The Influence of Computer Self-efficacy and Subjective Norms on the Students' Use of Learning Management Systems at King Abdulaziz University

Sami S. Binyamin, Malcolm J. Rutter, and Sally Smith

***Abstract*—Technology acceptance model (TAM) has been a standout amongst the most well-known models in understanding the users' acceptance of technologies. This study develops a model to predict the factors that influence the use of learning management systems (LMS) among higher educational students in Saudi Arabia by applying the TAM model and two psychological determinants: computer self-efficacy and subjective norms. The Partial Least Squares Structural Equation Modeling (PLS-SEM) technique was employed to examine the proposed model. The findings confirm the TAM model within the context of Saudi Arabia. Further, the students' perceived ease of use is positively influenced by computer self-efficacy, while the students' perceived usefulness is positively affected by subjective norm. As scholars have overlooked using TAM to assess LMS in the context of Saudi Arabia, the study may give a guide to future work to adopt additional factors that impact the students' utilization of LMS.**

***Index Terms*—Computer self-efficacy, e-learning system, learning management system, subjective norms, technology acceptance model.**

I. Introduction

Advances in information and communication technologies (ICT) have provided higher educational institutions with the opportunity to adopt many technologies in order to enhance the efficiency of learning [1]. The field of education in academic and learning settings in Saudi Arabia has been influenced by this advancement [2]. E-learning is one of the results of this development and cannot be delivered without the use of technologies. Learning management systems (LMS) have been the most popular technology for facilitating e-learning [3] and are considered the most commonly used technology in the field of education [4]. This is thanks to the accessibility and flexibility of ICT [5].

LMS have been extensively adopted in educational institutions internationally [6]. In the context of Saudi Arabia, the majority of Saudi higher educational institutions (87%) have adopted LMS where Blackboard is the dominant system [7]. However, the utilization of LMS in Saudi Arabia is minimal [5], [8]. This study aims to explore the acceptance and actual use of LMS within the context of Saudi Arabia. As many studies have concluded that Saudi students use e-learning systems ineffectively [9], it is necessary to identify the factors that have an influence on the usage of LMS from the students' perception. The original TAM model is not useful in explaining social influence [10]; therefore, it was extended in this study, and two external variables were adopted and examined: subjective norms and computer self-efficacy. Further, the majority of LMS studies in Saudi Arabia investigated functions of LMS, technical usability and users' attitude toward the system [8]. Little research has been conducted to understand the relationship between Saudi students' LMS utilization and external factors. Moreover, most studies focus on the teachers' perspective rather than the students' [1]. Alharbi and Drew in [8] asserted that scholars have overlooked using TAM to assess LMS in the context of Saudi Arabia. Therefore, it is not surprising that TAM has rarely been employed to assess Saudi students' acceptance of LMS.

The structure of this paper is organized as follows: First, the technology acceptance model is briefly described, and the conceptual model is presented. After explaining the research methodology, the data analysis is described. The study findings are presented, followed by the discussion and conclusion section.

II. Technology Acceptance Model

Many models have been utilized to investigate the acceptance and use of technologies. Technology acceptance model (TAM) has been a standout amongst the most well-known models in understanding the users' acceptance of technologies and used extensively in many studies [1], [8], [11]-[14]. According to Google Scholar, the model [15] has been cited more than 36,000 times. In 1989, TAM was developed by Fred Davis to introduce a theoretical framework based on the theory of reasoned actions (TRA) [15]. TAM explains the relationship between users and technologies to estimate the user's acceptance of the technology [16]. Most acceptance models have failed to combine the psychological and technical constructs into one theory; however, TAM is one of the theories that combines variables from both aspects [16].

The original TAM is composed of 5 constructs (see Figure 1). According to the TAM model, the acceptance of new technologies can be measured by assessing 4 determinants: perceived ease of use (PEOU), perceived usefulness (PU), attitude towards use (ATU) and behavioral intention to use

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(BIU). PEOU can be defined as the extent to which someone believes that utilizing LMS would be with minimal cognitive effort, and PU can be defined as the extent to which someone believes that utilizing LMS would improve his or her performance [15]. Fig. 1 shows that actual system use (AU) is directly influenced by BIU, which in turn is affected by both ATU and PU. ATU is directly influenced by PU and PEOU. PEOU defines PU directly, and both PEOU and PU are influenced by external factors.

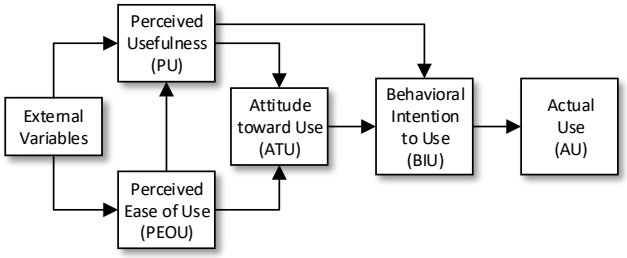

Fig. 1. Technology acceptance model (TAM) [17].

III. Conceptual Framework

Based on the original TAM model and previous literature, 2 factors (computer self-efficacy and subjective norms) were employed to investigate the students' acceptance and use of LMS. Fig. 2 depicts the proposed research model. In this section, a brief description of the variables is provided, research hypotheses are listed, and the proposed research model is introduced.

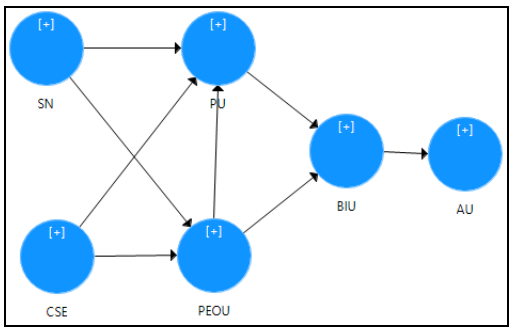

Fig. 2. Proposed research model.

Based on the original TAM model, 4 hypotheses were proposed to assess the students' acceptance and usage of LMS at King Abdulaziz University (KAU).

- H_1: PEOU positively influences PU.
- H_2: PEOU positively influences BIU.
- H_3: PU positively influences BIU.
- H_4: BIU positively influences AU.

A. Computer Self-efficacy

The first most widely employed variable to extend TAM in the field of e-learning is computer self-efficacy (CSE) [18]. This factor was introduced as a determinant of PEOU by Venkatesh and Davis in 1996 [16]. CSE measures a person's estimation of his or her ability to use computer technologies [19]. Therefore, if an individual feels that he or she has a high ability to use computer technologies, he or she is more likely to use the system. For the purpose of this study, CSE is meant to be the students' belief regarding their ability to use the LMS provided by their institution.

CSE has been adopted extensively into TAM-related studies in the field of e-learning, and the findings are inconsistent [20]. Abdullah and Ward in [18] conducted a quantitative meta-analysis of 107 studies in e-learning adoption and concluded that 17 out of 27 (63%) studies found a positive influence between CSE and PU and 33 out of 41 (80%) studies found a positive influence between CSE and PEOU. In the studies [21]-[23] of developing countries (as the case of Saudi Arabia), it was found that CSE influences PEOU of e-learning and does not affect PU. It was found that CSE of Jordanian students is correlated with PEOU [24]. In [25], it was concluded that CSE does not influence PU of e-learning systems. In Saudi Arabia, CSE has been said to affect the students' PEOU and PU of e-learning systems based on TAM [26]. The TAM3 model [27] and Venkatesh's model [28] tested the effect of CSE and postulated that CSE influences PEOU. Based on TAM3, [29] demonstrated this postulation in Saudi Arabia.

The relationships between CSE and TAM's constructs are depicted in Fig. 2. The authors assume that students with high CSE are more likely to use LMS. To test the influence of CSE on the students' use of LMS, the following hypotheses were proposed.

- H_5: CSE positively influences PEOU.
- H_6: CSE positively influences PU.

B. Subjective Norm

The second most widely employed variable to extend TAM in the field of e-learning is subjective norm (SN) [18]. Scholars use the terms social influence and subjective norm interchangeably [20]. This factor indicates the degree to which individuals feel that others think they should or should not perform a particular behavior [30]. In this study, if a student feels that people important to him or her believe that he or she should use an LMS, he or she is more likely to use the system. It is reasonable that subjective norm affects the usage of technologies in developing countries [31]. Various models tested the effect of SN, such as TRA [32], TPB [33], TAM2 [30], TAM3 [27] and UTAUT [34]. Comparing to the other models, one of the limitations in TAM is the lack of success to take a proper care of social influence factors that affect individuals' behavioral intention and actual use of the system under investigation [35]. Therefore, SN was adopted as an external factor into TAM.

The influence of SN on the constructs of TAM in e-learning has been studied in the literature, and the findings are contradictory [20]. It was concluded that 19 out of 22 (86%) researches indicated a positive influence between SN and PU and 4 out of 6 (67%) researches indicated a positive influence between SN and PEOU [18]. The influence of SN on PU of e-learning was demonstrated in [21], which contradicts with the results of [22]. In [36], it was concluded that SN affects PU of e-learning systems and does not affect PEOU. In Jordan, it was found that SN is correlated with PU [24]. TAM2 model [30] and TAM3 model [27] tested the effect of SN and postulated that SN influences PU. Based on TAM3, [29] demonstrated this postulation in Saudi Arabia.

The relationships between SN and TAM's constructs are depicted in Fig. 2. The authors assume that students with high SN are more likely to use LMS. To test the influence of SN

on the students' use of LMS, the following hypotheses were proposed.

- H_7: SN positively influences PEOU.
- H_8: SN positively influences PU.

IV. Methodology

This section describes the method used for data collection. The development of the instrument used, participants' profiles and the study sample are discussed in this section. The data analysis is described at the end of the section.

A. Data Collection

As TAM is quantitative in nature, the decision was made to use online survey for data collection [21]. Althobaiti and Mayhew asserted that surveys are suitable for the evaluation of LMS [37]. As Google Docs service is free of charge, mobile-friendly and easy to use and provides a variety of questions, it was used for collecting data from the participants. The users of learning management systems, studying at KAU in different colleges and levels of education were the target of this study. Due to the appropriateness in terms of resources and wide usage in technology acceptance research [20], the non-probability convenience sampling technique was used. The online survey was available for 3 weeks, and the link to the survey was sent by email to the participants. However, the majority of students did not show willingness to fill in the survey and only 31 responses were received. Consequently, the decision was made to distribute the survey manually. Eventually, 150 surveys were received, and 142 surveys were employed for the data analysis stage.

B. Instrumentation

The survey used for this study consists of 2 sections. The first one includes the students' profiles or demographic information and includes 6 items: age, gender, prior experience with LMS, education level, field of study and GPA (grade point average). The second section addresses the original TAM constructs and the external variables (see appendix). The 29 items can be answered using a 7-point Likert scale, where 1 indicates that students strongly disagree with the statements and 7 indicates that students strongly agree with the statements [8], [13], [14], [16], [21]. The constructs consist of PEOU (5 statements), PU (5 statements), BIU (5 statements), AU (4 statements), CSE (5 statements) and SN (5 statements). To ensure the reliability and validity, the 29 items were adopted mainly from previous literature [8], [15], [21], [36], [38]. Further, all the instruments were closed questions [14], [38].

At the first stage, the survey was developed in English and reviewed by 2 native English speakers to ensure that it is free of wording problems. Then, the English version of the survey was translated to Arabic by a bilingual speaker since Arabic is the native language in Saudi Arabia. As the back-translation method was used in [8], the Arabic version was reviewed by 2 bilingual speakers. Further, it is worth mentioning that the word LMS was replaced with Blackboard since Blackboard is the LMS in use there.

C. Data Analysis

After the completion of the data collection stage, the collected data were entered into SPSS Statistics 23.0 for descriptive statistical tests. In an earlier paper [1], the data set was used and analyzed using the regression analysis statistical technique. In this study, the Partial Least Squares Structural Equation Modeling (PLS-SEM) technique was employed to examine the proposed research model [39] using SmartPLS software version 3.2.7 [40]. Even though regression analysis has been used for simple modeling, it is not able to examine unobserved variables, indirect effects and complex models [41]. Therefore, PLS-SEM is more suitable for complex and causal modeling [42]. PLS-SEM requires the examination of the indicators' reliability, the constructs' reliability, the convergent validity, the discriminant validity and hypothesis testing [43], given in the next section.

V. Findings

In this section, the findings of the research are tabulated. The results are composed of demographic information, descriptive statistics, the reliability and validity results and the hypothesis testing.

A. Demographic Information

The students' profiles are summarized in Table I. 123 students (86.6%) are male, and 19 students (13.4%) are female. The majority of the students (66.9%) are within the range of 21 and 25 years old. All students have at least 1 year of experience with LMS. Regarding the education level, the majority of the participants are students with a bachelor's degree (73.2%). The study includes students from different disciplines and fields.

TABLE I: Participants' Demographic Information

Characteristics	Groups	N	%
Gender	Male students	123	86.6
	Female students	19	13.4
Age	< 21	28	19.7
	21 - 25	95	66.9
	26 - 30	11	7.7
	> 30	8	5.6
Experience with LMS	< 1 year	70	49.3
	1 - 2 years	48	33.8
	> 2 years	24	16.9
Education Level	Diploma	19	13.4
	Bachelor	104	73.2
	Master	16	11.3
	PhD	3	2.1
Field of Study	Medical Science	21	14.8
	Applied Science	48	33.8
	Natural Science	22	15.5
	Humanities and Social Sciences	51	35.9
GPA	0 – 2.99	16	11.3
	3 – 3.99	66	46.5
	4 - 5	60	42.3

B. Descriptive Statistics

Table II summarizes the means and standard deviation values of the students' responses for the 29 items. All the mean values are above 4.73, which demonstrate that the LMS is perceived positively among students. Among the two external variables, students rated computer self-efficacy as the most influential factor on LMS usage followed by

subjective norm. However, perceived ease of use was the highest among the original constructs of TAM. The standard deviation values are within the range of 1.14 and 1.52, which indicate that the data is very close to the mean.

C. The Reliability Test

The reliability was examined in terms of indicators' reliability and constructs' reliability as recommended by [43]. The indicators' reliability is acceptable when the loadings are greater than 0.7, while the constructs' reliability is acceptable when the values of Cronbach's alpha and composite reliability (CR) are greater than 0.7 [43], [44], [45]. Loadings with high values indicate that the indicators of a latent variable are quite similar [43]. It is worth mentioning that even though the loadings of PU01, AU02 and CSE04 are slightly below the threshold, the indicators were eliminated. Table II demonstrates the high reliability of the indicators and constructs.

TABLE II: RELIABILITY TEST RESULTS

Latent Variables	Indicators	Loadings	Cronbach's alpha	CR	Mean	Standard Deviation
PEOU	PEOU01	0.888	0.896	0.924	5.45	1.14
	PEOU02	0.874				
	PEOU03	0.886				
	PEOU04	0.700				
	PEOU05	0.850				
PU	PU01	0.692	0.876	0.910	5.23	1.28
	PU02	0.795				
	PU03	0.879				
	PU04	0.864				
	PU05	0.853				
BIU	BIU01	0.812	0.934	0.950	5.19	1.52
	BIU02	0.888				
	BIU03	0.933				
	BIU04	0.885				
	BIU05	0.927				
AU	AU01	0.874	0.842	0.898	4.74	1.48
	AU02	0.617				
	AU03	0.911				
	AU04	0.892				
SN	SN01	0.757	0.863	0.901	5.28	1.23
	SN02	0.867				
	SN03	0.834				
	SN04	0.791				
	SN05	0.765				
CSE	CSE01	0.855	0.868	0.904	5.30	1.36
	CSE02	0.900				
	CSE03	0.902				
	CSE04	0.648				
	CSE05	0.716				

D. The Validity Test

The validity was tested in terms of the convergent validity and discriminant validity as recommended by [43]. Convergent validity means that the indicators of one latent variable are positively correlated with each other [46]. Convergent validity can be achieved when the average variance extracted (AVE) is 0.5 or higher [44]. AVE is calculated by adding the squared loadings of the indicators of one latent variable and dividing them by the number of indicators [43]. Discriminant validity confirms that the latent variable is unlike the other latent variables [44]. Specifically, discriminant validity means that each latent variable has more correlation with its indicators than with the other latent variables [43]. Table III demonstrates that the convergent validity and discriminant validity were achieved.

TABLE III: CONVERGENT AND DISCRIMINANT VALIDITY TEST RESULTS

Variables	AVE	PEOU	PU	BIU	AU	SN	CSE
PEOU	0.7	**0.84**					
PU	0.7	0.62	**0.82**				
BIU	0.8	0.54	0.76	**0.89**			
AU	0.7	0.42	0.51	0.60	**0.83**		
SN	0.7	0.37	0.54	0.68	0.56	**0.80**	
CSE	0.7	0.61	0.55	0.50	0.51	0.47	**0.81**

E. Testing the Hypotheses

Using SmartPLS, the proposed research model and hypotheses were examined. Table IV summarizes the results of the path analysis test and indicate that most of the proposed paths are supported. The majority of the relationships maintain a high level of significance. The strongest path coefficient is presented in the relationship between PU and BIU; however, the weakest path coefficient is presented in the relationship between SN and PEOU. In terms of the coefficient of determination (R2), the predictive power of PU is 0.511 (high), PEOU is 0.379 (moderate), BIU is 0.582 (high) and AU is 0.360 (moderate).

TABLE IV: HYPOTHESES TEST RESULTS

	Path	Path Coefficient	t-value	p-value	Supported?
$\mathbf{H_1}$	PEOU → PU	0.417	5.585	0.000	Yes
$\mathbf{H_2}$	PEOU → BIU	0.111	1.246	0.213	No
$\mathbf{H_3}$	PU → BIU	0.689	8.847	0.000	Yes
$\mathbf{H_4}$	BIU → AU	0.600	8.485	0.000	Yes
$\mathbf{H_5}$	CSE → PEOU	0.558	7.297	0.000	Yes
$\mathbf{H_6}$	CSE → PU	0.152	1.669	0.096	No
$\mathbf{H_7}$	SN → PEOU	0.107	1.330	0.184	No
$\mathbf{H_8}$	SN → PU	0.312	4.388	0.000	Yes

VI. DISCUSSION

As little research has been done to understand students' use of LMS, this study was conducted to investigate the factors that influence the students' utilization of LMS. Similar to other studies [1], [2], [8], [11], [26], [47] this study emphasizes the robustness of using TAM as a theoretical model in understanding the acceptance and usage of e-learning, particularly in Saudi higher educational institutions. The study at hands aimed to examine two external variables (computer self-efficacy and subjective norms) that contribute to the appropriate use of LMS in Saudi Arabia. Generally speaking, the results prove that students in Saudi Arabia perceive LMS positively. This provides an indication of the students' acceptance of e-learning and an evidence that Saudi Arabia is fertile soil for educational development and technology adoption.

The path analysis test reveals that most of the proposed

paths and hypotheses are supported, and the relationships between the original TAM constructs [15] are demonstrated. Particularly, perceived ease of use has a positive influence on perceived usefulness ($\beta = 0.417$, $p < 0.001$). In the earlier work done by the authors [1], this relationship is supported with higher estimation ($\beta = 0.618$, $p < 0.001$). Other studies [11], [14], [21], [26], [29], [47], in e-learning are consistent with this result. Additionally, perceived usefulness has a positive effect on behavioral intention ($\beta = 0.689$, $p < 0.001$). In line with [15], this relationship has the strongest path coefficient. Various studies [11], [14], [21], [26], [29], [47]-[49] in e-learning are in line with the same finding. The students' behavioral intention strongly influences actual use ($\beta = 0.600$, $p < 0.001$) as in [11], [14], [21]. However, perceived ease of use does not have a positive influence on behavioral intention. In accordance to the original TAM [15], Davis did not postulate a direct effect between perceived ease of use and behavioral intention. The result is consistent with [14], [48] but not consistent with [21], [25], [26], [29], [47], [50]. Consequently, H_1, H_3 and H_4 are completely supported, but H_2 is rejected.

The students' computer self-efficacy is hypothesized to positively influence perceived ease of use (H_5). The findings indicate that perceived ease of use is directly affected by computer self-efficacy ($\beta = 0.558$, $p < 0.001$). This meets the assumptions of TAM3 model [27] and Venkatesh's model [28]. Similar result was reached in other e-learning studies [22], [23], [26], [29], [51]. As hypothesized, students with higher computer self-efficacy are more likely to perceive LMS easy to use. In line with [18], the result indicates that computer self-efficacy is the strongest predictor of perceived ease of use. Compared to the earlier work published by the authors [1], this relationship is supported with slightly higher estimation ($\beta = 0.572$, $p < 0.001$). Therefore, H_5 is supported.

It was hypothesized that students with higher computer self-efficacy are more likely to perceive LMS useful. However, the findings proved the opposite. In comparison to the authors' work [1], this hypothesis is supported ($\beta = 0.537$, $p < 0.001$). This might be attributed to the use of the rigorous PLS-SEM, more suitable for unobserved variables, indirect effects and causal models [41], [42]. Even though this is not the case in [26] and [51], the result is consistent with [22], [23], [25]. In [26], regression analysis technique was used for data analysis, whereas [51] was conducted in China. It was reported that the factors that influence the use of LMS might be different from one country to another [52]. Thus, H_6 is not supported. Nevertheless, computer self-efficacy positively affects perceived usefulness indirectly through perceived ease of use.

Subjective norm was hypothesized to positively influence perceived ease of use. However, the findings indicate that perceived ease of use is not influenced by subjective norm. Similar finding was also found in [36]. Hence, H_7 is not supported. Moreover, subjective norm does not affect perceived ease of use indirectly.

The students' perceived usefulness is positively affected by subjective norm ($\beta = 0.312$, $p < 0.001$). This meets the assumptions of TAM2 model [30] and TAM3 model [27]. The result is consistent with e-learning studies [29], [36], [50], [53] but not consistent with [22]. In line with [18], this indicates that subjective norm is the strongest predictor of perceived usefulness. As hypothesized, students with higher subjective norm are more likely to perceive LMS useful. In the earlier work done by the authors [1], this relationship is supported with higher estimation ($\beta = 0.512$, $p < 0.001$). Therefore, H_8 is supported.

VII. Conclusion

As TAM has been used in limited manners to explain students' utilization of LMS within the context of Saudi Arabia [8], the findings might provide the stakeholders of higher educational institutions with insights regarding the Saudi students' perspective of LMS. The results of the study may interest researchers, teachers, students, ministry of education and higher educational institutions in Saudi Arabia. Further, the research provides fundamentals for LMS acceptance and usage; so, the study provides directions to the stakeholders of higher educational institutions during the development stage of LMS to ensure the adoption of the proposed factors.

Linking the results to real life, this paper tries communicating two clear messages to higher educational institutions. First, investing more money on the students' computer skills and building their confidence about their ability to use computer technologies will impact the students' utilization of LMS. Second, the efforts of higher educational institutions should not be limited to the adoption of new technologies into education. Promoting and advising students contributes to better use of LMS. This study concludes that computer self-efficacy and subjective norm are two necessary factors that influence the students' use of LMS, which contribute to their academic achievements and performance as demonstrated by [54] that the use of Blackboard is correlated with the students' final grade.

VIII. Limitations and Future Work

The study is not free of limitations. The sample of the experiment includes only 19 female students and 3 PhD students. For this reason, another study might be conducted to expand the sample to include more female and PhD students. Additionally, the participants were students at a single institution. The scope of the study could be expanded to include students from different academic institutions or universities in Saudi Arabia. This study took two external variables into account, future research could consider the investigation of other variables in the context of Saudi Arabia. In addition, the research proposed model could be more complex by examining the moderation effect of personal characteristics, such as gender, age and experience. Finally, this study investigated the perceptions of only the students. Later, teachers and administrators can be added to the scope of the study.

Appendix

TABLE V: The Statements Used in the Instrument

Items	Statements
Perceived ease of use	
$PEOU_1$	It is easy to learn how to use Blackboard.

$PEOU_2$	It is easy to become a skillful at using Blackboard.
$PEOU_3$	It is easy to operate Blackboard.
$PEOU_4$	Blackboard is flexible to interact with.
$PEOU_5$	Overall, Blackboard is easy to use.
Perceived usefulness	
PU_1	Blackboard would enable me to achieve tasks more quickly.
PU_2	Using Blackboard would improve my learning performance.
PU_3	Using Blackboard would help me learn effectively
PU_4	Using Blackboard would make it easier to achieve learning tasks.
PU_5	Overall, Blackboard is useful.
Behavioral intention to use	
BIU_1	I would like to use Blackboard in the future if I have the chance.
BIU_2	I would like to use Blackboard in all future courses.
BIU_3	I would recommend using Blackboard to others.
BIU_4	I would encourage my teachers to use Blackboard in courses.
BIU_5	I will continue using Blackboard in the future.
Actual use	
AU_1	I use Blackboard frequently.
AU_2	I tend to use Blackboard for as long as is necessary.
AU_3	I have been using Blackboard regularly.
AU_4	I usually get involved with Blackboard.
Subjective norms	
SN_1	Blackboard is important for university students.
SN_2	Blackboard is important for university students.
SN_3	My colleagues at KAU think I should use Blackboard.
SN_4	People think I should use Blackboard.
SN_5	I would like to do what my teacher thinks I should do.
Computer self-efficacy	
CSE_1	I usually achieve the tasks in Blackboard without help.
CSE_2	I have the skills needed to use Blackboard.
CSE_3	I learned how to use Blackboard easily.
CSE_4	I know about many computer technologies.
CSE_5	If I face a problem in Blackboard, I usually know what I should do.

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