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Behavior Intention To Use Of Learning Management System Among Malaysian Pre-Service Teachers: A Confirmatory Factor Analysis

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Abstract

Learning Management system is a type of Information system that many universities invest on to be integrated with their curriculum. Therefore, factors which make students accept or reject Learning Management System is crucial for educational managers of universities. The main purpose of the present study is to modify and validate a measurement model based on two models of Technology Acceptance Model and Fit Model. The proposed measurement model included five constructs of perceived ease of use, perceived usefulness, behavior intention to use, technical support and task-technology fit. The sample size of the study was 300 pre-service teachers studying at Universiti Putra Malaysia (UPM) and Universiti of Malaya (UM). The results of the study revealed that after deleting eleven items, the proposed measurement model was validated and fit. Therefore, the modified measurement model was able to present the theoretical patterns of the actual data.

Keywords: Learning Management system, Technology Acceptance Model, Fit Model, Confirmatory Factor Analysis

1. Introduction

In recent years, the rapid growth of Information and Communication Technologies (ICT) has affected various aspects of life in general and education in particular. In this era, ICT provides different opportunities for schools and universities in order to improve their educational systems, meet students' needs, and prepare the new generation for challenges of tomorrow's world (Hernandez, Montaner, Sese, & Urquizu, 2011). In general, the role of ICT in education has grown to the extent that today educators consider instructional technology as some sort of equipment - particularly electronic equipment (Roblyer & Doering, 2010). Therefore, if schools and universities do not adjust themselves to new technologies, they will fall in vigorous challenges (Coates, James, & Baldwin, 2005). ICT assists higher education students to manage knowledge which is especially vital for pre-service teachers (Biasutti & El-Deghaidy, 2012). Through knowledge management, pre-service teachers will be able to share their resources and experiences and adopt good practice for further teaching (Biasutti & El-Deghaidy, 2012).

One of the popular concepts that ICT has produced in the realm of education is e-learning (Hernandez et al., 2011; Šumak, Heričko, & Pušnik, 2011). There are numerous definitions offered for e-learning. For example, Hill and Wouters (2010) have defined e-learning as the use of ICTs (e.g., Internet, Intranet, CD-Rom, interactive TV, teleconferencing, computer conferencing) to deliver instruction to learners. Clark and Mayer (2011) also consider e-learning as the devices such as computer, mobile and the Internet which deliver instruction, while O'Mahony (2004)

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and Chang (2008) argue that e-learning refers to any form of instruction delivered just through the web. In the present study, we also consider e-learning as any kind of instruction delivered through the web. Systems that conduct e-learning are different and have various names such as online systems, virtual systems, learning management system (LMS) and so on (Connolly, Gould, Baxter, & Hainey, 2012; Piotrowski, 2010).

The use of LMS almost started in the early 1990s (Coates et. al., 2005). Today, LMS is one of the most popular software in that its usefulness in higher education institutions is substantially increasing (Álvarez, Martín, Fernández-Castro, & Urretavizcaya, 2013; Dutta, Roy, & Seetharaman, 2013; Islam, 2013). In Malaysian Public Universities, the developing strategies of equipping educational institutions with LMS began in 1996 (Puteh, 2007). Today, the LMSs of most of the Malaysian universities were established by their own (Ayub, Tarmizi, Jaafar, Ali, & Luan, 2010; Lee, Chan, Thanimalay, Lim, & 2012). One of the most important benefits of LMS is to generate and manage reports on learners and assessment outcomes (Theis, 2005). Besides, through LMS features, instructors and students can convey instructional materials, send notice to class, submit assignments, and interact with students (Lonn & Teasley, 2009).

Although investing on LMS in institutional education is enhancing, research has reported that faculty and teachers are not interested in using technology (Hadjipavli, 2011; Stantchev, Colomo-Palacios, Soto-Acosta, & Misra, 2014). However, two significant models in determining predictors that influence information system utilization are more common (Dishaw & Strong, 1999). The first model is Technology Acceptance Model (TAM) and the other is Fit Model, which investigate factors that affect technology utilization and performance of individuals (Dishaw & Strong, 1999).

There are many factors which may influence on behavior intention to use of LMS utilization by students. On the other hand, measuring these factors requires instruments with high validity and reliability. Developing instruments also demands high expenses and takes time (Harrington, 2009). Confirmatory Factor Analysis (CFA) helps researchers to overcome these problems (Harrington, 2009). Additionally, using items validated by previous research studies in different contexts aids us to compare different results. To measure these factors, researchers require an instrument with high validity and reliability. Since developing an instrument is both costly and time-consuming, using Confirmatory Factor Analysis (CFA) assists researchers to save time and costs (Harrington, 2009). Therefore, the objectives of the present study are:

i. To confirm the validity of the proposed measurement model included perceived ease of use, perceived usefulness, task-technology fit, technical support, behavior intention to use of PutraLMS (LMS of University Putra Malaysia) and Spectrum (LMS of Universiti of Malaya).

ii. To investigate how well the theoretical pattern represent the actual data of the present study.

2. Literature of Review

2.1 Technology Acceptance Model

Technology Acceptance Model (TAM) which was introduced by Davis (1986) is one of the popular and powerful models in studying the utilization of an information system (Venkatesh & Bala, 2008; Igbaria, Guimaraes, & Davis, 1995). TAM adopted its foundation from the Theory of Reasoned Action (TRA), which is one of the models of social psychology proposed by Fishbein and Ajzen (1975). Unlike TRA, which is a general model and does not specify human behavior in a special situation), (TAM) can only be used to investigate computer technology acceptance behavior (Davis, Bagozzi, & Warshaw, 1989; Davis, 1993; Pituch & Lee, 2006). The factors which have key roles in TAM are perceived usefulness (PU) and perceived ease of use (PEU) (Davis, 1993).Figure 2.1 illustrates technology acceptance model in which external variables, perceived ease of use, perceived usefulness, attitudes and intentions are connected to each other (Davis et al., 1989).

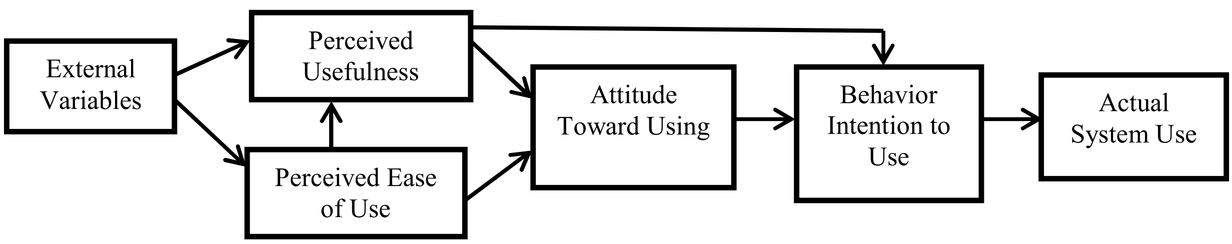

Figure 1.Technology Acceptance Model (Davis et al., 1989)

External variables have a crucial role in TAM, because without external variables the model cannot investigate human behavior in information system utilization (Davis et al., 1989; Pituch & Lee, 2006). In the original TAM, the external variables were not specified, but it was implied that it can encompass different intervention variables such as user characteristics, system design characteristics, organizational structure, political influences (Davis et al., 1989). In the present study, the measurement model includes two external variables of task-technology fit and technical support.

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2.2 Fit Model

Fit Model which was introduced by Goodhue and Thompson (1995) includes five constructs: task characteristics, technology characteristics, task-technology fit, performance impacts, and utilization. According to Goodhue and Thompson (1995), relying on just utilization of a system does not guarantee enhancing users' performance, even when utilization is not mandatory. Task- technology fit suggests that an information system is successful provided that the task and functionality of the system will be correspondent (Goodhue & Thompson, 1995). Figure 2 illustrates the relationship between the constructs of Fit Model.

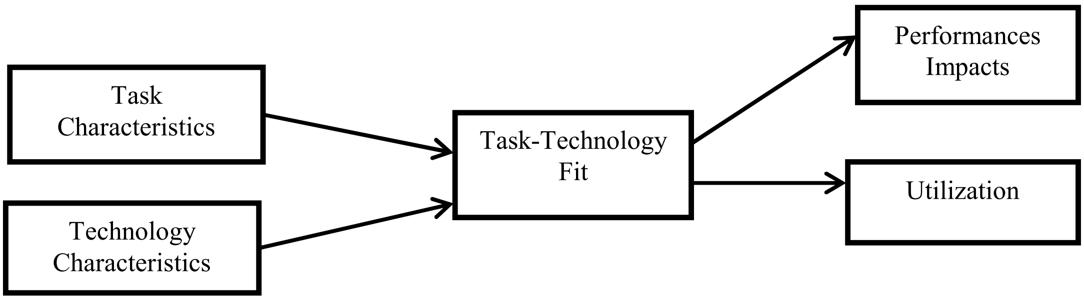

Figure 2. Fit Model (Goodhue &Thompson, 1995)

3. Constructs of the present Study

The present study includes five constructs (perceived ease of use, perceived usefulness, behavior intention to use of LMS, task-technology fit and technical support). Among these constructs perceived ease of use, perceived usefulness and behavior intention to use LMS are regarded as internal variables of TAM, technical support is considered as external variable of TAM, and task-technology fit belongs to Fit Model. Perceived ease of use refers to the degree to which the prospective user expects the target system to be free of effort (Davis et al., 1989), whereas perceived usefulness refers to prospective user' subjective probability that using a specific application system will increase his or her performance within an organizational context (Davis et al., 1989). Technical support is assisting people to solve problems they encounter when they are working with an information system (Ngai, Poon, & Chan 2007). Behavior intention to use is supposed to capture the motivational factors which affect a special behavior (Davis et al., 1989). Task-technology fit, in general, refers to correspondence between tasks and functionality of system (Goodhue & Thompson, 1995). In the present study, task-technology fit is considered as the ability of the LMS to support students in the range of learning activities they engage in, whilst accommodating the variety of student abilities (McGill and Klobas, 2009).

4. Research Method

4.1 Development of Instrument

The instrument of the present study was a questionnaire with 39 items measuring five constructs of perceived usefulness, perceived ease of use, behavior intention to use, technical support and task-technology fit. Among the 39 items, 29 were adapted from previous studies, while 10 items were self-developed (see Table 5). The content validity of the instrument was checked by four experts from the Faculty of Educational Studies at Universiti Putra Malaysia (UPM). The constructs of the study were measured through 5-point Likert-scale items labeled as 1 (strongly disagree), 2 (disagree), 3 (not sure), 4 (agree) and 5 (strongly agree).

4.2 Data Collection

The participants of the present study were 300 pre-services teachers of Universiti Putra Malaysia (UPM) and Universiti of Malaya (UM) in the second semester of the academic year 2012-2013. Among the 300 pre-service teachers, 216 were UPM students and 84 were UM students. The instrument was pilot tested with 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 0.82 to 0.92. 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	.92	8
Perceived usefulness	.95	8
Behavior intention to use	.87	6
Technical Support	.82	6
Task-technology fit	.91	11

Totally 39 items

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4.3 Demographic and descriptive statistics

Table 2 shows the demographic profile of the participants. According to Table 2, 84.3% of them were female, while 15.7% were male. Table 2 also reports that the majority of the participants (96.3%) were between 19 to 24. Most of the participants were Malay (75.7) followed by Chinese participants (15%).

Table 2. Demographic profile of respondents

Demographic Variables	Frequency	Percentage
Gender		
Male	47	15.7%
Female	253	84.3%
Age (by years)		
19-24	289	96.3%
25-30	11	3.7%
Race		
Malay	227	75.7%
Chinese	45	15%
Indian	13	4.3%
others	15	5%

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 perceived usefulness. These results mean that in views of pre-service teachers, LMS was user-friendly. Additionally, pre-service teachers believed that LMS was productive in their learning activities.

Table 3. Descriptive Statistics

Construct	Mean	Standard deviation
Perceived ease of use	3.74	.62
Perceived usefulness	3.65	.73
Behavior intention to use	3.59	.80
Task-technology fit	3.56	.64
Technical support	3.36	.67

5. Data Analysis and Results

Structural Equation Modeling (SEM) was used to analyze the results of the study. In general, SEM includes two sub-models: the measurement model and the structural model (Ho, 2006; Wang & Wang, 2012). Measurement model estimates the relationship between constructs (unobserved variables) and items (manifest variables), but structural model investigates the patterns of relationship among independent and dependent variables (Wang & Wang, 2012; Hair, Black, Babin, & Anderson, 2010). By considering the objectives of the present study, the first part of SEM (measurement model) was estimated.

Confirmatory Factor Analysis (CFA) assists researchers to test how well the theoretical pattern represents the actual data (Hair et al., 2010). CFA is also a statistical technique used for investigating the validity of a measurement model (Harrington, 2009). In other words, CFA allows us to find how well the theoretical measurement model fits with the data of the study and provides a confirmatory test for the measurement model (Hair, et al., 2010). In the present study, to assess the measurement model, AMOS 20 and SPSS 17 were used to investigate the validity of proposed measurement model. The proposed measurement model is reflective, because the paths of causality are from the latent variables (constructs) to the observed variable (Coltman, Devinney, Midgley, & Venaik, 2008). The measurement model of the study is also first order, because none of the latent variables has dimensions (Byrne, 2010). Figure 3 illustrates the initial measurement model of the present study.

To investigate the fitness of the proposed measurement model, 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. Table 4 shows the values of these indices in the initial measurement model. As the values of indices of the initial measurement model did not follow the criteria of indices, the proposed initial measurement model was not fit.

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Table 4. Fit Indices of Initial Measurement Model

Model Fit Indices	Criteria	Values	References
χ2	Insignificant, significant value can be expected	Insignificant	Hair et al. (2010)
χ2/df	=<2	2.394	Im & Grover (2004)
GFI	Near to .90	.870	Schumacker and Lomax (2010)
AGFI	=<.08	.751	Im & Grover (2004)
IFI	Near to .90	.873	Marsh & Hau, & Wen, 2004
TLI	>=.90	.863	Schumacker and Lomax (2010)
CFI	>=.90	.872	Im & Grover (2004)
RMSEA	>.07	.0628	Hair et al. (2010)
SRMR	=<.090	.068	Byrne, 2010

χ^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 toot mean squared residual

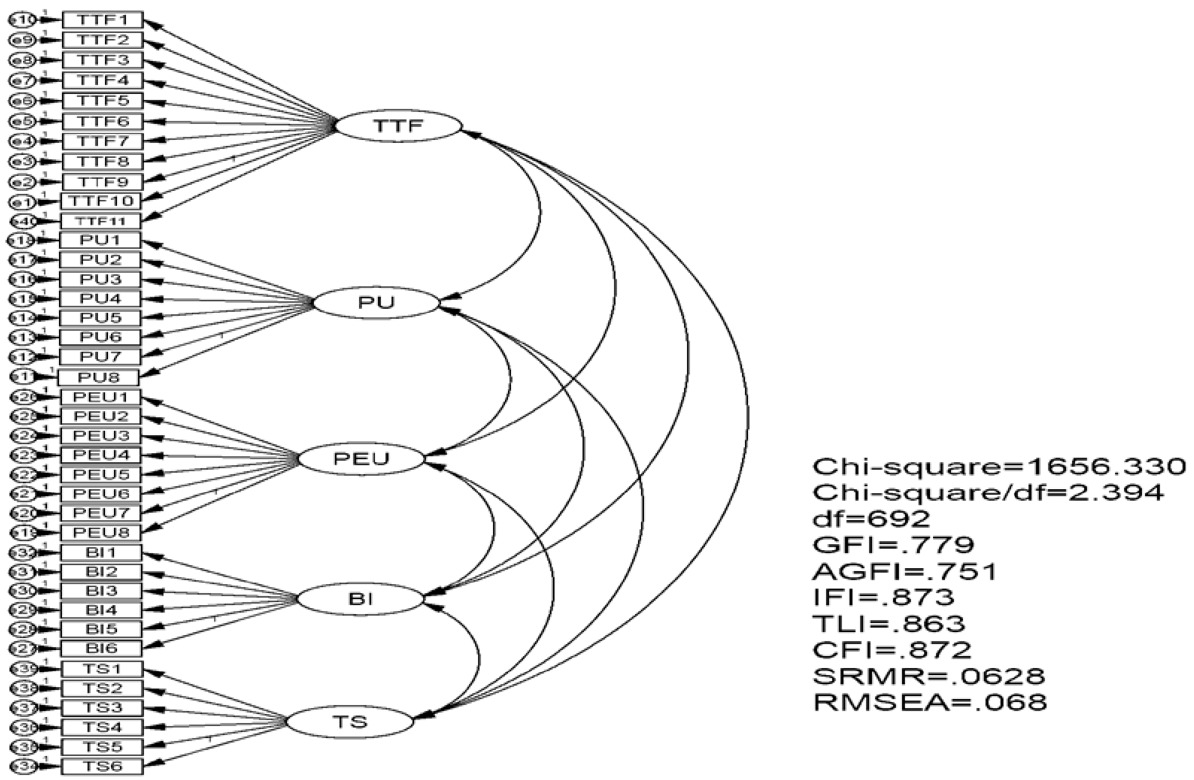

Figure 3. Initial Measurement Model

TTF: task-technology fit; PU: perceived usefulness; PEU: perceived ease of use; BI: behavior Intention to use; TS: technical support

According to Chin (1998), Schumacker and Lomax (2010), and Urbach, Smolnik and Riempp (2010), items with factor loading less than 0.7 are very unreliable and should be deleted. As Table 5 reports, in the present study there are eleven items with factor loading less than .70. Therefore, to modify the proposed measurement model these items were deleted and consequently, 28 items remained.

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Table 5.Items of Proposed Measurement Model

Code	Item	Source	Factor Loading	Mean	SD
TTF1	PutraLMS / Spectrum gives me a lot of help to do my coursework.	Self-developed	.620*	3.77	.859
TTF2	Using PutraLMS/Spectrum makes my task easy.	Self-developed	.645*	3.80	.804
TTF3	PutraLMS/Spectrum provides me with up-to-date information.	McGill & Klobas (2009)	.581*	3.82	.841
TTF4	PutraLMS/Spectrum provides output that seems to be just about exactly what I need.	McGill & Klobas (2009)	.692*	3.77	.837
TTF5	PutraLMS/Spectrum give me information I need in time.	McGill & Klobas (2009)	.714	3.67	.927
TTF6	If I didn't use PutraLMS/Spectrum the quality of my learning would be poorer.	Self-developed	.583*	2.99	1.038
TTF7	I recommend that my friends do their assignments using PutraLMS/Spectrum.	Self-developed	.740	3.47	.927
TTF8	PutraLMS/Spectrum helps me to accomplish my course work quickly.	Self-developed	.741	3.44	.932
TTF9	The features of PutraLMS/Spectrum will help me to learn better.	Self-developed	.753	3.56	.865
TTF10	I think learning by conventional teaching and learning methods could be replaced by PutraLMS/ Spectrum.	Self-developed	.574*	3.42	.987
TTF11	Overall, I like to do my task with PutraLMS/ Spectrum.	Chang (2010)	.681*	3.42	.973
PU1	Using PutraLMS improves my academic achievement.	Sánches & Huerous (2010)	.780	3.46	.923
PU2	PutraLMS makes it easier for me to learn at university.	Sánches & Huerous (2010)	.761	3.79	.851
PU3	PutraLMS gives me more control over my learning.	Sánches & Huerous (2010)	.812	3.64	.894
PU4	PutraLMS helps me to learn more efficiently.	Sánches & Huerous (2010)	.867	3.63	.877
PU5	PutraLMS system makes my learning more effective.	Sánches & Huerous (2010)	.864	3.62	.908
PU6	PutraLMS/iFolio/Spectrum has a positive effect on my learning.	Pituch & Lee (2006)	.813	3.78	.795
PU7	When I use PutraLMS/iFolio/Spectrum, my friends think my knowledge of ICT is updated.	Self-developed	.657*	3.45	.992
PU8	Overall, PutraLMS is beneficial for my learning.	Sánches & Huerous (2010)	.790	3.81	.874
PEU1	The process of using PutraLMS is clear.	Sánches & Huerous (2010)	.588*	3.85	.900
PEU2	The process of employing PutraLMS is understandable.	Sánches & Huerous (2010)	.608*	3.88	.847
PEU3	It is easy for me to become skillful at using PutraLMS.	Pituch & Lee (2006)	.758	3.78	.792
PEU4	PutraLMS is easy to handle whenever I encounter a problem.	Liu, et al. (2010)	.785	3.63	.873
PEU5	My interaction with PutraLMS does not require me to think a lot.	Venkatesh & Bala (2008)	.753	3.58	.799
PEU6	Learning to use PureLMS/Spectrum is easy for me.	Sánches & Huerous (2010)	.755	3.65	.789
PEU7	It is easy to get materials from PutraLMS.	Sánches & Huerous (2010)	.702	3.74	.837
PEU8	Overall, I believe that PutraLMS is easy to use.	Sánches & Huerous (2010)	.764	3.82	.752
BI1	I intend to increase the use of PutraLMS in the future.	Wang & Wang (2009)	.803	3.59	.959
BI2	I intend to continue using PutraLMS every semester.	Venkatesh et al. (2012)	.813	3.71	.931
BI3	I intend to use PutraLMS more in my learning activities.	Wang & Wang (2009)	.848	3.59	.930
BI4	I will always try to use PutraLMS as part of my daily activities.	Venkatesh et al. (2012)	.829	3.47	.966

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BI5	I intend to learn more about the features of PutraLMS.	Self-developed	.786	3.60	.947
BI6	I would recommend others to use PutraLMS.	Self-developed	.838	3.57	.914
TS1	A hotline for fixing user problems is available at any time in PutraLMS/Spectrum.	Sánches & Huerous (2010)	.731	3.37	.796
TS2	I can rely on the technical support group while using PutraLMS/Spectrum.	Self-development	.770	3.28	.820
TS3	Email inquiries to the technical support group can be made when there is a technical problem while using PutraLMS/Spectrum.	Sánches & Huerous (2010)	.811	3.37	.810
TS4	Web-based inquiries can be made when there is a technical problem while using putraLMS/Spectrum.	Sánches & Huerous (2010)	.772	3.35	.847
TS5	The manual on the operation of PutraLMS/Spectrum is sufficient.	Ngai et al. (2007)	.696*	3.34	.910
TS6	PutraLMS/ Spectrum offers good technical support.	Sánches & Huerous (2010)	.776	3.42	.816

TTF: task-technology fit; PU: perceived usefulness; PEU: perceived ease of use; BI: behavior Intention to use; TS: technical support

Figure 4 and Table 6 indicate the proposed modified measurement model and the values of indices. According to Table 6, in the modified measurement model, all nine indices are in good fit. Therefore, the observed variables (items) can identify the unobserved variables (constructs). In other words, the observed variables assess the theoretical constructs (Barroso, Carri´on, & Rold´an, 2010).

Table 6. Fit Indices of Modified Measurement Model

Model Fit Indices	Criteria	Values	References
χ2	Insignificant, significant value can be expected	Insignificant	Hair et al. (2010)
χ2/df	=<2	1.587	Im & Grover (2004)
GFI	Near to .90	.890	Schumacker and Lomax (2010)
AGFI	=<.08	.868	Im & Grover (2004)
IFI	Near to .90	.963	Marsh & Hau, & Wen, 2004
TLI	>=.90	.959	Schumacker and Lomax (2010)
CFI	=>.90	.963	Im & Grover (2004)
RMSEA	<.07	.0431	Hair et al. (2010)
SRMR	=<.090	.044	Byrne, 2010

χ2: 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 toot mean squared residual

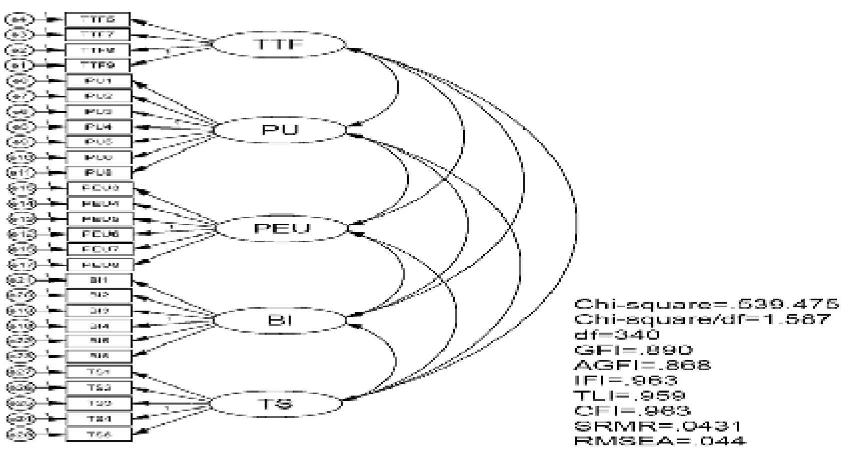

Figure 4. Modified Measurement Model

TTF: task-technology fit; PU: perceived usefulness; PEU: perceived ease of use; BI: behavior Intention to use; TS: technical support

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6. Validity and Reliability of Measurement Model

According to Hair et al. (2010), to confirm the validity of the proposed measurement model, its construct validity should be examined. To assess construct validity, confirmatory factor analysis (CFA) should be used (Harrington, 2009).

6.1 Construct Validity

6.1.1 Convergent Validity

In the present study, to investigate construct validity, convergent validity and discriminant validity were examined. 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 ways to 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 the items with factor loadings less than 0.7 were already deleted, all factor loadings were acceptable. The criteria for accepting Average Variance Extracted (AVE) and composite reliability are 0.5 and 0.7, respectively or even more (Chin, 1998; Hair et al., 2010). Table 7 reports Factor Loading, Composite reliability (CR), Average Variance Extracted (AVE), and items of proposed modified measurement model. As Table 7 shows, the modified measurement model met convergent validity.

Table 7. Criteria for Convergent Validity

Item	Factor Loading	CR>0.7	AVE>0.5
TTF5	0.719	0.867	0.576
TTF7	0.753		
TTF8	0.768		
TTF9	0.795		
PEU3	0.729	0.928	0.584
PEU4	0.796		
PEU5	0.766		
PEU6	0.768		
PEU7	0.736		
PEU8	0.786		
PU1	0.777	0.947	0.663
PU2	0.764		
PU3	0.814		
PU4	0.869		
PU5	0.869		
PU6	0.811		
PU8	0.788		
BI1	0.803	0.933	0.672
BI2	0.813		
BI3	0.848		
BI4	0.826		
BI5	0.878		
BI16	0.836		
TS1	0.750	0.933	0.806
TS2	0.782		
TS3	0.841		
TS4	0.761		
TS5	0.741		

CR: Composite reliability, AVE: Average Variance Extracted

6.1.2 Discriminant Validity

Discriminant validity measures the distinctness of constructs from each other (Hair et al., 2010). According to Fornell and Larcker (1981), discriminant validity will be met if the square root of AVE is higher than inter-construct

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correlation. Table 8 reports 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 8, 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 8. Discriminant Validity

Constructs	TS	BI	PEU	PU	TTF
TS	*0.898*				
BI	0.377	*0.820*			
PEU	0.468	0.436	*0.764*		
PU	0.498	0.513	0.533	*0.814*	
TTF	0.428	0.510	0.469	0.676	*0.759*

TS: technical support; BI: behavior Intention to use; PEU: perceived ease of use; PU: perceived usefulness; TTF: task-technology fit

7. Conclusion

Using ICT in the classroom assists students to enhance the quality of learning and manage knowledge which is a vital skill for pre-service teachers. In other words, using ICT provides a variety of opportunities for pre-service teachers to share their resources, which is a good practice for further career. One of the popular Information Systems which benefits ICT is Learning Management System (LMS). Today, the number of universities which invest in equipping themselves with LMS is increasing (Islam, 2013). Therefore, accepting LMS by students and lecturers is important for managers of higher education institutes. To measure factors affecting LMS utilization by students, researchers require validated instruments. Hence, the main purpose of the present study was to confirm the validity of the proposed measurement model through CFA. The constructs of the present study (perceived ease of use, perceived usefulness, behavior intention to use, technical support and task-technology fit) were adopted from two models: Technology Acceptance Model and Fit Model. Therefore, the proposed measurement model included five constructs (latent variables) and 39 items (observed variables). The result of testing the proposed initial measurement model revealed that it was not fit. After deleting eleven items with factor loadings less than .70, the proposed measurement model was fit. Therefore, the modified measurement model included 28 items and five constructs. The proposed modified measurement model also enjoyed construct validity consisting of both convergent and discriminant validity. By examining the construct validity, it was found that the constructs of the present study are significantly distinct from each other.

In general, the items of the present study were able to estimate the constructs of the study. In other words, the proposed measurement model adopted from Technology Acceptance Model and Task-Technology Fit 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).

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