VALIDATING INFORMATION SYSTEMS SUCCESS MODEL WITHIN OPEN EDUCATION CONTEXT

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Abstract

As being the most important component of distance and open education activities, Learning Management Systems (LMS) should be improved and evaluated for better management of learning facilities. In this study, it is aimed to evaluate Atatürk University, Open Education Faculty (ATA-AOF) LMS in the scope of updated DeLone and McLean (D&M) Information Systems Success framework. A Structural Equation Model (SEM) approach has been used to employ the model. The results show that system quality, service quality and information quality have significant effect on user satisfaction in the context of LMS. Additionally, in contrast to D&M model, the findings show that service quality does not have impact on perceived system use. The study has great importance because of high number of participants (3067) and validation of IS success model within Open Education Faculty for IS Success literature.

Keywords: *Information System Success, Learning Management Systems, Distance Education, Open Education, e-Learning.*

Açıköğretim Fakültesi Çerçevesinde Bilişim Sistemleri Başarı Modelinin Geçerlenmesi

Öz

Uzaktan ve açık öğretimin en önemli bileşeni olan öğretim yönetim sistemlerinin eğitim faaliyetlerini daha iyi yönetebilmek amacı ile değerlendirilmesi ve iyileştirilmesi gerekmektedir. Bu çalışmada Atatürk Üniversitesi Açık Öğretim Fakültesi (ATA-AOF) Öğretim Yönetim Sistemi (ÖYS) DeLone ve McLean'in bilişim sistemleri başarı modeli temel alınarak değerlendirilmiştir. Çalışmada kullanılan model ise yapısal eşitlik yaklaşımı kullanılarak değerlendirilmiştir. Ortaya çıkan sonuçlara göre sistem kalitesi, hizmet kalitesi ve bilgi kalitesinin ÖYS'nin başarıya ulaşmasında önemli bir etkiye sahip olduğu ortaya çıkmıştır. Ayrıca, D&M modelinin aksine hizmet kalitesinin algılanan sistem kullanımı ile ilgili önemli bir etkiye sahip olmadığı görülmüştür. Bu çalışma katılımcı sayısı (3067) ve bilişim sistemleri başarı modelinin Açıköğretim Fakültesi çerçevesinde değerlendirilmesi açısından alanyazın için büyük önem taşımaktadır.

Anahtar Kelimeler: *Bilişim Sistemleri Başarısı, Öğretim Yönetim Sistemleri, Uzaktan Eğitim, Açık Öğretim, e-Öğrenme.*

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1. INTRODUCTION

Although e-learning systems have been used since the middle of 1980s, with the latest developments in information and communication technologies, they are considered one of the most popular applications in educational institutions. (Islam, 2012; Alsabawy, Steel & Soar, 2013). With the spread of internet use, many universities focus on e-learning services and programs (Kanuka & Anderson, 2008). In this context, information systems that support learning and teaching processes have been developed and widely used in higher education. Among various systems that have been used in e-learning, Learning Management Systems (LMS) are one of the important tools to provide higher quality and learner centered education (Islam, 2012).

The purpose of LMS in higher education is to contribute teaching and learning activities (Ferdousi, 2009). Information technology and services are employed and utilized for providing higher quality information and learning materials in e-learning systems. (Cavus, Uzunboylu, & Ibrahim, 2009). This increases the need of evaluation of an e-learning system success like any other information system (IS). In this regard, several researches have been conducted for measuring the success of e-learning systems (Hassanzadeh, Kanaani & Elahi, 2012; Holsapple & Lee-Post, 2006).

IS Success models have been used to evaluate information system's success for more than two decades Some scholars developed IS success models in order to understand antecedents of IS Success. Among many IS Success models, DeLone and McLean model has gained great attention from IS researchers after it was originally developed in 1992 (DeLone & McLean, 1992). Shortly after the publication, many researchers began proposing modifications to the model. Finally an updated version was developed and has also been widely used by IS researchers (DeLone & McLean, 2003; Petter, DeLone & McLean, 2008). This mostly used model contains human and technological components of information systems (Chen, 2010). Therefore in this study we prefer to use updated version of DeLone and McLean's model in order to construct a suitable theoretical framework and measure LMS success.

In the study, it is aimed to use IS success model for evaluating LMS in Open Education context. According to many company and people, education is a lifelong enterprise. People around the world who work full time also want to update their knowledge and to earn certificates, diplomas and academic grades out of traditional education systems (Jarvis, 2009). Furthermore, there are a lot of people, who could not attend any traditional on campus universities, and still want to have higher education opportunity. Therefore a need for the establishment of Open/Distance Education Institutions arose within last years. For instance in Turkey, Open Education Faculties have more than 1.000.000 students (Latchem et al., 2006). Since there is a great number of students in Open and Distance Education Institutions, e-learning and information systems of these institutions should be carefully selected and validated in order to manage educational and administrative activities.

Generally students use LMS as a supporting tool for learning activities. However, in some cases LMS use can be mandatory for students as in ATA-AOF. In this study, we aim to understand which dimensions of D&M Model are crucial for system success in mandated learning management environment. Additionally, there is a limited number of studies in the literature that validate the IS success model for e-learning systems (Lin, 2007; Wang et al., 2007; Holsapple & Lee-Post, 2006). Hence, the main purpose and contribution of this research is to describe success factors for mandated use of LMS in open education faculties from IS perspective.

2. BACKGROUND

The evaluation of information systems success is a topic that has been widely investigated by Management Information Systems (MIS) researchers (Wang, 2008). Considering e-learning systems within the Information Systems (IS) context, e-learning systems have gained great attention by MIS community in recent years. As a result of this attention, a lot of research has been conducted for evaluation of e-learning systems in prior literature. Especially the models proposed by Davis (1989) (TAM), DeLone and McLean (1992-2003) (D&M) and Seddon (1997) have been used in many studies (Rai et al, 2002). The TAM model is used to measure the acceptance of technology and to investigate relationship between adoption antecedents/determinants and users' tendency to accept technology (Davis, 1989). Within e-learning context, the main drivers of TAM, "perceived usefulness" and "perceived ease of use" are used for predicting e-learner satisfaction and behavioral intensions to use e-learning (Arbaugh, 2002; Roca et al., 2006). This model differs from D&M and Seddon's success models as it is mainly used to predict the user's intention to use Information technology and does not measure IS Success.

The research model of this study is adapted from DeLone & McLean's (2003) updated information systems success model. This model is updated version of DeLone & McLean's original information success model (DeLone & McLean, 1992). After its first publication in 1992, many researchers validated the model in various information systems. For example, Seddon (1997) modified D&M Model (1992) and removed "system use" variable as a success measure. He argued that system use can be a consequence of IS success when usage of system is voluntary. He excluded system use from his study and defined "system use" as user behavior rather than a measure of system success. Regarding contributions from other researchers such as Seddon, DeLone and McLean (2003) developed an extended IS success model. The extended D&M model have been used in order to investigate the relationships between IS success dimensions for various information systems. Additionally, some researchers have modified the model in order to evaluate specific applications such as knowledge management, e-government and e-commerce (Wang & Liao, 2008; Petter, DeLone & McLean, 2008). Although it has been criticized by some researchers for including "Use" construct, in this research we evaluate

the success of LMS by using the theoretical framework of D&M's IS success model for the following reasons. First, the IS Success model assumes that system use is voluntary for users (Freeze et al., 2002). However, users have to use ATA-AOF LMS to cope with the learning facilities. Therefore, in this study, instead of systems use construct, perceived system use construct is employed. Second, DeLone and McLean (2003) stated that web-based application processes fit well into their updated IS Success model.

As we mentioned above, the success model of DeLone and McLean is one of the most widely cited IS success models and has been seen as the most influential theory in predicting and explaining system use and success (Kulkarni, Ravindran & Freeze, 2006; Freeze, Alshare, Lane & Wen, 2010). Majority of research that used D&M Model, brought together six dimensions of success factors. These success factors are defined as system quality, information quality, service quality, system use, user satisfaction and net benefits (DeLone & McLean, 2003; Holsapple & Lee 2006; Roca et al. , 2006; Wang et al. , 2007; Lee-Post,2009; Hassanzadeh et al. ,2012). The original model was developed by DeLone and McLean (1992) and due to emergence of information systems over time, DeLone and McLean (2003) extended it by adding Service Quality and replacing Net Benefits with individual/organizational impact. The updated model that is shown in Fig.1 consists of six interrelated variables that should be considered in the evaluation of information systems.
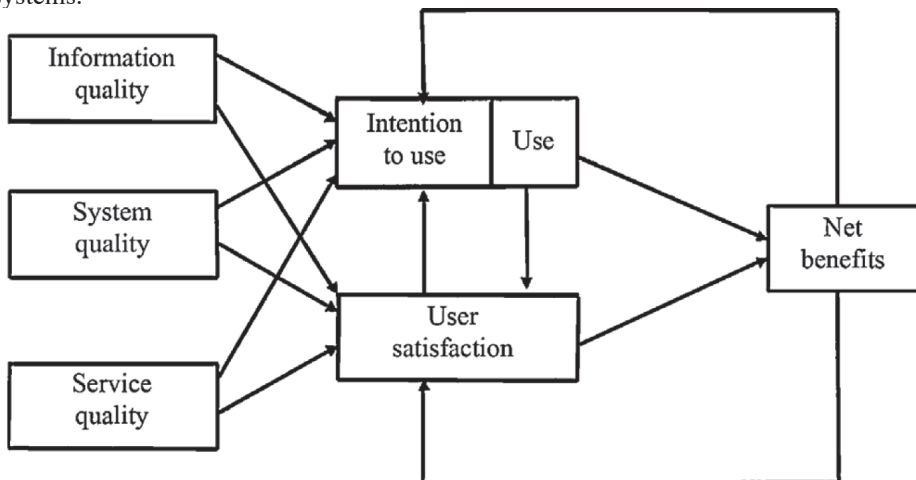
Fig. 1 - The updated D&M model Source: (DeLone & McLean, 2003, p. 24)

An e-learning system is a kind of information system that uses telecommunication and information technology for the delivery of learning materials via media to learners by eliminating environmental / physical barriers such as time or place (Panda & Mishra, 2007; Shee & Wang, 2008). Among e-learning systems, learning management systems (LMS) has been known as an information system that uses internet technology to deliver

courses/learning materials. LMS can be described as an information process system that processes learning content by supporting various types of materials to other learning systems (Lee & Lee, 2008).

In prior literature, some studies have been conducted to investigate e-learning success or e-learner satisfaction by using several models. Within the university context, Islam (2013) has empirically tested a model, combined Technology Acceptance (TAM) and D&M Model, to discover relationships between the use of e-learning system and e-learning outcomes.

Based on updated D&M model, Wang et al. (2007) has been conducted a research for measuring e-learning systems success within organizational context. Holsapple & Lee-Post (2006) proposed an e-learning success model, adapted from D&M (2003) model, and compared traditional and online students' thoughts for understanding of how to define, evaluate, and promote e-learning success. Chen (2010) used IS success model of Seddon (1997) to investigate the usage of e-learning system among employees and perceived beneficial consequences of IS impact in overall job outcome. Hasanzadeh et al. (2012) combined a few IS Success models, including D&M, and presented a model measuring e-learning systems success. Another study for assessing LMS success in high education was proposed by Mtebe & Raisamo (2014). Mtebe & Raisamo (2014) has deployed updated D&M model for evaluating LMS effectiveness and the model was validated through a survey of 200 students enrolled in various courses offered via Moodle LMS at a University.

As shown above, while some researchers have used D&M model in many instances, there is not any empirical study on a LMS that is used by open faculty. Moreover, DeLone and McLean (2003) suggest that further development and validation are needed to provide empirical validations for the updated model. Despite several attempts to apply updated D&M model to measure e-learning system's success, there is a limited number of studies that clearly identify e-learning systems evaluation within open or distance education context. Additionally, many studies have been conducted on small students groups and that challenges their generalizability and the accumulation of findings.

In the scope of LMS, to combine both the human and technological elements successfully is vital in order to get success of e-learning education. Therefore more attention should be paid to the management of LMS in e-learning. In this light, this study is constructed mainly on the basis of the D&M and focuses on the perspective of the e-learner to validate IS Success Model for a LMS success.

3. RESEARCH METHOD

The data used to test research model were collected from Ataturk University, a public university in Turkey that has open faculty and distance teaching with more than 10 diploma programs and enrollment of nearly 100.000 students in 2014-2015 academic year. Students

from different majors received an invitation to take a web based survey that is placed on LMS when they visit web site during the survey period. All items in questionnaire were measured using a five-point Likert-type scale, ranging from 'strongly disagree' to 'strongly agree'. A total of 3067 questionnaires were collected. The demographic profile of the respondents is given in Table 1.

Table 1. Demographic Information.

Measure & Items		F	Percent (%)
Age	16-20 years	246	8
	20-25 years	987	32.2
	25-30 years	627	20.4
	30-35 years	586	19.1
	> 35 years	621	20,2
Gender	Male	1307	42.6
	Female	1760	57.4
Employment	Full Time	1765	57.5
	Part Time	291	9.5
	Not Working	1011	33
Degree	High School	1485	48.4
	College	607	19.8
	Bachelor	790	25.8
	Master	175	5.7
	Doctorate	10	0.3

Since 2011 the university has been using same LMS version that is open source and called as "akademikLMS" (http://lms.atauni.edu.tr/). In the university, the main purpose of LMS usage is to provide an alternative teaching with online activities instead of face-to-face teaching.

Instrument Development

The literature was carefully reviewed to generate questionnaire items and all items are derived from literature. The questionnaire includes five constructs (information quality, service quality, system quality, system use, user satisfaction). Literature review on IS Success (Kettinger & Lee, 1994, Rai et al, 2002; DeLone & McLean, 2003; Chen, Soliman, Mao & Frolick, 2000; Holsapple & Lee-Post, 2006; Wang, 2003) revealed 14 items representing information quality, system quality, service system use and user satisfaction constructs of D&M IS Success Model. Internal validity and external validity of instruments were tested in above mentioned studies.

Research Hypotheses

The research hypotheses for this study address system success measures of LMS from e-learner perspective. Hence, we propose following hypotheses:

H1: The use of LMS is influenced significantly by Information Quality.

H2: The use of LMS is influenced significantly by System Quality.

H3: The use of LMS is influenced significantly by Service Quality.

H4: User Satisfaction in LMS is influenced significantly by System Quality.

H5: User Satisfaction in LMS is influenced significantly by Information Quality.

H6: User Satisfaction in LMS is influenced significantly by Service Quality.

H7: User satisfaction in LMS is influenced significantly by Perceived System Use.
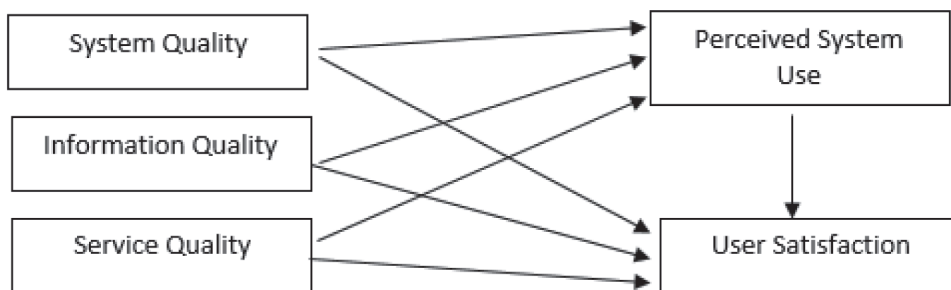
Fig. 2 - Research Model

The construcs of model was summarized as follows:

System Quality refers the quality of the features of LMS.

Information Quality refers the quality and relevance of the information offered by LMS.

Service Quality refers guidelines or support documents provided by LMS.

Perceived System Use refers frequency of LMS usage.

User Satisfaction refers user's level of satisfaction with LMS usage.

4. ANALYSIS

Following the Hair et al. (2010) suggestion, we used two-step analytical procedure to analyze data. First, the reliability and validity of each instrument was examined by calculating Cronbach's alpha value (α=0, 70). As second, the structural model was examined to discover the strength of relationships among the theoretical constructs. The seven hypotheses were tested using AMOS version 20.0.

Analysis of the Measurement Model

According to Fornell and Larckers (1981), all factor loadings of construct's indicators should be significant and all above the recommended value 0.50. After the result of SPSS analysis, four scale items that did not load properly on their intended constructs were removed. Finally, 14 -item instrument were analyzed for construct validation and reliability. At the end of the factor analysis procedure, we obtained a 5-factor, 14-items instrument.

The Cronbach's alpha scores, the composite reliabilities of constructs (CR) and the AVE are reported in Table 2. The Cronbach's were above 0.80 for all constructs. After the confirmatory factor analysis of the measurement model, the results showed that all coefficients exceed the recommended value 0.70.

According to Hair et al. (2010), composite reliabilities should exceed 0.70 and AVE should be above 0.50. As shown in Table 2 the composite reliabilities of constructs are higher than 0.7 and AVE is more than 0.50. All of these indicate that each construct in our model is reliable and reflective for data analyze.

Table 2. Results of Analysis

Construct	Questionnaire Items	Factor Loading	Composite Reliability	AVE	Cronbach Alpha
Information Quality	IQ1	0.704	0.857	0.668	0.84
	IQ2	0.975			
	IQ3	0.604			
System Quality	SQ1	0.805	0.822	0.607	0.82
	SQ2	0.646			
	SQ4	0.723			
Service Quality	SVQ1	0.628	0.863	0.678	0.86
	SVQ2	0.954			
	SVQ3	0.737			
Perceived System Use	PSU2	0.947	0.902	0.822	0.90
	PSU3	0.835			
User Satisfaction	US1	0.542	0.903	0.757	0.90
	US2	0.898			
	US3	0.644			

Analysis of Structural Model

Due to the chi-square test's sensitivity to sample size, the validity of measurement model was assessed by other fit indices (namely GFI, CFI, and NFI). Most of the studies (Chau and Hu, 2001; Hair et al., 2006) adopt .90 as a cut-off level for GFI and AGFI, .93 as a cut off level for CFI. In order to remove the effects of degree of freedom and sample

size, RMSEA is used as a supplementary fit for Fit Statistics. For a good fit model, less than 0.08 is acceptable value of RMSEA (Hooper, Coughlan, & Mullen, 2008). As shown in Table 3, these indices were meeting the standard for close fit and suggesting a good model fit.

Table 3. Overall Model Fit Indices

Fit Indices	Structural Model	Recommended Value
GFI (goodness-of-fit index)	0.963	≥ 0.90
AGFI (adjusted goodness-of-fit index)	0.943	≥ 0.90
CFI (comparative fit index)	0.976	≥ 0.93
NFI (normalized fit index)	0.974	≥ 0.95
RMR (root mean square residual)	0,034	≤ 0.10
RMSEA (root mean square error of approximation)	0.061	≤ 0.08

The standardized path coefficients of SEM analysis for the research model are presented in Fig. 3. According the results of the structural model, all of the paths are significant at 0.001 level. Every hypothesis is accepted with the exception of H6.
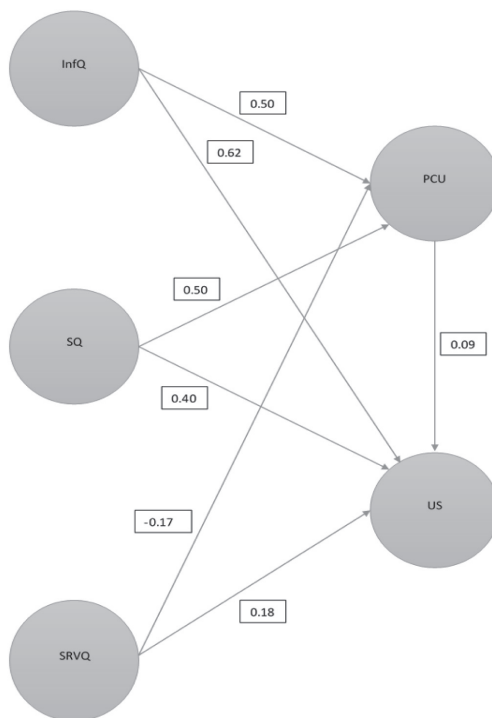
Fig. 3 - SEM Results

5. RESULTS & CONCLUSIONS

The results of this study show that information quality has the strongest effect on system use. Most of studies examined the relationship between information quality and system use when system use is not mandatory. The study points out that accurate up to date content and accurate information play crucial role in providing continuous usage of system even if the system use is mandatory.

Regarding information quality and system quality, the findings show that both information quality and system quality on system usage are significant and almost have the same level. However, in contrast to the prior findings of Ramayah & Lee (2012) we found that the effects of service quality do not have a significant impact on perceived system use. This is also consistent with the study of Petter & McLean (2009) who conducted a meta-analysis to determine whether the model had been validated by research studies reported in the literature. The reason of this finding can be explained by system usage attitude. More clearly, when system usage is mandatory, users can ignore service quality.

It is worth noting that although service quality does not have an impact on system use, it is associated with user satisfaction. This may be the result of users' not needing personalized support for use of main functions in system but they feel satisfied with its existence. This finding is consistent with a previous study of Wang & Liao (2008) in the e-government area.

The effects of system quality are also significant on user satisfaction. These results are also consistent with the results of Rai et al. (2002), Kim et al. (2002), Livari (2005) and Halawi et al. (2007) who also found that information quality and system quality significantly associated with user satisfaction. This finding can be interpreted as showing technical features such as system speed, reliability or aesthetic are important factors for user satisfaction.

The findings of this study provide support for DeLone & McLean's IS success model except for the construct service quality. The findings indicate that information quality, system quality, service quality and system use are valid measures of user satisfaction in LMS. In other words, e-learning managers or decision makers should take into account the constructs in IS model

In this study, we have reported findings from 3067 people who are student at Open Education Faculty and use LMS actively in their study activities. Due to the sample size that has been used in this study, the findings can be useful for large institutions that plan to adopt LMS to conduct educational activities. More important, the study confirms that information quality, system quality and system use constructs are important for user satisfaction on LMS Platform with thousands of users.

6. LIMITATIONS AND FUTURE RESEARCH

This study investigates the critical factors that affect LMS success from MIS perspective. The main purpose of the study is to broaden the viewpoint of e-learning system success measures within open education context. Like many studies, this study has several limitations. Firstly, the sample of this study is limited to one country (Turkey). Leidner and Kayworth (2006) stated that national culture should be considered as significant variable for IS studies. Secondly, we have only focused five dimensions (information quality, system quality, service quality, system use, user satisfaction). Future studies might incorporate models such as Seddon model or variables e.g. user loyalty, educational quality, goals achievement.

Finally, the sample of study used LMS mandatorily. We recommend examining to which degree system use would have an impact on user satisfaction when system use is optional.

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Appendix

Questionnaires

Information Quality

IQ1 The LMS provides accurate information.

IQ2 The LMS provides sufficient information.

IQ2 The LMS provides precise information that I need.

System Qality

SQ1 The LMS responds rapidly and generally works stable.

SQ2 I can use interactive features of LMS without error.

SQ4 It is easy for me to learn how to use LMS

Service Quality

SVQ1 I feel an individual attention because of LMS services

SVQ2 When I have a problem, I can contact to authorities via LMS

SVQ3 When I have a problem in LMS, I can solve my problem by user guides or help functions.

Perceived System Use

PSU2 Generally, LMS make my work easier

PSU3 I am satisfied with LMS because it supports my work procedures.

User Satisfaction

US1 I am satisfied with LMS because it provides every information that I need

US2 I am satisfied with overall performance of LMS

US3 I would like to use LMS if I had opportunity to study in another program.