance of e-learning [34] due to its success in identifying and foreseeing the aspects impacting a user's adoption behavior toward new technologies [35]. User acceptance is essential for system improvement.

Different information system (IS) theories and models have been created to examine how new technologies are received. Davis's technology acceptance model (TAM) is one of the hypotheses that have surfaced to explain why users embrace

information systems [36]. Established and based on his work on the theory of reasoned action (TRA), which was presented through numerous studies [37]–[39]. The Technology Acceptance Model (TAM) is a reliable theory that explains and predicts information system users' behavior. As a result, it has come out on top among models that aim to explain the

success and failure of information systems. [40]–[42]. The TRA maintains that a person's desire to act in a specific way, impacted by their attitude toward the activity and the subjective standards, determines their behavior. Fig. 1 below shows the display of TRA.

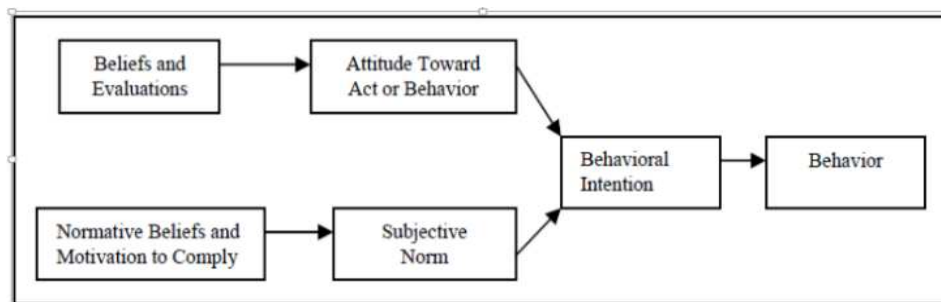


Fig. 1 Theory of reasoned action

David built his measurements on two factors that he viewed as critical determinants of user acceptance of the technology, perceived benefit (PU) and perceived ease of use (PEOU). The perceived usefulness factor (PU) measures how strongly a person thinks using a given technological system would enhance and improve their performance at work. The ease-of-use factor (PEOU) gauges a person's perception of how simple and adaptive utilizing a certain technology is,

providing no effort or difficulty is required. Later, David added two additional components to the model: Behavioral Variables, which are the attitude factor and the desire to use technology. Moreover, the attitude toward using (ATU) factor relates to how the person feels and behaves when using technology, whereas the behavioral intention to use (BIU) factor shows how likely the person is to use technology in the future [43].

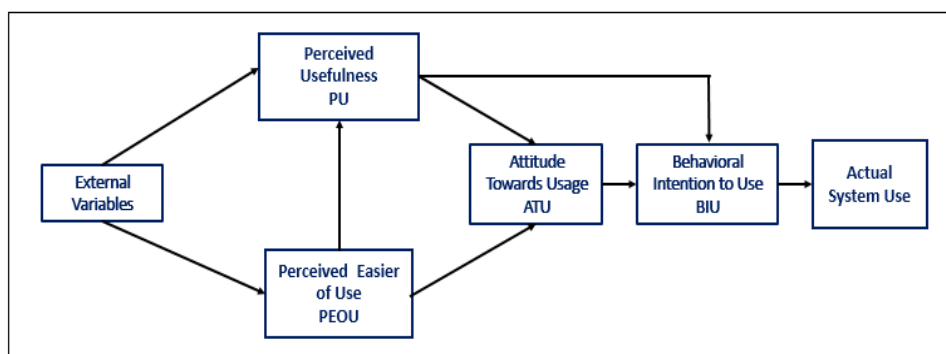


Fig. 2 The original version of TAM [44].

### B. Research Framework and Development Hypothesis

Fig. 3 shows the research framework and hypotheses development. Depicts the research methodology employed in

the study, which was applied to students who worked with e-learning information to learn about their effectiveness and degree of use.

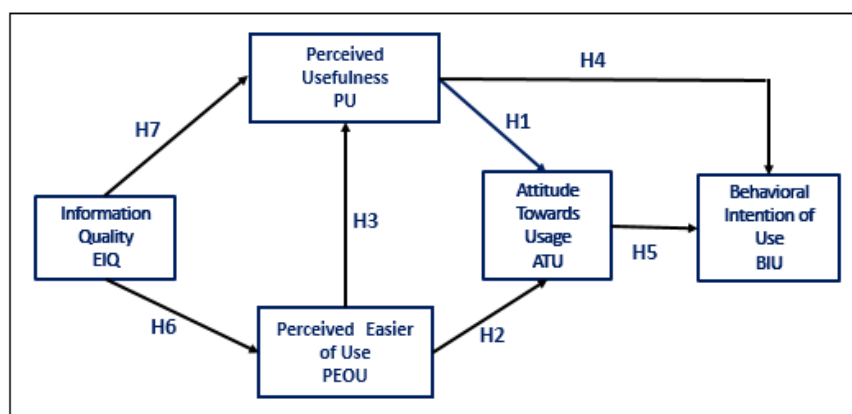


Fig. 3 Conceptual Model of Research

### C. Research Hypotheses

The researcher developed the following hypothesis under Fig. 3, as shown in Table 1.

TABLE I  
FUNDAMENTAL HYPOTHESES

Hypotheses	Content
H1	Perceived usefulness has a significant effect on attitude towards e-learning Information quality.
H2	Perceived ease of use significantly affects attitude towards e-learning Information quality.
H3	Perceived ease of use significantly affects the perceived usefulness of e-learning information quality.
H4	Perceived usefulness significantly affects behavioral intention to use towards e-learning Information quality.
H5	Attitude towards using significantly affects behavioral intention to use towards e-learning Information quality.
H6	e-learning Information quality has a significant effect on Perceived ease of use
H7	e-learning Information quality has a significant effect on Perceived usefulness

TAM did not cover general information, service, or quality, even though these significantly impacted user behavior [45]. As a result, external components were included, specifically (EIQ), the quality of the information provided to students during e-learning through the educational platform to enhance the model's capacity to develop the student's abilities when utilizing the platform, as represented by In H6 & H7.

### D. Measurement

Using previous studies as a guide, the core data for this study were gathered via a questionnaire the researcher had designed. The questionnaire consists of five main parts. The first measures Perceived Usefulness (PU) by asking students to answer six statements that include answers about (PU), and the second part measures Perceived Ease of Use (PEOU), including their conceptual assessment of (PEOU) by answering six statements. The third part measures Attitude towards Using (ATU) students' use of e-learning by asking students and determining the degree of their agreement with four statements about Attitude. The fourth part measures Behavioral International Use (BIU) and consists of four statements about students' behaviors towards e-learning. Finally, the fifth part measures E-learning Information Quality (EIQ), consisting of eight statements about the quality of information that were added as external factors. The researcher used a five-point Likert scale which ranged from (1=strongly disagree to 5=strongly agree) [46]. Table 1 shows the variables used to measure research.

TABLE II  
THE SCALE USED TO MEASURE THE RESEARCH VARIABLES.

Variable	code	Item
Perceived Usefulness (PU)	PU1	e-Learning is efficient
	PU2	e-Learning helps compatibility with a mobile screen reader
	PU3	e-Learning helps to improve the quality of assignments
	PU4	e-Learning doesn't require a lot of mental effort
	PU5	e-Learning helps to communicate information quickly
	PU6	e-Learning helps to have great control over the study
Perceived Ease of Use (PEOU)	PEOU1	e-Learning is easy to study the scheduled control
	PEOU2	e-Learning is easy to understand different concepts
	PEOU3	e-Learning is easy to learn individually
	PEOU4	e-Learning is easy to learn collectively
	PEOU5	e-Learning is easy to save time and effort
	PEOU6	e-Learning is easy to develop creative thinking
Attitude towards Using (ATU)	ATU1	I frequently use an online learning system.
	ATU2	I think deep learning is possible with the use of e-learning.
	ATU3	I think using online learning fulfils all cognitive needs.
	ATU4	In the near future, I'll probably adopt an e-learning system.
Behavioral International Use (BIU)	BIU1	I use e-Learning continuously
	BIU2	I use e-Learning comfortably in transfer information
	BIU3	I use e-Learning in university for education
	BIU4	I use e-Learning in a flexible manner at any time any where
	BIU5	I use e-Learning in more quickly to answer
E-Learning Information Quality (EIQ)	EIQ1	e-Learning provides content with individual differences
	EIQ2	e-Learning provides content that enriches students' knowledge
	EIQ3	e-Learning provides accurate and up-to-date content
	EIQ4	e-Learning provides content that is easy to access and browse
	EIQ5	e-Learning provides multimedia-supported content
	EIQ6	e-Learning provides interconnected content between new and previous information
	EIQ7	e-Learning provides content with a sequence of scientific material
	EIQ8	e-Learning provides content with individual differences

Depending on the number of items in each subscale, as illustrated in the depiction using the software application Smart PLS 3.0 in Fig. 4

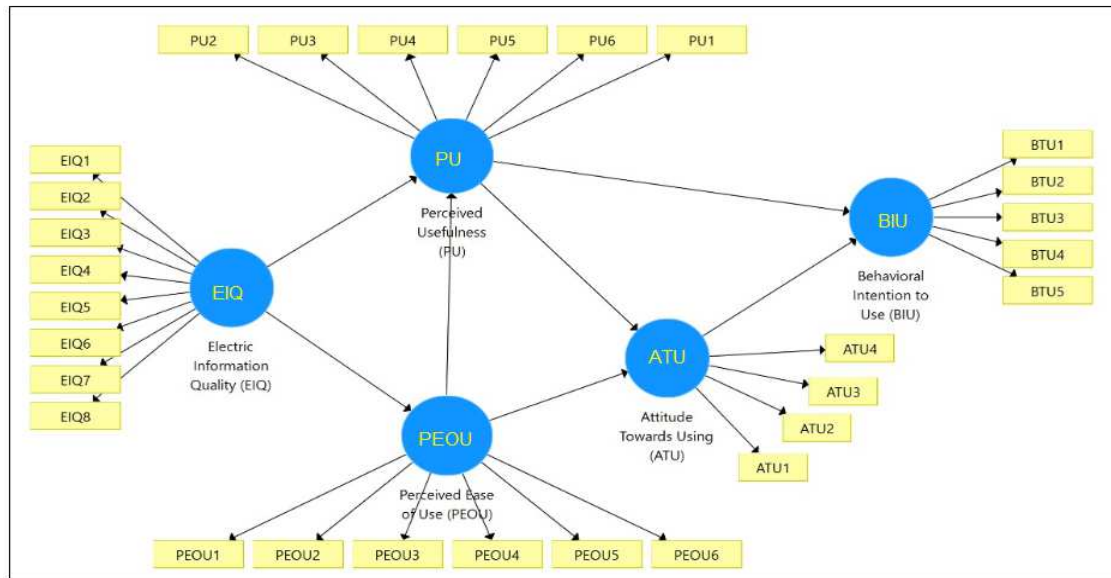


Fig. 4 The structural equations model & item distribution

### III. RESULTS AND DISCUSSION

#### A. Research Samples

This study mainly employed descriptive research methodology. The study was conducted after constructing the essential and external variables for the model and choosing the components for each variable; official research was carried out through online and direct survey questionnaires. Students from the banking and finance departments and the information technology departments participated in a survey at the Middle Technical University's Technical College of Management-Baghdad. To assess the application of (TAM) on the quality of e-learning information sources through platforms, the first computer subject application course for undergraduate students was given during the academic year 2020–2021. The total number of participants was 450 prediction questionnaires, of which 270 were administered via random selection. In addition, participants were asked to complete a Google Form questionnaire, rating each item on a five-point Likert-type scale for agreement or disagreement. The survey's scale items were modified from Davis [30].

TABLE III  
DEMOGRAPHIC INFORMATION

Item	Values	Frequency	Percentage
Gender	Female	153	56.7%
	Male	117	43.3%
Age	20 years	136	50.4%
	20-30 year	115	42.6%
Department	Above 30 years	19	7.00%
	Department of Banking and Finance	108	40%
	Department of Information Technology	162	60%
<b>Total</b>		<b>270</b>	<b>100%</b>

#### B. Measurement Model Assessment

The most common modelling and analytical technique, partial least squares (PLS), was used to evaluate the data [47].

To validate the indicator's properties and state their relationships, we undertake an outer loading assessment while measuring the reliability scales for the model assessment [48]. These are the standard values: Cronbach's Alpha:  $> 0.6$ , Outer Loadings  $> 0.7$ , Composite Reliability (CR):  $\geq 0.7$ , and Average variance extracted (AVE):  $\geq 0.5$ .

TABLE IV  
CONSTRUCT RELIABILITY AND VALIDITY

Item Indicators	Item Loading-Weights	Composite Reliability (CR)	Cronbach Alpha	AVE
Perceived Usefulness				
PU1	0.788	0.952	0.932	0.65
PU2	0.730			
PU3	0.790			
PU4	0.702			
PU5	0.865			
PU6	0.853			
Perceived Easier of Use				
PEOU1	0.871	0.940	0.920	0.723
PEOU2	0.849			
PEOU3	0.813			
PEOU4	0.894			
PEOU5	0.746			
PEOU6	0.811			
Attitude Towards Usage				
ATU1	0.900	0.953	0.944	0.831
ATU2	0.919			
ATU3	0.899			
ATU4	0.908			
Behavioral Internal Use				
BIU1	0.887	0.940	0.923	0.758
BIU2	0.751			
BIU3	0.877			
BIU4	0.901			
BIU5	0.848			
E-Learning Information Quality				
EIQ1	0.872	0.917	0.891	0.719
EIQ2	0.760			
EIQ3	0.849			
EIQ4	0.797			
EIQ5	0.889			
EIQ6	0.809			
EIQ7	0.816			
EIQ8	0.798			



Table 4 shows all elements satisfied, according to the reliability analysis findings. For example, AVE values are between 0.6- 0.8; rho\_A is 0.9; Cronbach's Alpha is between 0.8-0.9; CR is 0.9. Therefore, all potential variables satisfy conditions and are above the acceptable rate [49],[50].

### C. Structural Model Assessment

To investigate whether TAM can serve as a theoretical basis for evaluating students' views toward the quality of e-Learning information sources provided via an e-learning platform, a structural equations model was used to analyze path coefficients and examine causal relationships and the impact of external variables on the essential variables as shown in Fig. 5 and Table 5.

TABLE V  
ANALYSIS OF THE STRUCTURAL MODEL AND TESTING OF THE HYPOTHESIS

Hypothesis	Proposed Relation Ship	Path Coefficient ( $\beta$ )	T-Statistic ( $\beta$ /STDEV)	P-Value	Significant
H1	PU $\rightarrow$ ATU	0.204	0.079	0.011	Supported
H2	PEOU $\rightarrow$ ATU	0.715	0.071	0.000	Supported
H3	PEOU $\rightarrow$ PU	0.556	0.081	0.000	Supported
H4	PU $\rightarrow$ BIU	0.300	0.059	0.000	Supported
H5	ATU $\rightarrow$ BIU	0.643	0.059	0.000	Supported
H6	EQ $\rightarrow$ PEOU	0.876	0.017	0.000	Supported
H7	EQ $\rightarrow$ PU	0.347	0.082	0.000	Supported

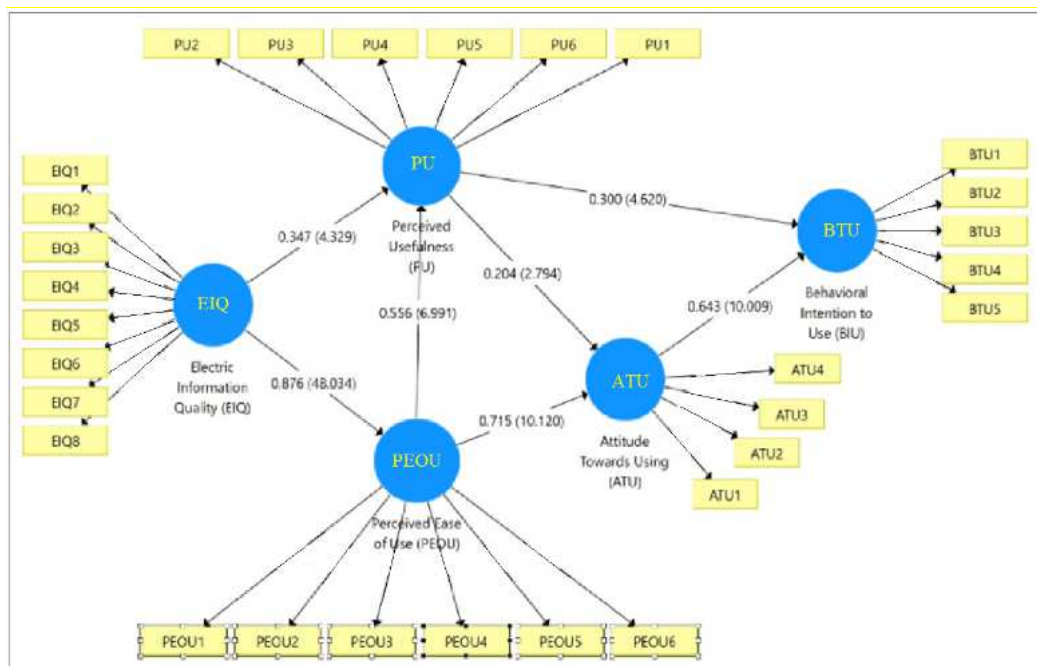


Fig. 5 Model Resulting from Research

Present the evaluations of the model and the results obtained by running the bootstrapping algorithm using PLS by formulating (7) hypotheses to evaluate the model. From the results presented, all the hypotheses were accepted. Table 5 shows that all the hypotheses were supported and fell within the acceptable range.

To explore the relationship between the previous variables of the behavioral attitude to online learning, interest, ease of use, and behavioral intention, as well as the relationship between behavioral attitude, usefulness, ease of use, and satisfaction with the quality of the information in e-learning. Finally, the model's degree of fit and the hypothesis test's acceptability is tested through path analysis.

According to (H1, H2), it is clear that perceived usefulness and perceived ease of use have a positive impact on students' attitudes about adopting e-learning, as demonstrated by the values of ( $\beta = 0.204$ ,  $\beta = 0.715$ ), respectively, where ( $p < 0.05$ ). The results of (H1, H2) may be attributed to the student's abilities to deal with the e-Learning platform. Their possession of such skills results from several factors, including the applied training that the study sample received and their possession of particular skills, like the ability to use

computers and mobile phones, which enables them to deal with technology and various information systems effectively.

About (H3), the findings show that students believe that perceived ease of use positively influences perceived usefulness, with testing values at ( $\beta = 0.556$ ,  $p < 0.05$ ). As well as the hypotheses (H4, H5), the testing values in H4 were at ( $\beta = 0.300$ ,  $p < 0.05$ ). Since e-learning makes it easy to transfer information resources, students' perspective on their propensity to use it is evident. Testing values for hypothesis (H5) were ( $\beta = 0.643$ ,  $p < 0.05$ ). This result makes sense since users are more likely to use an information system that easily satisfies their demands, increasing their behavioral intention to use the system.

Furthermore, the results also show that the e-learning information resources (EQ) positively affect hypotheses H6 and H7. The test results were ( $\beta = 0.876$ ;  $P < 0.05$ ) and ( $\beta = 0.347$ ;  $P < 0.05$ ). Students may have learned that e-learning information sources are easily accessible when the research sample was utilized in computer-based practical training. As a result, the (PEOU) was high compared to the perceived usefulness (PU) of using e-learning information sources to

enhance performance improvement, as is seen according to the Path Coefficient ( $\beta$ ) values.

#### IV. CONCLUSION

The study concludes that the quality of e-learning information sources provided by the Middle Technical University in the Administrative Technical College via e-learning courses to promote the level of students and that can be seen clearly in H6 & H7 when the value of ( $\beta=0.876$ ;  $P<0.05$ ) and ( $\beta=0.347$ ;  $P<0.05$ ) indicate with what they need from high-quality e-learning courses via the Internet is part of their educational experience. The model's results were positive. Students turn to e-learning as a supplement and alternative educational paradigm during crises. Despite its limitations, e-learning offers beneficial features that can improve education. The quality of e-learning information sources available through the educational platform might increase students' coursework and educational experiences. According to the research, the suggested method for evaluating e-learning information quality was successful.

The study found a relationship between (PEOU & PU) and behavioral intention to use. The foundational variables (PEOU & PU) and extrinsic factors (EIQ) determine behavioral intention to use that can be seen clearly in H1 & H2 when the value of ( $\beta=0.715$ ;  $P<0.05$ ) and ( $\beta=0.204$ ;  $P<0.05$ ). The simplicity of the usage of e-learning may explain this. That can be seen clearly in the (PEOU) Perceived ease of use was high compared to the perceived usefulness (PU) of using e-learning information sources to enhance performance improvement, as is seen according to the Path Coefficient ( $\beta$ ) values. So, the Perceived ease of use promotes student output.

Therefore, these results support the technology acceptance model as a framework for understanding students' e-learning behavior intentions. Can be seen clearly in H5 when the value of ( $\beta=0.643$ ;  $P<0.05$ ). It is considered a high value compared to the rest of the Path Coefficient ( $\beta$ ) values. The most crucial advantage of e-learning is its ability to be used in crises. Therefore, students must see the value and significance of the information sources used in e-learning. However, more research is required to evaluate the system's quality. Furthermore, the acceptability of e-learning may change as pedagogies change.

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