

A MODEL FOR ASSESSING LEARNING MANAGEMENT SYSTEM SUCCESS IN HIGHER EDUCATION IN SUB-SAHARAN COUNTRIES

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ABSTRACT

In recent years, there has been an increasing adoption of various Learning Management Systems (LMS) in higher education in Sub-Saharan countries. Despite the perceived benefits of these systems to leverage challenges facing education sector in the region, studies show that the majority of them tend to fail; partially or totally. This paper presents a model for evaluating LMS deployed in Higher Education Institutions in Sub-Saharan countries through adopting and extending the updated DeLone and McLean information system success model. The proposed model and the instrument have been validated through a survey of 200 students enrolled in various courses offered via Moodle LMS at University of Dar es Salaam, Tanzania. The findings of this study will help those who are involved in the implementation of LMS in higher education in Sub-Saharan countries to evaluate their existing systems and/or to prepare corrective measures and strategies to avoid future LMS failures.

KEYWORDS:

eLearning success model; eLearning; LMS; Learning Management Systems; Sub-Saharan countries; eLearning systems

1. INTRODUCTION

In recent years, there has been an increasing adoption and use of various Learning Management Systems (LMS) in higher education of Sub-Saharan countries. These are web-based systems used to plan, deliver and facilitate students learning via the internet (Unwin et al., 2010). They are normally integrated with learning resource tools for audio, video, and text as well as communication tools (chat, discussions forums, email, and whiteboards), and assessment tools (Pituch & Lee, 2006). The most popular systems deployed in several institutions in Sub-Saharan countries are: Blackboard, Moodle, Atutor, Sakai, and Kewl (Ssekakubo et al., 2011; Unwin et al., 2010). These systems are believed to be able to leverage the challenges facing education sector in Sub-Saharan countries.

The proper application of LMS have the potential to widen access, reduce cost, and to improve the quality of education (Andersson & Grönlund, 2009; Linna, 2013). These perceived benefits have heightened Higher Education Institutions (HEIs) in Sub-Saharan countries to adopt them in order to complement traditional face-to-face delivery and to introduce technology enhanced distance learning. So far, tens of systems have been adopted in various HEIs in Sub-Saharan countries every year.

For example, as of 2011, almost 80.2% of HEIs in Tanzania were using various systems with 78% adopted Moodle LMS and 2.5% the Blackboard system (Munguatosha et al., 2011). In Sudan, 25% of institutions were using Moodle LMS (Elmubark et al., 2013)

while in Zimbabwe, four HEIs were using Moodle and Claroline systems (Chitanana et al., 2008). In addition, a study conducted by Unwin et al. (2010) found that 49% of 358 respondents from 25 countries were using various LMS in their institutions.

A similar study by Ssekakubo et al. (2011) found five HEIs: University of Cape Town and the Nelson Mandela Metropolitan University in South Africa, the University of Zambia in Zambia, the University of Nairobi in Kenya, and Makerere University in Uganda were using Moodle LMS. These findings are consistent with another study which found seven institutions involved in Partnership of Higher Education Africa (PHEA) project were already installed and using Moodle LMS (Hoosen & Butcher, 2012). These institutions included Catholic University of Mozambique, Kenyatta University in Kenya, Makerere University in Uganda, the University of Dar es Salaam in Tanzania, the University of Education, Winneba in Ghana, and the Universities of Ibadan and Jos in Nigeria.

Clearly, these systems have found their way in higher education in Africa. The number of systems is expected to increase as several international agencies such as the World Bank (WB), Swedish International Development Cooperation Agency (SIDA), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Development Programme (UNDP), and United States Agency for International Development (USAID) are supporting various eLearning initiatives in Africa (Farrell & Isaacs, 2007). More recently, the African Development Bank Group (AfDB) approved a \$15.6 million grant to African Virtual University (AVU) in order to support various eLearning activities in Sub-Saharan Africa (Adkins, 2013). The AVU has 31 active partner institutions across Africa. The adoption of LMS have been costing HEIs thousands of dollars to procure, install and keep them running. For example, the cost of procuring and maintaining Blackboard system at the University of Education, Winneba, in Ghana was quoted as \$20 a year per student with a minimum of 15,000 students in 2008 (Unwin et al., 2010). Nevertheless, studies show that LMS usage across the continent is very low. For example, there were only 60 inactive registered users in a system installed at Makerere University (Mayoka & Kyeyune, 2012), and less than 10 active users at the University of Nairobi (Ssekakubo et al., 2011).

Similarly, 87.6% of 90 instructors at Open University of Tanzania (Bhalalusesa, Lukwaro, & Clemence, 2013), and 74% of 66 instructors from four institutions in Zimbabwe (Chitanana et al., 2008) said they had never used the system since they were trained. At University of Dar es Salaam (UDSM), they were 767 active users in Moodle LMS out of 8,000 users who were trained since 2008. These findings are consistent with another study conducted by Ssekakubo et al. (2011) in five institutions of Sub-Saharan countries.

According to Ssekakubo et al. (2011), the majority of LMS implemented in Sub-Saharan countries tend to fail; partially or totally. In fact, the majority of users in HEIs in Sub-Saharan countries do not use the LMS installed in their institutions. Such low usage or non-use of installed is normally regarded as system failure due to the fact that, the perceived benefits cannot be realised if users do not use them (Delone & Mclean, 2003; Pituch & Lee, 2006; Venkatesh et al., 2003). As the investments to LMS continue to increase, there is a need to help institutions with tools necessary to evaluate the effectiveness of these systems in order to realise expected benefits.

So far, however, few studies have proposed LMS evaluation tools for systems deployed in the context of HEIs in Sub-Saharan countries. Accordingly, this study has developed a model and instrument for evaluating LMS effectiveness through adopting and extending the updated DeLone and McLean information system success model. The model and instrument have been validated through a survey of 201 students enrolled in various courses offered via Moodle LMS at UDSM, Tanzania.

2. LITERATURE REVIEW

As organizations continue to adopt and use Information Systems (IS) to improve service delivery, to increase sales, and to reach more customers, some systems do not fulfil their potential. As a result, several models and tools have been developed to assess IS effectiveness in various settings. The most dominant models are DeLone and McLean of 1992 and 2003 respectively. The two models have been cited in more than 3500 articles to date, and they have been used to evaluate dozens of IS worldwide.

The original DeLone and McLean (D&M) model (1992) consists of six constructs: system quality, information quality, system use, user satisfaction, individual impact, and organizational impact. The system quality measures the quality of the system itself while information quality measures the quality of information produced by the system. The two constructs have directly influence on system use and user satisfaction, which in turn, have impact on individual user and organization in general. The D&M model is shown in Figure 1.

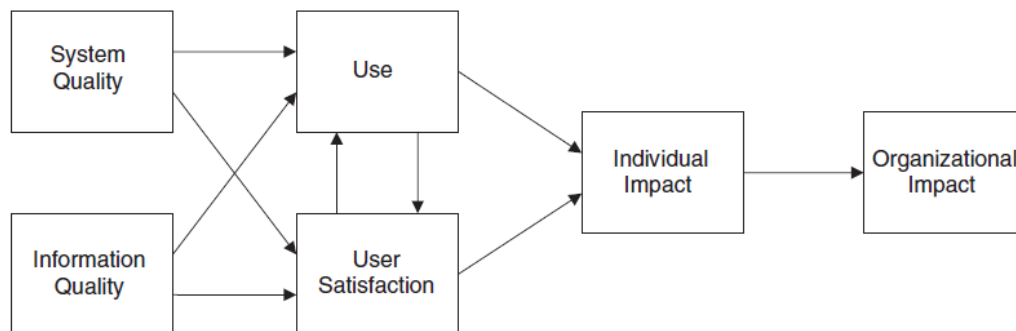


Figure 1: The D&M model (1992), Source: (DeLone & McLean, 1992, p. 87)

Just like many models and theories, the D&M model was reviewed by several researchers who proposed several improvements in order to cope with changing IT industry. Accordingly, the authors incorporated suggestions from researchers and extended it to the *updated D&M model*. Some of the notable amendments were to split *Use* construct into *Intention to Use* and *Use* in order to measure IS success in both voluntary and mandatory environment.

Moreover, *Service Quality* was added as a new construct in the model to measure the quality of services offered by the IT Unit as many organizations tend to sub-contract computing services to a separate IT Unit. Similarly, two constructs: *Individual Impact* and *Organizational Impact* were merged to form *Net Benefits* as the impact of IS was now beyond immediate user. DeLone and McLean (2003) described work group, organizational and industry, and consumers as some of the beneficiaries of the IS. Therefore, there was a need to measure net benefits of the IS rather than that of individual and organization only. The updated D&M model is shown in Figure 2.

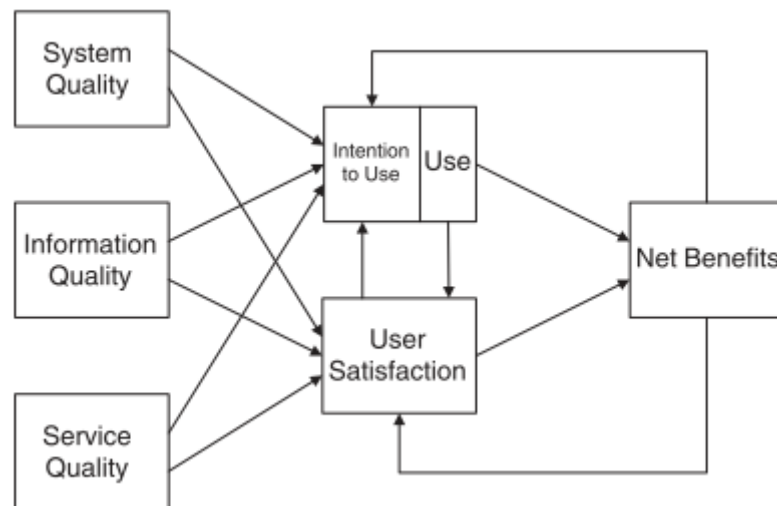


Figure 2: The updated D&M model Source: (DeLone & McLean, 2003, p. 24)

DeLone and McLean (2003) argued that the updated D&M model was not a generic model for measuring IS success. They argued researchers to extend and reduce the number of constructs so that it can be relevant in their context of studies. Accordingly, the recent developments in eLearning systems have heightened the need to extend D&M model to measure the success of these systems in various educational settings. The recent studies that have extended the D&M model include (Hassanzadeh et al., 2012; Holsapple & Lee-Post, 2006; Ozkan & Koseler, 2009). The majority of these models were validated in higher education in western countries using students as respondents.

These institutions include the University of Kentucky, USA (Holsapple & Lee-Post, 2006), the Brunel University, UK (Ozkan & Koseler, 2009), and five universities in Iran (Hassanzadeh et al., 2012). The extents of D&M model extension were different from each study. For example, Holsapple et al. (2006) divided D&M model in three stages: design, delivery and outcome. The design stage consists of service quality, system quality, and information quality while delivery stage consists of system use, and user satisfaction. Likewise, the net benefits construct was integrated into outcome stage. The model was validated using a sample of 369 students who were using Blackboard system. The model was found to be a good tool to assess LMS through an iterative process of diagnosing, action planning, action taking, evaluating, and learning.

Similarly, Ozkan et al. (2009) extended the D&M model by dividing its constructs into two categories: technical and social factors to form the Hexagonal eLearning Assessment Model (HELAM). In fact, only two constructs in the D&M model: system quality and service quality were retained while adding four new constructs: content quality, learner perspective, instructor attitudes and supporting issues. The model was validated using 84 students and found appropriate and useful to assess eLearning system success.

Another recent study to extend the D&M model for eLearning context was proposed by Hassanzadeh et al. (2012). They split net benefits into three new constructs: loyalty to system, goals achievement and educational system quality. They also split intention to use and system use and become two different constructs. They also renamed system quality to technical system quality, and information quality to content and information quality. In total the new model consists of ten constructs. The model was validated using a sample 2,858 students, 470 alumni and 270 instructors across five universities. All ten constructs in the model were found useful in measuring eLearning system success.

Despite several attempts to extend an updated D&M model to develop eLearning system success models, most of these studies have been carried out in western institutions. It

might be because LMS adoption in Africa was still at an infant stage. However, as institutions in Sub-Saharan countries increasingly adopting LMS, a model to evaluate effectiveness of these systems is urgently needed. The model that will be developed taking into account the contextual factors affecting users of Sub-Saharan countries and being validated in the same context.

3. RESEARCH METHODOLOGY

3.1 Research Model

The study adopted and extended the updated D&M model by renaming the constructs to suit eLearning evaluation context. The *information quality* was renamed to *course quality* and *user satisfaction* construct to *learner satisfaction*. Similarly, *net benefits* construct was renamed to *perceived net benefits*. The research model is shown in Figure 3.

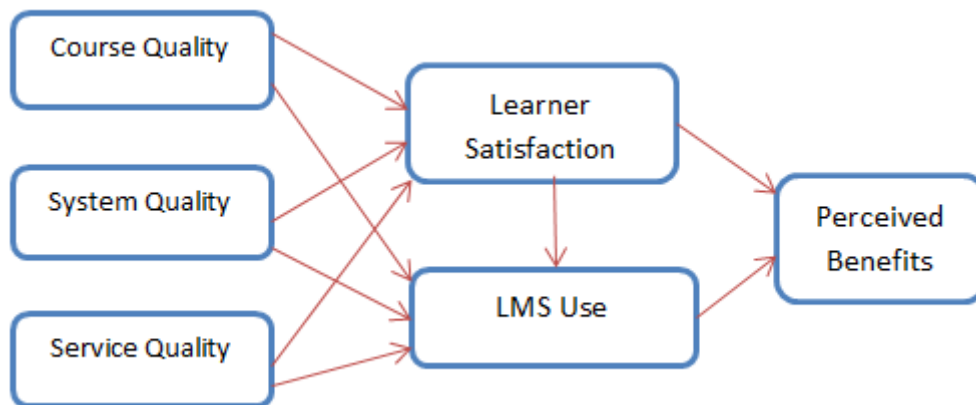


Figure 3: Research Model

3.2 Hypotheses and Scale Development

Each construct with associated hypotheses and instrument is described below:

3.2.1 System Quality

This construct measures the quality of LMS itself which includes both technical and usability features (DeLone & McLean, 1992). Many HEIs have been adopting popular LMS which do not have many technical problems. However, they have been customizing LMS interfaces and some features to meet the context of their institutions. Thus, there is a need to evaluate usability of these systems after they have been customized. If learners find the customized LMS is ease to use and easy to learn, then they will use the system and will be satisfied with it. The hypotheses for this construct are:

- **Hypothesis 1a:** System quality positively affects learner satisfaction with LMS.
- **Hypothesis 1b:** System quality positively affects LMS usage.

Similarly the proposed instrument to measure the construct is proposed in Table 1.

Table 1: Metrics for Measuring the System Quality

No.	Measure	Source
SQ1	The LMS is easy to use	DeLone & McLean, 2003
SQ2	The LMS is user friendly	DeLone & McLean, 2003
SQ3	The LMS is easy to learn	DeLone & McLean, 2003

3.2.2 Course Quality

Well-designed courses that meet intended learning outcome are believed to be a good predictor for learners to do well in courses offered through eLearning technologies. Therefore, the LMS with quality courses will help learners to improve their learning outcome and obtain better grades. Similarly, such courses will help learners to continue to use the system and get satisfied. The measures of this construct were adapted from Quality Matters Rubric Standards (QMRS, 2012) which are regarded as standard measures of the quality of courses offered in technology enhanced learning.

The instrument is shown in Table 2 and the hypotheses are:

- **Hypothesis 2a:** Course quality will positively impact learners' satisfaction.
- **Hypothesis 2b:** Course quality will have positive impact on LMS use.
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Table 2: Metrics for Measuring the Course Quality

No.	Measure	Source
CQ1	The courses have learning objectives that describe outcomes that are measurable	QMRS, 2012
CQ2	The course content contribute to the achievement of the stated module/unit learning objectives	QMRS, 2012
CQ3	The course content in the LMS is accurate	DeLone & McLean, 2003; Hassanzadeh et al., 2012; Lin, 2007; Ozkan & Koseler, 2009
CQ4	The course content in the LMS is up-to-date	Hassanzadeh et al., 2012; Lin, 2007; Ozkan & Koseler, 2009; QMRS, 2012
CQ5	The courses have sufficient content required for me to complete learning process	DeLone & McLean, 2003
CQ6	The content in the LMS is presented in ways appropriate to the learners' knowledge, skills and abilities	Researchers' experience
CQ7	The content in the LMS presents educationally significant concepts, models, and skills for the discipline	Researchers' experience

3.2.3 Service Quality

The majority of the learners in Sub-Saharan countries have not been exposed to many ICT solutions (Ssekakubo et al., 2011). As a result, their confidence levels towards using technologies are always low. To enable them use LMS more effectively, institutions have established IT Units to provide support services to learners during course delivery. Therefore, this construct measure the quality of services offered by IT Units.

It is expected that, learners with good support services from the IT Unit are likely to continue using the LMS and will have positive perception towards it. Likewise, such services will enable learners improve learning outcomes and be satisfied with the system. The proposed instrument to measure this contract is shown in Figure 3 while the hypotheses are:

- **Hypothesis 3a:** Service quality positively affects learners' satisfaction with LMS.
- **Hypothesis 3b:** Service quality positively affects towards learners using the LMS.

Table 3: Metrics for Measuring the Service Quality

No.	Measure	Source
SQ1	The staff in the IT Unit provide prompt support through various communication means such as email, telephone, chat etc.	DeLone & McLean, 2003
SLQ2	The training provided by the IT Unit has enhanced my ability to use LMS	Wang & Wang, 2009
SLQ3	The IT Unit staff are competent with LMS	DeLone & McLean, 2003
SLQ4	The IT Unit staff has adequate knowledge to help me if I experience any problems with system	Researchers' experience

3.2.4 User Satisfaction

This construct measures learner's attitude towards the system. According to Ives, Olson, and Baroudi (1983), when the system is perceived poor by users, regardless of any evaluation results, the system is indeed poor. On the other hand, increased "user satisfaction" of the system will lead to increased "intention to use", which subsequently increases usage (Delone & Mclean, 2003). Therefore, satisfied learners will continue to use the system and are likely to perceive the system as beneficial to their learning. The proposed metrics for measuring this construct are in Table 4 while the hypotheses are:

- **Hypothesis 4a:** Learners with a higher level of satisfaction are likely to have higher Perceived LMS benefits.
- **Hypothesis 4b:** Learners with a higher level of satisfaction are likely to have higher level of actual LMS use.

Table 4: Metrics for Measuring User Satisfaction

No.	Measure	Source
US1	I am pleased with the LMS	Lin, 2007
US2	I am very satisfied with the course content I access from LMS	Lin, 2007
US3	Overall, my interaction with LMS is very satisfying	Lin, 2007

3.2.5 LMS Use

This construct measures the extent of which learners use the LMS. The increased system use is an important indicator of LMS success (Delone & Mclean, 2003). If learners use the system more frequently and efficiently, they are likely to improve their learning outcome. By doing so, they bring net benefits to the institution. The proposed metrics for measuring this construct are in Table 5, and the hypothesis is:

- **Hypothesis 5:** Learners with a higher level of use are likely to agree that the LMS adds value to their learning experience

Table 5: Metrics Measuring LMS Use

No.	Measure	Source
LU1	I use LMS to help me to interact with my instructor (s)	Researchers' experience
LU2	I use LMS to access learning resources electronically	Researchers' experience
LU3	I use LMS to communicate and share knowledge with my colleagues	Researchers' experience
LU4	I use LMS to accomplish and submit my assignments	Researchers' experience

3.2.6 Perceived Net Benefits

According to Delone and Mclean (2003), the net benefits of the system depend on the system to be evaluated and the purpose of the system. The HEIs in Sub-Saharan countries have been adopting LMS in order to improve the quality of students learning as well as to widen access to education. However, measuring net benefits in terms of increased students enrolments, and improved learning outcome through the LMS is very difficult. In fact, they cannot be measured by assessing how students use the system.

The LMS use might be one of the many factors that can be used to measure improved students learning. Other factors such as good instructors and learning environment being can also be contributing factors. Studies have suggested measuring *perceived net benefits* through eliciting learners' perception on the benefit of the system as an alternative measure. Hence, this study focused on understanding learners' perceived net benefits through using Moodle LMS at UDSM. The instrument to measure this construct is shown in Table 6.

Table 6: Metrics Measuring Perceived Net Benefits

No.	Measure	Source
PLB1	Using LMS has helped me to accomplish my learning tasks more quickly	Researchers' experience
PLB2	Using LMS has made my learning activities become much easier than before	Researchers' experience
PLB3	My learning performance is enhanced since I started using LMS	Researchers' experience
PLB4	I find the system useful in my studies	Researchers' experience

3.3 Data Collection and Population

This study is based on quantitative research method using self-administered questionnaire. The questionnaire was created using Google Docs, and emailed to 619 students. The email addresses were requested from IT Support Unit at the University. All respondents were guaranteed confidentiality and the name field was treated as optional. The data collection was undertaken between November 2013 and December 2013. The questionnaire used in this study is presented in the Appendix. A random sample of 200 usable responses from students taking various courses via Moodle LMS was obtained. The study used Statistical Packages for Social Science (SPSS) version 20 to analyze data.

The majority of respondents were taking bachelor degree courses (98%) while the remainder was taking Diploma and postgraduate courses. Moreover, 57% of respondents were enrolled in one course in the Moodle LMS while 43% were enrolled in more than one course. The demographic information is shown in Table 7.

Table 7: Respondents' Demographic Profile

Respondents Profile	Classification	Frequency	Percentage
Enrolled courses	Bachelor	198	98
	Postgraduate	1	1
	Diploma	1	1
How many courses have you accessed in Moodle LMS?	One	114	57
	More than one	86	43
	None	0	0

3.4 Content Validity

To make the model useful to a wider context, the conceptual model and instrument were prepared, and emailed to people who are involved in LMS implementation from eight different countries in Africa. A total of 9 respondents (Out of 23 experts) from four countries responded to the email and provided their comments regarding the structure of the model and usefulness of each metric in the data collection instrument. The distribution of respondents is shown in Table 8.

Table 8: The experts who validated the initial conceptual model and the instrument

No	Institution	Country	URL to the current LMS involved	No. of Respondents
	South African Institute of Distance Education (SAIDE) http://www.saide.org.za	South Africa	http://www.oerafrica.org/phea	2
2	University of Makerere http://mak.ac.ug	Uganda	http://muele.mak.ac.ug	1
3	University of Jose http://www.unijos.edu.ng	Nigeria	http://moodle.unijos.edu.ng	2
4	University of Dar es Salaam http://udsm.ac.tz	Tanzania	http://lms.udsm.ac.tz/interface	3
5	Nelson Mandela Institute of Science and Technology http://www.nm-aist.ac.tz	Tanzania	https://flexcms.nm-aist.ac.tz	1

4. FINDINGS

4.1 Research Reliability

Reliability was evaluated by assessing the internal consistency of the items representing each construct using Cronbach's alpha. Based on SPSS results, the Cronbach's alpha coefficient for the 26-item instrument was 0.937 exceeding the minimum standard of 0.70 suggested for the basic research. As shown in Table 9, the Cronbach's alpha value for six constructs ranges from 0.846 to 0.991.

Table 9: Cronbach's alpha coefficients for construct reliability measurement

No.	Construct	Cronbach's alpha
1.	Course Quality	0.884
2.	System Quality	0.892
3.	Service Quality	0.846
4.	User Satisfaction	0.880
5.	LMS Use	0.886
6.	Perceived LMS Benefits	0.911

4.2 Identifying the Factor Structure

The Factor Analysis was conducted to determine the structure of the 26 item instrument. The sample data of 200 responses was examined using a principal components factor analysis as the extraction technique, and Varimax with Kaiser Normalization as the orthogonal rotation method. An iterative sequence of factor analysis was executed. All items loaded above 0.5, therefore, none of the items were deleted. Therefore, all items were highly correlated in the respective construct.

Moreover, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of Sphericity was conducted. The value for data set was found to be 0.886 which is very large; therefore the KMO supports factor analysis. Table 10 summarizes the result of the factor loadings for each construct obtained from Factor Analysis.

Table 10: Summary of Results from the Scale Purification

Construct		Factor loadings
Course Quality		
CQ1	The courses have learning objectives that describe outcomes that are measurable	.538
CQ2	The course content contribute to the achievement of the stated module/unit learning objectives	.640
CQ3	The course content in the LMS is accurate	.695
CQ4	The course content in the LMS is up-to-date	.719
CQ5	The courses have sufficient content required for me to complete learning process	.753
CQ6	The content in the LMS is presented in ways appropriate to the learners' knowledge, skills and abilities	.759
CQ7	The content in the LMS presents educationally significant concepts, models, and skills for the discipline	.734
System Quality		
SQ1	The LMS is easy to use	.823
SQ2	The LMS is user friendly	.872
SQ3	The LMS is easy to learn	.795
Service Quality		
SQ1	The staff in the IT Unit provide prompt support through various communication means such as email, telephone, chat etc.	.602
SLQ2	The training provided by the IT Unit has enhanced my ability to use LMS	.770
SLQ3	The IT Unit staff are competent with LMS	.872
SLQ4	The IT Unit staff has adequate knowledge to help me if I experience any problems with system	.809

	User Satisfaction	
US1	I am pleased with the LMS	.690
US2	I am very satisfied with the course content I access from LMS	.802
US3	Overall, my interaction with LMS is very satisfying	.788
	LMS Use	
LU1	I use LMS to help me to interact with my instructor (s)	.791
LU2	I use LMS to access learning resources electronically	.804
LU3	I use LMS to communicate and share knowledge with my colleagues	.809
LU4	I use LMS to accomplish and submit my assignments	.768
	Perceived LMS Benefits	
PLB1	Using LMS has helped me to accomplish my learning tasks more quickly	.758
PLB2	Using LMS has made my learning activities become much easier than before	.816
PLB3	My learning performance is enhanced since I started using LMS	.815
PLB4	I find the system useful in my studies	.805

4.3 Hypothesis Testing

The multiple regression analysis was conducted to test the hypotheses and determine the structure of the proposed research model. The results show that, two hypotheses were not significant. These are hypothesis 1a and hypothesis 3a. Table 11 shows a summary of predictive factors in terms of beta values for each hypothesis obtained from multiple regression analysis.

Table 11: Summary of Results Hypothesis Testing

Hypothesis	Results	Conclusion
Hypothesis 1a: System quality positively affects learner satisfaction with LMS.	No: Significant (Beta=0.145, $p<0.039$)	Not Supported
Hypothesis 1b: System quality positively affects LMS usage.	Yes: Significant (Beta=0.192, $p<0.005$)	Supported
Hypothesis 2a: Course quality will positively impact learners' satisfaction.	Yes: Significant (Beta=0.281, $p<0.0005$)	Supported
Hypothesis 2b: Course quality will have positive impact on LMS use.	Yes: Significant (Beta=0.210 $p<0.002$)	Supported
Hypothesis 3a: Service quality positively affects learners satisfaction with LMS	No: Significant (Beta=0.131, $p<0.070$)	Not Supported
Hypothesis 3b: Service quality positively affects towards learners using the LMS.	Yes: Significant (Beta=0.252 $p<0.0001$)	Supported
Hypothesis 4a: Learners with a higher level of satisfaction are likely to have higher Perceived LMS benefits.	Yes: Significant (Beta=0.226 $p<0.001$)	Supported

Hypothesis 4b: Learners with a higher level of satisfaction are likely to have higher level of actual LMS use	Yes: Significant (Beta=0.312 p<0.0001)	Supported
Hypothesis 5: Learners with a higher level of use are likely to agree that the LMS adds value to their learning experience	Yes: Significant (Beta=0.352 p<0.0001)	Supported

4.4 Final LMS Evaluation Model

The study conducted multiple regression analysis to determine the structure of the LMS evaluation model. The two paths were not significant: the relationship between system quality and learners' satisfaction, and the relationship between service quality and learners' satisfaction. Thus, they were removed from the model. All other paths were found significant. The final LMS evaluation model is shown in Figure 4.

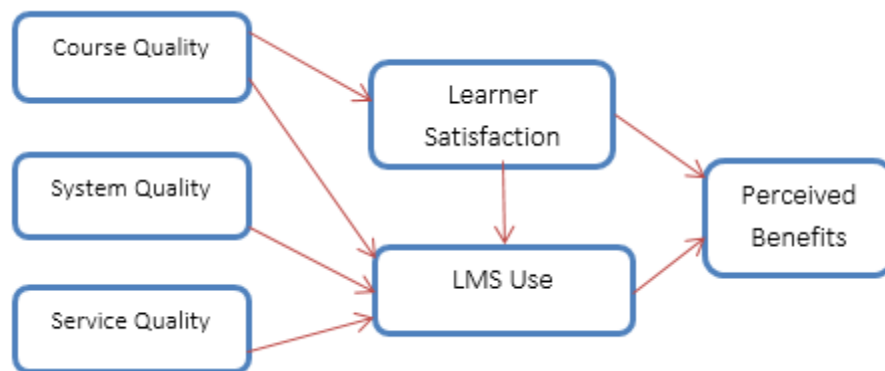


Figure 4: Final Research Model

5. DISCUSSION

The study aimed to present a model that will be used to evaluate LMS effectiveness for systems deployed in higher education in Sub-Saharan countries by adopting and extending updated D&M model. The study also aimed at developing evaluation metrics for each construct in the research model. One unanticipated finding was that, all items in each construct was found to be highly correlated during Factor Analysis, as a result, no item was deleted.

In determining the structure of the model, two paths were not significant. In other words, two hypotheses: system quality positively affects learner satisfaction with LMS, and service quality positively affects learners' satisfaction with LMS was not supported. This implies that, learners' satisfaction could not be explained by the quality of the system as well as the quality of services offered by IT Unit.

Other paths were found significant with LMS use having a strong and significant influence on perceived LMS benefits. Thus, institutions should find strategies to maximize LMS use in order to realize the perceived LMS benefits deployed in HEIs. One of the strategies is to increase learners' satisfaction towards the system. The study found learners' satisfaction towards the system has positive effect on LMS use, and has positive effect on learners' perception that the system is beneficial and will improve their learning outcome.

The study also found course quality has positive effect on learners' satisfaction towards the system as well as having positive effect on LMS use. These findings corroborate

with similar studies conducted by (Andersson & Grönlund, 2009; Ozkan & Koseler, 2009). These results provide further evidence that the quality of courses is very important for students to realize the benefits of using LMS in their learning activities. Hence, instructors should develop quality course content that meet intended educational benefits, appropriate to learners' knowledge, skills and abilities in order to maximize LMS use, and increase learners' satisfaction with the system. They should also ensure course content are accurate, up-to-date, and they present educationally significant concepts, models and skills for a given discipline.

Another finding from this study was that, service quality construct was found to have positive effect on LMS use. As many learners in developing countries are not exposed to many ICT solutions (Ssekakubo et al., 2011), this finding further proves that the quality of support services offered by IT Unit are important to maximize LMS usage. Institutions should find various strategies to provide support services such as training, hotline, helpdesk (Urbach & Müller, 2012) and other means in order to maximize LMS use.

Finally, system quality was also found to have positive effect on LMS use, though having the lowest significant level ($\beta=0.192$). This finding has important implications for system developers and those who are customizing LMS to suit the context of learners of HEIs in Sub-Saharan countries. They should develop and/or customize the LMS to ensure the system is ease to use, the interface is user friendly and the easy to learn in order to maximize LMS use.

6. CONCLUSION AND FUTURE RESEARCH

In this study, we have proposed and validated a model and relevant metrics that can be used to evaluate LMS effectiveness for systems deployed in HEIs in Sub-Saharan countries. The model was an outcome of modifying and extending the updated D&M model, and found all six constructs were significant. Although the model is expected to be used by HEIs in Sub-Saharan countries, the model was validated using a sample of responses from University of Dar es Salaam, Tanzania alone. We believe the context of Tanzania is a typical representative of many situations facing HEIs in Sub-Saharan countries. We request future studies to validate the model and its instrument using a cross-sectional survey involving large numbers of students from different countries in Sub-Saharan countries.

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APPENDIX

This questionnaire aims to collect data that will help develop an eLearning evaluation model. The model will help institutions to assess effectiveness of LMS deployed in institutions of Sub-Saharan countries. Your willingness to participate is very much appreciated.

- Your responses will be treated in confidence and used for the purposes of this study only.
- Completion of this questionnaire is completely optional.
- For further information contact Joel S. Mtebe jmtebe@gmail.com +255715 383366

1. Full name (optional).....
2. Which programme have you enrolled in? a) Diploma b) Bachelor c) Postgraduate
3. How many courses have you accessed in Moodle LMS? a) One b) More than one c) None

Course Quality (Please choose by ticking () on the appropriate box

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. The courses have learning objectives that describe outcomes that are measurable					
2. The course content contribute to the achievement of the stated module/unit learning objectives					
3. The course content in the LMS is accurate					
4. The course content in the LMS is up-to-date					
5. The courses in the LMS have sufficient content required for me to complete learning process					
6. The content in the LMS is presented in ways appropriate to the learners' knowledge, skills and abilities					
7. The content in the LMS presents educationally significant concepts, models, and skills for the discipline					

Service Quality (Please choose by ticking (✓) on the appropriate box

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
8. The staff in the IT Unit provide prompt support through various communication means such as email, telephone, chat etc.					
9. The training provided by the IT Unit has enhanced my ability to use the LMS					
10. The IT Unit staff are competent with LMS					
11. The IT Unit staff have adequate knowledge to help me if I experience any problems with system					

System Quality (Please choose by ticking (✓) on the appropriate box

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
12. The LMS is easy to use					
13. The LMS is user friendly					
14. The LMS is easy to learn					
15. The operation of the LMS is stable					

User Satisfaction (Please choose by ticking (✓) on the appropriate box

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
16. I am pleased with the LMS.					
17. I am very satisfied with the course content I access from LMS					
18. Overall, my interaction with LMS is very satisfying					

System Use (Please choose by ticking (✓) on the appropriate box-

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
19. I use LMS to help me to interact with my instructor (s)					
20. I use LMS to access learning resources electronically					
21. I use LMS to communicate and share knowledge with my colleagues					
22. I use LMS to accomplish and submit my assignments					

Perceived LMS Benefits (Please choose by ticking (✓) on the appropriate box-

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
23. Using LMS has helped me to accomplish my learning tasks more quickly					
24. Using LMS has made my learning activities become much easier than before					
25. My learning performance is enhanced since I started using LMS					
26. I find the system useful in my studies					

30. Do you have any other comment related to LMS?

THANK YOU