

Students' Satisfaction of E-Learning using Decision Support Systems (DSS)



Waleed Mugahed Al-Rahmi, Alhuseen Omar Alsayed, Nabil Hasan Al-kumaim, Hussein Abualrejal, Yousef Fazea, Qusay Al-Maatouk

Abstract: recently, a rapidly increasing type of education that is mostly adopted by higher education in developed countries is known as E-learning. The aim of the research was to evaluating students' satisfaction of e-Learning. In the current research, both the theory of technology acceptance model (TAM) and the method of employed structural equation modelling (SEM) with Smart PLS were used to examine the process of students' adoption. It has been found that the learning satisfaction was positively influenced by the perceived ease of use (PEOU), perceived usefulness (PU) and intention to use (IU) as witnessed among university students. Significant and positive perceptions towards e-learning and intend to practice it by university students in Malaysia have been observed by this research.

Index Terms: E-learning, students' satisfaction, TAM, SEM, Decision Support Systems

I. INTRODUCTION

Online learning that is also known as e-learning relies on tuitions and trainings that are based on technology. Through the use of this learning technique, students are involved in a variety of activities within a virtual environment. Example of that can be search and audiovisual interactions that involve a number of different subjects. The use of e-learning also ensures an excellent level of interaction between students and teachers. Through the identification of the major changes in the usage of this type of learning, it is expected that accessing these e-learning virtual courses can be made easy for educational and higher educational institutions [1].

Nowadays, universities worldwide are utilizing E-learning in the education. One of the famous definition of e-learning was by [2] who referred to this term as the type of leaning that involves the use of internet or intranet. Other researchers, such as [3], gave more general definition to this terms. The researcher states that that this term in online learning and teaching [4].The meaning of the 'e' in e-learning, as stated by [5], should not be restricted on electronic. According to the researcher, the letter refers to other meanings such as evolving, everywhere, every time, enhanced and everybody. The researcher also highlighted that both teachers and learners benefit a lot from e-learning. This term of e-learning is not new and it has received much research and explanations. However, the area of motivation in terms of e-learning has received little attention by research in this field. Using new multimedia technologies such as internet to enhance accessing the various resources, facilitating remote exchange and collaboration is known as e-learning [6, 7]. The area of evaluating individuals' satisfaction with the use e-learning has been studies thoroughly in literature and a number of theoretical models have been proposed in this regard [8, 9]. However, it is noticed that there is a lack of the models that explain and evaluate its usefulness. Moreover, the influence of e-learning on learning satisfaction within Malaysian higher education has received little attention by researchers [10]. Seven universities forming 26.9%, based on the results by institutions of higher learning, reported that the lack of facilities for this type of education is one of the major challenges. It was also reported by three institutions forming 11.5% that one of the essential challenges was that the carelessness by top managements in terms of supporting this type of education [11, 12]. Although, the use of this type of education is integrated in many universities, still using online learning within Malaysian educational setting has not received enough attention [7, 10].

II. THE RESEARCH MODEL AND HYPOTHESES

This research looked at the adaptive e-learning using decision support systems and how they can be influenced by PEOU & PU representing the two main tested TAM variables in this research. The purpose of exploring the relation between Decision support satisfaction and these two TAM variables was to have more insights on the findings of previous research in relation iE- learning use. Concerning the prediction of user acceptance and usage behavior in the area of Information System (IS), research has proved that TAM was one of the most effective models in this regard.

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It is also noticed that the relation between ease of use or perceived usefulness and system characteristics as antecedents has received little attention [13]. The literature on technology acceptance, based on the recommendations by Venkatesh et al. [14], should include system and information characteristics. In particular, the influence of these characteristics on core beliefs in TAM and how they indirectly shape the use of system should be highlighted and researched. Unlike the original model by Davis, this TAM, which is a revised model has added some casual explanatory power leading to the dropping of using construct. The same dropping issue was also used with the Variables construct as the impact of external variables is not examined by the revised TAM. One of the major roles played by the TAM is that it detects the influence of outside variables on attitudes, intentions, internal beliefs usage [15]. It is observed, when looking at both the TAM and the existing literature in the field of Diffusion Theory Rogers, that there are a large number of beliefs in charge of the prediction of adoption [16]. Some concepts in both of TAM and the model by Rogers are found to be equivalent. For example, perceived usefulness in the former is similar to the relative advantage of the other and ease of use in the former is equivalent to complexity in the latter. As for identifying the acceptance or the usage of innovation, perceived innovation attributes are considered the right choice in this regard. The purpose of this paper is to simplify the model proposed (See Figure 1). Basically, this model was proposed for the main aim of measuring learning satisfaction by looking at the intention to use e-learning among university student in Malaysia higher education in relation to TAM. This paper found out that learning satisfaction (LS) can be enhanced by the relation between PU and PEOU in one side and the IU of e-learning on the other side. The following hypotheses are proposed based on the discussion above.

H1: There is a positive impact between PU and IU e-learning.

H2: There is a positive impact between PEOU and IU e-learning.

H3: There is a positive impact between PU and PEOU.

H4: There is a positive impact between IU e-learning and LS.

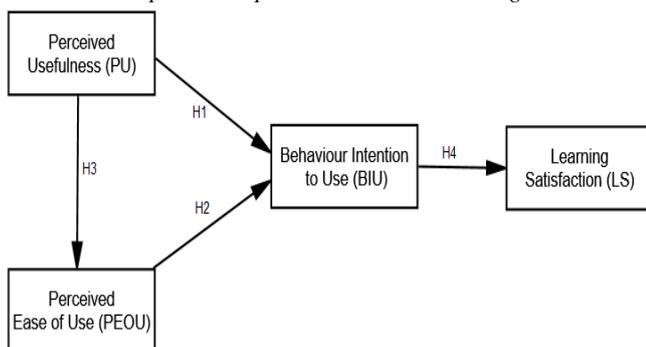


Fig. 1. Model of Research

A. PU & PEOU

Based on the assumptions by TAM, the process of conscious decision-making is the origin of behavioral intention [14]. These belief factors, which are salient, are identified by this models in relation to information technology usage and acceptance. These factors are PEU & PU. The former is known as "the degree to which a person believes that using a particular system would enhance his or her performance" while the latter refers to "the degree to which a person believes that using a particular system would be free

of effort". These two factors can be called and are known as cognitive factors. According to TAM Feelings either good or bad which affect a person's performance of a certain behavior is known as the attitude towards usage [16]. It has been found that there is a good connection among the factors of innovation and its adoption Tornatzky and Klein [17]. It was also found that the complexity of innovation is a major predictor, among the three examined factors, of the level of innovation acceptance. Furthermore, it was also found out that users use systems that are easy for them to use rather than the ones useful to them. As for the system benefits in case of complicated systems, they were found to be fewer than the challenges that system has. There is a relation between the items used in measuring the PEU, rigidity and flexibility of online learning and effort needed to learn and using [18].

B. Behaviour Intention to Use

The tendency of individuals to perform a specific behavior is known as behavior intention to use (BIU) [19]. It also refers to the person's intention to carry out an action. This term can be used as a predictor of Corresponding behaviors that lead people to voluntarily do action. It is assumed, since the intent is to identify the motivating factors which influence behavior; those factors determine the reluctance of individuals in trying, the effort they plan to put in in order to be involved in IU of online learning [15]. The user's caution of his actual behavior of using new information technology can be the aim of using a new information technology [20]. It was also observed that both PU and PEOU have a considerable influence on the intent of TAM. The staff attitudes towards using a certain system is determined by those terms. Eventually, the intention to use a certain system that leads to the use of that system can be decided when these attitudes are integrated with PU. It was found in [14] that the behavioral intentions can be influenced by PEOU and PU through "direct" and "indirect" ways. Moreover, it was revealed that the intention is influenced directly only by the construct known as PU Chen et al. [21]. Despite the fact that the beliefs of the use intentions are mainly predicted by PU and PEOU, It was also concluded by [22] that the influence of the usefulness of use on intention varies depending on the situation where the system is used. Two factors namely the use and the usefulness are found to have a considerable influence on the use of technology [23]. Thus, this research is guided by a certain a research model and a number associated hypotheses. As concluded by researchers in the field of technology use here in Malaysia, the adoption and the use of a certain technology is known to be highly predicted by PEOU and PU.

C. Learning Satisfaction

Both the communication and strategies attached to the enhancement of e-learning have been the main concern of many studies conducted in this area [25]. UTM was the stage of some studies in this regard. For example, the impact of e-learning on students was studied by Razak [25] while the Technology Acceptance Model (TAM) related to e-learning was examined and investigated by [26]. By looking at the studies in this area, it can be observed that the satisfaction of the student was not discussed in details.



Thus, this research is attempting to provide an ample explanation of the concept of students' satisfaction when it comes to e-learning in a university setting also to examine other models [8,9].

III. RESEARCH MYTHOLOGY

While carrying on this research, questionnaires were distributed among 226 students during 2017/2018 semester in order to gather the necessary data for this research. The student, through the different questions in the questionnaires, were required to provide information regarding the use of e-learning based on their experiences. A quantitative method (positivism paradigm) is followed in this research with the participants being students researching at University Technology Malaysia. This made it possible to verify the different concluded hypotheses empirically. The sample of this research comprised of 106 male respondents and 120 female students who answered the questionnaire based on their experiences related to the use of e-learning.

A. Respondents

The current research used a random sampling technique in which students from both undergraduate and post-graduate University Technology were asked to answer the questionnaire. IBM SPSS Version 21 and Smart PLS package 3.0 were used as the main tools of examination to analyze the data obtained from these questionnaires. Details on the examination and information on the different factors created based on the need of this research are illustrated and mentioned in the sections below. After carrying out the initial examination, it was found out that the reliability and validity of this research was acceptable as the results of the Cronbach's alpha was found to be 0.935. In order to simplify our questionnaire to the participants of this research, it was divided into five sections.

B. Data Collection Procedures

The different items of the questionnaire were rated by the participants using 5 Likert scale with the value of 1 that means strongly disagree and the value of 5 that means strongly agree. In order to finalize the final draft of the questionnaire, a pilot research was conducted as to solicit the students lived experienced concerning the use of e-learning and its impact in their learning satisfaction. After being reviewed and revised, the final draft of the questionnaire, which was finalized by the end of 2017/ 2018 semester, comprised of 23 items and was distributed among the students. The items of the questionnaire mainly measured two sets of items namely: perceived ease of use, perceived usefulness and intention to use e-learning which were measured using eighteen items adopted from Davis [15] while another five items which were adopted from [10, 27] were used to measure learning satisfaction. (See Table 1).

Table 1: Construct Measurement

Factors	Items	Measure
Perceived Ease of Use (PEU)	PEU 1	I found e-learning easy to use
	PEU 2	Learning to use e-learning would be easy for me
	PEU 3	My interaction with e-learning was clear and understandable
	PEU 4	It would be easy for me to find information at e-learning
Perceived Usefulness (PU)	PU 1	Using e-learning would enhance my effectiveness in learning
	PU 2	Using e-learning would improve my course performance
	PU 3	Using e-learning would increase my productivity in my course work
	PU 4	I found e-learning useful
	PU 5	Using e-learning improves the quality of our work
	PU 6	Using e-learning supports critical aspects of our work
Intention to Use (IU)	IU 1	I intend to use e-learning during the semester
	IU 2	I will return to e-learning often
	IU 3	I intend to visit e-learning frequently for my course work
	IU 4	I think that using e-learning is a good idea
	IU 5	I intend to fully integrate our work with e-learning
	IU 6	I intend to recommend the use of e-learning to learning
Learning Satisfaction (LS)	LS 1	I agree that the personalized services provided by the e-learning system satisfy my requirements
	LS 2	I am satisfied with the quality of the e-learning system
	LS 3	I am satisfied with the difficulty level of e-learning content, activities and tests
	LS 4	I am satisfied with the recommended adaptive e-learning path
	LS 5	The e-learning system is effective for gathering knowledge

IV. RESULTS AND DISCUSSION

Based on the data collected from the questionnaire concerning the demographic data of the participants, 106 of the respondents were males forming (46.9%) while the remaining 120 were females forming (53.1%). Moreover, three groups were identified to describe the ages of the participants. 53 of the participants forming (23.5%) were among 18 and 20 while 68 of them were between 21 and 24. With a percentage of 40.7%, 92 respondents were between the ages of 25 and 29 while 5.8% of them were above 30. third, the level of education 136 respondents (60.2%) undergraduate students and 90 respondents (39.8%) postgraduate students.



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Finally, specialization 86 respondents (38.1%) from social science, 92 respondents (40.7 %) from engineering, and 48 respondents (21.2%) from science and technology. One the main tools of examination used in this research was that Structural Equation Modeling (SEM) which was used mainly in two steps. First, it was used to measure the construct validity, convergent validity, discriminant validity. The second step was to examine the structural model. The use of Structural Equation Modeling (SEM) was recommended was by Hair et al. [28].

A. Construct Validity of the Measurements

The appropriate evaluation of a certain concept through the use of certain items generated for this purpose is called Construct validity [28]. The loading on the items' respective construct should be higher than it is on the other constructs. This criterion had been strongly supported and thoroughly verified by the existing literature in this field. Items were appropriately allocated to their constructs. Looking at the loading of these items, it was found out that they follow the criteria mentioned above and their loading are higher and accepted.

Table 1 below illustrates and proves that the items have significant loads on their respective constructs [28]. See Table 2.

Table 2: Loading and Cross-Loadings of the Items

No	Variables	Code	IU	LS	PEU	PU
1	Intention to Use (IU)	IBU1	0.777	0.522	0.587	0.500
2		IBU2	0.817	0.411	0.423	0.541
3		IBU3	0.822	0.426	0.533	0.496
4		IBU4	0.870	0.554	0.524	0.485
5		IBU5	0.815	0.609	0.571	0.505
6		IBU6	0.888	0.588	0.543	0.405
7	Learning Satisfaction (LS)	LS1	0.654	0.902	0.552	0.508
8		LS2	0.344	0.834	0.588	0.544
9		LS3	0.549	0.798	0.498	0.531
10		LS4	0.534	0.829	0.508	0.457
11		LS5	0.462	0.807	0.543	0.421
12	Perceived Ease of Use (PEOU)	PEOU1	0.439	0.543	0.813	0.542
13		PEOU2	0.547	0.430	0.866	0.432
14		PEOU3	0.560	0.543	0.837	0.341
15		PEOU4	0.430	0.490	0.890	0.402
16		PEOU5	0.467	0.345	0.873	0.432
17		PEOU6	0.306	0.444	0.798	0.432
18	Perceived Usefulness (PU)	PU1	0.537	0.495	0.572	0.830
19		PU2	0.571	0.501	0.505	0.899
20		PU3	0.498	0.547	0.430	0.828
21		PU4	0.568	0.505	0.423	0.880
22		PU5	0.501	0.560	0.560	0.808
23		PU6	0.468	0.449	0.542	0.832

B. Convergent Validity of the Measurements

As observed in the second table, the values of the composite reliability are ranging between 0.887 to 0.970. This indicates that they are above the approved value of 0.7. In addition, the results of Cronbach's Alpha came satisfactory as they were above of 0.7 being the approved value. As for the results on

the average variance extracted (AVE), its resulting values were above of 0.5 indicating a satisfactory result. It can be also observed that the numbers concerning factor loadings were satisfactory as they all exceeded 0.5. These results were above the acceptable recommendations stated in the literature [28, 30]. Table 3 and Figure 2 below illustrate the results of CFA in relation to the measurement model.

Table 3: Convergent Validity

No	Factors	Factor Loading	Composite Reliability	AVE	Cronbach's Alpha	R Square
1	Intention to Use (IU)	0.777	0.911	0.600	0.909	0.507
2		0.817				
3		0.822				
4		0.870				
5		0.815				
6		0.888				
7	Learning Satisfaction (LS)	0.902	0.970	0.607	0.913	0.656
8		0.834				
9		0.798				
10		0.829				
11		0.807				
12	Perceived Ease of Use (PEOU)	0.813	0.887	0.616	0.832	0.000
13		0.866				
14		0.837				
15		0.890				
16		0.873				
17		0.798				
18	Perceived Usefulness (PU)	0.830	0.910	0.633	0.917	0.587
19		0.899				
20		0.828				
21		0.880				
22		0.808				
23		0.832				

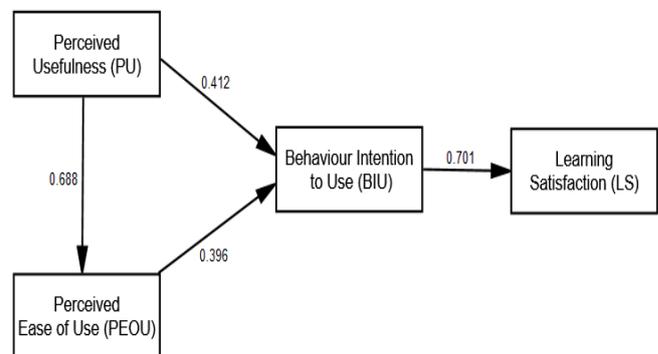


Fig 2: Path coefficient results

Four hypotheses are proposed and tested in this research. The first hypothesis was verified and supported as there was a important relationship among PU and IU e-learning ($\beta=0.412$, $t=4.902$, $p<0.001$). Similarly, the second hypothesis was supported as there we a positive and a strong relationship between PU and PEOU as the results came as ($\beta=0.688$, $t=37.092$, $p<0.001$). Concerning the relation between PU and PEOU, it was also positive and strong providing a strong support to the third hypothesis as ($\beta=0.688$, $t=37.092$, $p<0.001$). The relation between the IU e-learning and LS was also positive as ($\beta=0.701$, $t=38.832$, $p<0.001$). This provides a strong support to the fourth hypothesis. In this research, certain factors namely PEOU, PU and IU e-learning among university students were carefully studies for the relationship among them.

The research also investigated the impact of these relations on the students' LS at university. This research is expected to add more insights on these factors which were also discussed in the previous related literature [7, 10, 31]. It has been approved that the completion of various tasks including research by students has been positively influenced by of E-learning which also proved to be a helpful tool of evaluating their academic achievement. Other issues such as online learning, social media, and massive open open courses, support and help students for learning, also discussed in various studies on the use of online learning in higher education [12, 32].

The results disagree in showing the different characteristics of learners achievements based on whether they are current learners or new learners during the year the online learning platform was implemented. The results show dissimilar factors in learners achievements based on whether they are current or new learners achievements during the year the online learning platform was implemented. This means that the learners' achievements of both new and current learners during the year online learning was implemented was consistent with the previous years without the online learning. Nevertheless, during the formative evaluating, it is clear that the establishment of online learning could have had a positive impact on learners achievements. This does not comply with Bhuasiri et al.'s [33] whose assertion was that ill-prepared students didn't make use of the online learning whereas PU is considered one of the key indicators of IU online learning. Previous studies supports the IU online learning is positively influenced as users find out that e-learning is PEOU & PU [6, 7, 10]. Moreover, it would be advisable to view how this content was proposed to the students [12] and the importance of updating the content for student use. E-learning, social media, and Massive open online courses (MOOCs) users are said to be more likely to have access to the huge store of learning progresses, and this is typically in line with the satisfied of their field of education [34, 35, 36, 37].

V. CONCLUSION AND FUTURE WORK

The current research is on the satisfaction of e-learning used via university students. This research contains four hypotheses; all of them are substantiated and supported. There is a important relationship among the factors proposed in the hypotheses, which includes LS, PEOU, PU and IU online learning between students at universities. Online learning allows students to contribute to the sharing of knowledge and communicating with their peers' and instructors. It is recommended by this research that research in future shed more light on the different factors that assist in the e-learning development. In addition, other issues such as the impact of learners achievements on the individual's IU online learning should be tackled in future research. An example for these aspects might be the impact of self-efficacy on the support of online learning.

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