USABILITY EVALUATION OF LEARNING MANAGEMENT SYSTEM IN A HIGHER EDUCATION INSTITUTION: A SCALE DEVELOPMENT STUDY

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ABSTRACT

Learning Management Systems (LMSs) are used in many higher education institutions today. These systems provide a significant contribution to the effectiveness of the educational processes. However, to select a proper system/software tool and to construct well the user-interface and the functions of the aforementioned tool are important issues. In order to accomplish these issues, the measurements related to the usability of tool are made. The empirical methods are the most often used measurement methods. In this study, a scale for evaluating the usability of LMS that has been in service as a testing system for two years in a higher education institution was developed, and the validity and the reliability of it were set forth. At the end of the study, it is assessed that the newly developed scale can be used and easily applicable in order to evaluate the usability of LMS.

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***Keywords**: Usability, Human Computer Interaction, Learning Management System, LMS, Scale Development*

INTRODUCTION

As the software that automates the administration of training, LMSs are used in the higher education institutions. One of the most important features of LMS is to provide an environment for learning and teaching without the restrictions of time or distance (Thuseethan et al., 2014). Because the effectiveness of LMS affects the effectiveness of education processes, to use right LMS and to improve it in accordance with the needs of the end-users are very important. As an attribute of "acceptance" of the software (Shackel, 1991), usability is a metric to achieve quantified objectives with effectiveness, efficiency, and satisfaction in a quantified context of use.

In order to measure the usability of LMS, the researchers use some methods. Of these methods, survey is a popular one to send out inquires and collect data from a large population in a short period of time. The design of a good survey requires skill and time. The questions need to be correlated to what the evaluators want to find out; able to provide reliable results; and have certain validity to the study. One important thing to note is that what surveys truly measure is user preferences, not product usability. Another problem with surveys is that it is difficult to interpret the results. Despite its low effectiveness rating, organizations still identify survey as one of the most widely used methods because of its efficiency in reaching a large sample size quickly (Tsai, 2007).

In this study, a scale that provides to assess LMS according to the user perception was developed. This study is important because it offers a scale that helps both to decide whether LMS can be used effectively and to define features (especially related to interfaces and functions) that must be improved. The rest of the paper is organized as follows: Section 2 explains the background of this study, Section 3 describes the methodology of the empirical study of LMS, and presents results and analysis from this study, Section 4 includes discussion, conclusion, and advices.

LITERATURE REVIEW AND HYPOTHESES

Human Computer Interaction

Sometimes called as Man-Machine Interaction or Interfacing, concept of Human-Computer Interaction/Interfacing (HCI) was automatically represented with the emerging of computer, or more generally machine, itself. The reason, in fact, is clear: most sophisticated machines are worthless unless they can be used properly by men. This basic argument simply presents the main terms that should be considered in the design of HCI: functionality and usability. Why a system is actually designed can ultimately be defined by what the system can do i.e. how the functions of a system can help towards the achievement of the purpose of the system. Functionality of a system is defined by the set of actions or services that it provides to its users. However, the value of functionality is visible only when it becomes possible to be efficiently utilised by the user. Usability of a system with a certain functionality is the range and degree by which the system can be used efficiently and adequately to accomplish certain goals for certain users. The actual effectiveness of a system is achieved when there is a proper balance between the functionality and usability of a system (Karray, 2008). In this study, it is focused on the usability of software.

Learning Orientation

The ISO 9241 standard defines usability as “The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use”. This definition is expanded to include additional characteristics such as learnability, error tolerant (Alelaiwi, 2015: 24), memorability etc. by different researchers. Usability as an element of Human Computer Interaction (HCI) is defined as "the ease with which a user can learn to operate, prepare inputs for, and interpret outputs of a system or component" in IEEE Std.610.12-1990 (Al-Khalifa, 2010).

Usability contains some attributes in its meaning. Table 1 compares various perspectives on the attributes of usability. Usability has several aspects, including interface design, functional design, data and metadata, and computer systems and networks. Usability is a property of the total system. All the components must work together smoothly to create an effective and easy-to-use software. Indeed, software development involves interplay between people, organization, and technology. The usability issue should look at the system as a whole (Jeng, 2005: 98).

Table 1 Attributes of Usability (Jeng, 2005: 99)

Authors	Attributes
Booth (1989)	usefulness, effectiveness, learnability, attitude
Brinck et al. (2002)	functionally correct, efficient to use, easy to learn, easy to remember, error tolerant, and subjectively pleasing
Clairmont et al. (1999)	successfully learn and use a product to achieve a goal
Dumas & Redish (1993)	perform tasks quickly and easily
Furtado et al. (2003)	ease of use and learning
Gluck (1997)	useableness, usefulness
Guillemette (1995)	effectively used by target users to perform tasks
Hix & Hartson (1993)	initial performance, long-term performance, learnability, retainability, advanced feature usage, first impression, and long-term user satisfaction
ISO (1994)	effectiveness, efficiency, satisfaction
Kengeri et al. (1999)	effectiveness, likeability, learnability, usefulness
Kim (2002)	interface effectiveness
Nielsen (1993)	learnability, efficiency, memorability, errors, satisfaction
Oulanov & Pajarillo (2002)	affect, efficiency, control, helpfulness, adaptability
Shackel (1981)	ease of use, effectiveness
Shackel (1986, 1991)	effectiveness, learnability, flexibility, user attitude

Nielsen’s usability attributes are the most commonly used assessment tool to perform a heuristic evaluation (Paz, 2016). According to Nielsen (2003), usability is a quality attribute that assesses how easy user interfaces are to use, and usability is defined by 5 quality components: 1. Learnability (How easy is it for users to accomplish basic tasks the first time they encounter the design?) 2. Efficiency (Once users

have learned the design, how quickly can they perform tasks?) 3. Memorability (When users return to the design after a period of not using it, how easily can they reestablish proficiency?) 4. Errors (How many errors do users make, how severe are these errors, and how easily can they recover from the errors?) 5. Satisfaction (How pleasant is it to use the design?)

Importance of Usability in Learning Management Systems (LMS)

An LMS is the infrastructure that delivers and manages instructional content, identifies and assesses individual and organizational learning or training goals, and collects and presents data for supervising the learning process of an organization as a whole (Watson, 2007). LMS provides big contribution to the effectiveness and efficiencies of the education process in higher education institutions. That is why the past decade has seen enormous growth in the use of LMSs in higher education institutions (Weaver, 2008). There are lots of commercial and open source LMS tools. The leading commercial and open source LMS tools are listed in Table 2. It is seen that the leader of open source tools is Moodle while the leader of commercial tools is Blackboard ("The LMS Project", 2012).

Table 2 The leading commercial and open source LMS tools ("The LMS Project", 2012)

The Commercial Tools	The Open Source Tools
1. Blackboard/Angel/WEBCT	1. Moodle (2002)
2. Desire2Learn (1999)	2. Sakai (2004)
3. Pearson's eCollege (2007)	3. Canvas by Instructure (2008)
4. Edvance360	4. LoudCloud (2010)
5. Jenzabar e-Racer (2009)	5. OLAT (1999)
6. SharePoint LMS	6. Claroline (2001)

LMSs are becoming richer and more complex applications, and if they are not designed ease of use, it can be next to impossible to make them accessible and usable to users with various needs. In user's perspective, the use of LMS is constrained by the human's perceptual and cognitive abilities. The better human computer interaction that offers the LMSs users, the easier of use and greater satisfaction users will have with in systems or tools they involved. Usability can improve the learning experience for students as well as academic performance. Therefore, a sensible design of human computer interaction with usability study is one of the crucial components in the design and development of LMSs (Thuseethan et al., 2014).

Measurement of Usability

Within the scope of LMS, usability is about to design a LMS suited to the needs and expectations of the students and the teachers. The designed LMS must be compatible with the cognitive perception and the general attitudes of the end-users. The measurement of usability has a big role to develop a LMS that meets the needs and expectations of the end-users. The methods used for the measurement of usability are categorized into four basic groups by Nielsen (1995):

1. Automatically - in which usability measures are computed by running a user interface specification through special software.

2. Empirically - in which usability is assessed by testing the interface with real users or experts.

3. Formally - in which usability measures are calculated by exact models and formulas.

4. Informally - in which usability measures are obtained based on rules of thumb and the general skill and experience of the evaluators.

Of the four groups, empirical methods are the most often used. Empirical evaluation methods can be grouped into user study and system inspection methods. The categorization of empirical evaluation methodsa is presented in Table 3 (Tsai, 2007).

Table 3 The categorization of empirical evaluation methods

1. User study	2. System inspection
- Surveys	- Expert review
- Focus groups	- Heuristic evaluation
- Usability testing	- Cognitive walkthroughs
- Contextual inquiry	

Some researchers use only one of these techniques while the others use different combination of these techniques in their studies. For example, Vervenne et al. (2006) performed a multi-method usability assessment using questionnaires, guided interviews, eye-tracking, and the annotation of multimodal behavior. Lanzilotti et al. (2006) derived an evaluation methodology called e-Learning Systematic Evaluation (eLSE), which combines inspection tools with user-testing. Some researchers denote that at least two techniques must be used for making the best assessment in the usability study (Cakmak et al., 2011).

Usability testing is the evaluation of instructional tools/software for its ease of use to the frequent users within an instructional design practice. In other words, usability testing is the observation of typical users performing tasks with a product, conducted for the purpose of determining what changes need to be made to the content, presentation or user interface for that product (Alelaiwi and Hossain, 2015). Usability evaluation is considered one approach to assess the effectiveness of e-Learning systems. It is used to evaluate how well technology and tools are working for users. LMSs can benefit from usability research to evaluate the LMS ease of use and satisfaction of its users (Al-Khalifa, 2010).

Related Studies

Many research studies have been conducted to evaluate the usability of existing LMSs. Some of these studies will be explained briefly below. In Melton's small and preliminary study (2006), the usability of Moodle's registration process and assignment submission module was examined by asking users to accomplish some tasks. Inversini et al. (2006), conducted a comparative usability study on four LMSs, two commercial and two open source by using a technique called MiLE+ that balance between heuristic evaluation and task-driven techniques. Martin et al. (2008) used heuristics evaluation to conduct usability evaluation on three of the main e-learning open source platforms, which were: Moodle, Sakai and dotLRN. Al-Khalifa (2010) focused on using user satisfaction surveys to measure the usability of JUSUR LMS. Cakmak et al. (2011) developed a "User perception based web site usability scale", with a construct of four factors including of 25 items and applied the scale to 239 e-learners in order to determine the usability level of the LMS web site. The aim of Agariya and Singh's study (2012) was to develop a reliable and valid e-learning quality measurement scales from the learner as well as faculty perspectives in Indian context. Thuseethan et al. (2014), on the other hand, give an overview of LMSs used in Sri Lankan universities, evaluate the usability of LMS using some pre-defined usability standards, and measure the effectiveness of LMS by testing the LMSs in their study.

METHODOLOGY

Research Goal

As mentioned above, the broad aim of this study is to develop a scale for evaluating the usability of LMS that has been in service as a testing system for two years in a higher education institution. In order to accomplish this, the validity and the reliability of the newly developed scale were set forth.

Sample and Data Collection

In this study a descriptive, survey research method was used. The descriptive research approach is a basic research method that examines the situation, as it exists in its current state. In the survey research method, which is one of the descriptive research approaches, the researcher tends to capture phenomena at the moment (Williams, 2007: 67).

The scale used in this study, was developed by exploiting several sources. First important source was the System Usability Scale (SUS), a mature questionnaire constructed by John Brooke in 1986. This

questionnaire comprises 10 statements and it is very robust and has been widely used and adapted to evaluate usability (Thuseethan, et al. 2014). The other sources, which the questions used in the new scale were derived from, are;

- Anadolu University e-Learning Portal Questionnaire (AUEPQ) (Koseler, 2009),
- The practical survey tool tailored to academic library websites by Joo et al. (Joo et al., 2011),
- The scale of Website Analysis and Measurement Inventory (WAMMI) (Claridge, 2016), and
- WebCT Usability Questionnaire (WebCT, 2016).

Also some original questions related to higher education institution in which the study conducted were added to the scale. After the preliminary study that has been conducted with the experts, the new scale consisting of 26 questions was generated.

Questionnaires and other survey instruments (e.g., interviews) are tools that are commonly used to obtain data regarding people's perceptions. Questionnaires have a proven track record in the assessment of interactive applications. They have been applied to the assessment of e-learning applications and are considered highly appropriate for this purpose because they are inexpensive and easy to use (Althobaiti, 2016).

The new developed questionnaire/scale, named the Scale for Usability of Learning Management System (SULMS), was sent to all 110 faculty members between April 1st and May 1st, 2016 and 53 useful responses were returned, a response rate was 48%. 83% of the respondents comprising research and teaching academicians in a public higher education institution has up to six years of experience with computer aided learning and teaching systems.

Each respondent reported that he/she uses the subject LMS regularly. In this higher education institution, LMS is being used by academicians to upload course-related documentation, slides, sample exams etc, and by students to follow the course asynchronously, to download documentation, to self-study and self-check using the sample exams. LMS is also being used for the purposes of foreign language teaching very intensely. The respondents self-administered a 26-item questionnaire. Five-point Likert-type scale (Strongly Disagree {1}, Strongly Agree {5}) was used to measure respondents' attitudes toward the usability of LMS.

Purification

Various tests were performed to refine and purify the initial 26 items. According to Churchill (1979), screening the data would improve reliability levels. Thus, first we calculated reliability coefficients of the scale using Cronbach's alpha (Cronbach, 1951). Here, it seemed appropriate to assume that SULMS was a simple construct before going further using exploratory factor analysis to identify its underlying dimensions. We found that the initial 26 items had a reliability of 0.92 based on the assumption. For the remaining sets of items, item-to-total correlations were examined to eliminate the garbage items. We then screened the data and remove garbage items that had very low item-to-total correlations, i.e., <0.4. Four items that had the item-to-total correlation below 0.4 were deleted in this stage, and thus ending up with 22 items.

Further, exploratory factor analysis was conducted to purify the instrument by discarding items that did not load on an appropriate high-level construct (Churchill, 1979; Palvia, 1996; Straub, 1989). Factor analysis was used to identify the underlying factors or the multi-dimensional composition of SULMS instrument. The data from the 53 responses were examined using principal component and varimax as a method of rotation. According to prior studies' suggestions (Palvia, 1996; Straub, 1989), we used cut-off points of 0.5 for item loadings and 1 for eigenvalues.

In this stage, items with factor loadings of less than 0.5 on each factor or above 0.5 on additional factors were deleted to refine the scale (e.g., Straub, 1989). The iterative sequence of factor analysis and item deletion was repeated, resulting in a final instrument of 20 items. As summarized in Table 4, the results confirmed the existence of five factors with eigenvalues greater than 1 that cumulatively accounted for 76.3% of the total variance. These five factors were labeled as learnability, efficiency, memorability, errors and satisfaction (as defined by Nielsen (2012)). Additionally, there were no items with cross-factor loadings above 0.5. Moreover, items intended to measure the same factor exhibited prominently and distinctly higher factor loadings on a single factor than on other constructs.

Reliability

Reliability refers to the stability of scores over a variety of conditions (Klenke, 1992) and can be evaluated by assessing the internal consistency of items using Cronbach's alpha. As shown in Table 4, the reliability of each factor was: learnability= 0.73; efficiency= 0.77; memorability= 0.78; errors= 0.71; and satisfaction= 0.82. Furthermore, the minimum value of each corrected item-to-total correlation was above 0.5 (minimum = 0.51), suggesting good reliability of this instrument (see Table 5).

Table 4 Results of Exploratory Factor Analysis

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Learnability					
L1	0.554				
L2	0.714				
L3	0.786				
Efficiency					
E1		0.785			
E2		0.830			
E3		0.711			
E4		0.873			
E5		0.667			
Memorability					
M1			0.743		
M2			0.544		
M3			0.806		
M4			0.822		
Errors					
E1				0.602	
E2				0.804	
E3				0.565	
Satisfaction					
S1					0.752
S2					0.870
S3					0.698
S4					0.568
S5					0.811
Cron.Alpha	0.73	0.77	0.78	0.71	0.82
Mean	3.35	3.49	3.52	3.69	3.65
St.Dev.	0.19	0.21	0.15	0.05	0.27

Content Validity

The content validity of a questionnaire refers to the representativeness of item content domain (Klenke, 1992). It is the manner by which the questionnaire and its items are built that ensures the reasonableness of the claims of content validity (Klenke, 1992).

Generally, "specifying the domain of the construct, generating items that exhaust the domain, and subsequently purifying the resulting scale should produce a measure which is content or face valid and reliable" (Churchill, 1979). Therefore, conceptualization of SULMS constructs based on previous research to form the initial items, the personal interviews with several practitioners and experts, and the iterative procedures of the scale purification suggest that this SULMS instrument has strong content validity.

Table 5. Corrected Item-to-total Correlation

Items	Item Description	Corrected Item-to-total Correlation
Learnability		
L1	I think that various functions are well-integrated in LMS.	0.667
L2	I think that I received enough training on how to use LMS.	0.577
L3	I think that most people can learn very fast how to use LMS.	0.521
Efficiency		
E1	LMS helps me to do the necessary activities of the class faster.	0.626
E2	I can easily find the necessary information in LMS.	0.556
E3	LMS is very slow (Reverse coded)	0.593
E4	I can broadcast the announcements of the class very fast using LMS.	0.561
E5	I can make class plans very effectively using LMS.	0.702
Memorability		
M1	I think that usage of LMS is very easy.	0.592
M2	I find LMS is unnecessarily complex (Reverse coded).	0.772
M3	User interface of LMS is very suitable for LMS.	0.609
M4	I easily understand where I am in LMS while I am using LMS and can easily understand where to go.	0.626
Errors		
Er1	I think that I need help of a technician to be able to use LMS (Reverse coded).	0.516
Er2	I get several different system/network errors very often when using LMS (Reverse coded).	0.589
Er3	I think that there are several inconsistencies in LMS (Reverse coded).	0.720
Satisfaction		
S1	I think that I will use LMS very often.	0.725
S2	I think that LMS is a very useful tool.	0.529
S3	LMS has enough number of modules to provide enough user-system interaction (forum, chat rooms, etc.).	0.510
S4	I suggest all universities use LMS.	0.745
S5	I use LMS very easily and comfortably.	0.620

Criterion-Related Validity

Criterion-related validity is defined as the effectiveness of the measure in predicting behavior in specific situations (Klenke, 1992), which is assessed by the correlation coefficient comparing test scores with external criterion or overall satisfaction (Doll & Torkzadeh, 1988). In this study, the criterion-related validity was obtained by calculating the correlation between summed scores of two items measuring overall satisfaction with LMS and total scores of 20-item SULMS. The results showed that the 20-item SULMS instrument had a criterion-related validity of 0.79 ($P < 0.000$), suggesting an acceptable criterion-related validity.

Construct Validity

The construct validity of a measure is demonstrated by validating the theory behind the instrument. Construct validity is defined as the extent to which the test measures a theoretical construct (Klenke, 1992). Prior research suggests that validation strategies for establishing construct validity include item-to-total correlation (Doll & Torkzadeh, 1988) and convergent/discriminant validity (Churchill, 1979; Doll & Torkzadeh, 1988; Palvia, 1996; Straub, 1989). It also includes predictive and concurrent validity. In the present study, construct validity in terms of convergent and discriminant validity was examined by using a correlation matrix approach (Doll & Torkzadeh, 1988). Convergent validity determines whether associations between scales of the same factor are higher than zero and large enough to proceed with discriminant validity tests (Doll & Torkzadeh, 1988). As summarized in Table 6, the four lowest within-factor correlations are: learnability = 0.59; efficiency= 0.50; memorability= 0.52; errors= 0.61; and

satisfaction= 0.51. These correlations are all higher than zero (P < 0.000) and large enough to proceed with discriminant tests.

Table 6. Inter-Correlations among the Items.

	Learnability			Efficiency					Memorability				Errors			Satisfaction				
	L1	L2	L3	E1	E2	E3	E4	E5	M1	M2	M3	M4	Er1	Er2	Er3	S1	S2	S3	S4	S5
L1	1																			
L2	**.72**	1																		
L3	**.66**	**.59**	1																	
E1	.45	.25	.22	1																
E2	.21	.10	.17	**.57**	1															
E3	.27	.29	.03	**.66**	**.59**	1														
E4	.47	.06	.14	**.79**	**.50**	**.61**	1													
E5	.48	.08	.30	**.81**	**.61**	**.59**	**.78**	1												
M1	.51	.26	.49	.30	.17	.04	.14	.44	1											
M2	.64	.30	.39	.48	.35	.43	.47	.32	**.68**	1										
M3	.36	.11	.29	.47	.63	.39	.26	.33	**.52**	**.65**	1									
M4	.35	.43	.48	.36	.13	.18	.15	.32	**.69**	**.56**	**.57**	1								
Er1	.29	.45	.38	.13	.19	.05	.10	.14	.46	.25	.17	.50	1							
Er2	.36	.30	.23	.19	.23	.40	.18	.40	.50	.48	.28	.30	**.61**	1						
Er3	.54	.21	.29	.39	.43	.41	.37	.45	.51	.47	.39	.35	**.74**	**.67**	1					
S1	.31	.22	.21	.42	.26	.33	.56	.49	.41	.43	.41	.47	.23	.32	.47	1				
S2	.41	.09	.01	.43	.25	.41	.40	.36	.21	.32	.49	.19	.13	.35	.42	**.83**	1			
S3	.46	.10	.12	.47	.03	.08	.34	.41	.46	.46	.13	.31	.30	.11	.36	**.63**	**.51**	1		
S4	.34	.23	.31	.62	.30	.41	.51	.39	.34	.45	.35	.38	.70	.47	.51	**.79**	**.73**	**.53**	1	
S5	.47	.32	.41	.39	.15	.10	.28	.18	.28	.30	.23	.44	.46	.17	.38	**.62**	**.52**	**.60**	**.65**	1

Discriminant validity was examined by counting the number of times an item correlates higher with items of other variables than with items of its own variable (Aladwani & Palvia, 2002). For example, the lowest within-factor correlation for learnability is 0.59, and two of the correlations of content with items of other factors is larger than 0.59, i.e., number of violations is 1. Campbell and Fiske (1959) suggest this number should be less than 50%. The results showed that, for efficiency, number of violations is 2; for memorability, number of violations is also 2; for errors, number of violations is only 1; and for satisfaction, number of violations is 3; suggesting adequate discriminant validity. Jointly, the observed convergent and discriminant validity suggested the adequacy of the measurements used in this study.

In addition, confirmatory factor analysis was conducted using AMOS to confirm convergent and discriminant validity of the measures. In this study, confirmatory factor analysis was estimated on 20 items measuring five constructs. Suggested five-factor model resulted in a significant chi-square statistic ($\chi 2$ = 433.23, p<0.01, df = 160; $\chi 2$ / df = 2.70 (<3)), as expected. The resulting goodness-of-fit indices also suggest that the five-factor model fits the observed covariances reasonably well (CFI = 0.90; GFI = 0.88; NNFI = 0.91; RMSEA = 0.06). In addition, all items load significantly on their respective constructs (with the lowest t-value being 4.27), providing support for the convergent validity of measurement items.

Nomological (Predictive) Validity

In order to establish the construct validity of a scale, it must also be determined that (1) the extent to which the scale has a correlation with other scales developed to examine the same component; (2) whether the scale behaves as anticipated (Churchill, 1979). Nomological validity refers to the extent to which predictions based on the construct being measured are confirmed within a wider theoretical context or network of constructs (Bagozzi, 1981). In this current study, we assess nomological validity by specifying the construct within a nomological network of consequent variables and examine the relationships between user satisfaction and its consequent constructs.

According to The DeLone and McLean Information Systems (D&M IS) Success Model developed by DeLone and McLean (2003), user's satisfaction is closely related to the actual use of the system. From a process perspective, use must precede user satisfaction, but on the other hand, from a causal perspective, positive experience with use would lead to higher user satisfaction. Nevertheless, previous studies suggest that "intention to use" is a better measure than actual use (DeLone & McLean, 2003). Therefore, it can be considered that future intention to use the LMS and behavior to recommend the LMS to others should be associated with high levels of satisfaction. Thus, in order to assess nomological validity, we hypothesize:

H1: There would be a positive relationship between future intention to use the LMS and the SULMS.

H2: There will be a positive relationship between behavior to recommend the LMS to other people and the SULMS.

According to results of the correlation test, H1 ($r= 0.79$, $P < 0.000$) and H2 ($r= 0.68$, $P < 0.000$) were supported. Based on the purification process and previous analysis, a validated 20-item SULMS instrument was obtained.

CONCLUSION

In this study, the reliability and validity of a new developed scale, namely SULMS, was investigated in the context of LMSs perceived usability evaluation.

The SULMS was carefully and thoroughly tested and thus provided a high degree of assurance in the reliability and validity of scale. The efforts reported in this paper offer a lot of contributions to both the researchers and practitioners. First of all, it provides a framework describing the primary dimensions of user satisfaction with a LMS. This measure can also be used and easily applicable in several different types of organizations.

Since, information systems (ISs) can be viewed and developed in various ways, several different scales may be used to measure the success of implemented IS. In this study, we developed and validated a scale to measure user satisfaction and usability of a LMS used in a higher education institution. We identified five dimensions; namely learnability, efficiency, memorability, errors, and satisfaction as Nielsen (2012) did. These dimensions incorporate both organizational and socio-technical perspectives of an IS. Now, with a validated instrument of measuring user satisfaction with and usability of LMS, researchers can carry out studies to examine carefully the association between user satisfaction and relevant LMS-related variables (e.g., system quality, usability, etc.).

Nevertheless, additional work is still needed to develop scales of alignment of LMS with short and long-term learning strategies (e.g., business strategy alignment with knowledge management). Research on ISs' impact on efficiency, productivity, and competitive advantage would benefit from the availability of such measures.

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