DEVELOPMENT OF A MULTI-DIMENSIONAL MODEL TO EVALUATE HIGHER EDUCATION INSTRUCTORS' ADOPTION TOWARDS LEARNING MANAGEMENT SYSTEM

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Approval of the Graduate School of Informatics

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ABSTRACT

DEVELOPMENT OF A MULTI-DIMENSIONAL MODEL TO EVALUATE HIGHER EDUCATION INSTRUCTORS' ADOPTION TOWARDS LEARNING MANAGEMENT SYSTEM

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Through the rapid expansion of information technologies, Learning Management Systems have become one of the most important innovations for delivery of education. Successful implementation and management of these systems are primarily based on the instructors' adoption. However, too few researches have been conducted to evaluate instructors' adoption towards e-learning system as taking

higher education as base. This study aims to understand behavioral intentions of higher education instructors towards Learning Management Systems and further to identify the influencing factors. A research model has been proposed based on the belief variables of the Technology Acceptance Model. Additionally, Application Characteristics, Individual, Social and Technological dimensions were considered to identify the effects of key variables on behavioral intention of users. A survey instrument has been developed and conducted with 224 academicians after a pilot study through its reliability and validity has been assured. Although the items of the survey instrument were based on the literature, an explanatory factor analysis was performed to strictly determine which items belong to which factors. Then, in order to assess the measurement model Convergent validity and Discriminant validity were conducted via confirmatory factor analyses. After the required prior analyses, Component based Structural Equation Modeling (Partial Least Square - PLS) was used to validate the predictive power of the proposed research model. Consequently, relationships between the influencing factors were detected and the results showed that the factors related with Belief dimension directly influenced behavioral intention of instructors. Also, the factors under the Individual, Social and Technological dimensions indirectly affected behavioral intention of users towards learning management system use. Additionally, structured and informal interviews were performed with ten instructors and the findings of the research model were explained with the opinions of system users. The indications of this research will be valuable for implementation, management and continuous improvement of learning management systems.

Keywords: learning management system, technology adoption, structural equation modeling, partial least squares

ÖZ

YÜKSEK ÖĞRETİM EĞİTMENLERİNİN ÖĞRETİM YÖNETİM SİSTEMLERİNE KARŞI TUTUMLARINI ÖLÇMEK İÇİN ÇOK BOYUTLU MODEL GELİŞTİRME

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Öğretim Yönetim Sistemleri bilgi teknolojilerindeki hızlı gelişmeyle birlikte eğitimin dağıtılmasında rol alan önemli buluşların arasında yerini almıştır. Bu sistemlerin başarılı bir şekilde yürütülmesi ve yönetilmesi öncelikli olarak eğitmenlerin bu sistemleri benimsemelerine bağlıdır. Fakat çok az çalışma yüksek öğretimde görev yapan eğitmenlerin e-öğrenme uygulamalarına karşı olan tutumlarını incelemiştir. Bu bağlamda, bu çalışma yüksek öğretim eğitmenlerinin öğretim yönetim sistemlerine karşı olan tutmalarını ve tutumlarını etkileyen faktörleri belirlemeyi amaçlamaktadır. Bu sebeple, etkileyici faktörler ve aralarındaki ilişkileri belirlemek amacıyla çok yönlü bir model bu çalışma kapsamında geliştirilmiştir. Sunulan araştırma modeli

Teknoloji Kabul Modeline ait olan *İnanış* değişkenlerini temel almaktadır. Bunlara ek olarak *Uygulama Karakteri, Bireysel, Sosyal ve Teknolojik boyutlarda* kullanıcıların davranışsal niyetlerine etki eden anahtar değişkenlerin belirlenmesinde göz önünde bulundurulmuştur. Bu amaçla, pilot çalışma ile geçerliği ve güvenirliği kanıtlanmış olan bir araştırma anketi 224 akademik personele uygulanmıştır. Araştırma anketinde kullanılan tüm maddeler literatüre dayanmasına rağmen, hangi maddenin hangi faktöre ait olduğunu kesin olarak belirleyebilmek için açımlayıcı faktör analizi uygulanmıştır. Daha sonra, ölçme modelini doğrulamak amacıyla doğrulayıcı faktör analizi kullanılarak yakınsak ve ayrıt edici geçerlilikler ispatlanmıştır. Gerekli olan öncelikli analizler tamamlandıktan sonra, Bileşen temelli Yapısal Eşitlik Modeli (Parsiyel En Küçük Kare) kullanılarak sunulan araştırma modelinin tahmin gücü doğrulanmıştır. Sonuç olarak, faktörler arasındaki ilişkiler göstermektedir ki, *İnanış* boyutuna ait olan faktörler eğitmenlerin öğretim yönetim sistemine karşı olan davranışsal niyetlerini doğrudan etkilemiştir. Ayrıca, Bireysel, Sosyal ve Teknolojik boyutlar altında bulunan faktörler kullanıcıların davranışsal niyetlerini dolaylı olarak etkilemişlerdir. Bunlara ek olarak 10 eğitmenle yapılı ve resmi olmayan görüşmeler gerçekleştirilmiş ve araştırma modeline ait bulgular kullanıcıların görüşleriyle desteklenerek tartışılmıştır. Sonuç olarak bu çalışmaya ait bulgular, sistemlerin yürütülmesi, yönetilmesi ve gelişimlerinin devam ettirilmesi için değerlidir.

Anahtar Kelimeler: öğretim yönetim sistemi, teknoloji benimseme, yapısal eşitlik modellemesi, parsiyel en küçük kare

to my little nephew, Ahmet Orhan

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TABLE OF CONTENTS

LIST OF TABLES

TABLE OF FIGURES

LIST OF ABBREVIATIONS

CMP	Compatibility
CMS	Content Management System
E-Learning	Electronic Learning
DIT	Diffusion of Innovations Theory
IS	Information Systems
LCMS	Learning Content Management System
METU	Middle East Technical University
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
SCT	Social Cognitive Theory
TAM	Technology Acceptance Model
TC	Technological Complexity
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
VLE	Virtual Learning Environment
WBLMS	Web-Based Learning Management System

CHAPTER 1

INTRODUCTION

In this section, argument for the significance of the instructors' adoption towards learning management systems is introduced. Additionally, objectives, importance and overall design of the study are presented.

1.1 Instructors' Adoption towards Learning Management System

Basic changes are necessary in education through the recent revolutions in developments of information and communication technologies (ICTs) and knowledge that enable greater, faster human communication and collaboration and produce new knowledge economy (Harasim, 2000). The increasing use of ICTs leds to radical changes by converting traditional forms of teaching and learning to online and virtual forms (Lockwood, 2000). The advancements of technology encourage universities to transform their educational programs. Through this transformation, universities promote online courses to establish new revenue resources, and reduce the location dependency and time constraints that are associated with traditional education. Online education helps to distribute some educational context and provides a platform for teachers and students to communicate without face-to-face education (Sewart, Keegan, & Holmberg, 1998). Moreover, online learning environments help faculty and student developments by promoting communication between students and college, collaboration among students, active learning styles,

feedback and timing on task (Henderson, 2004). Paulsen (2003) states that while the term of online education much indicates a broader range of services, the term of electronic learning (e-learning) is only one element of education; in other words, e-learning focuses on a course content, but online education covers whole range of educational tasks. However, today, the terms of online education and e-learning are used interchangeably. Additionally, e-learning is used interchangeably with "*web-based learning*", "*internet-based training*", "advanced distributed learning", "web-based instruction", "*online learning*" and "*open flexible learning*" (Khan, 2001).

E-learning environments assist faculties when organizing student groups, training students, promoting their learning and evaluating their performance (McInnis, 2002). Development of computers, information and communication technologies and the rapid expansion of the Internet provide tools to expand and support e-learning applications in higher education institutes. One of the major technological innovations is Learning Management System (LMS) to support online educational programs. Today, LMS has become one of the most important innovations in IS field to support traditional, distance and lifelong learning. The main idea behind LMS is that e-learning is planned and managed with the help of an integrated system including various tools to organize the learning activities and materials in a course (Dalsgaard, 2010).

LMS provides to access online learning services for instructors, students, and administrators (Paulsen, 2003). Successful delivery of online learning services via LMS was affected by the several issues and challenges; such as "technology", "instructor", "course" and "student" characteristics (Webster & Hackley, 1997). Collins (1995) emphasizes the importance of instructors' role in the efficiency of online delivery by emphasizing the importance of instructional implementation of technology. According to Webster and Hackley (1997), three instructor characteristics that are "*attitude towards technology*", "*teaching style*" and "*control of technology*" influence learning outcomes. For this reason, Instructors' adoption has become an increasingly critical issue for a successful LMS.

1.2 Objectives, Importance and Contribution of the Study

Integration of e-learning systems can be problematic and even end in failure because of the challenges of the development, management and continuing improvement processes of information technologies (Lergis, Ingham & Collerette, 2003). Additionally, building such a system is not an inexpensive option for educational institutions (Lee, Cheung & Chen, 2005). Successful online education should be sustainable; however much of offered online education services are transient, unsuccessful and far from sustainable (Paulsen, 2003). Success of e-learning systems depends on variables related to attitudes and opinions of *instructors* and *students* (Davis et al., 1989). Although instructors, students, information technologies and university supports are primary considerations of LMS, instructors have a central role in the efficacy and success of e-learning based training (Webster, Hackley, 1997; Selim, 2007). Instructors' decision on continuing to use the system after trying is one of the success indicators of the system; for this reason, determining the factors affecting users' intention to continue e-learning facility is one of the vital issues for researchers (Chiu et al., 2005). The studies show that instructors' attitudes towards a technology will affect learning outcomes (Webster & Hackley, 1997) and their opinions should be considered when technology-mediated distance learning systems are evaluated (Dillon & Gunawardena, 1995). It is seen that, instructors have become more and more important point for the success of LMS. Therefore, the reasons affecting instructors' adoption towards LMS use must be revealed for the successful implementation of systems in higher education.

E-learning revolutionizes education and makes it more accessible with the innovative use of information technologies; however it brings formidable challenges for instructors and students (Liaw, Huang & Chen, 2007). Upon the knowledge we gathered so far, the studies concentrating on students' adoption (Saade' & Bahli, 2005; Pituch & Lee, 2006; Lee et al., 2009) towards e-learning system have reached to a certain level of maturity. However, the number of studies examining instructors' adoption towards e-learning system is immature; in other words, the number of studies is not sufficient to make a generalization. There is no single study examined instructors' adoption towards e-learning system considering **Belief -** *Perceived*

Usefulness and Perceived Ease of Use, **Application Characteristic** – *Compatibility,* **Individual** – *Application Self Efficacy***, Social** – *Subjective Norm* and ***Technological*** – *Technological Complexity* dimensions all together. For example, while Wang and Wang (2009) only concentrated on Usefulness, Ease of Use, Subjective Norm and Self-Efficacy factors, Sánchez-Franco, Martínez-López and Martín-Velicia (2009) only examined flow construct.

In these contexts, in order to increase the LMS use, it is essential to understand the reasons behind instructors' rejection and identify the critical factors affecting their adoption. Therefore the aims of this study are as follows:

a) Identifying the key factors affecting instructors' adoption towards LMS in higher education.

Identification of the influencing factors that affect instructors' adoption of LMS use helps to understand the reasons behind acception or rejection of the system use and take efficient expediencies to improve users' acceptance of the system. Additionally, e-learning system developers and distance educators may utilize the result of this research by realizing the factors that affect end users' system usage intention and how learning management systems can be improved to promote behavioral intentions of instructors.

b) Developing a multidimensional model to reveal the main reasons behind the instructors' rejection of LMS

This thesis concentrates on the extension of Technology Acceptance Model (hereafter TAM) to explore instructors' behavioral intention towards LMS use in higher education. A predictive model is developed with Structural Equation Modeling in the scope of this study. Researchers should avoid using a single linear methodology when evaluating e-learning suggested by Liaw et al. (2007). Therefore multidimensional approach is considered when developing the proposed research model. The research model mainly includes the Belief Factors of the generic TAM and Technological, Social, Application Characteristics and Individual dimensions to measure the effects of related factors that are technological complexity, subjective norm, compatibility and application self-efficacy on behavioral intention to use. The

proposed research model is introduced with five dimensions and their variables: ***(1) Belief*** - Perceived Usefulness and Perceived Ease of Use, ***(2) Application Characteristic*** – Compatibility, ***(3) Individual*** – Application Self Efficacy, ***(4) Social*** – Subjective Norm, ***(5) Technological*** – Technological Complexity.

1.3 Overall Design of the Study

This research is organized as follows. First, concepts of LMS, e-learning and their prominent parameters are emphasized and the reasons behind the necessity of considering instructor's adoption for LMS use is explained via a detailed literature review including user intention theories and related researches. Second, the proposed research model is introduced with five dimensions and their variables: ***(1) Belief*** - Perceived Usefulness and Perceived Ease of Use, ***(2) Application Characteristic*** – Compatibility, ***(3) Individual*** – Application Self Efficacy, ***(4) Social*** – Subjective Norm, ***(5) Technological*** – Technological Complexity. Additionally, the hypotheses of the research model are introduced. Third, information is given about preparation of the survey instrument, data collection process and participants of the research. Fourth, the survey instrument has been explored for content validity and reliability, and explanatory factor analysis has been conducted to identify the factor structure of the data set. Then, the model is tested for construct validity through convergent and discriminant validity. In addition, structural model is presented considering the relations between factors and result of the analysis. Lastly, the findings of the research are discussed in the light of literature and qualitative analyses results. Additionally, contributions of this study are summarized and potential future research topics are addressed. The organization of the research is shown in Figure 1.

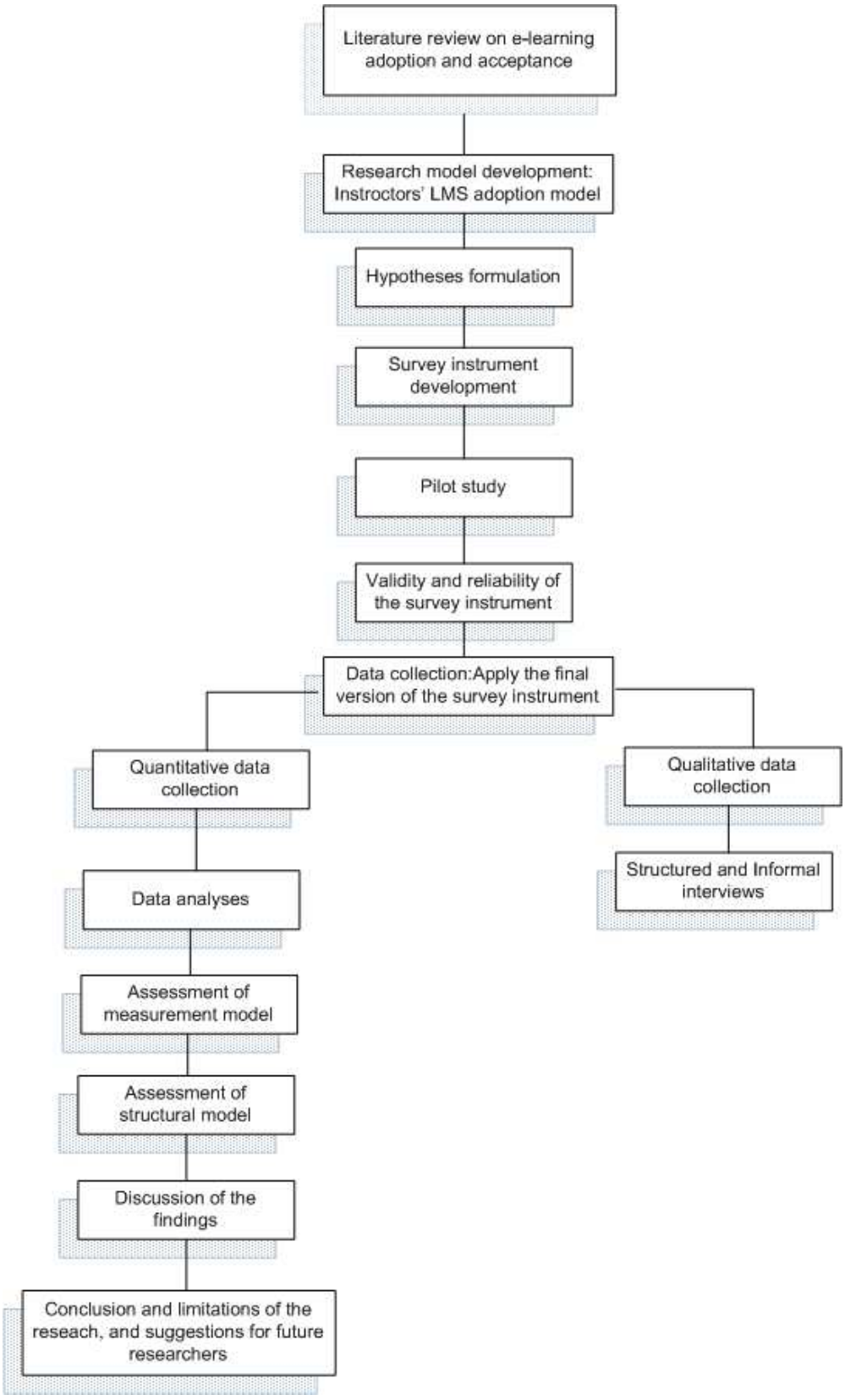

Figure 1 Overall design of the study

CHAPTER 2

LITERATURE REVIEW

This chapter includes five sections. The first and second one gives information about e-learning and learning management systems contexts. The third section covers the literature review presenting the importance of instructors' learning management system adoption. The fourth section introduces user intention theories. The last section is a literature review concerning the users' e-learning system acceptance and adoption.

2.1 E-Learning

Recent improvements on computer and networking technologies encourage learning to be a more personalized, flexible, portable and on demand manner and support people to learn information and skills in a up-to-date and effective manner (Zhang, Zhao & Zhou, 2004). The computer networking revolution effected social and economic area. Educators were the first to embrace the revolution because it provides new opportunities and new learning models that are now influencing education and society as a whole (Harasim, 2000). The enormous development and increasing availability of the technology and the Internet have motivated educators to support traditional collegiate instruction with electronic learning approaches, and today most

of the educational institutions share their course contents and materials with e-learning activities at an increasing rate.

Many definitions about e-learning exist in the literature. Some of them are as follows;

> "*E-learning covers a wide set of applications and processes, such as web-based learning, computer-based learning, virtual classroom, and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio and videotape, satellite broadcast, interactive TV, and CD-ROM*". (ASTD, 2010)

> "*E-learning is a technology-based learning in which learning material are delivered electronically to remote learners via a computer network*" (Zhang, et al., 2004)

> *"E-learning is defined as interactive learning in which the learning content is available online and provides automatic feedback to the students' learning activities*" (Paulsen, 2003)

In the literature, some researchers have been criticized e-learning activities in education. Cantoni, Cellario & Porta (2004) indicates that development of e-learning activities may be costly especially in case of highly developed visual contents and it requires new ability for content producers. Also they criticize that e-learning activities may be intimidating, confusing and reducing unofficial social relations and face-to-face communication of traditional classroom. In addition to these, students must have more responsibility and discipline to keep up free and unconstrained learning process and schedule. According to the results of Zhang et al. (2004) study, although students find e-learning system interesting and effective, e-learning cannot form the real life on a collage; therefore, they prefer traditional classroom instead of e-learning.

Although several studies criticize e-learning, it is inevitable to emphasize positive aspects of e-learning activities. Volery and Lord (2000) state that collaborative tools provide interaction between individual and technology and many-to-many

interpersonal communication. They emphasized that interactive tools integrated into e-learning applications such as simulations or self-administrated exams enable students to learn at their own pace and assess their progress. Cantoni et al. (2004) summarized advantages of e-learning activities as follows;

- It is usually less costly to deliver course contents and materials
- It is self-pace which means e-learning courses can be learned when they are needed
- It is faster because learners can skip materials they already know
- It provides consistent content so there won't be any differences among instructors course management process
- It can be reached anywhere and anytime
- It can be reorganized easily and quickly
- It can be easily organized for large group of students

Investments in e-learning area encourage universities to support their course curriculum with e-learning tools. E-learning is supported with online education support systems. The Jigsaw Model (in Figure 2) shows online education support systems that are "*Content Creation Tools*", "*Learning Management Systems*", "*Student Management Systems*" and "*Accounting Systems*" and their relations. In the scope of this study, context of Learning Management System is discussed in the next section.

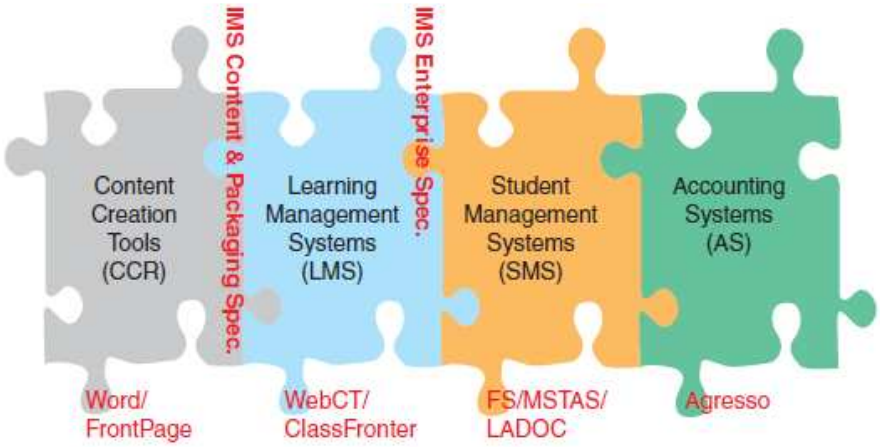

Figure 2 The jigsaw model for online education support system

http://www.studymentor.com/PartOne.pdf

2.2 Learning Management Systems

The rapid development of information technologies increases the demands of universities to deliver the education in an innovative way. Universities support LMS use in their courses to reduce the dependency on "*same-time*", "*same-place*", and "*face-to-face environment*" (Volery & Deborah, 2000). Paulsen (2003) indicates that LMS provides online learning services for students, teachers and administrators. He stated that LMS helps to obtain "*access control*", "*provision of learning content*", "*communication tools*" and "*administration of user group services*". LMS are not limited with distance education; it has been using commonly in traditional, campus-based instructions (Keller, 2005). The traditional learning environments can be supported with LMS by integrating many optional tools which provide learning and communication platforms, forum, online grade posting, online exams, audio-video clip integration, live chat, e-mail, functions that manage class materials and syllabi, schedules, course announcements and assignments posting.

In the literature Learning Content Management System (LCMS), Content Management System (CMS), Virtual Learning Environment (VLE), Web-Based Learning Management System (WBLMS) are often being used interchangeably (Cyber Media Creations LLC, 2010; Paulsen, 2003; Keller, 2005). Several LMS definitions exist in the literature as followings;

> "*LMS is software that automates the administration of training events. The LMS registers users, tracks courses in a catalog, and records data from learners; it also provides reports to management. An LMS typically designed to handle courses by multiple publishers and providers. It usually does not include its own authoring capabilities; instead, it focuses on managing courses created by a variety of other sources*" (ASTD, 2010)

> "*LMS is software that automates the administration of training events. All LMSs manage the log-in of registered users, manage course catalogs, record data from learners, and provide reports to management."*(Brandon Hall Research, 2010).

> *"A web based system that allows for the addition, deployment and tracking of learning content used for training purposes. Typically an LMS includes functionality for course catalogs (search/browse functionality), launching courses, registering new students, tracking current/completed student progress and assessments. Most of the learning management systems are developed to be independent of any content development/authoring packages. In addition, an LMS usually does not incorporate any authoring functionalities, but rather focuses on managing learning content."*(Cyber Media Creations LLC, 2010)

Most of the time, implementation of the systems may be problematic and even end with a failure (Lergis et al., 2003). Davis, Bagozzi & Warshaw (1989) stated that success of any new technology depends on variables related to users' attitudes and opinions. Therefore, the reasons effecting instructors' adoption towards LMS use must be revealed for the successful implementation of systems in higher education.

2.3 Importance of Instructors' Adoption towards Learning Management Systems for the System Success

Today, web-based courses are being introduced by universities all over the world (Keller, 2005). Success of these courses depends on several factors. While instructors, students, information technologies and university supports are primary considerations of web-based learning systems (Selim, 2007; Volery & Deborah; 2000), instructors play a vital role in the efficacy and success of e-learning based courses (Selim, 2007). Additionally, Webster and Hackley (1997) indicates that instructors' attitudes towards a technology influence educational outcomes based on Dillon and Gunawardena (1995)'s study emphasizes that instructors' attitudes should be considered when technology-mediated distance learning systems are evaluated. According to the study of Arbaugh (2000), successful technology mediated distance learning courses have instructors who project positive attitudes towards the system. Instructors' decision on continuing to use the system after trying it is one of the success indicators of LMS; for this reason, determining the factors affecting users'

intention to continue e-learning service use is one of the important issues for researchers (Chiu, Hsu, Sunb, Lin & Sun 2005).

Although e-learning revolutionizes education and enables it more accessible with the innovative use of information technologies, it causes difficult challenges for instructors and students (Liaw, et al., 2007). For example, Volery and Deborah (2000) state that students taking online courses frequently have technical problems; therefore it is critical that an instructor has a good control of the technology and can achieve simple operations like modifying students' password, changing course settings. They indicate that students have more learning outcomes if their instructors have appositive attitudes towards distributed learning and promote technology in their courses. According to study of Morgan (2003), the faculties reject the use of system like LMS because they find the related technology time consuming, inflexible and difficult to use; also they find the system inflexible, overly-structured and most of the LMS could not easily handle mathematical and scientific notation. Additionally, such a system takes much time of the instructor to develop the class materials used during the courses (Leidner & Jarvenpaa, 1993).

As a result, instructors should have interactive teaching style, promote communication among students, have good control over IT and be capable of performing basic troubleshooting tasks (Volery & Deborah, 2000). More importantly, if LMS use is wanted to be increased in universities, it is essential to understand the reasons behind instructors' rejection and identify the critical success factors affecting their adoption. In order to identify instructors' adoption towards LMS use, the user intention theories are considered in the scope of this study.

2.4 User Intention Theories

2.4.1 Technology Acceptance Model

Researchers require understanding on why people resist computer usage, how users will respond it, and how users' acceptance will be improved by changing the nature of the systems and processes which they are implemented (Davis et al., 1989). TAM is the widely accepted model in the IS literature to be able to answer these questions.

TAM (Davis et al., 1989) is adapted from TRA (Fishbein & Ajzen, 1975) and specifically aims to explain computer usage behavior. In the present ability of TAM is examined to predict the users' acceptance and rejection of computer-based technologies (Davis et al., 1989). According to Davis et al. (1989), the main purpose of TAM is to provide a basis for tracing the effects of external factors on internal beliefs, attitudes and intentions. Venkatesh and Davis (2000) indicated that the TAM has become well-built as a robust, powerful and parsimonious model for predicting user acceptance.

TAM specifies the fundamental linkages between two key beliefs that are perceived usefulness and perceived ease of use and users' attitudes, intentions and actual computer usage behavior (in Figure 3). Perceived usefulness was defined by Davis (1989) as "the degree to which a person believes that using a particular system would enhance his or her job performance." High perceived usefulness in a system affects users' beliefs positively in a user-performance relationship (Davis, 1989). On the contrary, perceived ease of use was defined by Davis (1989) as "the degree to which a person believes that using a particular system would be free of effort." Davis (1989) indicated that an application perceived easier to use than another is accepted by users. TAM determines the technology usage by behavioral intention which is affected by attitude toward use and also direct and indirect effects of perceived usefulness and perceived ease of use.

Although TAM has been using in the IS literature widely, some researchers are criticizing TAM because of its parsimony. Ma, Andersson & Streith, (2005) emphasized that TAM included only two key explanatory factors that are perceived usefulness and perceived ease of use; for this reason it is insufficient to fully understand the relations between information systems and users acceptance behavior. Even though Davis (1989) indicated the importance of external variables on internal beliefs, attitudes and intentions, there is no clear guide for determining the external variables of a research model (Lergis, et al., 2003).

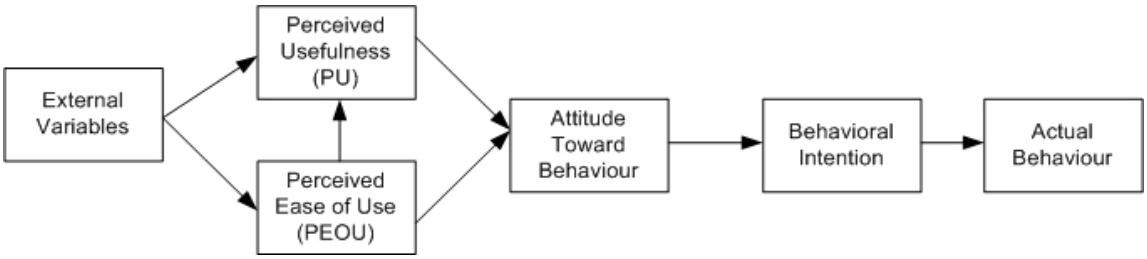

Figure 3 Technology acceptance model

2.4.2 Theory of Planned Behavior (TPB)

In order to handle the complexities of human social behavior, theory of planned behavior (TPB) was developed as an expansion of the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975) by Ajzen in 1985. The TPB introduced perceived behavior control as a third independent expositive factor of intention because of the limitation of TRA. Figure 4 depicts the TPB. The key factor in the TPB is the individual's intention to perform a certain behavior (Ajzen, 1991). The intention is determined by three independent determinants that are attitude towards the specific behavior, subjective norm and perceived behavioral control. Attitude, subjective norm and perceived behavioral control affect the actual behavior over behavioral intention. Attitude toward the behavior refers to "degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question" (Ajzen, 1991). If individuals have positive attitude towards using LMS, they will have a stronger intention toward adopting it, and they are more likely the use it (Lee, 2008). Subjective norm refers to "the perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991). Lastly perceived behavioral control refers to "people's perception of ease or difficulty in performing the behavior of interest." (Ajzen, 1991). In this research the role of subjective norm is considered.

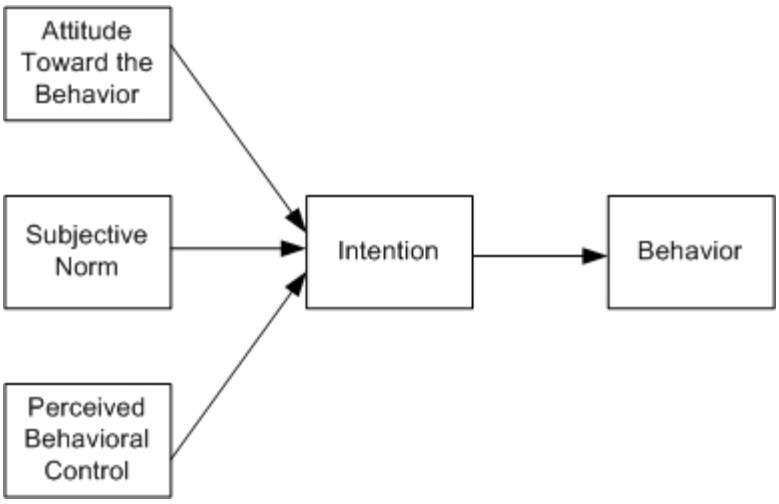

Figure 4 Technology planned behavior

2.4.3 Diffusion of Innovations Theory (DIT)

Diffusion of innovation theory (DIT) was introduced by Rogers (1995) to execute the innovation-decision process. The theory includes five stages (Rogers, 1995) shown in Figure 5. The first one is the knowledge: a person realizes an innovation and obtains some insights about how it functions. The second one is the persuasion: this stage occurs when an individual has a positive or negative attitude towards the innovation. The third one is the decision: in this stage person choose the adaption or rejection of the innovation. The fourth one is the implementation: this stage occurs when an individual start to use an innovation. The last stage is the confirmation: with this stage an individual assesses the consequences of an innovation-decision already made. The persuasion stage includes five innovation attributes that are "relative advantage", "compatibility", "complexity", "triability" and "observability" (Rogers, 1995). These attributes are defined by Rogers (1995) as follows;

Relative Advantage refers to "the degree to which an innovation is perceived as being better than the idea it supersedes". Compatibility is defined as "the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of the receivers". Complexity refers to "the perceived difficulty of learning to use and understand a new system or technology". Triability refers to "the ease of experimenting with an innovation". Lastly observability refers to the "degree to which the results of the innovation are easily seen and understood".

While innovation diffusion theory has many constructs, this research mainly concerned with the effects of compatibility and complexity.

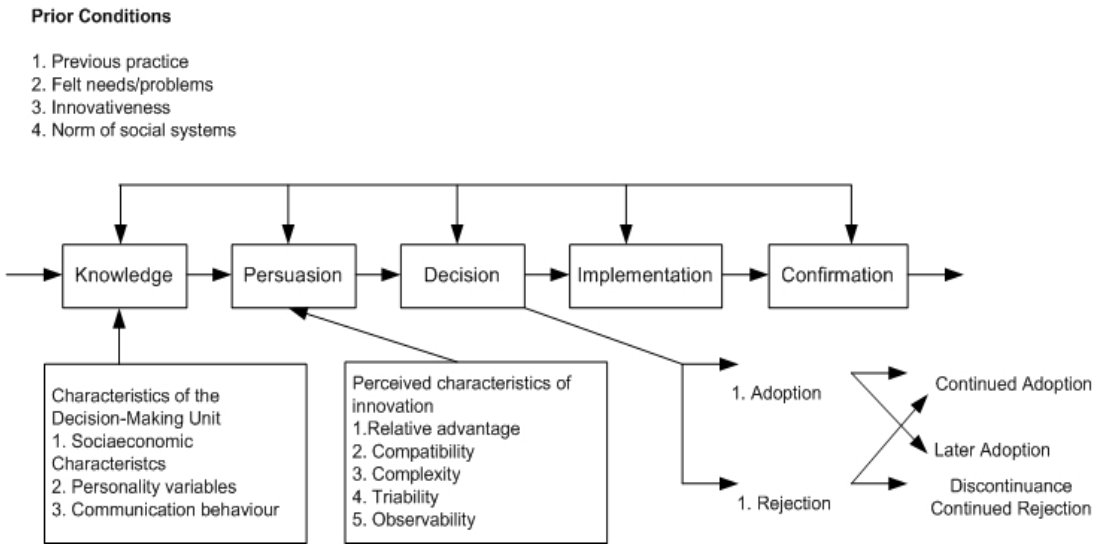

Figure 5 Diffusion of innovations theory

2.4.4 Social Cognitive Theory (SCT)

Compeau and Higgins (1995) indicated that social cognitive theory (SCT) (Bandura, 1977) is widely accepted and empirically validated model of individual behavior. The theory is based on the reciprocally determined factors that are environmental influences, cognitive and other personal factors and behavior. Individuals select the environment in which they exist and influenced by those environments. In addition behavior is affected by environmental factors or situational characteristics and cognitive and other personal factors. Bandura (1977) defined the relations of these three factors as "triadic reciprocality" shown in Figure 6. Although SCT has three factors, this study includes the personal dimension of the theory. Bandura (1986) interested with self-efficacy as a cognitive factor in his theory and defined it as "*People's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses"*. Compeau et al. (1999) interested with information systems and developed a model which is about computer usage based on Bandura's theory. The research model of SCT is shown in Figure 7. Although the relations among the

factors are seen confusing, self-efficacy directly influences affect, anxiety, and usage, and also it affects usage over outcome expectations and affect.

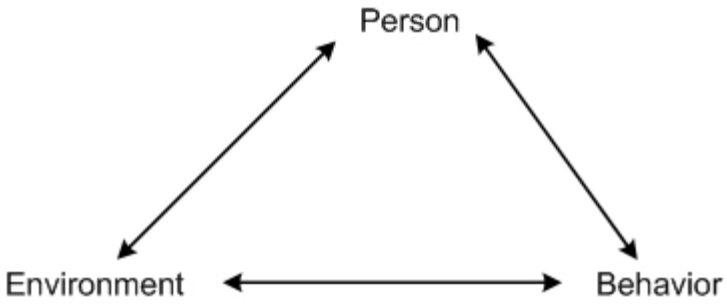

Figure 6 Technology planned behavior

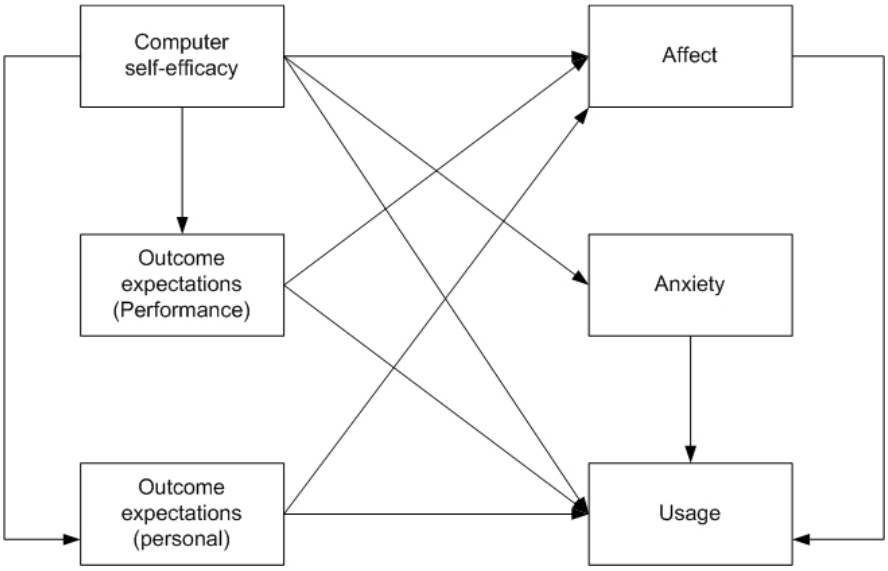

Figure 7 Social cognitive theory (SCT) research model (Compeau et al., 1999)

2.5 Prior Studies of E-Learning Adoption and Acceptance

A literature review was conducted to find the researches examining end users' e-learning adoption and acceptance. The e-learning related journals in the list SSCI or SCI (Information & Management, Computers & Education, Computers in Human Behavior, British Journal of Educational Technology, Educational Technology and Society, International Journal of Human Computer Studies, Academy of Management Learning & Education, Behaviour & Information Technology) were

reviewed to find the related studies. The studies mainly considered the applications related with e-learning, virtual learning environment, online learning, internet-based learning, learning management system, web-based learning, synchronous and asynchronous web-based technologies, course web site, community oriented learning management system, web-based comprehensive class management system, web-base course management system concepts. The literature review revealed that the majority of these studies (see Table 1) analyzed "students" when measuring users' perception towards e-learning and related applications.

Table 1 Studies related with Students' E-learning Acceptance or Adoption

#	Year	Authors	Title	Journal	Sample
1	2005	Matthew K.O. Lee, Christy M.K. Cheung, Zhaohui Chen	Acceptance of Internet-based learning medium: the role of extrinsic and intrinsic motivation	Information & Management	Campus-based students (undergraduate students) at a university in Hong Kong.
2	2009	Byoung-Chan Lee, Jeong-Ok Yoon, In Lee	Learners' acceptance of e-learning in South Korea: Theories and results	Computers & Education	Undergraduate students
3	2010	Ming-Chi Lee	Explaining and predicting users' continuance intention toward e-learning: An extension of the expectation–confirmation model	Computers & Education	Undergraduate Students in National Pingtung University

Table 1 (continued)

4	2010	Manuel J. Sanchez-Franco	WebCT – The quasimoderating effect of perceived affective quality on an extending Technology Acceptance Model	Computers & Education	Undergraduate students (University of Seville)
5	2009	Su-Houn Liu, Hsiu-Li Liao, Jean A. Pratt	Impact of media richness and flow on e-learning technology acceptance	Computers & Education	Undergraduate Students enrolled in an online section of an information systems course department at the Chung Yuan University in Taipei
6	2008	Ya-Ching Lee	The role of perceived resources in online learning adoption	Computers & Education	Undergraduate Students of universities in Taiwan which had developed WBL system
8	2007	S.L. Toral, F. Barrero, M.R. Martı´nez-Torres	Analysis of utility and use of a web-based tool for digital signal processing teaching by means of a technological acceptance model	Computers & Education	Undergraduate Students who has attended the DSP course in University of Seville

Table 1 (continued)

9	2007	E.W.T. Ngai, J.K.L. Poon, Y.H.C. Chan	Empirical examination of the adoption of WebCT using TAM	Computers & Education	Undergraduates and postgraduates students of Hong Kong 's universities
10	2006	Keenan A. Pituch, Yao-kuei Lee	The influence of system characteristics on e-learning use	Computers & Education	Post secondary students who had completed basic computer literacy classes including traditional and non-traditional students
11	2005	Raafat Saade´, Bouchaib Bahli	The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: an extension of the technology acceptance model	Information & Management	Students in an introductory undergraduate management information systems course at Concordia University in Montreal,
12	2008	Su-Chao Chang, Feng-Cheng Tung	An Emprical investigation of students' bahavioural intentions to use the online learning course websites	British Journal of Educational Technology	Undergraduate students

Table 1 (continued)

13	2008	M. R. Martínez-Torres, S.L. Toral Marín, F. Barrero García, S. Gallardo Vázquez, M. Arias Oliva and T. Torres	A Technological acceptance of e-learning tools used in practical and laboratory teaching according to the European higher education area	Behavior & Information Technology	Undergraduate students
15	2009	Sung Youl Park	An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioural Intention to Use e-Learning	Educational Technology & Society	University students (undergraduate) at Konkuk University's Seoul Campus.
16	2009	Maxwell K. Hsu, Stephen W. Wang, Kevin K. Chiu	Computer attitude, statistics anxiety and self-efficacy on statistical software adoption behaviour: An empirical study of online MBA learners	Computers in Human Behaviour	Online MBA students in graduate level
17	2003	Hassan M. Selim	An empirical investigation of student acceptance of course websites	Computers & Education	Undergraduate students

Table 1 (continued)

18	2003	Mun Y. Yi, Yujong Hwang	Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model	International Journal of Human Computer Studies	University students (undergraduate)
19	2005	J. B. Arbaugh	IS there an optimal design for on-line MBA courses?	Academy of management learning & education	Students of MBA program
20	2004	Luis L. Martins, Franz Willi Kellermanns	A model of business school students' acceptance of a web-based course management system	Academy of management learning & education	University students (undergraduate)
21	2010	I-Fan Liu, Meng Chang Chen, Yeali S. Sun, David Wible, Chin-Hwa Kuo	Extending the TAM model to explore the factors that affect Intention to Use an Online Learning Community	Computers & Education	Senior high school students from all over Taiwan

Table 1 (continued)

22	2009	Siong-Hoe Lau and Peter C. Woods	Understanding learner acceptance of learning objects: The roles of learning object characteristics and individual differences	British Journal of Educational Technology	College or university students
23	2003	Jae-Shin Lee, Hichang Cho, Geri Gay, Barry Davidson, Anthony Ingraffea	Technology Acceptance and Social Networking in Distance Learning	Educational Technology & Society	Senior students
25	2008	"Antonio Padilla-Mele´ndez , Aurora Garrido-Moreno, Ana Rosa Del Aguila-Obra"	"Factors affecting e-collaboration technology use among management students"	Computers & Education	Management students
26	2008	Siong-Hoe Lau and Peter C. Woods	"An investigation of user perceptions and attitudes towards learning objects"	British Journal of Educational Technology	Undergraduate students

Upon the knowledge gathered via the literature review, it can be concluded that the studies examining students' e-learning adoption and acceptance have reached to a certain level maturity. However, only few studies were conducted to explore instructors' intention to use LMS (Wang & Wang, 2009; Liaw et al., 2007; Kollias,

Mamalougos, Vamvakoussi, Lakkala & Vosniadou, 2005; Yuen & Ma, 2008; Xu & Yu, 2004). These studies are summarized in the following sections.

2.5.1 Web-Based Learning System Acceptance Model by Wang and Wang (2009)

Wang and Wang (2009) examined the higher education instructors' intention towards web-based learning systems by considering TAM and DeLone and McLean's (2003) information system success model. The researchers developed the model (see Figure 8) by considering the outcomes of the existing educational researches mainly about technology adoption. The generic TAM model was examined to reveal the acceptance of higher education instructors towards web-based learning systems. Additionally, the study examined the effects of System Quality, Information Quality, Service Quality, Subjective Norm and Self-Efficacy towards instructors' system acceptance. The statistical analyses showed that System Quality, Service Quality and Self-Efficacy had positive direct effects on Perceived Ease of Use. While Information Quality, Subjective Norm and Perceived Ease of Use had direct and positive effects on Perceived Usefulness, System Quality did not affect Perceived Usefulness directly. Perceived Usefulness and Subjective Norm directly and positively affected Intention to Use; however, Perceived Ease of Use and Self-Efficacy did not have any direct effect on Intention to Use. As conclusion System Use was directly and positively affected from Intention to Use. The variables in the research model were able to explain 0.562 variance of actual system use. The findings of this study showed that effective and timely support, having basic computer literacy and social encouragement towards system use increase the instructors' intention towards system use.

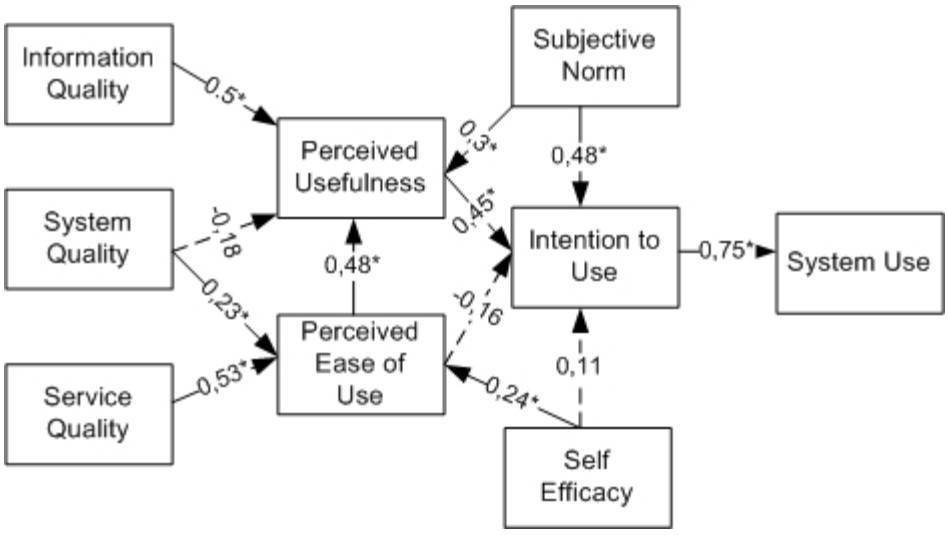

Figure 8 Research Model of Wang & Wang (2009)

*p<0.05; **p<0.01; ***p<0.001

2.5.2 IT Acceptance Model by Xu and Yu (2004)

Xu and Yu (2004) conducted a study interesting with full time teachers' IT acceptance. In their study, the generic TAM model and SCT were combined to provide a new framework. The research model is shown in Figure 9. The results of the study were consistent with the TAM factors; also the computer self-efficacy had significant influence on the teachers' technology acceptance. Statistical analyses of the research showed that Perceived Ease of Use directly and positively affects Perceived Usefulness and Attitude. Perceived Usefulness directly affects Attitude and Intention to Use. Computer self-Efficacy directly affects Perceived Ease of use and Intention to Use. Additionally, Intention to Use directly and positively affected from Attitude. The result of the research model showed that factors in the proposed research model were able to explain 0.560 variance of behavioral intention. The study indicated that when a new information system is implemented to an educational intuitions or school, it is crucial to provide a variety of features to encourage usefulness perception and it is also needed to provide user friendly and interactive interface to increase ease of use perception. Additionally they emphasized the importance of carefully planned training programs to enhance users' computer self-efficacy and correspondingly their intention to use information technology. The comprehensively planned training programs should include knowledgeable trainer,

control the training task into small steps, ensure users to finish one task before pass the next one, show feedbacks with that users could handle the system by themselves, and display a checklist or outline for users.

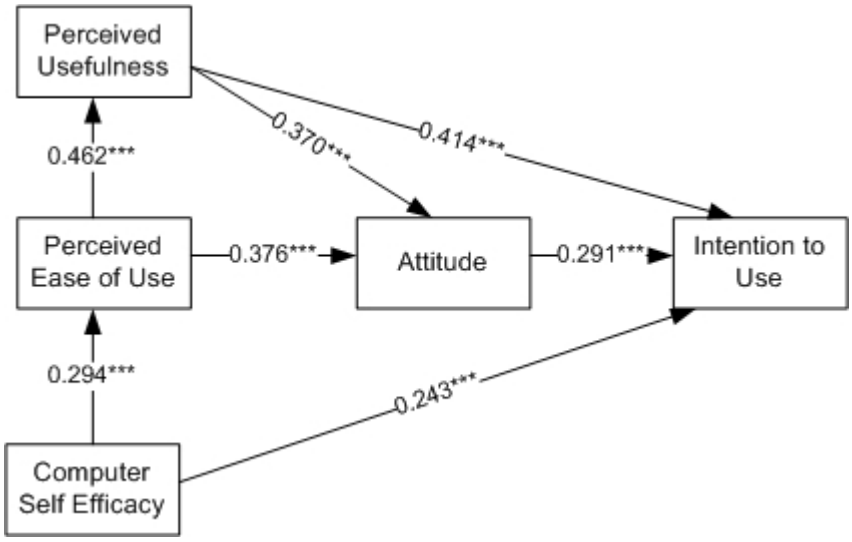

Figure 9 Research Model of Xu and Yu (2003)

*p<0.05; **p<0.01; ***p<0.001

2.5.3 Presentation Technology Acceptance Model by Hu, Clark and Ma (2003)

Hu, Clark & Ma (2003) proposed a model to measure public school teachers' Microsoft PowerPoint presentation technology acceptance decision-making. TAM was used as a base model in the research model. Also effects of Job Relevance, Compatibility, Computer Self-Efficacy and Subjective Norm on behavioral intention to use were examined in the scope of proposed research model. The relations between factors were examined before and after the training program of the Microsoft PowerPoint (see Figure 10 and Figure 11). Job Relevance positively and directly affected Perceived Usefulness after and before training program. Compatibility positively affected Perceived Ease of Use before and after training program. While Compatibility did not have any effect on Perceived Usefulness before training program, it was negatively and significantly affected Perceived usefulness after training program. Computer Self-Efficacy positively and directly affected both Perceived Ease of Use and Intention to Use in two cases. Subjective Norm negatively and significantly affected Perceived Usefulness in two cases. While

Subjective Norm positively and significantly affected Intention to Use before training program, it did not have any effect on Intention to Use after training program. Additionally, direct and positive relations were identified between perceived Ease of Use and Perceived usefulness and Perceived Usefulness and Intention to Use. The results showed that although the variables in the research model were able to explain 0.47 variance of users' intention to system use before training, they were able to explain 0.72 variance of behavioral intention after training completion. The important results of the study as follows; first they emphasized that a teacher consider a technology useful when it is relevant to his o her work. Second, teachers unwittingly may gain their initial acceptance decision by affecting their colleague's opinions or suggestions. However, teachers have become independent in decision-making process after they gain additional knowledge and experiences. Third, teachers keep richer set of factors in mind when obtaining initial acceptance decisions; however they focus on crucial acceptance drivers in their continued acceptance decision-making. Fourth, compatibility of hardware and software of the systems consistently affects teacher's perception of technology ease of use; therefore the administrators or government agencies should evaluate compatibility of the system when implementing new technologies. Last, the researchers highlighted the importance of self-efficacy. Teachers should feel comfortable when they using the technology.

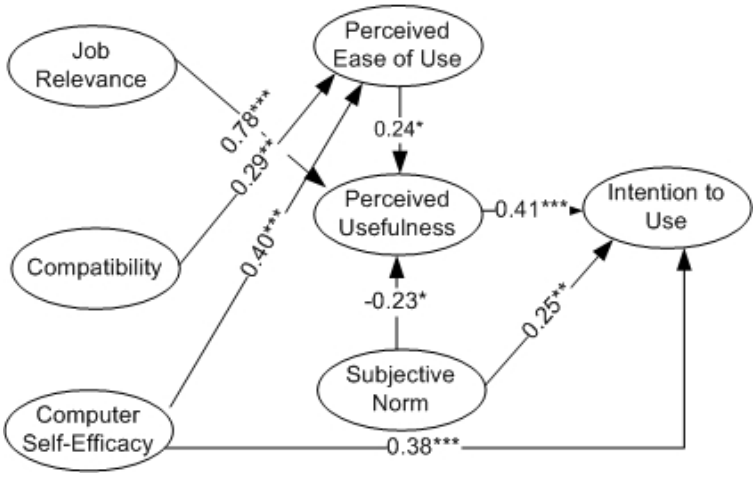

Figure 10 Research Model of Hu, Clark and Ma (2003)

*p<0.05; **p<0.01; ***p<0.0001

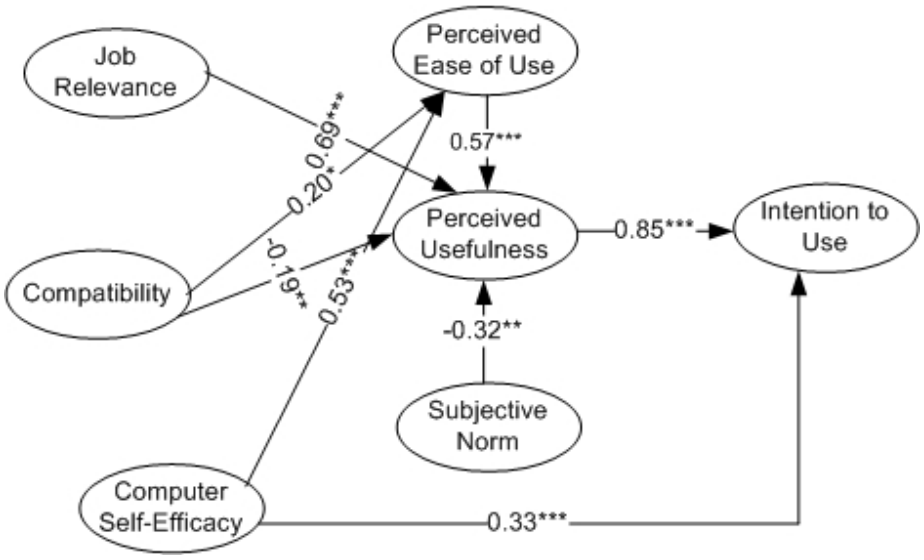

Figure 11 Research Model of Hu, Clark and Ma (2003)

*p<0.05; **p<0.01; ***p<0.0001

2.5.4 Web Acceptance Model by Sãnchez-Franco, Martínez-López and Martín-Velicia (2009)

Sãnchez-Franco et al. (2009) focused on the acceptance and usage of ICT especially the Web by considering the national cultural differences of professors. The study compared the technology adoption of university professors working in Nordic and Mediterranean countries. The study examined the relations among Perceived Ease of Use, Perceived Usefulness, Attitude, Flow and Intention (see Figure 12). Also it considered the national culture as a moderating factor. The study found the following results. First, attitude had direct significant effect on intention to use and its effect was stronger in PSG-Mediterranean culture than in the Nordic culture. Second, perceived usefulness had positive significant effect on intention to use and its effect was larger in the Nordic culture than in the PSG-Mediterranean culture, Third, perception of ease of use effected users behavioral intention to use system to in both culture, but perceived ease of use had a negative direct effect on attitude towards use in the Nordic sample. Also perceived ease of use posited greater influences in the

PSG-Mediterranean culture than in the Nordic culture. Fourth, the study found that, there was a discernible difference between the cultures in terms of the relation between perception of ease of use and usefulness. Fifth, the effect of ease of use on flow was lower in the PSG-Mediterranean culture than in the Nordic culture. Another result showed that flow factor did not have a significant effect on behavioral intention to use in the PSG-Mediterranean sample. The results showed that although the variables in the research model were able to explain 0.47 variance of users' intention to system use. As a result, the study proved that cultural differences have a important impact on attitudes and behaviors towards using web-based applications.

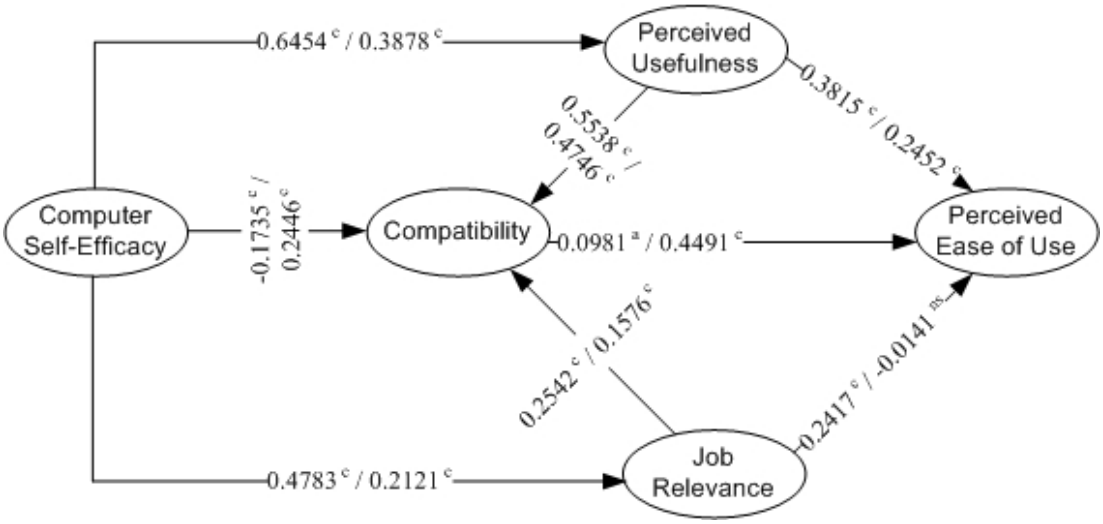

Figure 12 Research Model of Sãnchez-Franco, Martínez-López and Martín-Velicia (2009)

Nordic/Mediterranean samples. $^{a}p < 0.05$; $^{b}p < 0.01$; $^{c}p < 0.001$; ns: not significant

2.5.5 E-Learning Technology Acceptance Model by Yuen and Ma (2008)

Yuen and Ma (2008) explored a model (see Figure 13) to understand part time in-service teachers' acceptance of e-learning technology. The study examined the effects of Subjective norm and Computer Self-Efficacy by using TAM as a core framework. According to the result of this study, Perceived Usefulness was not significant for future intention to use e-learning system. This indication was not consistent with previous research results. Perception of ease of use had the most significant effects on behavioral intention to use and this result indicated that the

perceived ease of use is particularly important among teachers. Subjective norm did not significantly affect intention of teachers; however, it highly correlated with perceive ease of use and perceived usefulness. Also, computer self-efficacy did not have significant effect when predicting teachers' intention to system use. However, it had a significant positive direct effect on users' perceived ease of use perception. In addition to these relations, the study emphasized that that principals or head teachers should be prominent figures in promoting the use e-learning technology. This would help teachers to form the perception to use e-learning technologies.

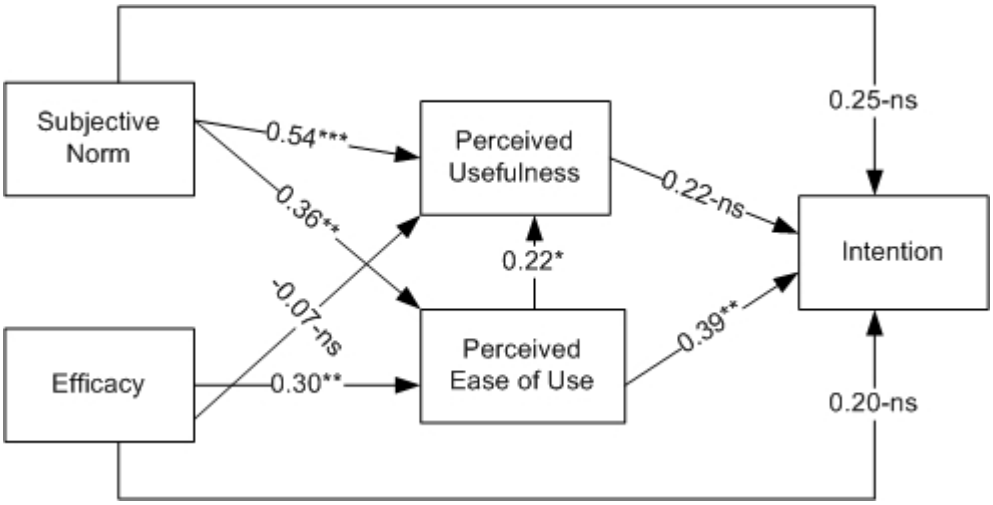

Figure 13 Research Model of Yuen and Ma, 2008

*p<0.05; **p<0.01; ***p<0.001

2.5.6 E-Learning Adoption by Liaw, Huang & Chen (2007)

Liaw et al. (2007) examined instructors' e-learning adoption as a part of their study. They confirmed that instructors are reluctant to use e-learning applications to aid their teaching facilities. They emphasized that social, behavioral, cognitive and affective components are needed to be considered when developing e-learning environments. Additionally, "multimedia instruction", "autonomous learning", "instructor-led interaction" and "learning effectiveness improvement" should be taken as guidelines when developing e-learning environments.

2.6 Discussion of the Literature

It is evident from the literature that most of the studies have examined users' e-learning acceptance or adoption either by using the original TAM or by extending the original TAM adding different variables. It has been explored that, the previous researchers have not considered a framework when developing their research models. This situation is evaluated as a limitation because there is no clear pattern when selecting the external variables of the research models. According to Cho (2006), technology adoption should be examined under a three-level framework including Technological, System and Application levels (see Figure 14). This three-level framework classifies Technological, Social and Application Characteristics, as well as Individual dimensions to provide an overall picture of technology adoption and usage (Cho, 2006; Cho, Cheng & Hung, 2009). Cho (2006), in his study, classified constructs of user intention theories in a three-level framework regardless of concentrating on a particular subject area - i.e. focus areas such as e-commerce, e-learning, e-health. For example, in that particular study, based on his three-level classification framework, he developed a research model to measure customers' intention towards information centered online legal services. According to his classification, Technological dimension includes the PU and PEOU constructs of TAM and Relative Advantage, Complexity, Triability, Observability and Perceived Risk constructs of DIT. Social dimension includes SN constructs of TPB. Application Characteristics dimension includes Compatibility construct of DIT. Individual Dimension examines self-efficacy, self-ability and experience of users considering attitude, intention, behavior, and usage constructs of TPB and TAM. In addition to TAM, TPB and DIT, he considered TRA (Fishbein & Ajzen, 1975), Triandis (Chang & Cheung, 2001) and ETAM (Chen, Gillenson, Sherrell, 2002). Chao did not constrain his classification based on his three levels framework to be maintained in a specific subject area. In light of this background information, the research model is proposed in the next chapter.

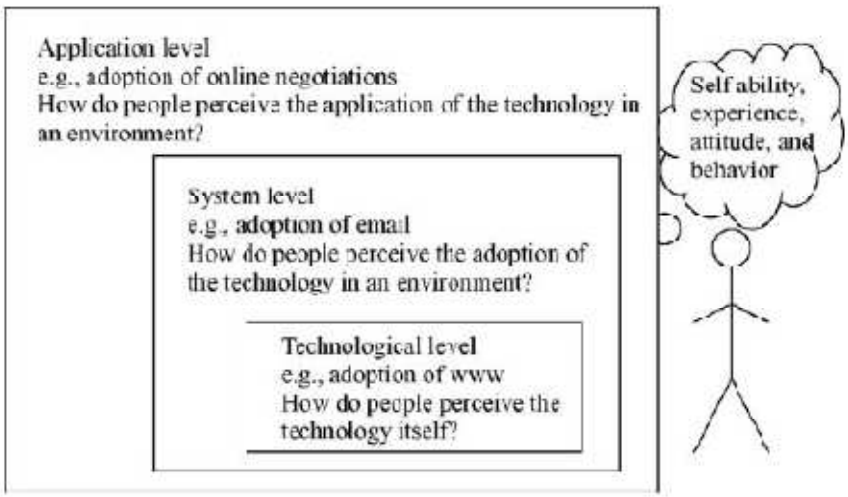

Figure 14 Three level technology adoption framework Cho (2006)

CHAPTER 3

A NEW LMS ADOPTION MODEL

In this chapter objectives of the proposed research model, model definition and components are introduced. Then the research hypotheses are presented supporting with the literature.

3.1 Model Objectives

Development and improvement of a LMS requires multidisciplinary approach and consideration of instructors' acceptance towards system usage is one of the most important target need to be considered. The main objective of the research model is to identify the relationships among the influencing factors that evaluate the behavioral intention of instructors towards LMS in higher education. It is evident from the literature that too many variables affect end users' behavioral intention towards use of information technologies. However, when the focus is on e-learning systems and their instructors, the specific issues; such as complexity, suitability, usefulness, ease of use, users' self ability, confidence and social effects, etc come into prominence when evaluating end users' adoption towards e-learning systems. The proposed research model aims to contribute by promoting the usage of LMS in higher education, fulfilling the expectation of users and analyzing the reasons behind resistance towards LMS. Most importantly, a great amount of model has been

developed to explore acceptance of end users towards information technologies. However, upon the knowledge we gathered so far, only two studies (Wang & Wang, 2009; Sánchez-Franco, 2009) focused on behavioral intention of instructors towards LMS in higher education and none of them examined instructors' adoption towards e-learning system considering **Belief** - *Perceived Usefulness and Perceived Ease of Use*, **Application Characteristic** – *Compatibility,* **Individual** – *Application Self Efficacy***, Social** – *Subjective Norm* and ***Technological*** – *Technological Complexity* dimensions all together. In addition, this research will be the first study focusing on the effects of *technological complexity* and *compatibility* on the instructors' intention towards LMS use.

3.2 Model Definition and Components

The research model, shown in Figure 15, has been proposed to assess the instructors' intention towards LMS in higher education. After a comprehensive literature review, prominent theories and models that have been using in the area of Information Systems have been examined to determine the necessary measurement constructs to evaluate the intention of end users. As a result, addition to Technological, Social, Application Characteristics and Individual dimensions, Belief Factors were considered in the research model by taking the generic TAM as base.

When developing the model, Belief, Technological, Application Characteristics, Social and Individual dimensions were considered by taking the user intention theories (TAM, DIT, TPB and SCT) as base.

In summary, the proposed research model aimed to measure the impacts of Belief, Technological, Application Characteristics, Social and Individual dimensions on behavioral intentions of higher education instructors towards LMS with Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Technological Complexity (TC), Compatibility (CMP), Subjective Norm (SN), and Application Self-Efficacy (ASE) constructs.

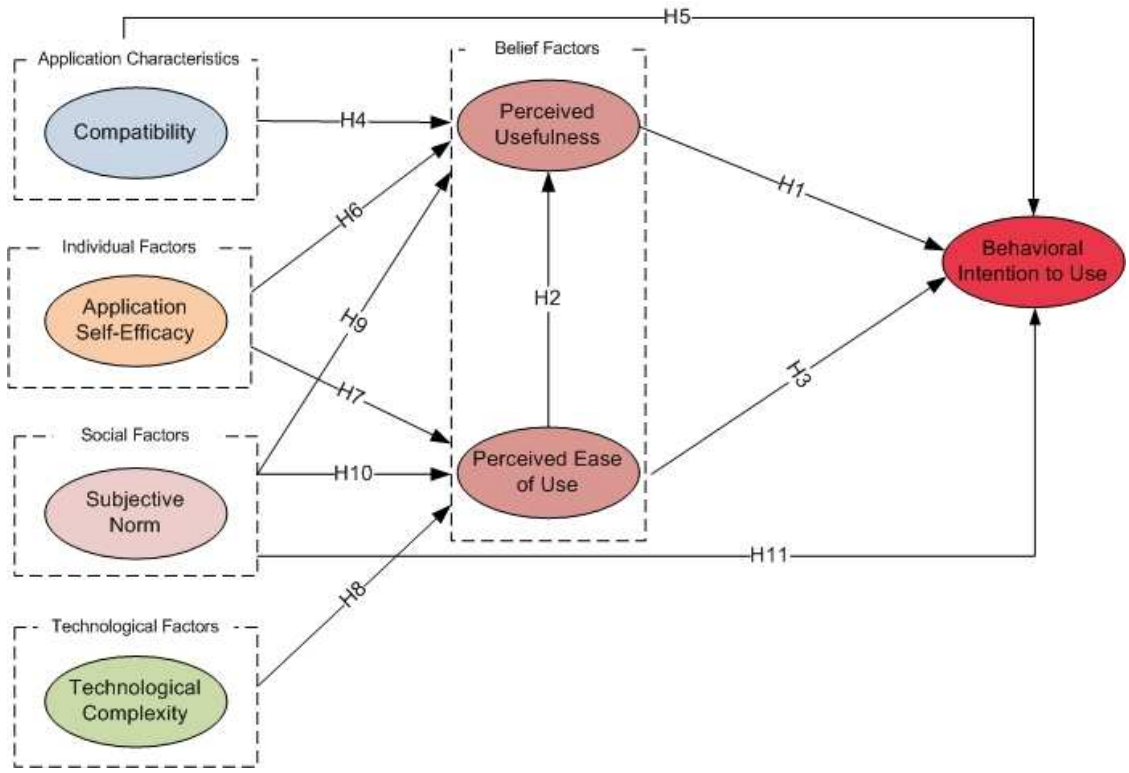

Figure 15 Proposed research model

3.3 Research Hypotheses

The following research hypotheses are proposed in the scope of research model;

Belief Factors:

Too few researches (Liaw et al., 2007; Wang & Wang, 2009) exist in the literature empirically verifying the perception-intention relationship from higher education instructors' perspective in the context of e-learning systems. In the proposed research model PU of LMS is defined as "the degree to which an instructor believes that using such systems will enhance his or her teaching performance" and PEOU of LMS is defined as "the degree to which an instructor believes that the system will be used easily" (Davis et al., 1989). Davis in 1989 found a significant direct relation between PU and PEOU. Most of the existing studies empirically verified this relation in the context of LMS use (Ngai et al., 2004; Lee et al. 2005; Raaij & Schepers, 2006; Chang & Tung, 2008; Lee, 2008; Lee et al., 2009), except one study, which aimed to predict university students' perception towards a web-based comprehensive class

management system (Yi & Hwang, 2003). Although, attitude towards using is one of the specified variables of generic TAM, Lergis et al. (2003) indicates that it is not the key factor influencing behavioral intention. For this reason, attitude towards using construct is not considered in the proposed model. Additionally, actual use variable of the generic TAM model is not considered in the proposed research model because behavioral intention is the key factor to predict the future behavior. Based on the various studies (Chau & Hu, 2001; Chau & Hu, 2002), Holden and Karsh (2010) indicate that behavioral intention is used to predict the actual use and the latter stages are difficult to measure, so behavioral intention is sometimes the only measured outcome of interest in TAM studies (Holden & Karsh, 2010). PU and PEOU are the key variables that affect the behavioral intention to use technology (Cheung & Huang, 2005). Previous studies stated that both PU and PEOU directly affect the intention to use (Toral et al., 2007; Chang & Tung, 2008; Selim, 2003). Thus the following hypotheses based on the TAM are proposed in the research model:

Hypothesis 1: PU will have a positive direct effect on BI.

Hypothesis 2: PEOU will have a positive direct effect on PU.

Hypothesis 3: PEOU will have a positive direct effect on BI.

Application Characteristics: This dimension mainly interests with the task and service characteristics of the systems. In order to expose the effects of satisfaction that is between the system characteristics and instructors' needs on behavioral intention to use, CMP construct integrated into the research model under the Application Characteristics dimension. In other words, CMP construct is grouped under Application Characteristics and adapted into the proposed research model to assess the effects of user's *existing values, previous experiences* and *needs* (Rogers, 1995) over the user's perception towards LMS use. Effects of CMP have not been verified from the perspective of higher education instructors in the scope of LMS. Chang and Tung (Chang & Tung, 2008) examined the relations among CMP, PU and BI to measure the students' behavioral intention to use the online learning course web site by inspiring from the study of Wu and Wang (2005) who integrated DIT into TAM to investigate the constructs that determine users' mobile commerce

acceptance. As a result, both studies found that CMP has a direct effect on PU and BI. Thus the hypotheses related with CMP are as follows:

Hypothesis 4: CMP will have a positive direct effect on PU.

Hypothesis 5: CMP will have a positive direct effect on BI.

Individual Factors: This dimension analyzes the effects of self-abilities and experiences when evaluating LMS adoption and use. Therefore, effect of Application Self-Efficacy (ASE) over behavioral intention is measured under the Individual Factors. This construct aims to measure the effects of instructors' judgments about their capability to use a LMS on their intention towards LMS use. Paraskeva, Bouta & Papagianni (2006) indicated that strong sense of computer self-efficacy of school teachers can affect their technology usage way in everyday instructional practice and also affect teachers and students roles. Venkatesh and Davis (1996) states that PEOU and self-efficacy are related and many studies have proved that self-efficacy has a direct relation with PEOU in the scope of web-based learning systems (Wang & Wang, 2009; Pituch & Lee, 2006; Condie & Livingston, 2007; Franklin, 2007). The relation between ASE and PEOU is assessed in the proposed model. Thus, hypotheses related with ASE are as follows:

Hypothesis 6: ASE will have a positive direct effect on PU.

Hypothesis 7: ASE will have a positive direct effect on PEOU.

Technological Factors: This dimension examines the characteristics of the technology. Technological Complexity (TC) is included in the research model and grouped under technological factors inspiring from DIT, in order to understand the effects of technological characteristics on behavioral intention to use. This construct strengthen the research model by showing that whether the system is perceived as difficult to use and understand, and how it will affect the instructors' intention towards the system usage. Teo, (2009) analyzed the effect of TC on PEOU was analyzed to examine pre-service teachers' intention toward technology. The study stated that if a technology perceived as being difficult, it is perceived as being boring

and time consuming; as a result, a lot of effort has to be spent to gain advantage from it. The hypothesis related with TC is as follow for this study:

Hypothesis 8: TC will have a positive direct effect on PEOU.

Social Factors: SN is added into the research model as a Social Factor in order to analyze the effects of social pressure over instructors' system adoption. In other words, SN aims to measure the effect of others' opinions over the instructors' decisions towards the LMS use. SN is grouped under environmental factors and defined in the model to evaluate the effects of others' opinions on the instructors' decisions. Many instructors choose to use LMS upon recommendation from their colleagues or students, who are the users of the system. Previous studies indicate that SN has a direct relation with both PU (Wang & Wang, 2009; Yuen & Ma, 2008; Raaij & Schepers, 2006; Park, 2009; Lee, 2010) and BI (Wang & Wang, 2009; Yuen & Ma, 2008; Park, 2009; Lee, 2010) in the scope of e-learning systems. Although Park (2009) did not find any significant effects of SN on PEOU when evaluating university students' adoption of e-learning, Yuen and Ma (2008) found a significant relation between SN and PEOU in their study that concentrated on teachers' acceptance of e-learning technology. To offer a new viewpoint, relation between SN and PEOU is being analyzed in the proposed model. Thus the following hypotheses are formulated by considering literature;

Hypothesis 9: SN will have a positive direct effect on PU.

Hypothesis 10: SN will have a positive direct effect on PEOU.

Hypothesis 11: SN will have a positive direct effect on BI.

CHAPTER 4

RESEARCH METHODOLOGY

In this section, METU Online learning management system is introduced and the detailed design of the study is presented.

4.1 Information about Learning Management System - METU Online

METU Online is a learning management system developed by Informatics Institute of Middle East Technical University (METU) and being used since 1997 to meet the e-learning needs of METU students and academicians. METU Online's website is the source to be informed about the system (https://online.metu.edu.tr/help/help_english/Help.html). METU Online provides an educational environment in which instructors and students can easily communicate with each other synchronously and asynchronously. Instructors can support their courses with educational tools (shown in Figure 16) provided by METU Online.

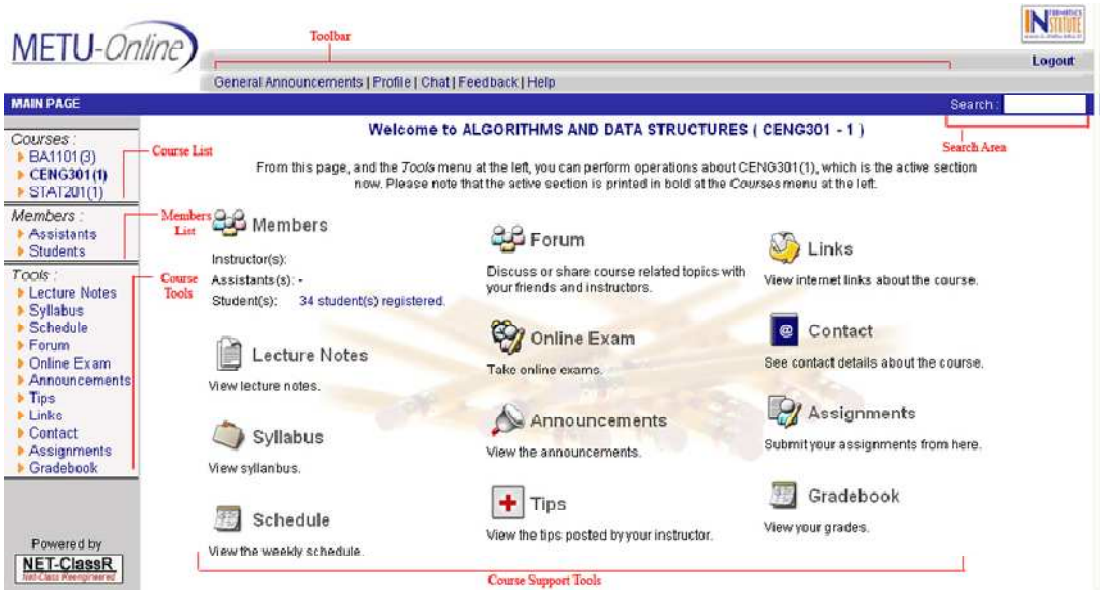

Figure 16 METU Online Tools

http://online.metu.edu.tr

4.2 Survey Instrument Development

A comprehensive survey instrument was developed after a detailed literature review in order to measure higher education instructors' perception towards LMS use. The survey comprised a cover letter (see Appendix A) to introduce the study with participants. It was stated that this research aimed to assist the university to see instructors' intention towards LMS use, and to understand reasons behind their accepting or rejecting the LMS use. Also the participants were informed that, the results of this study would reveal the instructors' opinions about LMS, and development team of the application would be able to enhance the system by considering results of this study.

Content validity (in Chapter 4, Section 4.6.1.4) was considered within the survey instrument in order to evaluate whether the measurement reflected the specific intended domain of content (Carmines & Zeller, 1994). A total number of seven experts' judgments were taken to assess the effectiveness of each item. Four of the experts were from the Information Systems Evaluation and Integration Group (ISEing), Brunel University, London, UK; two from the Education Sciences, Middle East Technical University, Ankara; and one from the Middle East Technical

University, Informatics Institute, Ankara, Turkey. The instrument was tested over a small group including ten PhD students.

4.3 Pilot Study: Data Collection and Participants

A pilot study was carried out to reveal weaknesses of the questionnaire and assess the feasibility of the collected information. A pilot survey can be seen as the small version of the main survey. According to Morgan, Leech, Gloeckner & Barrett (2004) implementation of pilot study is important especially if a researcher develops a new instrument or the instrument has been already developed and it would be used in different population. Sample size requirement for pilot survey may range from 25 to 100 (Cooper & Schindler, 1998). Major objectives of a pilot study are in below (Lancester et al., 2002);

- "Sample size calculation"
- "Integrity of study protocol"
- "Testing of data collection forms or questionnaires"
- "Randomization procedure"
- "Recruitment and consent"
- "Acceptability of intervention"
- "Selection of most appropriate outcome measure"

According to Ticehurst and Veal (2000), pilot study is needed to analyze wording of the questions, sequence of the questions, layout of the questionnaire, obtaining familiarity of respondents, estimating response rate, estimating questionnaire completion time and testing analysis procedures. For this reason, before the main survey distribution, a pilot survey was applied to a small group in order to reveal misunderstandings, incorrect wordings, approximate response rate and completion time of the survey.

A pilot study was applied to 140 instructors who were training at the various institutions of Middle East Technical University. Out of the 140 responses, 86 respondents had been using LMS and 27 respondents had never used the tool before. In addition, 27 respondents did not complete the survey; so their responses were

eliminated from the analysis. 48.7% of the respondents were male and 51.3% of the respondents were female whose 69% and 83% used LMS respectively. 51% of the respondents were in 20-29 age range. PhD Assistants had the highest participation level with 30.1%. In terms of faculties, engineering faculties had the highest participation range with 34%.

Before main survey was conducted, a pilot study was applied including 46 items to measure the constructs of the research model. The results and feedbacks of the pilot survey were taken as a base to prepare the main survey. The last version of the survey consisted of two main parts. The first part included demographic questions. The second part included 27 five-point likert-type scale questions aiming to assess the seven constructs of the proposed research model. These questions were anchored from 1 to 5, where 1 indicated totally disagreement and 5 indicated totally agreement. The measurement items of the survey instrument are shown in Table 2. The full version of the survey instrument can be seen in Appendix B.

Table 2 Constructs' Items and References

Item Number	**Item**	**Pertinent Literature**
Perceived Usefulness (PU)		
Item 1- PU 1	METU Online enhances my course performance	Davis (1989); Franco (2010); Hsu and Lu (2004)
Item 9- PU 2	METU Online increases productivity of the course	
Item 17- PU 3	METU Online helps me to satisfy the purpose of the course easily	
Item 25 – PU 4	METU Online gives me a greater control over my course	

Table 2 (continued)

Perceived Ease of Use (PEOU)		
Item 2 – PEOU 1	Interacting with METU Online is clear and understandable	Davis (1989); Chang and Tung (2008); Saade' and Bahli (2005); Franco (2010)
Item 10 – PEOU 2	Interface of the METU Online is clear and easy to understand	
Item 7 – PEOU 3	Navigation among tools is not difficult	
Item 15 – PEOU 4	Interacting with METU Online is not complicated	
Application Self-Efficacy (ASE)		
Item 6-ASE 1	I can use METU Online without support	Compeau and Higgins (1995); Toral et al. (2007); Pituch and Lee (2006); Wang and Wang (2009); Hsu, Wang & Chiu (2009)
Item 14-ASE 2	I can use METU Online, even if there is no one for help when I get stuck	
Item 22-ASE 3	I was able to use METU Online without observing anyone use it	
Technological Complexity (TC)		
Item 26-TC 1	Interacting with METU Online does not require much mental effort	Davis (1989); Thompson, Higgins & Howell (1991); Teo (2009)
Item 23-TC 2	It does not take too long to learn how to use METU Online	

Table 2 (continued)

Item 27-TC 3	Using METU Online does not take too much of my time	
Subjective Norm (SN)		
Item 8-SN 1	My colleagues encourage me to use METU Online	Fishbein and Ajzen (1975); Ma, Andersson & Streith (2005); Wang and Wang (2009)
Item 16-SN 2	My assistants / instructors support me to use METU Online	
Item 24-SN 3	Head of my department supports me to use METU Online	
Behavioral Intention (BI)		
Item 4-BI 1	I will use METU Online in the next semesters	Lee et al. (2005); Agarwal and Karahanna (2000); Franco (2010)
Item 12-BI 2	I plan to use METU Online in all of my courses	
Item 20-BI 3	It is worth to use METU Online	
Not Measured Items		
Item 3	I feel good about supporting the course with METU Online	Wu and Wang (2005), Chang and Tung (2008); Loyd and Gressard (1984); Martins and Kellermanns (2004); Hsu and Lu (2004); Chang and Tung (2008)
Item 5	METU Online is compatible to manage the course progress	
Item 11	METU Online provides an attractive learning environment	

Table 2 (continued)

Item 13	METU Online fits my teaching style	
Item 18	Interacting with METU Online does not demand much care or attention	
Item 19	Supporting the course with METU Online is better than the traditional methods to manage course	
Item 21	METU Online is helpful to fulfill the needs of the course	

4.4 Main Study: Data Collection and Participants

Initially, for data collection, an electronic version of the survey was distributed to 1000 instructors via e-mail. Due to low response rate (0.5%), the researchers decided to reach each survey participant in person. In addition, for qualitative analysis, 10 active users of the LMS were interviewed face-to-face via structured (see Appendix C) and informal questions. In addition informal questions were asked during the interview.

A total of 500 questionnaires were distributed to the higher education instructors. The data used to evaluate the proposed research model was collected from full time instructors working in School of Foreign Languages, Faculty of Education, Faculty of Arts and Science and Faculty of Engineering of Middle East Technical University, Turkey. In the scope of this study, an instructor refers to any user of METU Online who organized and managed courses so that the data was collected from teaching assistants, assistant professors, associate professors and professors without any discrimination in their degrees. The data was collected in one and a half months. In total, 250 surveys were retrieved. The resulting total response rate was 50%. 224 respondents were active users of the LMS. Table 3 shows the demographic profile of

the respondents, including LMS usage, gender, age, academic position, department, computer skill, preferred class type, and major motivation of users. The demographic results showed that while 89.6% of the participants were using LMS, 10.4% of them had not used it before. Also the sample population showed diversity in gender as 62.8 % of the respondents was female, 37.2% of them were male. Additionally, 62% of the respondents were between 20 and 39 years old. In parallel with the age result, the most attendance trend was seen among PhD assistant with 52.4%. The survey results showed that, participation of the research was more popular in engineering faculties than other faculties. In addition, 68.1% of the instructors evaluated their computer skill as a pretty good, 85.7% of them preferred a face to face class supporting with a LMS and 36.9% instructor used LMS with their own decision.

Table 3 Demographic Profile of the Respondents

Demographic Characteristics	**Group of Users**	**Number of Cases**			**Percentage (%)**		
Usage of METU Online	Yes	224			89,6%		
	No	26			10,4%		
		Usage of METU Online					
		Yes	No	Total	Yes	No	Total
Gender	Male	84	9	93	37.5%	34.6%	37,2%
	Female	140	17	157	62.5%	65.4%	62,8%
Age	20-29	142	13	155	63.3%	50%	62%
	30-39	62	7	69	27.6%	26.9%	27,6%
	40-49	11	4	15	4.9%	15.3%	6%
	50-plus	9	2	11	4.0%	7.6%	4,4%
Academic Position	Assistant (MS)	59	5	64	26.3%	19.2%	25,6%
	Assistant (PHd)	119	12	131	53.1%	46.1%	52,4%
	Lecturer	16	5	21	7.1%	19.2%	8,4%
	Assistant Professor	13	1	14	5.8%	3.8%	5,6%
	Associate Professor	8	0	8	3.5%	0%	3,2%
	Professor	9	3	12	4.0%	11.5%	4,8%

Table 3 (continued)

Department	School of Foreign Languages	9	4	13	4.0%	15.3%	5,2%
	Faculty of Architecture	0	1	1	0%	3.8%	0.4%
	Faculty of Education	66	7	73	29.4%	26.9%	29,2%
	Faculty of Arts and Sciences	26	3	29	11.6%	11.5%	11,6%
	Faculty of Engineering	123	11	134	54.9%	42.3%	53,6%
Computer Skill	Expert	34	3	37	15.2%	11.5%	14.8%
	Pretty Good	152	17	169	68.1%	65.3%	67.8%
	Basic	26	6	32	11.6%	23%	12.8%
	Limited	11	0	11	4.9%	0%	4.4%
Preferred Class Type	A traditional class	27	5	32	12.0%	21.7%	21.9%
	A face to face with LMS	192	18	210	85.7%	78.2%	85.0%
	Totally Online	5	0	5	2.2%	0%	2.0%
Major Motivation	Myself	99	-	99	36.9%	-	36.9%
	Course Content	84	-	84	31.3%	-	31.3%
	Student	58	-	58	21.6%	-	21.6%
	The Colleagues	27	-	27	10.0%	-	10.0%

4.5 Ethic Clearance

The researches that consider human as base for data collection need to obtain ethics approval. In this research, human participation was necessary for the data collection phase. For this reason, the ethic clearance related to data collection of the research has been approved by Practical Ethics Research Board at the Middle East Technical University (Appendix D).

4.6 Data Analysis

In this study, quantitative and qualitative research methods have been applied via survey instrument and structured and informal interview methods respectively. Preliminary data analyses (missing value analysis, outlier detection, normality assumption, multicollinearity), reliability, validity and factor analyses, and structural equation modeling were applied to conduct quantitative research method. Additionally, qualitative analysis was performed through the structured interview and informal interview methods to gather and record the users' general opinions towards the use of LMS.

4.6.1 Quantitative Analysis

4.6.1.1 Data Management for Multivariate Analysis

Data management is an essential step to eliminate the errors for the successful data analysis. Moreover, missing value analysis, outlier detection, normality assumption and multicolinearity should be considered for further analysis.

Data Editing and Coding

Before the data set was entered in SPSS environment, the raw data was checked to clean disused information to ensure that the all data were clear, consistent and readable. Then, the codebook was prepared to bring data set in a suitable format that SPSS can understand. For the each variable, unique label was assigned and numbers were determined for the possible answers of respondents. Measure types of the variables were identified, hence only nominal and scales were used in this study. Codebook of the pilot study and main study can be found in the Appendix E. Second part of the survey instrument included Likert Scale type questions and they were coded as Totally Disagree: 1, Partially Disagree: 2, Neither Agree or Disagree: 3, Partially Agree: 4 and Totally Agree: 5. Then, descriptive analysis including maximum, minimum, mean scores, standard deviation was explored to correct existing problem. The data editing and coding process mentioned was applied both pilot and main studies.

Missing Value Analysis

Hair, Black, Babin, Anderson & Tatham (2006) defines missing data as "where valid values on one or more variables are not available for analysis, are a fact of life in multivariate analysis". Leech, Barrett & Morgan (2005) noted that missing values cause difficulty in a dataset and disturb certain type of analysis. For this reason, missing values should be replaced considering interpolation, multiple imputations, inserting a mean or median of nearby values. Hair et al. (2006) offered four steps missing data process to identify missing values and apply suitable remedies.

First, the process starts with determining whether the missing values are ignorable or not. If missing data can be ignored, some specialized techniques can be used related to missing data. If the type of missing value is non-ignorable, the researcher should consider the extent and impact of the missing data.

Second, determining the type of the missing value, the researcher should give a decision, whether size of the missing data substantial enough to warrant action. If the extent of missing values is greater upper than 50%, the related case of variables should be deleted. On the other hand, if missing data under 10% for an individual case or observation can be ignored in the case of the missing data occurs in a specific nonrandom fashion.

Third, the researcher diagnoses the randomness of the missing data process to check whether the process is nonrandom (MAR) or random (MCAR). Hair et al. (2006) emphasized that if the data set is small, the researcher may visually see and perform simple calculations to show whether the missing data process occurs in a completely random manner. MAR refers that although the missing data process is random in the sample, its value cannot be generalizable for the population. Hence it needs some special method to arrange nonrandom component. MCAR refers the higher level of randomness and it can be accommodate any type of missing data remedy. SPSS provides four methods to determine the randomness of the missing values which are Listwise, Pairwise, Expectation Maximation (EM) and Regression.

Fourth, imputation method should be considered after determining the randomness of the missing data process. If nonrandom missing data process is found, the researcher

can handle missing data with the specifically designed modeling approach. If the missing data process is determined as totally random, the researcher should decide whether he/she wants to replace the missing data or not. If replacement is ignored, the researcher should decide either to use only cases with complete data which is known listwise method in SPSS or to use all possible valid data known as pairwaise method in SPSS. If replacement is considered, the researcher can handle missing values with one of the following methods; first one is using known replacement values such as hot cold deck imputation or case substitution, second one is calculating replacement values such as mean substitution and regression imputation.

Lastly, the researcher gives the replacement decision according to the following rules.

- If the missing data is under %10, any of the imputation methods can be used.
- If missing data range from 10% to 20% in the case of MCAR (completely at random), the all available, hot deck case substitution and regression methods are the most preferred, however in the case of MAR (random), the model-based method is most preferred.
- If the missing data level is over 20%, regression method is preferred in the case of MCAR, and model based method is preferred in the case of MAR.

Outlier Detection

Outliers should be determined for further data analyses. Hair et al. (2006) indicated outliers as the observations with a unique combination of characteristic identifiable as distinctly from the other observations. They state that multivariate detection is the most appropriate method when the researcher considers more than two variables to measure the multidimensional position of each observation.

Hair et al. (2006) indicates that Mahalanobis (D^2) measure is considered for a multivariate assessment of each observation across a set of variables. This method provides single values by examining each observation's distance in multidimensional space from the mean center of all observations without considering how many variables are available. The threshold level for the D^2/df (the D^2 measure divided by the degree of freedom) should be conservative. In small sample (80 or fewer) the

D^2/df value exceeding 2.5 is indicated as possible outlier, whereas in large samples the values 3 or 4 are designated as possible outliers.

Normality Assumption

Gravetter & Wallnau (2000) described normal as "a symmetrical, bell shaped curve, which has the greatest frequency of scores in the middle, with smaller frequencies towards the extremes". Pallant (2001) stated that normality can be designated with the skewness and kurtosis values and Kolmogorov-Smirnov statistic. Skewness refers an indication of the symmetry of the distribution, and kurtosis refers the peakedness of the distribution. While positive skewness refers that scores clustered to the left, negative skewness states that scores clustered right-hand side of the graph. While positive kurtosis value indicates peaked distribution, negative kurtosis indicates a flatter distribution. West, Finch & Curran (1995) recommend that skewness value shouldn't be greater than 2, and the kurtosis value shouldn't be above 7 to satisfy normality. Kolmogogorov-Smirnov test indicates that a non-significant result (Sig value of more than .05) indicates normality (Pallant, 2001).

Multicolinearity

Leech et. al (2005) emphasized that multicollinearity occurs when there are high intercorrelations among some set of the predictor variables. Correlation up around .8 or .9 causes problem. In case of such a problem, one of the strongly correlated pairs of dependent variables needs to be removed or these pairs (variables) need to be combined to form a single measure (Pallant, 2001).

4.6.1.2 Reliability of the Instrument

Pallant (2001) indicated that there are two frequently used methods available (i.e test-retest reliability and internal consistency), to measure reliability of a scale. Test-retest reliability analysis measures that whether a person can take same score on a questionnaire if he/she completes it at two different points in time (Field, 2006).

Inter-item consistency assessed by Cronbach's Alpha is a frequently used measure of reliability in the research literature (Morgan et al., 2004). This indicator refers the degree of items of the scale which are all measuring the same underlying attribute (Pallant, 2001). In order to support internal consistency, the value of Cronbach's Alpha should be positive and usually should be greater than 0.7. (Morgan et al., 2004). Hair et al. (2006) noted that Cronbahch's Alpha value range from 0 to 1. The value between 0.6 and 0.7 indicates the lower level of acceptability. It is desired that the reliability coefficient gets closer to 1. Value of alpha directly depends on the number of scale items; in other words, if number of items on the scale increases, alpha value will increase (Cortina, 1993). Similarly, if there is a scale that has small number of items such as less than ten, alpha value will decrease. In such a case, Pallant (2001) stated that the mean inter-item correlation should be calculated, and optimal mean inter-item correlation values should range from .2 to .4.

According to Field (2006), values of "inter-item correlation", "item-to-total correlation", and "Alpha if item deleted" should be considered for internal consistency. "Inter-item correlation", which indicates to the correlation between items (Hair et al., 2006) and its value should be over 0.3 (Robinson, Shaver & Wrightsman, 1991a; Hair et al., 2006). "Item-to-total" correlation, which indicates the correlation between each item and total score of the questionnaire, should be over 0.3 (Field, 2005). "Alpha if item deleted" suggests that items with greater alpha values than the overall alpha value should be deleted to increase reliability of the scale (Field, 2005). Field (2005) indicated that reliability analysis should be conducted on any subscales individually.

4.6.1.3 Factor Analysis

The aim of exploratory factor analysis is to "*identify the factor structure or model for a set of variables by determining number of existing factors*" (Stevens, 2002). Exploratory factor analysis is not capable to manage variables to load only on certain factors. However, confirmatory factor analysis includes more complex and sophisticated techniques to confirm specific hypothesis or theories (Pallant, 2001). In addition, this method enables researchers to look at which variables will load on which factors as well as which factors are correlated. Additionally, the measurement

models are assessed with confirmatory factor analysis to guarantee that the items used to measure each of the constructs are sufficient.

4.6.1.4 Validity of the Instrument and Assessment of Measurement Model

According to Hair et.al (2006) validity refers to the degree that is accurately represents what is supposed to do; moreover, degree of freedom from any systematic or nonrandom error. It must be considered after meeting necessary level of reliability for a scale. Pallant (2001) emphasized that validation of a scale is based on collection of empirical evidence by considering the content validity, criterion validity, and construct validity.

Content Validity

Content Validity, called as face validity, examines the relation between the individual items and the concept. Content validity is conducted through ratings by expert judges, pretests with multiple subpopulations (Hair et al. 2006).

Construct Validity

Confirmatory factor analysis (CFA) is one of the special types of factor analysis.CFA enables researchers to tell structural equation modeling program which variable belongs to which factors, before an analysis can be conducted (Hair, 2006). CFA must provide acceptable fit and show evidence of construct validity. Ridley (2005) described construct validation in his dissertation as "*the degree of confidence that the information provided by the questionnaire reflects the activities that are being measured*". Construct validity ensure confidence that item measures taken form a sample represent an actual true score that exist in the population. Convergent validity and Discriminant validity that are two important components of construct validity (Hair et al. 2006). CFA is used for construct validity, and assess the measurement model via convergent validity and discriminant validity, which are two important components of construct validity.

Convergent Validity

Convergent validity is defined as *"measures of constructs that theoretically should be related to each other are, in fact, observed to be related to*

each other"(Research methods Knowledge Based, 2010*)*. Convergent validity can be assessed with Factor Loadings, Composite Reliability and Average Variance Extracted methods. Hair et al. (2006) explains these concepts as follows.

Factor Loadings: High loadings on a factor represent high convergence validity; because they converge on some common point. Standardized factor loading estimates should be .5 or higher, ideally .7 or higher.

Average Variance Extracted: Average Variance Extracted (AVE) is calculated using standardized loadings with the following formula;

$$AVE = \frac{\sum_{i=1}^{n} \lambda \mathrm{i}^2}{n}$$

AVE is calculated as the total of all squared standardized factor loadings (λ represents the standardized factor loading and I is the number of items) divided by the number of items. AVE should be .5 or greater for adequate convergent validity and should be computed for each latent construct in a measurement model.

Composite Reliability: Composite reliability can be preferred as alternative to Cronbach' Alpha for a measure of reliability. This is because, Cronbach' alpha may be over- or under- estimate scale reliability and underestimation is common. In this case, in order to obtain higher estimates of true reliability, CR is preferred (Garson, 2010). Although the CR value between .6 and .7 may be acceptable, its higher value indicates good reliability (Hair et al., 2006). High CR indicates that internal consistency exists, meaning that all measures consistently signify the same latent factor. Construct reliability can be easily computed from the squared sum of factor loadings (λ_{i}) for each construct, and the sum of the error variance terms for a construct (δ_{i}) as following;

$$CR = \frac{\left(\sum_{i=1}^{n} \lambda_{\mathrm{i}}\right)^2}{\left(\sum_{i=1}^{n} \lambda_{\mathrm{i}}\right)^2 + \left(\sum_{i=1}^{n} \delta_{\mathrm{i}}\right)}$$

Discriminant Validity

Study of Peter (1981) stated that discriminant validity is determined by demonstrating that a measure does not correlate with another measure very highly. Correlation between latent constructs greater than 0.8 or 0.9 refers a lack of discriminant validity (Holmes-Smith et.al, 2006). Moreover, Fornell and Larcker (1981) indicated that "*square root of the average variance calculated for each construct should be greater than the correlation between a given construct and all other constructs"* for a reasonable discriminant validity.

4.6.1.5 Assessment of Structural Modeling

Structural Equation Modeling (SEM) is used for the generation of a model that describes the adoption of academics towards LMS. SEM is described as it is "*multivariate technique combining aspects of factor analysis and multiple regression that enables the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and latent constructs as well as between several latent constructs"* (Hair, 2006). SEM is used to assess the relation between constructs including latent variables (LVs-conceptual term used to express theoretical concepts or phenomena) and observed variables (OVs- measures, indicators or items that are measured directly) (Andreev, Heart, Maoz & Pliskin, 2009). SEM enables a researcher to asses both measurement model (loadings of observed items on their latent constructs) and structural model (the assumed causality among a set of dependent and independent factors) at the same time and as a result of this combined assessment, measurement errors of the observed variables can be analyzed as an integral part of the model; additionally factor analysis can be combined with the hypothesis testing (Gefen, Straub & Boudreau, 2000). SEM has four important advantages when compare to the other multivariate techniques such as multiple regression, PCA, cluster analysis (Byrne, 2001)

- Most of the multivariate techniques are essentially descriptive e.g. exploratory factor analysis indeed hypothesis testing is possible but difficult to do. SEM employs confirmatory approach rather than an exploratory approach and enables data analysis with the purpose of inferential statistics.

- While traditional multivariate techniques are capable of neither assessing nor correcting measurement errors, SEM can provide explicit estimates of error variance parameters.
- SEM includes important features like modeling multivariate relations, estimating point and-or interval indirect effects while there are no widely and easily applied alternative methods for these kinds of features for traditional multivariate techniques.
- Although first generation data analysis methods are only based on observed measurements techniques, SEM can incorporate both observed and unobserved variables.

There are two types of SEM that are covariance based and component based (partial least square - PLS) SEM. Covariance-based SEM with Maximum Likelihood (ML) or Unweighted Least Squares (ULS) methods is usually used to model validation and to make generalization for the population, but it needs a large sample (more than 200 subjects is assumed to be large sample) (Tenenhaus, 2008). Covariance based SEM is popular among many research discipline because of the widespread availability of the software programs like LISREL, AMOS, CALIS, EQS and SEPATH (Andreev & Heart, 2009). Component-based SEM also referred PLS path modeling is mainly used for score computation and making prediction based on the data and it can be carried out on small samples (Tenenhaus, 2008; Kanat, 2009). PLS path modeling is defined as a data analysis framework for analyzing multiple relationships (among the variables that are established taking into account previous theory of the phenomenon under analysis) between a set of variables (Sãnchez, 2009). Andreev and Heart (2009) indicates that (according to the studies of Chin (1998); Diamantopoulos (2006) and Gefen, Straub & Boudreau, (2000) "*Unlike covariance-based SEM, PLS attempts to estimate all model parameters in such a way that the result should be a minimized residual variance of all dependent variables (DV), LVs, and OVs (of the reflective LVs). In other words the main objective of the PLS approach is the best predict of LVs by the DVs, instead of obtaining a good of fit to the data, which is the main goal of covariance based SEM*". Several programs exist to perform PLS path modeling that are PLS-Graph, SmartPLS, Visual PLS, etc. In this study, SmartPLS is used to evaluate proposed research model. PLS might be presented as a two steps

method (Tenenhaus, 2008). The first step indicates path estimates of the **measurement model** that used to compute LV scores. The second step indicates the path estimates of **structural model**. Chin (1998) indicates that measurement model is evaluated with Factor loadings, Composite reliability, AVE and Discriminant validity measures (see Chapter 4, Section 4.6.1.4 for details). Also quality and fit of the structural model is evaluated with predictive power – *significance of path coefficients* and explanatory power - R^2 *of latent endogenous variables*.

Predictive Power: Andreev & Heart (2009) summarized the predictive power in their study. They indicate that predictive power is based on testing the *significance of path coefficients*. The standardized path estimates is calculated by the re-sampling techniques (bootstrapping) to indicate the magnitude of the impact of an independent construct on a dependent construct (Chin 1998).

Explanatory Power (R^2): Andreev & Heart (2009) indicates that explanatory power is evaluated with assessing R^2. R^2 is calculated with PLS algorithm for each dependent LV at the first stage of evaluating the PLS structural model. In addition, indirect effects are not given by SmartPLS; however they can be calculated with subtracting the direct effect from the total effect. The significance of indirect effect is calculated by using Sobel Test Equation as follow (Preacher & Leonardelli, 2003):

$$\text{z-value} = (a*b) / \text{sqrt}(a^2 * sb^2 + b^2 * sa^2)$$

a: regression coefficient between independent and mediator variable, b: regression coefficient between mediator and dependent variable, sa: the standard error of the relation between mediator and independent variable, sb: the standard error of relation between mediator and dependent variable.

Tenenhaus (2008) highlighted several weaknesses of PLS. First, diffusion of PLS path modeling software is limited in comparison with covariance based SEM. Second, PLS does not allow testing equality constrains on path coefficients or defining specific imposing values to different model paths. Lastly, PLS is most heuristically used for explanatory research (Chin 1998). However, PLS based SEM has some advantages over covariance based SEM (Sãnchez, 2009). First, PLS identifies the most useful variables in predicting outcomes and identification of those

variables that maximize the predictive power of the model. Secondly, although explanatory power of the PLS is higher, it can be used for both confirmatory and explanatory purposes. The main goal is to understand the relationships between constructs and phenomenon of interest. Thirdly, there is no constraint on distributional assumptions. Fourthly, PLS is a soft modeling because it requires less stringent assumptions like sample size (sample size should be more than 10 times the number of free model parameters, use a minimum 10 cases per predictor).

4.6.2 Qualitative Analysis

Qualitative analysis was used to capture important information that cannot be directly obtained with quantitative statistics. Qualitative analysis was performed with the structured interview and informal interview methods to gather and record the users' general opinions towards the use of LMS. Structured interviewing method was performed since it is more useful for obtaining information to test a specific hypothesis that the researcher has in consideration (Fraenkel & Wallen, 2006). Informal interview tends to resemble casual conversations, pursuing the interests of both researcher and the respondent in turn; also it does not include any specific type and sequence questions (Fraenkel & Wallen, 2006). The interview was conducted with randomly selected 10 instructors who were in different departments (Engineering Sciences, Petroleum and Natural Gas Engineering, Electrical and Electronics Engineering, Department of Modern Languages, Information Systems, Elementary Education, Department of Biology, Department of Chemistry, Department of Architecture, Department of Physical Education and Sports). The age range of the participants was between 25 and 50. The qualitative data questions are given in Appendix C.

CHAPTER 5

RESULTS

In this section, data management and multivariate analysis results of the pilot and main study are presented and the result of the structural model is given.

5.1 Pilot Study

A pilot survey was applied to validate reliability of the survey instrument. The feedbacks showed that the number of items were quite a lot. In order to increase the response rate of the questionnaire, some of the items were eliminated by considering the following statistical analyses. Firstly ***missing values*** were handled in the data set. In the pilot study, 27 cases which had missing values above 50% were deleted over 113 cases. There were no variables having 50% or above missing values to delete. After examining the extent of missing variables, randomness of the missing data process was determined. Although the sample size was small enough to see the missing data as a completely random manner, EM technique was used to diagnose the randomness of the missing data. EM technique gives the Little's MCAR test Chi-Square:556.197, DF: 545, Sig: .361. P value is significant at the 0.05 and if it is less than 0.05, the data are not missing completely at random. The significance value

was not less than 0.05 in this study and the result showed that there was no significant difference and the missing data can be classified as MCAR. After determining the missing value process was completely random, imputation method was selected. According to Hair et al. (2006), regression method was selected to replace missing value because of randomness determined as MCAR. Please refer to Chapter 4, Section 4.6.1.1 for detailed explanation about missing value analysis.

After missing values were handled, ***outliers in the data set*** were determined. Firstly, scatter plots were examined to detect outlier. None of the cases had extreme values. Additionally, D^2/df value was considered to determine extreme cases. In the pilot study, maximum Mahalanobis value (D^2) is 70 and the degree of freedom value (df) is 49; as a result D^2/df is 1.42. In this regard, there were not any cases demonstrating the characteristics of outliers, because D^2/df did not exceed the threshold value 4. This result showed that any case did not have an extreme value that cause a problem for further analyses. Please refer to Chapter 4, Section 4.6.1.1 for detailed explanation about outlier detection.

Then the ***normality assumption*** of pilot study was considered. In the pilot study, the skewness values were not larger than 2 and the kurtosis values were not larger than 4. Even though there were negative and positive skewness and kurtosis values, neither of them was extreme. Please refer to Chapter 4, Section 4.6.1.1 for detailed explanation about normality assumption.

Multicollinearity of the pilot study was examined before analyzing reliability of the survey instrument. The correlations between items of the pilot study were examined. The results showed that some of the items had high correlation (over 0.8) with other items. Therefore these items were removed from the data set. Please refer to Chapter 4, Section 4.6.1.1 for detailed explanation about multicollinearity.

Lastly, ***Reliability*** analysis of the pilot study was identified. The reliability assessment was considered for 40 items and Cronbach' Alpha of the scale found 0.948. Additionally, there were not any items found increasing the alpha value to delete. As a result the scale could be categorized reliable to use for main study.

Please refer to Chapter 4, Section 4.6.1.1 for detailed explanation about reliability analysis.

5.2 Main Study

5.2.1 Data Management for Multivariate Analysis

Missing Value Analysis of Main Study

In the main study, any cases and variables did not exceed the limits of missing value percentage that is 50%. Missing value statistic of main survey can be seen Appendix F. Percentage of missing value of the variables changes between 0 and 24. Although the sample size was small enough to see the missing data process occurs in a completely random manner, EM technique gave the MCAR test Chi-Square = 775,823, DF = 730, Sig. = .117 and the results can be seen in Appendix G. The significant value was not less than 0.05 for the data set and the missing data could be classified as completely random (SPSS Missing Value Analysis 16.0). In these contexts, if the missing data level is over 20% regression method is preferred in the case of MCAR. For this reason, regression method was used to handle missing values of the data set. Please refer to Chapter 4, Section 4.6.1.1 detailed explanation about missing value analysis.

Outliers Detection of Main Study

In the main study the outliers were determined with scatter plot and removed from the dataset. For the data set maximum Mahalanobis value was $D^2 = 90$ and the degree of freedom value was df = 27, as a result $D^2/df = 3.3$. In this regard, there were not extreme cases, because the value of D^2/df did not exceed the threshold value 4. Please refer to Chapter 4, Section 4.6.1.1 for detailed explanation about outliers detection process.

Normality Assumption of Main Study

In the main study, the skewness values were not larger than 1.3 and the kurtosis values were not larger than 1.6. Although negative and positive skewness and kurtosis values existed, neither of them was extreme. The skewness and kurtosis

values are shown in Appendix H. Although skewness and kurtosis values were in the acceptable level the significant value (Sig = 0.0) was not larger than .05, so the distribution of the data set was not normal. Please refer to Chapter 4, Section 4.6.1.1 for detailed explanation about normality assumption.

Multicollinearity of Main Study

In the main study, none of the variable strongly correlates (above 0.8) with another variable. Please refer to Chapter 4, Section 4.6.1.1 for detailed explanation about multicollinearity issue.

5.2.2 Reliability Assessment

Cronbach' Alpha value of total scale was 0.920 that could be considered as good for scale reliability and there was not any item that changes the value of Cronbach' Alpha considerably to delete. After the factor structure of the study was determined, the reliabilities of the subscales were examined. Cronbach' Alphas, Inter-Item Correlation, Item-to-Total Correlation and Alpha if Item Deleted values of the subscales are given in the Table 4. While the Cronbach' Alpha value of PU, PEOU, BI, TC exceeded 0.7, ASE and SN had 0.684, 0.665 respectively that values refered the lower level of acceptability. As a result, Cronbach' Alpha values were sufficient for the reliability of the sub-scales. Both all inter-item and item-to-total correlations values exceeded 0.3. Please refer to Chapter 4, Section 4.6.1.1 for detailed explanation about reliability assessment.

Table 4 Summary of Cronbach's Alpha, Inter-Item Correlation and Item-to-Total Correlation Values

Measurement Item	**Number of Items**	**Cronbach' Alpha**	**Reliability Result**	**Inter-Item Correlation**	**Item to Total Correlation**	**Alpha if Item Deleted**
Perceived Usefulness(PU)	4	0.808>0.7	Good	0.453-0.558	0.599-0.701	0.722-0.773

Table 4 (continued)

Perceived Ease of Use (PEOU)	4	0.819>0.7	Good	0.433-0.620	0.553-0.714	0.735-0.810
Behavioral Intention (BI)	3	0.805>0.7	Good	0.591-0.608	0.664-0.677	0.713-0.752
Application Self Efficacy (ASE)	3	0.684>0.6	Acceptable	0.364-0.503	0.455-0.565	0.533-0.661
Technical Complexity (TC)	4	0.845>0.7	Good	0.616-0.684	0.682-0.734	0.762-0.812
Social Norm (SN)	3	0.665>0.6	Acceptable	0.351-0.491	0.411-0.513	0.519-0.658

5.2.3 Identifying Factor Structure

In order to identify the factor structure of the study, explanatory factor analysis was applied. After missing value analysis, outliers, and multivariate normality and multiclollinearity issues were handled, an explanatory factor analysis was conducted. Pallant (2001) indicates that two statistical values are considered for the factorability of the data which are Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's test of Sphericity. KMO value ranges from 0 to 1 and 0.6 is suggested as the minimum value for a good factor analysis (Tabachnic and Fidell, 1996). KMO value was found 0.901. The Bartlett's test of Sphericity should be significant ($p<0.05$) and the significant value was found 0.000 in the pilot study. The values showed that the factor analysis to be considered appropriate for the data set.

Explanatory factor analysis was performed to show whether the related items were clustered under the same factors or not. Screen plot and Eigenvalues were greater than 1 criterion shows that the number of factors should be 6. These six components explained variance was 67.75%. According to Simsek (2007), Maximum likelihood method is considered and Direct Oblimin rotation is performed because the factors are related (majority of the items had over 0.20 correlation value). Item 3, 5, 11, 13,

18, 19 and 21 (shown in Table 2) were removed from the study because they did not cluster any of the factors properly. None of the items clustered appropriately under the Compatibility dimension; for this reason this dimension was removed from the proposed research model. According to Hair et al. (2006) factor loadings in the range of 0.3-0.4 meet the minimal level for explanation of structure. Most of the factor loadings exceeded 0.4 shown in the Table 5.

Table 5 Survey Instrument's Factor Analyses and Reliabilities

Construct / Item	**Factor Loading**	**Cronbach's Alpha Coefficient**	**% Total Variance Explained**
Perceived usefulness (PU)			
PU1 : METU Online enhances my course performance	.490		
PU2 : METU Online increases productivity of the course	.697	.808	34.93
PU3 : METU Online helps me to satisfy the purpose of the course easily	.452		
PU4 : METU Online gives me a greater control over my course	.566		
Perceived ease of use (PEOU)			
PEOU1 : Interacting with METU Online is clear and understandable	.572		
PEOU2 : Interface of the METU Online is clear and easy to understand	.660	.819	12.92
PEOU3 : Navigation among tools is not difficult	.578		
PEOU4 : Interacting with METU Online is not complicated	.427		

Table 5 (continued)

Application self-efficacy (ASE) ASE1 : I can use METU Online without support ASE2 : I can use METU Online, even if there is no one for help when I get stuck ASE3 : I was able to use METU Online without observing anyone use it	.456 .686 .336	.684	7.47
Technological complexity(TC) TC1 : Interacting with METU Online does not require much mental effort TC2 : It does not take too long to learn how to use METU Online TC3 : Using METU Online does not take too much of my time	.676 .585 .654	.845	4.52
Subjective norm (SN) SN1 : My colleagues encourage me to use METU Online SN2 : My assistants / instructors support me to use METU Online SN3 : Head of my department supports me to use METU Online	.584 .849 .431	.665	4.10
Behavioral intention (BI) BI1 : I will use METU Online in the next semesters BI2 : I plan to use METU Online in all of my courses BI3 : It is worth to use METU Online	.696 .779 .650	.805	3.78

5.2.4 Assessment of the Proposed Research Model

Research model was validated with the evaluation of measurement model and structural model.

5.2.4.1 Assessment of Measurement Model

Confirmatory factor analysis (CFA) was conducted using SMART PLS to validate the correlation between items and factors before structural model was evaluated. Additionally, CFA assesses the measurement model via Convergent Validity and Discriminant Validity that are two important components of Construct Validity. The three primary measures were considered to evaluate the convergent validity. Factor Loading is the evidence of the variance shared between an item and construct, and also its standardized value should be ideally 0.7 or higher, but 0.5 or higher is also acceptable. As shown in Table 6, standardized factor loadings ranged between 0.679 and 0.886. The values of the factor loadings validated the correlation between each item and their constructs in the data set. Composite Reliability (CR) refers to internal consistency indicating that all measures consistently represent the same latent construct. A reliability value of 0.7 or higher refers to good reliability. In this study, CR values were between 0.816 and 0.902; so all of the CR values exceeded 0.7 that suggests adequate reliability. CR values are shown in Table 6. Average Variance Extracted (AVE) value was computed for each latent construct of the measurement model. That value should be 0.5 or higher to provide adequate convergent validity. The AVE values ranged from 0.598 to 0.756. This indicated that each construct was strongly related to its individual indicators. AVE values are shown in Table 6. The results of item factor loadings, CR and AVE showed that the measurement model had adequate construct validity to apply SEM.

Table 6 Standardized Factor Loadings, Construct Reliabilities and Variance Extracted Values

Item	**Factor Loadings**	**Composite Reliability (CR)**	**Average Variance Extracted (AVE)**
PU1	.782	.876	%63
PU2	.845		
PU3	.781		
PU4	.788		
PEOU1	.728	.879	%64
PEOU2	.857		
PEOU3	.824		
PEOU4	.802		

Table 6 (continued)

ASE1 ASE2 ASE3	.843 .782 .734	. 830	%62
TC1 TC2 TC3	.869 .852 .886	.902	%75
SN1 SN2 SN3	.812 .820 .679	.816	%59
BI1 BI2 BI3	.855 .852 .861	.892	%73

Another important dimension of construct validity is Discriminant Validity which demonstrates that a measure should not correlate highly with another measure (Peter, 1981). Table 7 shows that square root of average variance for each construct on the diagonal is greater than the correlation between a given construct and all other constructs. For this reason, Discriminant Validity is reasonable to verify construct validity.

Table 7 Discriminant validity for the measurement model

Construct	**BI**	**ASE**	**PEOU**	**PU**	**SN**	**TC**
BI	**0.856**					
ASE	0.391	**0.788**				
PEOU	0.397	0.629	**0.804**			
PU	0.627	0.349	0.395	**0.799**		
SN	0.216	0.114	0.245	0.398	**0.773**	
TC	0.352	0.653	0.707	0.351	0.164	**0.869**

5.2.4.2 Assessment of Structural Model

Because of the non-normal data distribution, component based SEM was used to evaluate the structural model. SMART PLS was used to assess the statistical significance of each hypothesis considering the path coefficient values that were standardized betas. The data composed of 224 samples and it was analyzed with a

bootstrapping procedure to evaluate the significance level of the relations between constructs. The estimated path coefficients of the structural model are shown in Figure 17.

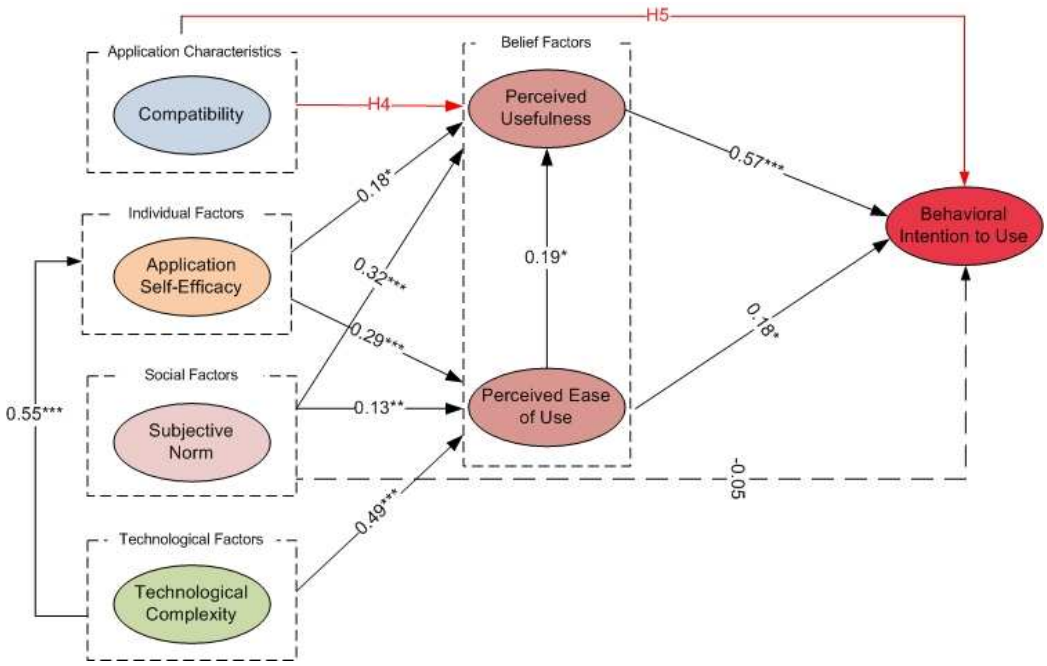

Figure 17 Result of the proposed research model

Path significance: *p<0.05; **p<0.01; ***p<0.001

None of the items clusters under the CMP construct when explanatory factor analysis had been performed. For this reason CMP was not included in the content of structural model, and relations between CMP and PU, CMP and BI were not analyzed. Therefore, H4 and H5 could not be measured. None of the hypotheses were rejected except the one indicating the relation between SN and BI. So, H11 was rejected. Strong positive relations were found between PU-BI, ASE-PEOU, TC-PEOU and SN-PU at the p<0.001 level, so H1, H7, H8 and H9 were accepted. Additionally, structural model showed strong relation between TC and ASE at the p<0.001 level which was not a situation estimated before. The relation between TC and ASE was named as Additional Relation (AR). A new constructed hypothesis had positive direct relation between TC and ASE. Also the results showed that the relations proposed in H3 and H10 were significant at the p<0.01 level, thus the hypotheses were accepted. Lastly, the relations between PEOU-PU and ASE-PU

were significant at the p<0.05 level; therefore H2 and H6 were accepted. Table 9 shows the direct, indirect and total effects. The indirect effect size shows all path coefficients between two latent variables that are at least two edges apart. The total effect size includes both direct and mediated relations among latent variables.

Table 8 Summary of Hypotheses Tests

Relationships	**H_i**	**T-Values**	**β**	**Decision**
PU -> BI	H1	9.010	0.579***	Accepted
PEOU -> PU	H2	2.382	0.197*	Accepted
PEOU -> BI	H3	2.950	0.183**	Accepted
CMP ->PU	H4	-	-	Cannot be determined
CMP ->BI	H5	-	-	Cannot be determined
ASE -> PU	H6	2.378	0.188*	Accepted
ASE -> PEOU	H7	4.995	0.291***	Accepted
TC -> PEOU	H8	8.294	0.497***	Accepted
SN -> PU	H9	5.207	0.328***	Accepted
SN -> PEOU	H10	2.621	0.131**	Accepted
SN -> BI	H11	0.941	-0.058	Rejected
TC -> ASE	AR	15.310	0.553***	Accepted

*p < 0.05; **p < 0.01; ***p<0.001

Table 9 Summary of direct, indirect and total effect sizes

	PU			PEOU			ASE				
	Direct	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**
PU	-	-	-	-	-	-	-	-	-	0,578***	-
PEOU	0,196*	-	0,196*	-	-	-	-	-	-	0,182*	0,114*
ASE	0,187*	0,057*	0,244***	0,290***	-	0,290***	-	-	-	-	0,194*
TC	-	0,257*	0,257***	0,496***	0,19***	0,686***	0,653***	-	0,653***	-	0,274**
SN	0,328***	0,026	0,354***	0,130**	-	0,130**	-	-	-	-0,058	0,112*

Perceived usefulness had the strongest effect on the behavioral intention. The perceived usefulness was followed by perceived ease of use with the second largest total effect on behavioral intention. Technological complexity had the third largest effect on behavioral intention to system use. Subjective norm had the most influential effects on perceived usefulness in both in total and direct effect. Technological complexity had the strongest effects on perceived ease of use in both direct and total relations. Technological complexity was the most influential figure to predict application self efficacy of users.

The central criterion for evaluating the structural measurement model is the rate of R^2 of the latent endogenous variable success (Höck & Ringle, 2006). The result of analyses shows that the proposed model accounted for 27%, 57%, 43% and 42% variances in PU, PEOU, ASE and BI respectively.

CHAPTER 6

DISCUSSION

In this chapter, the results and findings of the research are discussed with respect to the literature, qualitative and quantitative data analyses.

Belief Factors

The first dimension identified the effects of Belief Factors- *Perceived Usefulness* and *Perceived Ease of Use* on behavioral intention towards LMS use from the perspective of higher education instructors.

Firstly, the effect of PU on behavioral intention to use was examined in the proposed research model. Statistical results showed that PU had a positive direct effect and significant relation with behavioral intention to use. PU was the strongest predictor of behavioral intention. According to this finding, it could be suggested that instructors used LMS in teaching because they find LMS useful. This result was in parallel with the literature and the original TAM (Davis et al., 1989; Lee, 2008; Toral et al., 2007; Saade' & Bahli, 2005). Although some of the instructors opposed the usefulness of the system, the interviews supported the significant relation between PU and BI. Some of the instructors thought that the system was not useful due to the unexpected error such as collapse of the system and lack of the automatic update in student lists. However, qualitative findings supported that the usage of LMS reduces

the time and location dependency via forum, chat and e-mail tools and the effort spent for sharing and archiving course materials without loss of information. One of the instructors stated that "…although I have some troubles when contacting METU Online, I cannot ignore the benefits of the system like organizing lecture notes, announcing grades, taking a decision via discussing by forum, connecting with students via e-mail and sharing power point presentations and articles, assignments and announcements…". Another instructor stated that "… I can archive my course materials easily with METU Online. The prepared lecture notes, syllabi and schedules are kept in the system, so I won't need to prepare same documents for upcoming semesters…". Commonly, users find the system useful as a supportive tool because it enhances communication and collaboration, reduces the administration load of instructors and make teaching more effective and easier. The qualitative and quantitative findings suggest that PU is an important determinant of instructors' behavioral intention. Instructors use LMS because they think that LMS is useful. This perception increases their motivation to utilize the technology in their course curriculum.

Secondly, the relation between PEOU and BI was examined in the proposed research model. Statistical findings showed that PEOU had a positive and direct relation with behavioral intention to use. This finding was parallel with the studies of Davis et al., 1989; Lee, 2008; Toral et al., 2007; Saade' & Bahli, 2005. In addition, the results showed that the effect of PU on behavioral intention to use was more influential than the effect of PEOU. The results of the interview explained the positive relation between PEOU and behavioral intention to use and the reason behind the fact that significance of the relation was lower than the relation between PU and BI. One of the instructors stated that "…although, in the first time, the relation between course and its application tools seemed a little bit confusing, learning the usage of the system did not take too much time and effort…". Another instructor stated that "…I had problems in creating lecture notes. I didn't find it user friendly and I had to ask a friend for help. However, I learned it easily and now I can use it without any difficulties…". Another interpretation was "…I cannot follow the discussions in the forum tool because of confusing structure...". The statistical findings and the comments show that instructors generally found the LMS easy to use; however,

sometimes they thought that there were some obstacles related with using it because of the difficulties in some applications of the system; so they might reject LMS use in teaching and teaching related tasks. Also, the structural model showed that PEOU had a significant indirect effect on the instructors' intention towards LMS use through perceived usefulness. Generally, easiness perception enhances the effectiveness, performance and productivity of the instructors and their intention is affected positively with the effects of positive motivations.

Thirdly, relation in the proposed research model showed that PEOU was positively correlated with PU. The result was consistent with the previous studies and the original TAM (Davis et al., 1989; Lee et al., 2009; Lee, 2009; Franco, 2010). The relation emphasized that if an instructor perceives LMS as easy to use, his/her usefulness perception will increase to support the course with the system. When interview was conducting, the instructor stated that "…I don't have to spend too much time in order to submit grades of the students through user friendly interfaces; also I don't have to enter each student's grade separately, thank to the mass grades registration…". Another instructor stated that "…assignment tool is my primary reason to use LMS. Because I can easily give an assignment and collect uploaded files at once. I don't have to spend my time and effort to solve how to prepare an assignment or collect documents of students …". The findings of the statistical results and comments of instructors show the easiness of the system use and its effects on the users' usefulness perception.

The structural model showed that application self-efficacy, subjective norm and perceived ease of use explained directly and indirectly 27% of perceived usefulness's variance. The related exogenous variables did not strongly explain perceived usefulness. Additionally, application self efficacy, subjective norm and technological complexity accounted for 57% of the variance of perceived ease of use. This result showed that the variables directly affected perceived ease of use had a strong prediction power on perceived ease of use.

Application Characteristics

The second dimension tried to identify the impacts of Application Characteristics' effect on behavioral intention. However, CMP construct was removed from the model because of the inconsistent explanatory factor analysis result. Therefore, the effects of CMP on usefulness and behavioral intention to use were not analyzed. When interviews were conducted, it seemed that the instructors' opinions varied on the compatibility of the system. While a group of instructors found the system compatible to organize their courses, some of them thought that the system is inappropriate to support the courses. Qualitative findings supported that the main reason of the diversity emerged because of the courses' properties. An engineering science instructor stated that "…there is no tool available to support laboratory activities so I cannot use LMS to organize my laboratory sections…". The result of the interview was in parallel with the literature. Bourne, Harris & Mayadas (2005) stated that engineering education fell behind some other education areas in the field of adoption of online methodologies, due to laboratory works, intensive mathematical computations, designing tools requiring computing power and graphics. Also an instructor working in Modern Language Departments stated that "…video/audio embedding features could be added to help me design the point materials online when creating lecture notes and online exam. The related materials are important in language teaching…". Also the instructors criticized the system because it does not allow reaching all of the students at the same time who are in different sections of a course. Therefore, instructor may need to spend same effort for all section of the course. Assignment tool was also criticized by instructors in term of its incompatibility. The tool is not capable to resend the evaluated files uploaded by students, so the instructors need to prepare an e-mail for resending the files; therefore they reject the use of the tool. Despite these criticisms, a group of instructors found the system compatible in terms of enhancing communication and collaboration by using chat, e-mail, forum, announcement and managing the course materials and teaching more effective with the help of organizing lecture notes, syllabi, schedules, online exam and sharing tips and links.

Individual Factors

The third dimension identified the effects of Individual factors on behavioral intention towards LMS use. Like previous studies, ASE positively affected both PU (Hsu, Wang & Chiu, 2009) and PEOU (Toral et al., 2007; Hsu et al., 2009; Yi & Hwang, 2003). However, effect of ASE on PU was lower than the one on PEOU. An instructor statement explained this situation by saying that "…when I created lecture notes for the first time, the interface confused me. Because, the resource files of the lecture notes and the files to be shared with students are being organized in the same interface. I could not understand the difference between these two structures, so I called the help desk for assistance in creation of the lecture notes…". ASE significantly influenced PU, as in parallel with the study of Hsu et al. (2009) that concentrate on statistical software-self efficacy of students.

Users' self-confidence towards LMS usage increases their ease of use perception towards system. As indicated in the study of Wang & Wang (2009), higher education instructors have basic computer literacy; for this reason, they have self-confidence while using web-base learning systems. The similar result was seen in the research, 68% of the instructors evaluated their computer abilities as pretty good, which shows the instructors' self-confidence towards system use. Moreover, Morris and Venkatesh (2000) examined age differences in a workplace to reveal their technology adoption, and they found that older workers may be less self-confident in their ability to use a new technology. In this study, 63% of the participants were young people whose ages were 20 and 29 years. For this reason, most of the participants of this research had ASE when using LMS, so self-confidence positively influences their ease of use perception. In addition, an instructor indicated that "…availability of the manual increases my self-confidence, so I don't care about the difficulty of the system. Since, I know that I will be able to use the system with the help of the manual…".

Additionally, ASE had a significant indirect effect on the instructors' usefulness perception through perceived ease of use and the behavioral intention of the instructors through both perceived usefulness and perceived ease of use. Furthermore, technological complexity accounted for 43% of the variance of

application self-efficacy. This result showed that although technological complexity was the only one exogenous variable affecting application self-efficacy directly, it had a strong effect on application self-efficacy.

Technological Factors

The fourth dimension identified the effects of Technological factors on behavioral intention of instructors towards LMS use. Statistical results showed that TC had a strong and positive effect on PEOU. This relation emphasized the importance of complexity perception for higher education instructors. An instructor's comment supported the strong relation between TC and PEOU. He said that "…the applications, such as sending announcements, posting assignments and file sharing, integrated to the system are not confusing. However, preparing an online exam with the system is a little bit confusing, so I prefer paper based exam instead of using online exam tool…". One of the instructors stated that "…technical support is so beneficial, so I don't need to spend much time to solve a problem…". The instructors commonly criticized the complexity of the preparation of lecture notes, creating online exam and readability of the discussions in forum tools. The complexity perception was directly affected instructors' easiness perception. The result of this relation was parallel with the study of Teo (2009). He indicated that the perception of difficult technology discourages instructors towards LMS use, because they think that the usage of the system is so tedious and time confusing that a lot of effort is needed to benefit from the system.

Additionally, a positive significant relation, which was not estimated before, was detected between Technological and Individual dimensions. This relation showed that the complexity of the technology affects user's self-efficacy towards application use. One instructor stated that "…I am not so successful in computer use, so simplicity of the system increases my self-confidence towards LMS….". Moreover the structural model showed that TC had a significant indirect effect on the instructors' usefulness perception through perceived usefulness and application self-efficacy constructs.

Social Factors

The fifth dimension identified the effects of Social factors on behavioral intention of instructors towards LMS use. Statistical results showed that SN positively and directly influenced PU. In parallel with the literature, social environments of instructors' increase their usefulness perception (Wang & Wang, 2009; Park, 2009). Additionally, SN was positively correlated with PEOU even if its effect was lower than the one on PU. The result of this relation was inconsistent with the study of Park (2009). In this study, SN did not have any direct effect on behavioral intention to use. This relation was not consistent with the previous studies (Lee, 2010; Wang & Wang, 2009). The study of Morris and Venkatesh (2000) indicated that age has a positive direct influence on subjective norm which means that older people may consider the opinions of friends and coworkers more. In this research, most of the respondents were young, and they did not care about what people around them believe. Additionally, a generic question was asked in the questionnaire to obtain information about the major motivation of users when deciding about the system use. The results showed that, users' own decision and course content (44% and 38%, respectively) were more effective than the students and the colleagues (27% and 12% respectively) as motivation to use LMS. According to these finding, the insignificant relation between SN and BI was reasonable. Additionally, an instructor stated that "…before I used the system, my students and friends were mentioning about the LMS. After I tried it, I realized that the system could be beneficial to support my courses…". This comment showed that, although the user was influenced by the others' opinions at the beginning, the others' opinions were not as effective as when giving decision about continuing system use. Although usefulness and ease of use perceptions were affected from the people around the user; the final decision towards system use was given by the user him or herself. In addition, the structural model showed that SN had a significant indirect effect on the instructors' behavioral intention towards LMS use through perceived usefulness and perceived ease of use perceptions. Also the interviews supported this indirect relation. An instructor stated that "…my friends and students said that they have some problems about uploading files, lecture notes, etc.; so I don't want to use the system…".

CHAPTER 7

CONCLUSION

In this chapter summary and contributions of the study are given. The limitations of the study and suggestions for further research are also discussed.

7.1 Summary of the study

This study proposed a LMS adoption model from the perspective of higher education instructors. The model included five dimensions – Belief, Application Characteristics, Individual, Social and Technological – and a scale has been developed to examine the relations among their variables. Validity tests have proved that the following variables and their corresponding dimension of the model were significant in explaining the behavioral intention of instructors towards LMS use: (1) Belief - Perceived Usefulness and Perceived Ease of Use, (2) Individual – Application Self Efficacy, (3) Social – Subjective Norm, (4) Technological – Technological Complexity. However, the fifth dimension and its variable, i.e. Application Characteristic – Compatibility, could not be incorporated within the proposed model because of the inappropriate correlation between the items and the

factors. The final model explained a significant amount of the variance of behavioral intention towards LMS use (R^2 = 0.423). The results provide considerable insights about instructor adoption of LMS in higher educations. Moreover the findings of this study contribute to the e-learning literature by identifying the factors that influence instructor adoption of LMS for successful system use in learning and teaching in higher education.

7.2 Contribution of the study

Although there are several stakeholders of learning management systems; such as, "system developers", "technicians", "administrators", "instructors", "instructional designers", "multimedia designers", "online facilitators", "independent evaluators", etc. (Koseler, 2009), instructors play the central role for the success of these systems (Selim, 2003). For this reason examining the adoption of instructors towards e-learning systems is important for the successful systems. Few studies exist in the literature examining instructors' adoption or acceptance of the e-learning; however, none of them concentrates Belief - Perceived Usefulness and Perceived Ease of Use, Individual – Application Self Efficacy, Social – Subjective Norm, Technological – Technological Complexity altogether according to the results of knowledge gathered so far. This research model was developed considering the constructs of technology acceptance model, theory of planned behavior, diffusion of innovations theory and social cognitive theory in order to analyze the instructors' adoption from the multidimensional perspective. The developed model is not exhaustive so it can be improved by adding different dimensions and factors to adapt the changing e-learning technologies.

The instructor adoption of LMS model presented in this study can greatly benefit the management and development of learning management systems as a guidance to better understand how instructors' adoption can be increased and how the use of LMSs can be continuously improved. In addition, this study reveals the reasons affecting instructors' adoption towards LMS for the successful implementation of systems in higher education and the result of this study will help system developers, educational instructions for the successful LMS implementations.

7.3 Limitations and future researchers

Information systems success is based on the multidimensional approach and interdependency of constructs (DeLone & McLean, 2003). In that regard, different dimensions were considered to investigate external variables of the proposed research model. However, there may be other influencing factors; such as Enjoyment, Prior Experiment, Faculty Encouragement, Access to the System, Availability of the Technical Support, User Interface Design, Perceived Interaction, Technical Quality, Content Quality, Pedagogical Quality for instructor adoption of LMS. Hence future research should be performed to examine and test the causal relations among different factors considering the proposed dimensions within the range of LMS. In this model, the prediction power of the exogenous variables explaining instructors' behavioral intention to learning management system use was 42%. Different external variables should be considered to enhance the prediction power of the research model. Another future study would be to confirm the validity of the research model on various learning management systems. The proposed research model is not a rigid model and is open to continuous improvement. Future studies may be conducted to strengthen or expand this adoption model through adding other dimensions or external factors valid for various educational level contexts, i.e. elementary level education, etc. For future work, the validated model could be considered as a base to form a starting point when developing research model for LMS evaluation with respect to other educational level instructors' perceptions.

Data was collected from several departments (Information Systems, Work Based Learning, Cognitive Science, Medical Informatics, Food Engineering, Mining Engineering, Environmental Engineering, Electrical and Electronics Engineering , Petroleum and Natural Gas Engineering , Engineering Sciences, Industrial Engineering, Computer Engineering, Statistics, Secondary Science and Mathematics Education, Computer Education and Instructional Technology , Elementary Education, Physical Education and Sports, Foreign Language Education, Modern Languages, Sociology, Psychology, Biology) of METU. The variety of the departments may be improved. Additionally, the effects of departmental differences

were not examined in the scope of this research. The behavioral intention of instructors who are working in different departments should be examined and compared with each other. In addition, the effects of moderating factors; such as age, gender, awareness of the other LMSs etc. should be examined by future researchers. In this study, awareness of instructors towards other LMSs was not considered. The effects of the awareness moderating factor should be examined by future researchers. Lastly, in time, changes in e-learning technologies and their perceptions by users will inevitably raise the need for a continuous research for technology adoption in this field.

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APPENDICES

APPENDIX A: LETTER OF THE SURVEY

Dear Respondent,

I am a MS student under the supervision of Assistant Professor Sevgi ÖZKAN at Information Systems department of Informatics Institute in Middle East Technical University.

This research study entitled "*Applying an Extended Technology Acceptance Model to Explore Academicians' Intentions towards Using Learning Management System"*. This study aims to apply an enhanced Technology Acceptance Model (TAM) which will be the most powerful model to explore academicians' intentions towards learning management system METU Online provided by METU. This study will help to understand reasons behind accepting or rejecting the usage of METU Online system. Also the development team of the application will be able to enhance the system by considering result of this study.

In this study, it is expected to obtain significant information to enhance the learning management systems to improve the quality of working life of academics. The generated model will make a significant contribution to determinants of learning management system usage by academics.

I would appreciate taking your opinion about the usage of METU Online. I need you to respond as accurately as possible to each question for the reliability of this study. The results will be used for academic researches and treated with confidentially. Please make your choice that is the closest to your view. If you use METU Online, please try not to leave any question blank. If you don't use METU Online, please answer the questions only have *.

Thank you very much for your time and cooperation.

Research Assistant
DUYGU FINDIK

If you have any question and additional comment, you can contact me by;

email address: duyguf@ii.metu.edu.tr

phone: 0312 210 37 44

I have filled the survey with my own consent.

Signature:

APPENDIX B: SURVEY INSTRUMENT OF MAIN STUDY

* 1. Gender: Male Female

* 2. Age: 20-29 years 30-39 years 40-49 years 50 years up

* 3. What is your academic status?

Assistant (MS) Assistant Professor Associate Professor

Assistant (PhD) Lecturer Professor

*4. What is your department?

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*5. In general, how long have you been using computer?

1. Less than 1 year
2. 1 to 5 years
3. 6 to 10 years
4. 11 to 15 years
5. More

*6. How do you rate your computer skills?

1. Expert
2. Pretty Good
3. Basic
4. Limited

*7. What type of class do you prefer?

1. A traditional face-to-face class without using METU Online
2. A face to face class with using METU Online
3. A totally online class
4. Other, please specify…….

*8. Have you ever used METU Online to support the course activities?

Yes No

9. What is the major motivation for using METU Online?

1. Myself
2. The colleagues
3. Students
4. Course Content
5. Other, please specify…….

10. Which METU Online tools do you usually use in your courses? (You can select more than one)

1. Lecture Notes (to organize lecture notes and share them with students)
2. Online Exam (to prepare and implement online exam)
3. Forum (to discuss, share or announce course related topics)
4. Syllabus (to create syllabus and share it with students)
5. Student Tracking (to track students' access to the system)
6. Assignment (to give assignment and collect submitted files)
7. Announcement (to post announcement to course members)
8. Links (to share any important internet links about course)
9. Gradebook (to store students' grades)
10. E-Mail (to send e-mail to course members)
11. Tips (to give some tips about course related topics)
12. Contact (to give any contact details)
13. Schedule (to create and edit course schedule)
14. Chat (to discuss anything with others synchronously)

Please Rate the extent to which you agree with each statement below	Totally Disagree	Partially Disagree	Neither Agree or	Partially Agree	Totally Agree
METU Online enhances my course performance	1	2	3	4	5
Interacting with METU Online is clear and understandable	1	2	3	4	5
I feel good about supporting the course with METU Online	1	2	3	4	5
I will use METU Online in the next semesters	1	2	3	4	5
METU Online is compatible to manage the course progress	1	2	3	4	5
I can use METU Online without support	1	2	3	4	5
Navigation among tools is not difficult	1	2	3	4	5
My colleagues encourage me to use METU Online	1	2	3	4	5
METU Online increases productivity of the course	1	2	3	4	5
Interface of the METU Online is clear and easy to understand	1	2	3	4	5
METU Online provides an attractive learning environment	1	2	3	4	5
I plan to use METU Online in all of my courses	1	2	3	4	5
METU Online fits my teaching style	1	2	3	4	5
I can use METU Online, even if there is no one for help when I get stuck	1	2	3	4	5
Interacting with METU Online is not complicated	1	2	3	4	5
My assistants / instructors support me to use METU Online	1	2	3	4	5
METU Online helps me to satisfy the purpose of the course easily	1	2	3	4	5
Interacting with METU Online does not demand much care or attention	1	2	3	4	5

Supporting the course with METU Online is better than the traditional methods to manage course	1	2	3	4	5
It is worth to use METU Online	1	2	3	4	5
METU Online is helpful to fulfill the needs of the course	1	2	3	4	5
I was able to use METU Online without observing anyone use it	1	2	3	4	5
It does not take too long to learn how to use METU Online	1	2	3	4	5
Head of my department supports me to use METU Online	1	2	3	4	5
METU Online gives me a greater control over my course	1	2	3	4	5
Interacting with METU Online does not require much mental effort	1	2	3	4	5
Using METU Online does not take too much of my time	1	2	3	4	5

If you have additional comments you wish to make about usage of METU Online, please add them here.

……

……

……

……

……

……

……

……

……..

Thank you for your cooperation.

APPENDIX C: QUALITATIVE RESEARCH QUESTIONS

1. What do you think about the tools integrated into METU Online: Lecture Notes, Online Exam, Assignment, Announcement, Grading, E-Mail, Chat, Forum, Schedule, and Syllabus?
2. Why do you choose METU Online to support your courses?
3. Are you satisfied with the use of METU Online system?
4. Do you have any problems when using METU Online? Please give some examples.
5. What is your overall thought about METU Online?

APPENDIX D: ETHICS CLEARANCE

1956

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08/12/2009

ENFORMATİK ENSTİTÜSÜ MÜDÜRLÜĞÜNE

İlgi: 25/11/2009 tarih ve 707- 14505 sayılı yazımız.

Üniversitemiz Bilişim Sistemleri Anabilim Dalı Yüksek Lisans öğrencisi Duygu Fındık'ın, 01/07/2009-01/02/2010 tarihleri arasında tezi ile ilgili *"Applying the Technology Acceptence Model to Explore Instructors"* başlıklı araştırma çalışmasına ilişkin olarak Orta Doğu Teknik Üniversitesi öğretim elemanlarına uygulama yapmak için, öğrencinin isteği doğrultusunda görevlendirilmesi Etik Komite onayı ile uygun görülmüştür.

Gereğini bilgilerinize arz ederim.

Saygılarımla.

Nesrin Ünsal
Öğrenci İşleri Dairesi Başkanı

Ekler:
İAEK Başvuru Kontrol Listesi
İAEK Başvuru Formu Proje Bilgi Formu
İAEK Başvuru Formu

BD

APPENDIX E: CODEBOOK OF THE STUDY

Table 10 Codebook of the Study

Variable	Label	Measurement Level	Values
ID	ID	Scale	_
V1_1	Sex	Nominal	1: Male 2: Female
V1_2	Age	Nominal	1: 20-29 years 2: 30-39 years 3: 40-49 years 4: 50 years up
V1_3	Academic Status	Nominal	1: Assistant (MS) 2: Assistant (PhD) 3: Lecturer 4: Assistant Professor 5: Associate Professor 6: Professor
V1_4	Department	Nominal	1: School of Foreign Languages 2: Faculty of Architecture 3: Faculty of Education 4: Faculty of Arts and Sciences 5: Faculty of Economic and Administrative Sciences 6: Faculty of Engineering 7: Graduate Schools 8: Departments Reporting to Rectorate 9: METU-SUNY Dual Diploma Programs 10: Technical Vocational School of Higher Education

Table 10 (continued)

V1_5	How Long Have You Been Using Computer?	Nominal	1: Less than 1 years 2: 1 to 5 years 3: 6 to 10 years 4: 11 to 15 years 5: More
V1_6	How do you rate your computer skills?	Nominal	1: Expert 2: Pretty Good 3: Basic 4: Limited
V1_7	What type of class do you prefer?	Nominal	1: A traditional face-to-face class without using METU Online 2: A face to face class with using METU Online 3: A total online class 4: Others
V1_8	Have you ever used METU Online to support the course activities?	Nominal	1: Yes 2: No
V1_9_1	Myself	Nominal	1: Yes 2: No
V1_9_2	The colleagues (Inst)	Nominal	1: Yes 2: No
V1_9_3	Students (Inst)	Nominal	1: Yes 2: No
V1_9_4	Course Content (Inst)	Nominal	1: Yes 2: No
V1_9_5	Other (Inst)	Nominal	1: Yes 2: No
V1_10_1	Lecture Notes	Nominal	1: Yes 2: No
V1_10_2	Online Exam	Nominal	1: Yes 2: No
V1_10_3	Forum	Nominal	1: Yes 2: No
V1_10_4	Syllabus	Nominal	1: Yes 2: No

Table 10 (continued)

V1_10_5	Student Tracking	Nominal	1: Yes 2: No
V1_10_6	Assignment	Nominal	1: Yes 2:No
V1_10_7	Announcement	Nominal	1: Yes 2:No
V1_10_8	Links	Nominal	1: Yes 2: No
V1_10_9	Gradebook	Nominal	1: Yes 2: No
V1_10_10	E-Mail	Nominal	1: Yes 2: No
V1_10_11	Tips	Nominal	1: Yes 2: No
V1_10_12	Contact	Nominal	1: Yes 2:No
V1_10_13	Schedule	Nominal	1: Yes 2: No
V1_10_14	Chat	Nominal	1: Yes 2: No
V2_1_1 to V2_16_9	PU-1	Scale	1: Totally Disagree 2: Partially Disagree 3: Neither Agree or Disagree 4: Partially Agree 5: Totally Agree

APPENDIX F: MISSING VALUE STATISTICS FOR MAIN STUDY

Table 11 Missing Value Statistics for Main Study

	N	Mean	Std. Deviation	Missing		No. of Extremes(a,b)	
	Count	Percent	Low	High	Count	Percent	Low
V2_1_1	220	3,90	,953	3	1,3	0	0
V2_2_1	222	4,10	,868	1	,4	14	0
V2_3_1	221	4,23	,833	2	,9	9	0
V2_4_1	221	4,36	,896	2	,9	10	0
V2_5_1	216	3,86	,891	7	3,1	1	0
V2_6_1	219	4,24	,919	4	1,8	15	0
V2_7_1	219	3,95	,996	4	1,8	0	0
V2_8_1	221	3,15	1,109	2	,9	22	0
V2_1_2	222	3,77	,892	1	,4	4	0
V2_2_2	223	3,93	,956	0	,0	0	0
V2_3_2	222	3,44	,914	1	,4	7	0
V2_4_2	218	3,98	1,047	5	2,2	0	0
V2_5_2	221	3,70	,931	2	,9	6	0
V2_6_2	222	3,94	1,009	1	,4	0	0
V2_7_2	222	3,96	,965	1	,4	21	0
V2_8_2	215	3,55	1,096	8	3,6	16	0
V2_1_3	219	3,69	,809	4	1,8	2	0
V2_2_3	220	3,70	,975	3	1,3	5	0
V2_3_3	219	4,00	,974	4	1,8	19	0
V2_4_3	222	4,21	,857	1	,4	13	0
V2_5_3	223	4,03	,773	0	,0	10	0
V2_6_3	223	3,93	1,095	0	,0	0	0
V2_7_3	222	4,29	,867	1	,4	14	0
V2_8_3	219	3,17	1,164	4	1,8	24	0
V2_1_4	221	3,71	,894	2	,9	4	0
V2_2_4	223	4,09	,876	0	,0	10	0
V2_7_4	221	4,19	,863	2	,9	12	0

APPENDIX G: EM MISSING DATA ANALYSIS

Table 12 EM Missing Data Analysis

	V2_1_1	V2_2_1	V2_3_1	V2_4_1	V2_5_1	V2_6_1	V2_7_1	V2_8_1	V2_1_2	V2_2_2	V2_3_2	V2_4_2	V2_5_2	V2_6_2	V2_7_2	V2_8_2	V2_1_3	V2_2_3	V2_3_3	V2_4_3	V2_5_3	V2_6_3	V2_7_3	V2_8_3	V2_1_4	V2_2_4	V2_7_4	filter_$
V2_1_1	1																											
V2_2_1	,340	1																										
V2_3_1	,559	,358	1																									
V2_4_1	,390	,345	,601	1																								
V2_5_1	,362	,363	,368	,359	1																							
V2_6_1	,223	,435	,265	,289	,264	1																						
V2_7_1	,289	,486	,311	,289	,330	,516	1																					
V2_8_1	,268	,181	,232	,155	,243	,038	,210	1																				
V2_1_2	,573	,276	,485	,502	,376	,169	,232	,344	1																			
V2_2_2	,225	,596	,346	,311	,437	,489	,619	,186	,283	1																		
V2_3_2	,476	,416	,382	,289	,307	,297	,422	,365	,531	,402	1																	
V2_4_2	,451	,293	,527	,635	,349	,347	,267	,186	,498	,251	,423	1																
V2_5_2	,553	,292	,556	,444	,311	,292	,299	,233	,530	,294	,530	,606	1															
V2_6_2	,209	,372	,259	,295	,406	,489	,380	,122	,317	,415	,335	,367	,326	1														

Table 12 (continued)

V2_7_2	,211	,468	,170	,253	,345	,504	,573	,176	,186	,584	,370	,249	,255	,506	1														
V2_8_2	,220	,220	,289	,207	,273	,117	,249	,555	,318	,227	,252	,169	,216	,162	,225	1													
V2_1_3	,502	,349	,456	,374	,363	,234	,319	,268	,578	,299	,521	,410	,564	,287	,246	,341	1												
V2_2_3	,033	,274	,077	,106	,142	,315	,393	,035	,209	,397	,206	,159	,139	,320	,427	,068	,163	1											
V2_3_3	,489	,282	,481	,431	,393	,255	,234	,144	,556	,265	,454	,520	,540	,365	,179	,117	,427	,098	1										
V2_4_3	,482	,294	,527	,593	,335	,274	,240	,151	,534	,283	,317	,590	,527	,291	,303	,159	,386	,192	,607	1									
V2_5_3	,516	,446	,538	,487	,438	,305	,283	,219	,583	,405	,459	,519	,519	,383	,290	,302	,600	,217	,508	,624	1								
V2_6_3	,127	,317	,267	,179	,205	,410	,305	,019	,158	,379	,178	,247	,303	,367	,362	,118	,208	,314	,198	,169	,364	1							
V2_7_3	,110	,392	,138	,236	,148	,427	,431	,035	,128	,423	,232	,247	,195	,359	,558	,160	,219	,431	,136	,235	,343	,448	1						
V2_8_3	,254	,045	,170	,154	,189	,022	,089	,394	,309	,035	,314	,163	,178	,064	,096	,378	,244	-,017	,204	,137	,153	,017	,007	1					
V2_1_4	,530	,303	,453	,452	,366	,293	,254	,249	,586	,349	,547	,495	,520	,270	,243	,205	,534	,148	,551	,453	,555	,228	,213	,320	1				
V2_2_4	,128	,392	,175	,208	,311	,460	,467	,077	,155	,524	,261	,205	,194	,403	,511	,150	,189	,518	,209	,168	,335	,490	,650	,064	,340	1			
V2_7_4	,222	,510	,267	,315	,347	,517	,528	,115	,314	,587	,415	,374	,266	,465	,518	,252	,311	,456	,330	,330	,450	,428	,536	,083	,410	,670	1		
filter_$	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

a Little's MCAR test: Chi-Square = 775,823, DF = 730, Sig. = ,117

APPENDIX H: DESCRIPTIVE STATISTICS OF MAIN STUDY

Table 13 Descriptive Statistics

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
V2_1_1	224	-,829	,163	,734	,324
V2_2_1	224	-,937	,163	1,233	,324
V2_3_1	224	-,742	,163	,016	,324
V2_4_1	224	-,974	,163	,082	,324
V2_5_1	224	-,515	,163	-,231	,324
V2_6_1	224	-1,255	,163	1,580	,324
V2_7_1	224	-,852	,163	,241	,324
V2_8_1	224	-,250	,163	-,384	,324
V2_1_2	224	-,220	,163	-,549	,324
V2_2_2	224	-,811	,163	,241	,324
V2_3_2	224	-,324	,163	,580	,324
V2_4_2	224	-,967	,163	,349	,324
V2_5_2	224	-,251	,163	-,179	,324
V2_6_2	224	-,906	,163	,452	,324
V2_7_2	224	-,892	,163	,632	,324
V2_8_2	224	-,625	,163	,185	,324
V2_1_3	224	-,046	,163	-,454	,324
V2_2_3	224	-,420	,163	-,387	,324
V2_3_3	224	-,626	,163	-,332	,324
V2_4_3	224	-,956	,163	,569	,324
V2_5_3	224	-,455	,163	,236	,324
V2_6_3	224	-,908	,163	,060	,324
V2_7_3	224	-1,245	,163	1,558	,324
V2_8_3	224	-,166	,163	-,424	,324
V2_1_4	224	-,324	,163	-,315	,324
V2_2_4	224	-,756	,163	,685	,324
V2_7_4	224	-,860	,163	,345	,324