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Learning Management System Utilization among Malaysian Higher Education Students: A Confirmatory Factor Analysis

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Abstract

Today,the number of universities equipped with leaning management system (LMS) is increasing.However, the true potential of LMS is not yet fully utilized to support learning activities. Studies in the domain of LMS utilization will help universities to enhance their knowledge of educational management.A validated instrument in the domain of LMS utilization will assist lecturers to integrate it in the process of teaching and learning and increase the quality of learning. There are different factors which may affect LMS utilizationamong students and lecturers, but in the present study only four factors were investigated. Among the four factors, three were adopted from Technology Acceptance Model (perceived ease of use, perceived usefulness, behavior intention to use)and one was adopted from Theory of Reasoned Action (subjective norm).The purpose of the present study is to provide a confirmatory test for the proposed measurement model.The participants were 216 students at University Putra Malaysia (UPM) and the instrument used was a questionnaire with 39 items. After testing the proposed measurement model, ten items were deleted because of cross-loading. The result of testing the proposed modified measurement model revealed that the theoretical measurement model was fit and validated with the data of the present study.

Key words: Confirmatory Factor Analysis, Measurement Model, Technology Acceptance Model, Theory of Reasoned Action, Learning Management System (LMS)

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1. Introduction

In the last few years,in order to take advantage of new information systems in education, many universities across the world have invested a substantial budget to equip themselves with a kind of Information System (IS)known as learning management system (LMS) (Deng & Tavares, 2013; Islam, 2013). LMS, whichhas different names such as platforms, portals, and content management system,supports teaching and learning activities in higher education (Álvarez, Martín, Fernández-Castro, &Urretavizcaya, 2013). Through LMS students will be able to download learning contents, and build and deliver contents in the online learning environments (Piña, 2012). One of the most important benefits of LMS is to generate and manage reports on learners and assessment results (Theis, 2005).Besides, through the features of LMS, instructors and students can convey instructional materials, send notice to class, submit assignments, and interact with their lecturers and other students (Lonn&Teasley, 2009).

Despite the advantages of LMS for supporting the process of teaching and learning, the true potential of LMS has not yet been fully utilized to supportlearning activities (Álvarez, et al., 2013). For example, Lam, Lo, Lee, and McNaught (2012) investigated the use of WebCT by undergraduate students and found out that only 14.8 percent of the students used related features for online discussion. Islam (2013) investigated LMS utilization among 249 higher education students in Finland and found out that most of the students use LMS for downloading course materials and submitting their assignments. Embi, Hamat, and Sulaiman (2012) examined LMS utilization among 26 Malaysian university lecturers and discovered that two-thirds of the lecturers used LMS in such a way that 65 percent of utilization was restricted to course delivery.

Studies in the domain of system utilization areimportant to assess success of a system (Alvarez et al., 2013). Therefore, managers will be able to overcome the limitation of systems in order to enhance the quality of learning activities (Ku, 2009). The patterns of actual use will increase perceptions of academic staff and educational policy makers (Ku, 2009). Understanding more factors which affect acceptance of technology will extend the pedagogical horizons of educators (Dishaw& Strong, 1999). In fact, when lecturers become aware of the factors which impact on accepting new technologies by their students, they will be in a better position to guide their students to use LMS and enhance the quality of their learning.

There are many factors which may affect LMS utilization by students or lectures. However,in the present studyby reviewing the related literature, the constructs of perceived ease of use, perceived usefulness, behavior intention to use, and subjectivenormwere regarded as factors that may affect LMS utilization among higher education students at University Putra Malaysia (UPM).To measure these constructs, researchers require an instrument with high validity and reliability, but developing an instrument often demands high expenditure and also takes time. Using Confirmatory FactorAnalysis (CFA) assists researchers to save time and costs (Harrington, 2009). Besides, using the established items assist researchers to compare the results of the researches with different population. Therefore, the main purpose of the present study is toconfirm the validity of the proposed measurement model including perceived ease of use, perceived usefulness, behavior intention to use, subjective norm, and LMS use.

2. Literature Review

2.1 Technology Acceptance Model

Technology Acceptance Model (TAM), introduced for the first time by Davis (1986), is based on the Theory of Reasoned Action (TRA) (Davis, Bagozzi, &Warshaw, 1989). Unlike TRA, TAM is used only for computer technologies acceptance (Davis, 1993; Pituch& Lee, 2006). In Technology Acceptance Model,the factors which have the key roles are perceived usefulness and perceived ease of use, which are considered as beliefs (Davis et al., 1989).Moreover, behavior intention to use and attitude toward use are mediators (Davis et al., 1989). Although TRA includes subjective norm, TAM does not include it. However, Davis et al. (1989) suggested that in future studies the effect of subjective norm beinvestigated on system usage. Hence, in the present study,in addition to the variables of TAM (perceived usefulness, perceived ease of use, behavior intention to use, and system use) the construct of subjective norm was also regarded in the proposed measurement model. Figure 1 indicates Technology Acceptance Model, which was suggested by Davis et al. (1989).

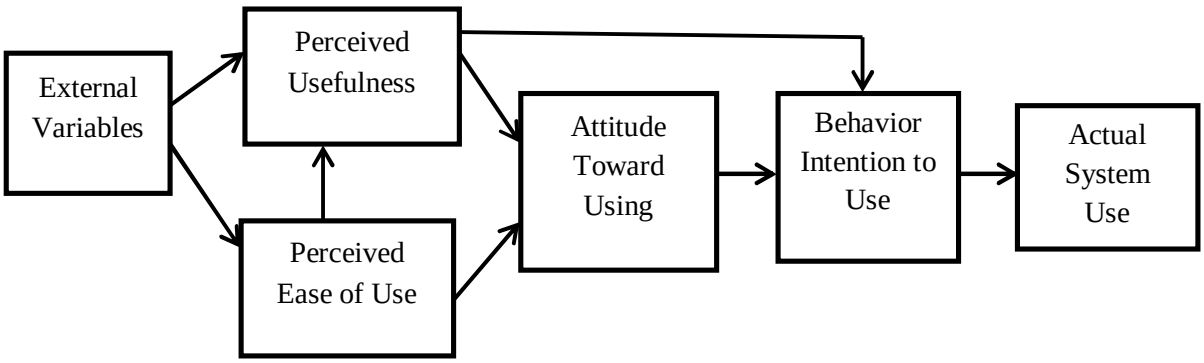


Figure 1. Technology Acceptance Model(Davis et al., 1989)

2.2 Constructs of the study

As mentioned earlier, the present studyincludesfive constructs (perceived usefulness, perceived ease of use, behavior intention to use, subjective norm, and LMS use). Among these constructs, perceived ease of use, perceived usefulness, behavior intention to use and LMS use belong to Technology Acceptance Model (TAM), while subjective norm belongs to Theory of Reasoned Action (TRA) (Davis et al., 1989).

Perceived usefulness is the degree to which an individual believes that using a system will increase his/her performance (Davis et al., 1989; Ngai, Poon, & Chan, 2007); Perceived ease of use the degree to which an individual thinks that using the system is free of effort (Davis et al., 1989; Ngai et al., 2007); behavior intention to use is supposed to capture the motivational factors which affect a special behavior (Davis et al., 1989), and subjective norm is the influence of people who are important to us in our minds to accept or to reject something (Venkatesh & Bala, 2008).

A comprehensive review of the related literature in the domain of LMS utilization reveals that these factors have a crucial role in the acceptance ofan information system in general and LMS in particular. For example, Motaghian, Hassanzadeh, and Moghadam (2013) investigated the influence of perceived usefulness, perceived ease of use, behavior intention to use, and subjective normon LMS utilization among 115 Iranian lecturers and found out that these factors have a significant effect on accepting LMS.

Van Raaij and Schepers (2008) examined LMS acceptance among 49 Chinese managers and found that social norms had a significant effect on perceived usefulness. De Smet et al. (2012) also investigated LMS acceptance among 505 teachers in Belgium and the region of Flanders and discovered that the effect of subjective norm on perceived usefulness of LMS was significant. Likewise, Sánchez and Hueros (2010) investigated the effect of perceived usefulness and perceived ease of use among 226 students in Huelva University (Spain) and showed that both perceived usefulness and perceived ease of use have a significant direct and indirect effect on LMS utilization.

In their proposed model, Ngai et al. (2007) postulated that direct paths were linked from beliefs (perceived ease of use and perceived usefulness) to system usage. They investigated the effect of perceived ease of use and perceived usefulness on LMS utilization among 1263 undergraduate and postgraduate students of seven universities in Hong Kong and indicated that both perceived ease of use and perceived usefulness had a significant effect on system use. Pituch and Lee (2006) also posited that direct paths linked perceived ease of use and perceived usefulness to LMS utilization and found these constructs had a significant effect on system usage. Pituch and Lee (2006) and Ngai et al. (2007) also found that compared to the effect of perceived ease of use on system usage, the effect of perceived usefulness on system usage was stronger.

Wang and Wang (2009) investigated the effect of subjective norm on behavior intention to use among 268 lecturers of three universities in Taiwan and found out that there is a significant relationship between subjective norm and behavior intention to use. Besides, there was an indirect effect between subjective norm and LMS use.Still in another study, Teo (2010) investigated technology acceptance among 314 pre-service teachers in Singapore and showed that subjective norm had a significant effect on perceived usefulness. The results of testing TAM 2 and TAM 3 revealed that subjective norm has a key role in behavior intention to use of an information system (Venkatesh & Davis, 2000; Venkatesh & Bala, 2008).

3. Research Methods

3.1Development of the Instrument

The instrument used in the present study was a questionnaire with 39 items measuring five constructs of subjective norm, perceived usefulness, perceived ease of use, behavior intention to use, and LMS use.

Among the 39 items, 28were adapted from previous studies, while 11 items were self-developed. The content validity of the instrument was checked by two experts from the Faculty of Educational Studies atUniversity Putra Malaysia (UPM). Theconstructs of perceived usefulness, perceived ease of use, behavior intention to use, and subjective normwere measured through 5-point Likert-scale items labeled as 1 (strongly disagree), 2 (disagree), 3 (not sure), 4 (agree) and 5 (strongly agree), while the construct of LMS use was measured through 5-point Likert-scale items labeled as 1 (not at all), 2 (once per semester), 3 (once a month), 4 (once a week) and 5 (every day).

3.2 Data Collection

The participants of the present study were 216 full time undergraduate students of faculty of educational studies in the second semester of the academic year 2012-2013 selected through cluster sampling.Table 2shows the profile of the respondents.

The instrument was pilot tested on a sample of 40 undergraduate students. To measure the reliability of the instrument, Cronbach's Alpha was used. As Table 1 shows, the range of Alpha Cronbach of the five constructs of the present study was from 0.87 to 0.90. According to Leech, Barrett and Morgan (2008), a reliability coefficient of over 0.70 is favorable. Therefore, no further change was made in the questionnaire.

Table1.Cronbach's alpha Coefficient of the Constructs Investigated

Construct	Cronbach's alpha	Number of item
Perceived ease of use	87%	8
Perceived usefulness	92%	8
Behavior intention to use	90%	6
Subjective norm	86%	7
LMS use	89%	10

Totally 39 items

3.3 Demographic and descriptive statistics

Table 2 reports the demographic profile of the respondents. As Table 2 shows, the majority of the respondents (82.9%) were female.

Table 2 also displays that the majority of the respondents (96.8%) were between 19 to 24 years of age and were mostly Malay followed by Chinese students.

Table 2.Profile of the respondents

	Frequency	Percentage
Gender		
Male	37	17.1%
Female	179	82.9%
Age (by years)		
19-24	209	96.8%
25-30	7	3.2%
Race		
Malay	178	82.4%
Chinese	18	8.3%
Indian	9	4.2%
others	11	5.15%

Table 3 shows the descriptive statistics of each construct of the study. As Table 3 reports, the highest mean belongs to perceived ease of use, followed by subjective norm. These results show that in views of respondents, the system was user-friendly. Additionally, social pressure has an important role in LMS use among higher education students.

Table 3. Descriptive Statistics of the Investigated Constructs

Construct	Mean	Standard deviation
Perceived ease of use	3.80	.59
Perceived usefulness	3.71	.71
Behavior intention to use	3.61	.84
Subjective norm	3.72	.62
LMS use	3.05	.87

4. Data Analysis and Results

To estimate the proposed measurement model, Structural Equation Modeling was used (SEM).In general, SEM is divided into two sub-models: the measurement model and the structural model (Ho, 2006; Wang & Wang, 2012). The measurement model estimates the relationship between unobserved and manifest variables,whereas structural model examines the patterns of relationship among independent and dependent variables (Hair et al., 2010; Ho, 2006; Wang & Wang, 2012). By considering the main purpose of the present study, the first part of SEM (measurement model) was estimated.

Confirmatory Factor Analysis (CFA)tests how well the theoretical pattern represents the actual data (Hair et al., 2010). In fact,CFAis a statistical technique for investigating the validity of a measurement model (Harrington, 2009). In other words, CFA allows us to find how well the theoretical measurement model corresponds with the data of the study and provides a confirmatory test for the measurement model (Hair, et al., 2010). To assess the measurement model, the researchers used the software of Amos 20 and SPSS 17 and investigated the output of CFA. In the present study, the proposed measurement model is reflective, because the paths of causality are from the latent construct to the observed variable(Coltman, Devinney, Midgley, & Venaik, 2008). Themeasurement model of the study is also first order, because none of the latent variables has dimensions(Byrne, 2010). Figure 2 illustrates the initial measurement model of the present study.

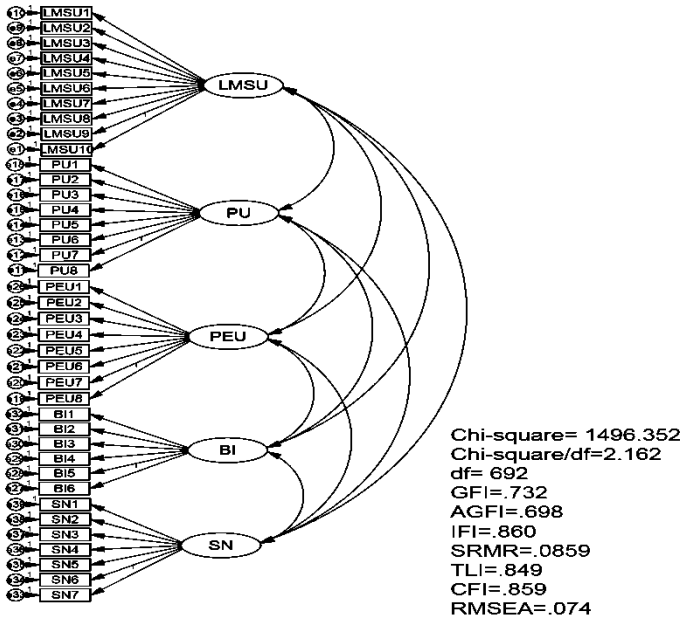
To investigate whether the items of the proposed measurement model indicate the latent variables, first fitness of the measurement model was investigated through the output of CFA. In the present study, toassess the fitness of the proposed measurement,nine indices were used: Chi-square, Chi-square/df, GFI, RMSEA, SRMR (absolute fit indices), IFI, CFI, TLI (incremental fit indices), AGFI (parsimony fit indices). Among these indices, RMSEA, Chi-square/df, Chi- square and SRMR are badness of fit, while TLI, AGFI, CFI and TLI are goodness of fit indices. Figure 2 shows the values of these indices in the initial measurement model. By considering the criteria indices in Table 5, the initial measurement model was not fit. According to Chin (1998), Schumacker and Lomax (2010),Urbach, Smolnik and Riempp (2010),items with factor loading less than 0.7 are very unreliable and should be deleted. As Table 4 reports, in the present study there are nine items with factor loading less than 0.70.Therefore, to modify the proposed measurement model,these nine items were deleted and consequently 30 items remained.

Table 4. Items of Initial Measurement Model

Code	Item	Source	F.D.	Mean	SD
LMSU1	I use PutraLMS to download course materials uploaded by mylecturers.	Wang & Wang (2009)	.788	3.01	1.195
LMS2	I use PutraLMS to submit my assignments.	Wang & Wang (2009)	.755	2.89	1.113
LMSU3	I use PutraLMS to discuss topics of my studies with my classmates.	Wang & Wang (2009)	.786	3.01	1.161
LMSU4	I use PutraLMS to take quizzes.	Self-developed	.807	2.84	1.167
LMSU5	I use PutraLMS to communicate with my classmates.	Wang & Wang (2009)	.843	2.89	1.238
LMSU6	I use the PutraLMS calendar to find out about the events.	Self-developed	.303*	3.79	1.064
LMSU7	I use the chat room to communicate with my peers/ lecturers through PutraLMS.	Self-developed	.813	2.82	1.243
LMSU8	I send messages to my classmates/ lecturers through PutraLMS.	Self-developed	.847	2.82	1.239
LMSU9	I use PutraLMS to find out about my marks and/ or report progress.	Self-developed	.372*	2.92	1.448
LMSU10	I use PutraLMS to read notifications given by my lecturers.	Self-developed	.400*	3.48	1.343
PU1	Using PutraLMS improves my academic achievement.	Sánches & Huerous (2010)	.776	3.57	.870
PU2	PutraLMS makes it easier for me to learn at university.	Sánches & Huerous (2010)	.792	3.85	.818
PU3	PutraLMS gives me more control over my learning.	Sánches & Huerous (2010)	.809	3.69	.878
PU4	PutraLMS helps me to learn more efficiently.	Sánches & Huerous (2010)	.890	3.68	.860
PU5	PutraLMS system makes my learning more effective.	Sánches & Huerous (2010)	.876	3.69	.896
PU6	PutraLMS/iFolio/Spectrum has a positive effect on my learning.	Pituch & Lee (2006)	.790	3.85	.763
PU7	When I use PutraLMS/iFolio/Spectrum, my friends think my knowledge of ICT is updated.	Self-developed	.651*	3.48	.974
PU8	Overall, PutraLMS is beneficial for my learning.	Sánches & Huerous (2010)	.774	3.88	.851
PEU1	The process of using PutraLMS is clear.	Sánches & Huerous (2010)	.502*	3.92	.845
PEU2	The process of employing PutraLMS is understandable.	Sánches & Huerous (2010)	.538*	3.99	.786

PEU3	It is easy for me to become skillful at using PutraLMS.	Pituch & Lee (2006)	.740	3.83	.795
PEU4	PutraLMS is easy to handle whenever I encounter a problem.	Liu, et al. (2010)	.765	3.73	.843
PEU5	My interaction with PutraLMS does not require me to think a lot.	Venkatesh & Bala (2008)	.757	3.65	.763
PEU6	Learning to use PutraLMS is easy for me.	Sánches & Huerous (2010)	.759	3.69	.784
PEU7	It is easy to get materials from PutraLMS.	Sánches & Huerous (2010)	.731	3.80	.825
PEU8	Overall, I believe that PutraLMS is easy to use.	Sánches & Huerous (2010)	.763	3.83	.743
BI1	I intend to increase the use of PutraLMS in the future.	Wang & Wang (2009)	.787	3.62	.981
BI2	I intend to continue using PutraLMS every semester.	Venkatesh et al. (2012)	.826	3.75	.989
BI3	I intend to use PutraLMS more in my learning activities.	Wang & Wang (2009)	.848	3.63	.941
BI4	I will always try to use PutraLMS as part of my daily activities.	Venkatesh et al. (2012)	.856	3.50	.988
BI5	I intend to learn more about the features of PutraLMS.	Self-developed	.815	3.58	.995
BI6	I would recommend others to use PutraLMS.	Self-developed	.856	3.60	.950
SN1	My lecturers think that I should use PutraLMS.	Venkatesh et al. (2012)	.434*	3.96	.755
SN2	My friends' opinion is that I should use PutraLMS.	Venkatesh et al. (2012)	.839	3.54	.949
SN3	The university supports using PutraLMS in my study.	Wang & Wang (2009)	.433*	4.17	.610
SN4	My lecturers encourage students who use PutraLMS.	Self- developed	.434*	4.15	.659
SN5	My friends encourage me to use PutraLMS.	Self- developed	.844	3.57	1.036
SN6	My friends who have influence on my behavior think that I should use PutraLMS/ .	Venkatesh et al. (2012)	.861	3.47	.964
SN7	People respect me if I use PutraLMS.	McGill & Klobas (2009)	.735	3.22	.943

*Item deleted; LMSU: LMS use; PU: percreived usefulness; PEU: perceived ease of use; BI: behavior intention to use; SN:subjective norm; SD: standard deviation. F.D. : Factor Loading



LMSU: LMS use; PU: perceived usefulness; PEU: perceived ease of use; BI: behavior intention to use; SN: subjective norm.

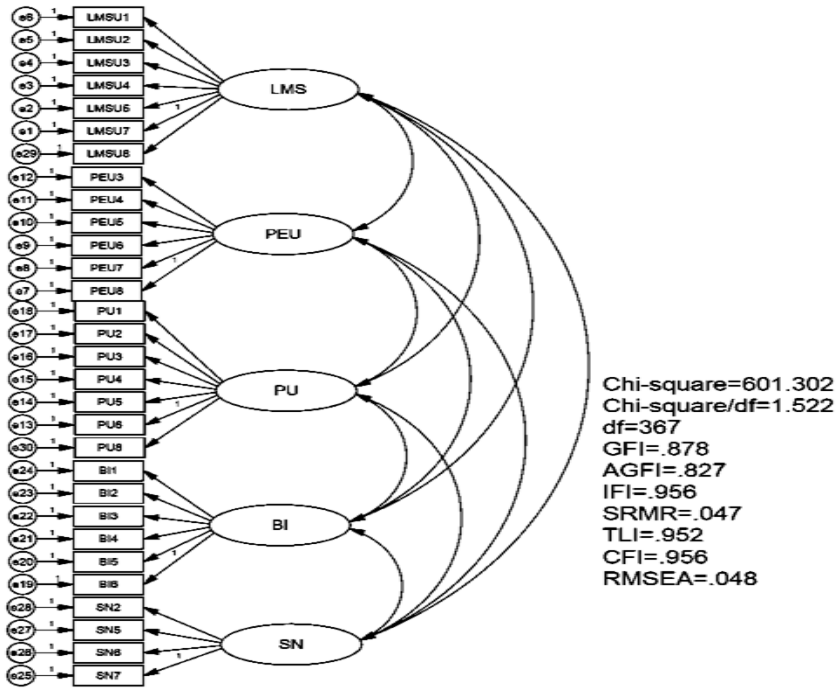
Figure 2. Initial Measurement Model

Table 5.Criteria Fit Indices

Model Fit Indices	Criteria	Fit indices of Initial Measurement Model	Fit indices of Modified Measurement model	References
$\chi 2$	Insignificant, significant value be considered	Insignificant	insignificant	Hair et al. (2010)
$\chi 2/df$	**=<**2	2.162	1.486	Im& Grover (2004)
GFI	Near to .90	.790	.878	Schumacker& Lomax (2010)
AGFI	**>=**.08	.698	.834	Im& Grover (2004)
IFI	close to .90 or higher	.860	.961	Marsh &Hau, & Wen(2004)
TLI	**>=**.90	.849	.956	Schumacker& Lomax (2010); Cheung &Rensvold, 2002
CFI	**>=**.90	.859	.960	Im& Grover (2004)
RMSEA	**<**.07	.074	.048	Hair et al. (2010)
SRMR	**=<**.080	.859	.046	Hair et al. (2010)

$\chi 2$: chi- square); df : degree of freedom; GFI: goodness of fit; AGFI: Adjusted GFI; IFI: Incremental fit index, TLI: Tucker-Lewis Index, CFI: Comparative Fit Index; RMSEA: Root Mean Squared Error of Approximation; SRMR: Standardized Root Mean Squared Residual

Figure 3 illustrates the modified measurement model and the values of indices. According to Table 5, in the modified measurement model, all nine indices are in a good fit. Therefore, it could be concluded that the observed variables (items) can identify the unobserved variables (constructs). In other words, the observed variables measure the theoretical constructs (Barroso,Carri´on, &Rold´an, 2010).



LMS: Learning management system; PEU: perceived ease of use; PU: perceived usefulness; BI: behavior intention to use; SN: subjective norm.

Figure3.Modified Measurement Model

4.1Validity and reliability of Measurement Model

To confirm the proposed measurement model, its construct validity which includes discriminate and convergent validities was to be examined (Hair et al., 2010). To assess the construct validity, confirmatory factor analysis (CFA) should be used (Harrington, 2009). This analysis should be carried out through investigating construct validity (Barroso et al., 2010). In the present study, to investigate construct validity, convergent and discriminant validities were measured. According to Hair et al. (2010), convergent validity determines the value of common variance in observed variables of each construct. Hair et al. (2010) suggest three waysto estimate convergent validity: Factor Loading, Average Variance Extracted (AVE) and Construct Reliability (CR). In estimating the convergent validity, the size of factor loading should be 0.7 or higher(Chin, 1998).As mentioned earlier, in the present study, the items with factor loadings less than 0.7 were deleted. Therefore,all factor loadings were acceptable.

Thecriteria for accepting Average Variance Extracted (AVE) and composite reliability are 0.5 and 0.7 or even higher, respectively (Chin, 1998; Hair et al., 2010). As mentioned above, the criteria for acceptingCronbach's alpha is 0.7 or higher (Leech et. al., 2008). Table 6reports Cronbach' Alpha (CA), Composite reliability (CR), Average Variance Extracted (AVE), Square Root of AVE, and items of modified measurement model, all of whichconfirmthat convergent validity was met.

Table 6. Criteria of Convergent Validity

Item	Factor Loading	Ca>0.7	CR>0.7	AVE>0.5	SQAVE
LMS1	0.777	0.929	0.903	0.652	0.807
LMS2	0.748				
LMS3	0.788				
LMS4	0.803				
LMS5	0.851				
LMS7	0.820				
LMS8	0.858				
PEU3	0.709				
PEU4	0.777	0.891	0.929	0.578	0.760
PEU5	0.761				
PEU6	0.760				
PEU7	0.771				
PEU8	0.782				
PU1	0.772				
PU2	0.794	0.932	0.952	0.667	0.817
PU3	0.813				
PU4	0.892				
PU5	0.878				
PU6	0.786				
PU8	0.773				
BI1	0.787				
BI2	0.825	0.931	0.934	0.691	0.832
BI3	0.848				
BI4	0.856				
BI5	0.815				
BI16	0.856				
SN2	0.833	0.896	0.903	0.687	0.829
SN5	0.857				
SN6	0.870				
SN7	0.750				

Ca: Cronbach's Alpha, CR: Composite reliability, AVE: Average Variance Extracted; SQAVE: Square Root of Average Variance Extracted.

Discriminant validity measures the distinctness of constructs from each other (Hair et al., 2010). According to Fornell and Larcker(1981), discriminant validity will be metif the square root of AVE is higher than inter-construct correlation. Table7reports the matrix of inter-construct correlation in which the terms of the diagonal are square root of AVE in each construct. As shown in Table 7,the square root of AVE in each construct is higher than inter-construct correlation.

Therefore, the discriminant validity was met and the measurement model enjoyed construct validity.

Table 7. Discriminant validity

Constructs	SN	BI	PU	PEU	LMS
SN	**0.829**				
BI	0.446	**0.832**			
PU	0.659	0.522	**0.817**		
PEU	0.469	0.389	0.490	**0.760**	
LMS	0.328	0.551	0.336	0.226	**0.807**

5.Conclusion

The purpose of the present study was to confirm the validity of the proposed measurement model through CFA.The constructs of measurement model were adopted from two theories of Technology Acceptance Model (perceived ease of use, perceived usefulness, behavior intention to use and LMS use)and Theory of Reasoned Action (subjective norm). Therefore, the proposed measurement model included five constructs, namely the latent variables of perceived usefulness, perceived ease of use, behavior intention to use, subjective norm, and LMS useas well as 39 items/observed variables. The result of testing the proposed initial measurement model revealed that it was not fit. To modify the initial measurement model, nine items whose factor loadings were less than 0.7 were deleted.

Therefore, the modified measurement model included 30 items and five constructs. The result of confirmatory factor analysis revealed that the modified measurement model was fit. In other words, the theoretical measurement model was fit with the data of the present study. The proposed modified measurement model also enjoyed construct validity consisting of both convergent and discriminant validity.

Therefore, there was a significant relationship between all the constructs of the present study (perceived ease of use, perceived usefulness, behavior intention to use, subjective norm, and LMS use). Moreover, the constructs of the present study are significantly distinct from each other.

In general, the items/observed variables of the present study were able to measure constructs/ unobserved variables.In other words, the proposed measurement model adopted from TAM and TRA provides acceptable validity.Existing measures such as the measurement of the present study are of immense help to researchers to make research findings comparable when the same measure has been done (Harrington, 2009).

The present study like all other empirical studies has several limitations which should be acknowledged. The respondents of the study were full time students of educational studies. It is recommended that future studies include part-time students along with students from the other faculties. The present study is limited to one Malaysian public university. It is recommended that future studies focus on the other Malaysian public universities as well as private universities. The external variable of the present study was limited to "subjective norm." It is suggested that future studies consider the other external variables such as system functionality, system interactivity, facilitating conditions, personal innovativeness towards information technology and Internet experience.

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