Structural Equation Modeling (SEM) of an Extended Technology Acceptance Model (TAM) to Report Web Technology Adoption Behavior in Higher Education Institutions

by

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Abstract

Web technologies used in higher education institutions are aimed to offer practical value to faculty members and students in facilitating their teaching learning and other academic processes. However, a number of recent studies revealed that instructors and students are reluctant to engage in activities that require information technology (Reffell & Whitworth, 2002). This dissertation aimed to contribute in the current understandings of what factors influence faculty members' and students' attitudes toward web technology adoption in higher education settings. Using a sequential mixed method research design, three research studies were conducted in three phases of this dissertation. Three different web technologies were tested, one in each study. Davis's (1989) Technology Acceptance Model (TAM) was used as the baseline model for all three studies. The dissertation reported on findings from these three studies that examined factors leading to users' adoption of three different web technologies in higher education settings.

The purpose of study 1 was to explore faculty members' attitudes toward Blackboard Learning Management Systems (LMS). The study used Davis's (1989) Technology Acceptance Model (TAM) as the baseline model to identify how faculty attitudes toward LMSs impact their LMS adoption behavior. Data were collected from 36 faculty members through a web-based survey. Directive content analysis was utilized to analyze and interpret the data. The findings of Study 1 shed light on the factors that affect faculty members' acceptance of LMS. The strengths and weaknesses of Blackboard from the faculty members' perspective were revealed as well. Also, faculty members' recommendations on ensuring increased use of LMSs were reported.

Study 2 examined faculty attitudes toward Canvas Learning Management System (LMS) in higher education settings. The study proposed an extension of Davis's (1989)'s Technology Acceptance Model (TAM) by incorporating system quality, perceived self-efficacy and facilitations conditions as three external factors and examined its validity in explaining faculty attitudes toward LMS usage. A total of 560 usable responses were collected through a web-survey. Quantitative data were analyzed using Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). The study results confirmed the validity of the extended TAM in determining faculty attitudes toward LMS usage. All three exogenous variables were found to be significant predictors of faculty usage of LMS.

Study 3 took a holistic view and examined the validity of the extended TAM proposed in Study 2 in determining students' acceptance of university web portals. Quantitative data collected from 429 respondents were analyzed using CFA and SEM. The results of the study revealed that all three external constructs were significant in explaining students' acceptance of university web portals. Overall, the results indicated that the extended TAM had sufficient explanatory power to explain students' attitude towards university web portals.

In summary, the results of Study 1 provided evidence of the applicability of TAM in organizing and analyzing open-ended data. The results of Study 2 and Study 3 provided overall general support for the extended TAM in determining web technology adoption behavior in higher education settings. Common issues that act as barriers in web technology adoption were revealed. Based on the overall findings, important recommendations were provided to reduce these barriers and ensure increased use of web technologies in higher education settings. Specific findings, theoretical and practical implications and future research directions were discussed as well.

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List of Abbreviations

AIC	Akaike Information Criterion
AMOS	Analysis of Moment Structures
ATT	Attitude toward Using
AU	Actual Use
BI	Behavioral Intention
CFA	Confirmatory Factor Analysis
CMIN/DF	Relative Chi-Square
FC	Facilitating Conditions
IFI	Incremental Fit Index
IS	Information Systems
IT	Information Technology
LMS	Learning Management System
NFI	Normed Fit Index
P	*p* value
PEOU	Perceived Ease of Use
PSE	Perceived Self-efficacy
PU	Perceived Usefulness
RMSEA	Root Mean Square of Error Estimation

SD	Standard Deviation
SEM	Structural Equation Modeling
SQ	System Quality
SRMR	Standardized Root Mean Residual
TAM	Technology Acceptance Model
TLI	Tucker Lewis Index
TPB	Theory of Planned Behavior
WQ	Web portal Quality
WWW	World Wide Web
χ^2	Chi square

CHAPTER 1. INTRODUCTION

Introduction

After the Internet was introduced to the public, like all other sectors, the education sector has been changed significantly in the United States. The computer and Internet have become important change agents and significant educational and information management tools within the learning environment (Tolentino, 2011). The World Wide Web (WWW) has gained wide degree of acceptance as a research and information tool (Surry & Land, 2000). Universities have started utilizing the WWW to develop web portals and offer their virtual presence to their stakeholders, primarily faculty members, students, and employees.

In past, higher educational institutions invested in information technology infrastructure to facilitate their administrative goals. During the last two decades, these institutions have been investing in web-technology infrastructure not only for the administrative purposes but also for academic purposes to provide web-technology assisted enriched academic environments for their students. Educational researchers have estimated more than 40 billion dollars have been spent in the United States on educational technology infrastructure and training in the past ten years (Amiel & Reeves, 2008). With the advancements in affordable web-technologies, higher educational institutions are no longer limited to traditional settings. Most of the universities have started using their own web portals as information management tools to deliver education and to provide supportive services. To mention a few, the information management tools could be the university web portal itself, Learning Management Systems (LMSs), online library systems, online registration systems, email, online payment systems, etc. Implementation of web-technologies like these has opened many opportunities for the higher educational institutions to be more flexible and efficient for their faculty members and students. Web-enabled technology tools have provided faculty members as well as students with the opportunity to improve and upgrade the teaching learning method by integrating these technologies in their teaching-learning and related academic activities.

Statement of the Problem

Since web-technology adoption in higher education is still not mature, many of the faculty members and students are not very comfortable in using the new technologies. Many of them are novice web-technology users and for them Internet and Internet based technologies are still difficult to use. For example, web based technologies sometimes frustrate the novice users because they search for specific information or feature but once they log on they become lost on the site with too much information and complex screens and lose their confidence to navigate properly. So, they prefer working with the traditional systems even though it is time-consuming and cumbersome compared to working with the web enabled systems. However, the tech-savvy user, if interested, can get through most web-technology and can locate what they need. Therefore, to capture the attention of novice users and to meet the requirements of the tech-savvy users together is a big challenge for the web-technology developers. Considering these issues, there is a current thrust for universities to discover the key to successful adoption of web-technologies by their stakeholders, especially by the faculty members and students.

Referred to as the ‘fingertip effect,’ Perkins (1985) stated that if a technological support system is available, users will automatically take advantage of the opportunities that it affords. But the question is to what extent would the users use it? Why would they use or not use it?

.Prior research revealed that the lack of user acceptance has long been an impediment to the success of new information systems (Davis, 1993: Gould, Boies & Lewis, 1991: Nickerson, 1999).

Technology adoption is a complex matter (Steel, 2009). Adopting web-based technology is more than installing a new web-product. The important thing is to introduce the technology and to get the maximum advantage. Researchers found that many end-users are often unwilling to use available technologies for job/ task performance gains (Davis, Bagozzi & Warshaw, 1989; Nickerson, 1999). Butler and Sellbom (2002) noted that the general categories of barriers to adoption of technology include concerns about reliability, lack of time to learn, uncertainty that using technology matters and lack of support.

To get full advantages of web-based technologies in higher educational settings it is important to successfully maintain and ensure the maximum use of the technologies by the users. Successful adoption of a web-based technology depends on many factors, like users' acceptance of, and satisfaction with the technology. According to Perkins (1985), three conditions must be met in order for technology to be utilized effectively: (a) the opportunity is available, (b) users recognize it, and (c) users are sufficiently motivated to use it.

Several aspects have been stated by researchers as significant factors in determining users' web-technology adoption behavior. Butler and Sellbom (2002) and Roger (2003) as cited in Abrahams (2010), stated that barriers affect the rate of adoption and prevent individuals, groups, and institutions from adopting a technology. Relative advantage, complexity, observability, image (Yi, Jackson, Park, & Probst, 2006), users' perceptions of the system and organizational support (Butler & Sellbom, 2002) were reported as the most important factors in predicting users' intention to make use of technology. Abrahams (2010) opined that, the issues associated with technology adoption are multidimensional factors influenced by different barriers. Potential individual barriers to adoption of technology could be lack of technological literacy or competency, inertia and comfort with traditional methodology, and time commitment to learn the new technology (Miller, Martineau, & Clark, 2000, Bjarnason, 2003, Surry & Land, 2000, Roberts, 2008). Jonas and Norman (2011) stated that though web-based technologies are ubiquitous in higher education, they are still underutilized. Prior research indicated that technology is only useful if the intended users embrace the technology and apply it within their work routines (Venkatesh & Bala, 2008; Venkatesh, Morris, Davis & Davis, 2003). It raises the importance of exploring and determining the factors affecting the web-technology adoption behaviors of the students and faculty members in higher education settings.

Central to this dissertation was a focus on the end-users who experience the web-technology adoption in higher education settings. Since faculty members and students are the key users of the web-technology services provided by higher educational institutions, exploring their attitudes toward web-technology adoption was the main purpose of this dissertation. This dissertation investigated the factors behind the students' and faculty members' using/ not using of the web-technologies as effectively as they might be. The dissertation was centered on those web-technologies that are not mandatory for users or potential users but rather voluntary.

Research on individual level technology acceptance

Research on individual-level technology acceptance and adoption are well-established and provide rich theories and explanations of the determinants of adoption and use (Venkatesh et al., 2003). Researchers have developed several theoretical models in this area with roots in information systems, psychology and sociology that routinely explain over 40% of the variance in individual intention to use the technology (Davis et al., 1989; Taylor & Todd, 1995a;

Venkatesh & Davis, 2000; Venkatesh et al., 2003). These theoretical models were proposed for a better understanding concerning technology adoption, diffusion, acceptance and usage (Davis 1989; Rogers, 2003; Scurry, Ensminger & Habb, 2005; Taylor & Todd, 1995a;1995b; Venkatesh & Davis, 2000; Yi et al., 2006). Researchers studied users' attitude toward technology and released some useful theories such as theory of reasoned action (TRA) (Fishbein & Ajzen, 1975), theory of planned behavior (TPB) (Ajzen, 1991), technology acceptance model (TAM) (Davis, 1989) etc. to determine users' technology adoption behavior. Among the theoretical models, TAM is one of the most frequently employed models in determining the end-users' technology adoption behavior. Researchers have shown this model to be highly predictive of information technology adoption (Davis et al., 1989; Adams, Nelson, & Todd, 1992; Venkatesh & Davis, 2000; Venkatesh & Morris, 2000). As stated by Lin (2007), the main reason for its popularity is perhaps its parsimony as well as its wealth of recent empirical support. Lee, Kozar and Larsen (2003) analyzed 101 articles published between 1986 to 2003 and stated that over 30 different types of information systems (ISs) were used as target systems for TAM studies and out of them the most widely-tested systems (28%) were general purpose systems (i.e. Computer, WWW or e-commerce, computer resource center etc.). More recently the Internet was the most widely applied target technology in TAM studies (Lee et al., 2003).

Technology Acceptance Model (TAM)

This dissertation utilized the technology acceptance model (TAM) developed by Davis (1989) as a baseline model to determine the users' technology adoption behavior. TAM is based on Fishbein and Ajzen's (1975) theory of reasoned action (TRA). TRA claims beliefs influence attitudes, which in turn lead to intentions. Finally, intentions generate behavior (See Figure 1.1).

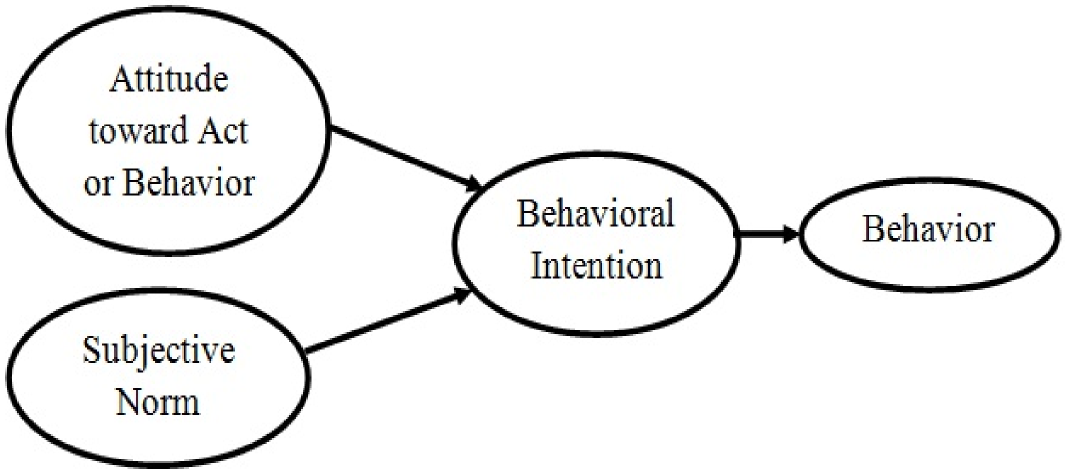

*Figure 1.1.*Theory of Reasoned Action (Fishbein & Ajzen, 1975)

TAM (See Figure 1.2) specifies the causal linkages among human attitude beliefs and intentions to determine the technology adoption behavior. "The TAM is based on on principles adopted from Fishbein and Ajzen's (1975) attitude paradigm from psychology which: (1) specifies how to measure the behavior-relevant components of attitudes; (2) distinguishes between beliefs and attitudes; and (3) specifies how external stimuli are causally linked to beliefs, attitudes and behavior" (Davis, 1993, p. 476).

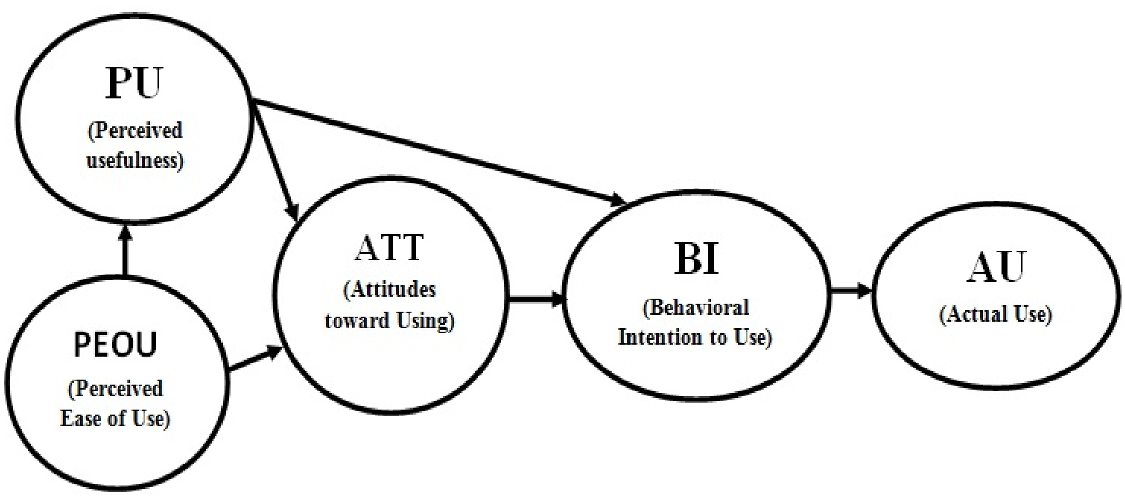

Figure 1.2 Technology Acceptance Model (Davis, Bagozzi & Warshaw, 1989, p.985)

The purpose of TAM is to "provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified" (Davis et al., 1989, p. 985).

TAM determines the causal relationships between perceived usefulness (PU), perceived ease of use (PEOU), attitude toward the technology (ATT), intention to use the technology (BI), and the actual use of the technology (AU). It states a causal influence of perceived ease of use of the technology on perceived usefulness of the technology and claims that if a person finds a technology ease to use, then he or she perceives the technology as useful. Regarding users' attitude toward technology, TAM claims that users formulate a positive attitude toward the technology when they perceive the technology is useful and easy to use. According to TAM, the users' behavioral intention to use a technology is also influenced by the PU and PEOU of the technology and finally the actual use (AU) of the technology is shaped by the behavioral intention (BI) of the users to use the technology. TRA and TAM are explained in detail in Chapter 2.

TAM is one of the most insightful frameworks frequently used in studies to predict and explain computer based technology adoption behavior. Because of its simplicity and understandability (King & He, 2006), TAM has been widely accepted by the researchers in predicting technology usage since it was first proposed.

TAM was utilized in this dissertation to explore the end-users technology adoption behavior in higher education settings. This dissertation implemented the model in determining the web-technology adoption behavior of three different web-technologies in higher education settings and anticipated providing new insights into areas that remain as of yet unexplored.

Purpose of the Research

The dissertation aimed at determining the users' web-technology adoption behavior in higher education settings. It explored users' attitude toward web-technology usage in higher education settings and the factors that affect their attitudes. The dissertation first introduced the web-technologies to be examined, reviewed prior research on web-technology usage in higher education, and clarified the theoretical foundation of the dissertation. Three web-technologies were examined in three phases of this study. The three web-technologies were two different LMSs and one university web portal (website). All three studies utilized TAM to explore the research question. The first two studies examined the faculty attitude toward two different types of LMSs (Blackboard and Canvas). The third study took a more generalized approach and examined students' attitudes toward a university web portal.

The three fold purposes of this dissertation were

1. To present a theoretical framework and a conceptual model for web-technology adoption behavior (i.e. Blackboard) by faculty members in higher education settings.
2. To examine the validity of an extended TAM in determining the web-technology adoption (i.e. Canvas) behavior of faculty members in higher education settings.
3. To examine the validity of an extended TAM in determining university students attitude toward web-technology adoption (i.e., University web portal) in higher education.

Web-technologies to be examined

To help ensure results of the dissertation would be robust across contexts, the heterogeneity across web-technologies and participants was maintained. As mentioned earlier, three web-technologies: two LMSs and a university web portal were examined in three phases. TAM was used as the theoretical framework in all three phases. Using the TAM framework, this study examined the nature of attitude under conditions of non-mandatory use of web-technology.

Learning Management System. "The majority of LMSs are web-based to facilitate anytime, anywhere access to learning content and administration. They utilize synchronous and asynchronous technologies to facilitate access to learning materials and administration" (Black, Beck, Dawson, Jinks, & DiPietro, 2007, p. 36). Using this web-based software application or web-based technology, instructors can create and deliver content, monitor student participation, and assess student performance. Currently, most of the universities in the United States use LMSs to facilitate their teaching-learning activities. Examples of LMSs are Blackboard, WebCT, and Canvas, etc. This dissertation examined two LMSs: Blackboard and Canvas.

The majority of LMSs are web-based to facilitate anytime, anywhere access to learning content and administration. They utilize synchronous and asynchronous technologies to facilitate access to learning materials and administration.

Blackboard. Blackboard was formed in 1997. It offers various web-based software products for online learning. Falvo and Johnson (2007) conducted a study on the use of LMS based upon a random sample of 100 of the approximately 2000 higher learning institutions of the United States, and found that the most popular LMS used at colleges and universities was Blackboard and the second most used system was WebCT, which was later acquired by Blackboard.

Canvas. In February 2011, Instructure Inc. (http://www.instructure.com) launched a LMS called Canvas which is free to download with a mission to become the standard platform for education. It is built around an open architecture and has rich features including e portfolios, web conferencing, integrated learning outcomes, rubrics, choices of pedagogy, style formation of ad hoc groups and assignment submission (News & Notes, 2011).

University web portal. Tatnall (2005) stated (as cited in Manouselis, Kastrantas, Sanchez-Alonzo, Caceres Ebner, Palmer, & Naeve, 2009) a portal, in general, is a gateway to information and services from multiple sources. Educational web portals serve as gateways to information and services of some learning or teaching relevance and may cover a variety of types (Manouselis et al., 2009). University websites are, therefore, educational web portals that provide all sorts of information necessary for their stakeholders especially for their students, faculty members and employees.

Three phases of the dissertation

At the first phase, the dissertation used the original TAM framework and conducted a content analysis of open-ended data to determine the faculty attitude toward Blackboard use. In the second and third phase of the study, an extended TAM framework was conducted by adding three external variables in the original TAM framework to determine the users' attitude toward Canvas and University web portal respectively. The dissertation examined the relationships between the external variables and the original TAM variables and provided greater insights into concepts that needed further exploration. This study is important to both the education research and technology acceptance research because it closed the gap between two desperate bodies of literature.

Research Questions and Hypotheses

This dissertation followed a sequential mixed methods approach (Creswell, 2008; Creswell & Plano Clark, 2007; Creswell & Tashakkori, 2007) consisting of three studies. Each of the studies represented a different phase of the research. Study one followed an inductive exploratory approach and consisted of a content analysis study that examined the basic TAM framework. Study two and three followed a quantitative approach for data analysis to examine the extended TAM framework.

Study One

The first study focused on the faculty attitude toward Blackboard use. The research question for study one was:

To what extent, is TAM a valid framework in explaining faculty attitudes toward LMS (Blackboard) in higher education settings? To answer the research question, some of the open-ended questions asked to the respondents were as follows:

1. According to faculty members, what are the reasons behind using or not using Blackboard?
2. According to faculty members, what are the strengths of Blackboard?
3. According to faculty members, what are the limitations of Blackboard?
4. According to faculty members, what should be done to improve or modify Blackboard to ensure more usability and acceptance by faculty members?

A web based survey was conducted among 36 faculty members of a large southeastern university. The survey data were coded on the basis of five basic TAM constructs. A content analysis of the survey data was conducted to determine the faculty members' attitude toward

Blackboard use. The study also revealed the strengths and weaknesses of Blackboard and the initiatives to be taken to ensure more acceptance of Blackboard from faculty perspective.

A critical review of the TAM literature identified a shortcoming of TAM as the non-inclusion of external variables (Legris, Ingham, & Collerette, 2003). Study 2 and Study 3 addressed this issue by adding three external variables in the original TAM framework to extend the model. In both of the studies, the extended TAM was used to determine the chain of effects of these three external variables to the technology usage behavior. Study 2 and Study 3 tested two different web technologies using the extended TAM.

The results of Study 1 identified important factors that affect web-technology adoption behavior in higher education settings. Based on the findings obtained from Study 1 and findings revealed from prior technology adoption literature, Study 2 and Study 3 proposed an extension of the original TAM by incorporating exogenous variables and examining the validity of the proposed model in determining users' web technology adoption behavior for two other web-technologies in higher education settings.

Study Two

Study 2 was focused on determining faculty attitude toward Canvas Learning management system. It offered an extension of TAM by adding three external variables: System Quality (SQ), Perceived Self-efficacy (PSE), and Facilitating Conditions (FC) within the original TAM framework (See Figure 1.3) and examined its validity in determining faculty members attitudes toward Canvas Learning Management Systems.

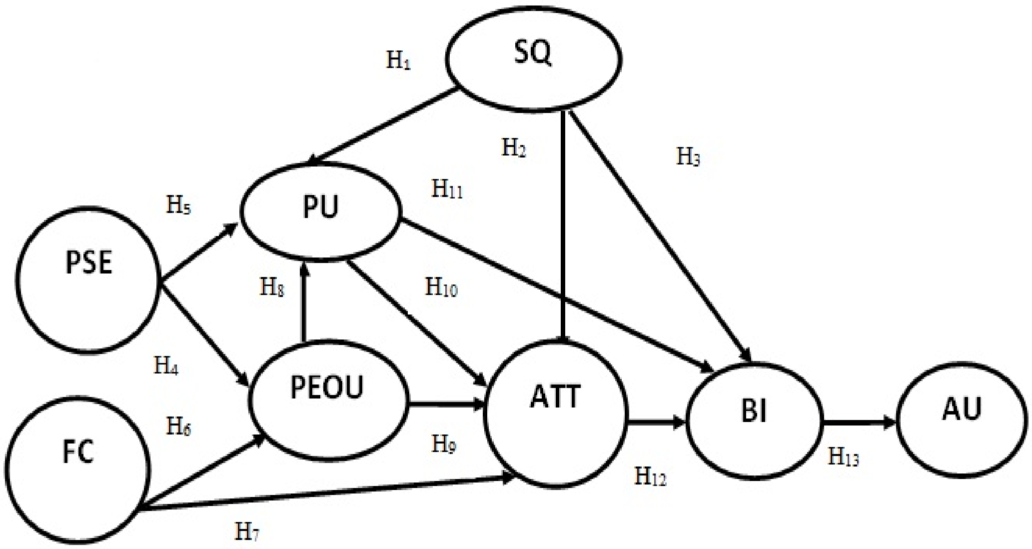

Figure 1.3 Proposed Extension of Technology Acceptance Model for Study 2

The research question for study two was: “To what extent is the extended TAM a valid framework to explain faculty attitude toward LMS (Canvas) in higher education settings?”

Study 2 proposed and examined the following thirteen hypotheses:

- System Quality (SQ) of LMS has a significant positive effect on the perceived usefulness (PU) of LMS
- SQ of LMS has a significant positive effect on faculty members’ attitudes (ATT) toward using LMS
- SQ of LMS has a significant positive effect on faculty members’ behavioral intention (BI) of using LMS
- Faculty members’ perceived self-efficacies (PSE) have significant positive effects on their perceived ease of use (PEOU) of LMS
- Faculty members’ PSEs have significant positive effects on their PU of LMS

- FC has a significant positive effect on faculty members' PEOU of LMS
- FC has a significant positive effect on faculty members' attitude (ATT) toward using LMS.
- The PEOU of LMS will have a significant positive effect on PU of LMS
- PEOU of LMS will have a significant positive effect on Faculty members' ATT toward using LMS
- PU will have a significant positive effect on faculty members' ATT toward LMS use
- PU will have a significant positive effect on faculty members' BI to use LMS
- Faculty members' ATT toward using LMS will have a significant positive effect on their BI of using LMS
- Faculty members' ATT toward using LMS will have a significant positive effect on their actual use (AU) of LMS.

A web-based survey was conducted among the faculty members from two universities. The survey included close ended and Likert scale questions. The validity of the extended TAM was tested using Confirmatory Factor Analysis and Structural Equation Modeling to determine the faculty members LMS usage behavior.

Study Three

Study 3 took a broader view and examined students' attitude toward university web portals. Similar to Study 2, it also proposed an extension of Davis's (1989) TAM by adding three external variables within it (See Figure 1.4). Study 3 examined the validity of the proposed TAM in determining students' attitude toward university web portals. The three external variables added were web portal Quality (WQ), Perceived Self-efficacy (PSE), and Facilitating Conditions (FC).

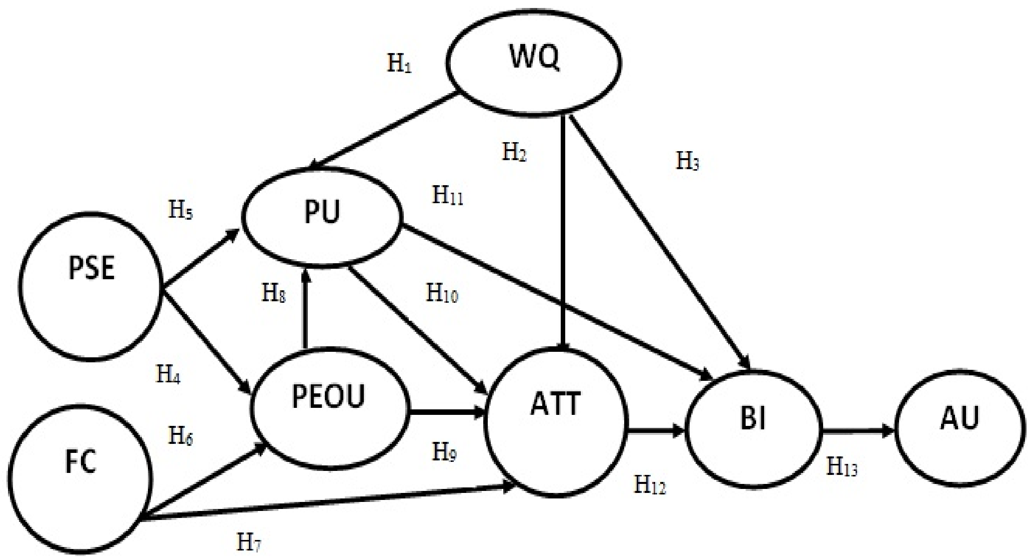

Figure 1.4 Proposed Extension of Technology Acceptance Model for Study 3

Study 3 answered the following research question: “To what extent is the extended TAM a valid framework to explain students’ attitudes toward university web portal use?”

Study 3 proposed and examined the following thirteen hypotheses:

- WQ has a significant positive effect on PU of university web portals
- WQ has a significant positive effect on students’ attitude (ATT) toward university web portals
- WQ has a significant positive effect on students’ behavioral intention (BI) to use university web portals
- PSE has a significant positive effect on PEOU of university web portals
- PSE has a significant positive effect on PU of university web portals.
- FC has a significant positive effect on PEOU of university web portals

- FC has a significant positive effect on students' attitude (ATT) toward university web portals.
- PEOU has a significant positive effect on PU of university web portals
- PEOU has a significant positive effect on ATT toward using university web portals
- PU has a significant positive effect on ATT toward using university web portals
- PU has a significant positive effect on BI of using university web portals
- ATT has a significant positive effect on BI of using university web portals
- BI has a significant positive effect on AU of university web portals.

A web-based survey was conducted among the students of a large southern university. The survey included close ended and Likert scale questions. To test the validity of the proposed model in determining students' attitude toward university web portal, quantitative data were analyzed using Confirmatory Factor Analysis and Structural Equation Modeling.

Significance of the study

This dissertation is significant for several reasons.

1. Most of the prior technology adoption research in education settings focused on K-12 settings. This dissertation investigated the web-technology adoption behavior at the higher education settings rather than k-12 settings. Thus the findings of this dissertation complemented the picture of web-technology adoption in higher education institutions.
2. Most of the prior technology adoption research focused on students view only. This dissertation investigated both the faculty and students' views. It addressed the adoption behavior of three different web-technologies among the faculty members and students in higher education settings. Emphasis was given on (i) the

web-technologies that are mostly in practice and on (ii) the web technology adoption behaviors of the two major groups: faculty members and the students.

3. Since TAM is an Information Systems (IS) model and this dissertation utilized the model in the education sector, it provided benefits to both sides of the literature. Using TAM in exploring web-technology adoption behavior in higher education settings had been limited in the past. Thus, this dissertation enriched the literature by providing further evidence of the applicability of TAM in technology adoption research in higher education settings.
4. Literature showed numerous studies that relied on the TAM in some form, used longitudinal data, multiple studies and meta-analysis. TAM had been applied to different technologies under different situations (e.g. time and culture) with different control factors (e.g. gender, organizational type and size) and different subjects (e.g. undergraduate students, MBAs and knowledge workers). Very few of the previous TAM studies examined the nature of attitude under conditions of non-mandatory use of technology. This dissertation examined the web-technology adoption behavior under conditions of voluntary use of technology. None of the three web-technologies tested in this dissertation was mandatory to use by the users. Therefore, the findings of this study contributed to the literature by adding information about users' web-technology adoption behavior under conditions of non-mandatory use of technology in higher education settings.
5. This dissertation examined three web-technologies. The first one was Blackboard Learning Management System, which was the most popular (Falvo & Johnson, 2007) and matured LMS comparative to its competitor LMSs. The second web

technology examined in this dissertation was Canvas, which was a new LMS, launched in the 2011 market. The third web technology examined in this dissertation was a current web technology: a university web portal. Therefore, this dissertation examined three web-technologies, in three different life-cycle stages, and provided significant insights about users' attitudes and whether any differences existed among the users' attitudes toward the technology according to its current life-cycle stage. Also, this dissertation collected data from different groups of subjects (faculty members and students) helping to ensure the robustness of the findings across contexts.

6. Special emphasis was given to the theoretical framework of the research. The same theory was utilized to examine each of the three different web-technologies, which was an added benefit to validate the efficiency of TAM in determining the users' web-technology adoption behavior for each web-technology.
7. A sequential mixed method approach (Creswell, 2008; Creswell & Plano Clark, 2007; Creswell & Tashakkori, 2007) was used for data analysis. Study 1 used content analysis approach, and Study 2 and Study 3 used a quantitative approach for data analysis. Few past studies have utilized both qualitative and quantitative research together (Tashakkori & Teddlie, 1998). Though a number of prior TAM studies utilized a quantitative data analysis approach, a search of the literature did not reveal TAM studies using a mixed-method approach. Therefore, by utilizing a sequential mixed method approach for data analysis, this dissertation added value to the literature by linking theory building to empirical evidence.

8. The content analysis in this dissertation enriched the literature by providing insightful evidence and findings regarding the users' views about the reasons behind use of web-technology, the problems associated with it, expectations from web-technology and users' recommendations for improvements. The quantitative research in this dissertation explored the extent to which the extended TAM explained users' attitudes toward web-technologies (i.e. LMSs and web portals) and contributed to theory by providing a model based on TAM that is expected to explain the web technology adoption behavior in higher education settings. Therefore, this dissertation can serve as a starting point for future research on web-technology acceptability in higher education settings.
9. The dissertation contributed to the web-technology adoption literature in higher education settings by providing insightful findings about faculty and students attitudes toward three web-technologies. Knowledge of web-technology usage patterns of the faculty members and students and the factors that affect their usage patterns were revealed. Therefore, this dissertation provided important information to the educational policy-makers that will help facilitate evaluation of web-technologies in current use, or those being considered for use by faculty members and students.
10. Findings of this dissertation benefit web-technology developers as well, by providing users' feedback about their products. This will help developers identify the strengths, weaknesses and the initiatives to improve their products and ensure more acceptance by users in the future.

Assumptions of the Study

1. Study 1 of this dissertation used five constructs and Study 2 and Study 3 used eight constructs each. The constructs were difficult to measure as they could not be measured directly. An assumption was made that the constructs do exist and the items (survey questions) used to measure these constructs were appropriate for measuring them.
2. It was assumed that, the survey questions accurately delivered the message to the respondents and the respondents were able to read and comprehend all the survey questions correctly.
3. It was assumed that all the participants of the three studies responded to the survey questions honestly and accurately.

Limitations of the Study

1. All three studies included in this dissertation were non-experimental studies. Therefore the results should be interpreted with caution when generalizing them to other population.
2. Survey respondents were not randomly selected. A convenience sampling method was used for data collection. Hence, generalization of results may be limited. So the results may not reflect the normal population distribution.
3. All instruments used in this dissertation were self-reported measures that relied upon the participants' ability and willingness to report accurately. The responses might be based on social desirability or response acquiescence. However, prior research suggested that self-reported measures may not be precise but they are appropriate as relative measures. Therefore, this limitation was not a major one (Blair & Burton, 1987).
4. The order questions appeared in the surveys may directly impact the responses. To control for potential order effects *question randomization* was utilized in the surveys.

5. Data were collected through three web based surveys. A common limitation of a web based survey is that the survey may result in sample bias as people with certain characteristics may be more likely to respond to web surveys. Therefore, those who responded might not be representative samples of the population. This could limit the generalizability of the study results.
6. For all three studies of this dissertation, the web based survey links were emailed via university email system. It is possible that potential subjects did not check or ignored the emails with survey links.
7. This dissertation examined the web-technology adoption behavior at a single point of time. Since the users' perception and intention can change over time (Lee et al., 2003) the data may not demonstrate representative behavior.

Operational Definitions of the Terms

The definitions of the terms used in this dissertation:

1. Internet: "The Internet is a large computer network made up of many smaller interconnected networks. Internet is also commonly referred to as the Net, the Information Superhighway, Cyberspace, and the Infobahn" (Hannon, 1998, p.4).
2. World Wide Web: "The World Wide Web often referred to as the Web or WWW is a network that connects electronic documents. These electronic documents, referred to as Web pages, contain a variety of information ranging from simple text to complex multimedia that consists of integrated graphics, sound, text and in some cases video clips" (Hannon, 1998, p.6).
3. Web technology: Web technology is the development of the mechanism that allows two or more computer devices to communicate over a network. In other words, any

technology based on World Wide Web is known as web technology. Example of web technology could be LMSs, web portals, online library systems etc.

4. Information systems (IS): Businessdictionary.com defines Information systems (IS) as "a combination of hardware, software, infrastructure and trained personnel organized to facilitate planning, control, coordination, and decision making in an organization" (http://www.businessdictionary.com/definition/information-system.html). IS can also be defined as "an integrated set of components for collecting, storing, and processing data and for delivering information, knowledge, and digital products" (http://www.britannica.com/EBchecked/topic/287895/information-system). Examples of IS are LMS, web portals, wikis etc.
5. Information Technology: Businessdictionary.com defines Information Technology (IT) as " a set of tools, processes, and methodologies (such as coding/programming, data communications, data conversion, storage and retrieval, systems analysis and design, systems control) and associated equipment employed to collect, process, and present information. In broad terms, IT also includes office automation, multimedia, and telecommunications" (http://www.businessdictionary.com/definition/information-system.html). Actually IT falls under the IS umbrella and deals with the technologies involved in the system itself. For example, LMS is an information system that contains many information technologies like servers, software, hardware etc. Currently, most people in the profession and in research no longer make a distinction between these two terms IS and IT. Most of the prior research used the term IT and IS synonymously (Chau, 1996). As this dissertation examined three web-based Information systems, the three

terms IT, IS, and Web technology were used interchangeably within the context of this dissertation.

6. Learning Management Systems (LMS): "The majority of LMSs are web-based to facilitate anytime, anywhere access to learning content and administration. They utilize synchronous and asynchronous technologies to facilitate access to learning materials and administration" (Black, Beck, Dawson, Jinks, & DiPietro, 2007).
7. Web portal: A Web portal can be generally viewed as a single, distilled view of information from various sources that integrates information, content, and other software services or applications (Averweg, 2007). Examples of web portals could be university websites, organizational web portals, educational web portals etc.
8. Perceived ease of use (PEOU): "The degree to which an individual believes that using a particular system would be free of physical and mental effort" (Davis 1986, p.82).
9. Perceived usefulness (PU): "The degree to which an individual believes that using a particular system would enhance his or her job performance" (Davis 1986, p.82).
10. Attitude toward using (ATT): "The degree of a person's positive or negative feelings about performing the target behavior" (Davis, et al., 1989, p.984).
11. Behavioral intention (BI): The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior (Davis 1989).
12. Actual use (AU): A behavioral response measured by the individual's action in reality (Davis, 1989).
13. Adoption: "A decision to make full use of an innovation as the best course of action available" (Rogers, 2003, p.22).

14. Complexity: "The degree to which an innovation is perceived as difficult to understand and use" (Rogers, 2003, p.16).
15. Diffusion: "The process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p. 5).

Overview of the Method

This dissertation followed a sequential mixed method approach (Creswell, 2008; Creswell & Plano Clark, 2007; Creswell & Tashakkori, 2007). It consisted of three studies representing three phases of the research. All three studies used the TAM as the baseline model to determine the users' attitude toward three different web-technologies in higher education settings. Study 1 and Study 2 focused on the faculty attitudes toward Learning Management Systems and Study 3 focused on students' attitude toward the university web portals. Study 1 used a content analysis approach while Study 2 and Study 3 used sequential mixed method approaches for data analysis. A synopsis of the proposed research is presented in Table 1.1.

Table 1.1: Synopsis of the research

	Study 1	Study 2	Study 3
Study Title	Faculty attitudes toward Learning Management Systems (LMSs): An analysis using Technology Acceptance Model (TAM)	A Structural Equation Modeling of an Extended Technology Acceptance Model for faculty acceptance of Learning Management Systems (LMSs)	A Structural Equation Modeling of an Extended Technology Acceptance Model for student acceptance of university web portals

	Study 1	Study 2	Study 3
Objective	To determine faculty attitude toward Learning Management system (Blackboard) in higher education settings	To determine faculty attitude toward Learning Management system (Canvas) in higher education settings	To determine student attitude toward university Web portal usage
Subject	Faculty members	Faculty members	University students
Web-technology	Blackboard Learning Management System	Canvas Learning Management System	University Web portal
Baseline Model	Technology Acceptance Model (TAM)	Extended Technology Acceptance Model (TAM)	Extended Technology Acceptance Model (TAM)
Data Collection	Web survey	Web survey	Web survey
Data analysis	Content analysis	Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) with AMOS	Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) with AMOS

Organizational overview of the Study

This dissertation has 6 chapters. Chapter 1 presented a detailed introduction of the dissertation topic including the problem statement, purpose of the research, web technologies to examine, research questions and hypotheses, significance, assumptions and limitations of this dissertation etc. Chapter 2 reviewed the web-technology adoption literature in general as well as Technology Acceptance Model (TAM) based web-technology adoption literature. Also, Chapter 2 reviewed literatures of three specific technologies (Blackboard, Canvas and University

Website/ web portal) that the dissertation examined. Chapter 3, 4 and 5 presented three manuscripts that were prepared based on the research conducted in three phases of this dissertation. Each of these chapters represented one phase of this dissertation. Chapter 6 provided a discussion on the summary, implications and conclusion of this dissertation.

CHAPTER 2. REVIEW OF LITERATURE

Introduction

The purpose of this dissertation was to examine the users' attitude toward web technology adoption in higher education settings. This chapter provides reviews of literature relevant to the web-technology adoption behavior in general and in higher education settings. Several theories have been used by prior researchers in determining the web-technology adoption behavior. Among them, Technology Acceptance Model (TAM) is the most widely used model. This chapter presents a summarized view of the prior research in web-technology adoption behavior research using TAM. It also narrates the development of the technology acceptance model. The chapter proceeds as follows.

A brief overview of web-technology adoption behavior in higher education is presented first. Then the chapter discusses the web-technologies: Learning Management System (LMS), and university web portal that were examined in this dissertation. Prior literature on these web-technologies in higher education settings is reviewed. Following this, the theoretical overview of the dissertation is presented, including discussion about two theories: Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB), which are treated as the theoretical foundation of TAM. The evolution and explanation of TAM constructs and their inter-relationships are also presented. Following the discussion, the chapter provides the reasons behind developing and proposing the extended technology acceptance model through literature support. Finally the extended TAM and the research hypotheses are presented.

Web technology adoption in Higher Education

With the advancement in affordable web-technologies, the infrastructures of most of the universities in the US are now web-enabled and technologically rich. Universities are providing their faculty and students with the opportunity to integrate web-technology in on campus classrooms as well as in virtual classrooms. Consequently, students, faculty and administrators are more or less dependent on web-based information technology operations and services for conducting their respective responsibilities in universities.

Driven by advances in web-technologies, though many aspects of higher education have undergone fundamental shifts, a number of scholars have pointed out the shifts have been taking place at a slower rate in higher education institutions than in other types of organizations (Getz, Siegfried & Anderson, 1994). According to Henshaw (2008), higher education takes a conservative approach in responding to change. If we were to understand why this is happening, we must understand the context of the technology and higher education, the perceptions of faculty members, students and other stakeholders in the process, and their real reasons for using or not using the technologies. Prior research indicated that the field of information technology itself is quite young and the practice of researching the field is even newer (Grajek, 2011). Considering these issues, this dissertation found it appealing and important to address the web-technology adoption behavior in higher education settings.

Learning Management Systems (LMSs) adoption in Higher Education

Currently, web-based technologies are critical components in support of teaching, learning and research, as well as in the administration of higher education. The rapid growth of web-based technologies provides new and advanced ways to design, develop, distribute and store teaching-learning materials online to advance the process. The adoption of LMSs to support the teaching-learning process is one of the most significant developments in the last decade in the use of information technology (IT) in universities (Coates, James & Baldwin, 2005).

LMS is perceived as a software application that uses the internet as a medium to support education and the learning process (Cavus & Momani, 2009). LMSs process, store and disseminate educational material and support administration and communication associated with teaching and learning (Mcgill & Klobas, 2008). In other words, LMSs are web-based systems that allow instructors and students to share materials, submit and return assignments and communicate online (Lonn & Teasley, 2009). LMS allows faculty members to teach courses online and supplement their on-campus courses. It could be utilized with a major focus on managing the education process rather than merely delivering course and training materials electronically (Al-Busaidi & Al-Shihi, 2010). Some of the widely known LMSs available in the market today are Moodle, WebCT, Learn.com, Krawler LMS, Joomla LMS, ATutor, Blackboard, Canvas etc. Of these examples, the most widely used LMSs are WebCT, Moodle and Blackboard (Cavus & Momani, 2009; Momani, 2010).

Hawkins and Rudy (2007) cited the Educase Fiscal year 2006 report that showed that over 90% of all responding universities and colleges in the US and about 95% of the same institutions in the UK have adopted LMS for use by students and faculty. However, according to Abrahams (2010), despite the fact that colleges and universities have increased commitment to infuse information technology into instruction and the learning process, faculty members have generally been slow to integrate this technology into the instruction and learning process. Keeping this in mind, some important questions arise about LMSs adoption behavior: How and to what extent are university faculty members adopting LMSs in higher education settings?

What barriers to LMSs use do they perceive? What can facilitate LMSs adoption in higher education settings?

It is important for the IS research to answer the above questions and to understand why people accept or reject a particular Information system (i.e LMS, web portal). User acceptance is a crucial factor in determining the success or failure of any Information system. The majority of the prior IS research examined technology acceptance in business settings. Very few of the studies were conducted in educational settings. Abraham (2010) indicated that according to faculty members, the lack of information regarding the quality of web-based products, the quality and effectiveness of the use of web-based instruction versus the traditional instruction and how students react to the use of the new medium versus the traditional medium of textbooks and articles are some of the barriers to web technology adoption in instruction.

In McGill and Klobas's (2009) words: "LMS research is characterized by a diversity of studies conducted in a wide range of contexts on a various outcome variables using a variety of different explanatory variables and models" (p.497). They noted that, prior research on LMS mostly consisted of LMS implementations; the other foci include the adoption and continuance of LMSs use by students. They also indicated that prior studies were largely based around the technology acceptance model (TAM) (Davis et al., 1989) and related models such as TAM2 (Venkatesh & Davis, 2000) and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003).

Though a large number of prior studies examined students' attitudes toward different types of LMS in the market, very few studies explored faculty attitudes toward LMS use. Among them, only a few of the studies (i.e. Ball & Levy, 2008; Liaw, Huang & Chen, 2007;

Samarawichkrema & Stacey, 2007; Sumner & Hostetler, 1999; Weaver, Spratt, & Nair, 2008) were conducted in higher education settings using faculty members as participants.

Al-Busaidi and Al-Shihi (2010) noted that several issues might influence instructors' acceptance of LMS which might be related to the instructors' characteristics (Ball & Levy, 2008), organizational factors (Sumner & Hostetler, 1999), and the technology (DeLone & McLean, 2003). Selim (2007) specified eight critical success factors (based on students' perceptions) for acceptance and adoption of e-learning in higher education institutions which include: instructor characteristics (attitude towards and control of the technology, and teaching style), student characteristics (computer competency, interactive collaboration, and e-learning course content and design), technology (ease of access and infrastructure), and support. Among the eight, he found the most critical indicators were instructors' attitude toward interactive learning and teaching via e-learning technologies. A number of recent surveys (Steel, 2007; University of Denver Center for Teaching & Learning, 2006; Weaver, Chenicheri & Spratt, 2005) on students' perceptions of teachers' use of LMS (as cited in Steel, 2009) indicated that learners are concerned about the low levels of integration and quality of LMS use in universities. Samarawichkrema and Stacey's (2007) case study on web based learning and teaching through LMS found that technology adoption in higher education was not influenced much by the teachers' technology skills and their preferences to use technology, but mainly by the differences in academic teachers' motivations, approaches to change, and their learning and applying of new processes.

Faculty members are relatively independent and have considerable autonomy over their teaching activities, including technology choice and use (Gong, Xu & Yu, 2004). Groves and Zemel (2000) pointed out that the extent and rate of technology adoption is related to availability of resources and acceptance of innovations by faculty and teaching assistants. However, the question of whether faculty members are making full use of LMS to justify the investments of the universities has not been fully answered. Since faculty members are the key deciders of using technology in education, additional investigations on the factors influencing faculty members' attitude toward web-technology usage are warranted.

As mentioned earlier, one of the focuses of this dissertation was to determine the LMS adoption behavior by the faculty members in higher education settings. Using the original TAM and extended TAM respectively, this dissertation examined two LMSs; Blackboard and Canvas, in the first two phases of the dissertation. The objective was to propose relevant external variables that influence the instructors' acceptance of LMS.

Before going into detailed discussion about Blackboard and Canvas, a little explanation of Learning Management System (LMS) and Content Management System (CMS) is presented here to remove the confusion between the two terms. The definitions of CMS and LMS are provided below.

According to Watson and Watson (2007) EDUCAUSE Evolving Technologies Committee' (2003) defined CMS as "a CMS provides an instructor with a set of tools and a framework that allows the relatively easy creation of online course content and the subsequent teaching and management of that course including various interactions with students taking the course" (p.29). LMS is a framework that handles all aspects of the learning processes and delivers and manages instructional content, identifies and assesses individual and organizational learning or training goals, tracks the progress toward meeting those goals and collects and presents data for supervising the learning process of an organization as a whole (Szabo & Flesher, 2002). By using this web based software application or web- based technology instructors can create and deliver content, monitor student participation, and assess student performance.

Confusion arises because both CMS and LMS provide many similar functions. However LMS provides some additional functions over CMS. In this sense, CMS could be a part of LMS. But in the literature, both terms have been used synonymously.

Blackboard

Blackboard Inc. refers to *Blackboard* as a Content Management System (CMS), however in prior research Blackboard has been mostly identified as LMS. Therefore, this dissertation addressed Blackboard as a LMS. Blackboard Inc. based in Washington, D.C (USA) (founded in 1997), provides variety of internet based software products and services for education programs. Blackboard Academic Suite: one of its software products is a widely used web based LMS. It is commonly employed in secondary and tertiary education in the US and other countries.

Major functions of Blackboard include Blackboard homepage, teaching-learning materials, quiz, homework assignment, discussion board and link (Liaw, 2008). The homepage works as the source of all key information about the courses. The faculty can provide overall course information, syllabus, text books' information, assessment and any other course related information in the Blackboard homepage. Additionally, the faculty members can upload their teaching learning materials and give their students access to the documents. The documents can be uploaded in the form of pdf, MS word, MS Excel, Acrobat PDF documents or video files. Students can log-in to Blackboard from anywhere anytime and get access to these files. Instructors can assign homework assignments online and allow the students to upload their works in pdf, MS word, and Acrobat pdf documents form. Blackboard has an online discussion option where students can post to their peers and instructors about any course related issues, technical problems or queries and instructors can answer the queries and support the students online. The discussion board also helps students work together in groups and solve problems online while they are off-campus. For students' assessment, instructors can use the quiz option. Blackboard provides a function that allows the instructors to set online quizzes in the form of multiple choice questions and get the students access to the quizzes. Students can take the quizzes online and test themselves. Students can receive immediate feedback on the quizzes and evaluate their performances. Blackboard also allows instructors to present relevant Internet links and give their students easy access to the links. Students and instructors, both, can get updated information from the links since these links are regularly updated (Liaw, 2008).

A number of studies have been conducted on Blackboard. Abdallah (2007) examined the effectiveness of e-Blackboard system using the basic TAM framework. His empirical analysis was based on the perceptions of undergraduate students. His study confirmed that perceived ease of use (PEOU) and perceived usefulness (PU) of Blackboard positively influenced students' attitude (ATT) toward Blackboard. Steel (2009) conducted a case study on three Australian university teachers to elicit their beliefs and learning designs in a LMS (Blackboard) environment. The case study reported that all three teachers emphasized that use of Blackboard needs to be derived from an educational need and not by the technology itself. Mismatch of technology and pedagogy was noted as one of the limitations of Blackboard in his study. Tella (2011) conducted a reliability and factor analysis of Blackboard and developed an eight factor success measure for Blackboard which includes system quality, content quality, service quality, teaching and learning quality, self-regulated learning, and intention to use, user satisfaction and net benefits as the success measures.

Prior research indicated that Blackboard is the most popular (Falvo & Johnson, 2007) and one of the leading commercial LMS software packages used by the North American and European universities (Beatty & Ulasewicz, 2006). Because of its widespread use and familiarity, Blackboard was selected as one of the web-technologies to be tested in this dissertation. At the first phase of this dissertation, using the original TAM framework, a content analysis study was conducted to determine the faculty attitude toward Blackboard.

Canvas

Instruture Inc., an educational software company, based in Sandy, Utah (US) (founded in 2008) is the developer of Canvas learning management system. In February 2011, it launched Canvas, which is free to download. Its key features include: Speedgrader (to grade the assignments faster), Learning outcomes (sets tracks and optimizes the instructor's pedagogy with Canvas's simple learning outcome features), Integrated calendar (calendar events automatically populate into a single calendar), Rubrics (easy to use rubrics), Rich content editor (allows embed videos, audio and photos from the web into the course), Communication preferences (notification via email, facebook, text message), Flexible pedagogy (supports variety of teaching styles and new web technologies), Groups (ad-hoc group creation option allows users to form groups of different types beyond the classroom), Online testing (create quizzes from scratch or a bank of questions), Assignment submission (allow assignments in a variety of ways: webpages, word doc, videos audio, slide show etc.), Chat/Video (built-in video and live chat option), and Reporting and Analytics (monitor course and student activity with real time reporting and analytics) (www.instructure.com/Canvas).

During the time when LMS was chosen to be one of the web technologies to be tested in this dissertation, Canvas was new in the market and to the best of the researcher's knowledge, no publications had been written regarding Canvas. Therefore, it offered an attractive avenue to examine Canvas usage behavior using the TAM framework. Considering this, Canvas was chosen for examination. The second phase of the dissertation focused on determining the faculty attitudes toward Canvas usage at higher education settings. At this stage, an extended TAM was proposed and its validity was examined in determining faculty attitudes toward LMS. The extended TAM offered three external variables: system quality, facilitating conditions and perceived self-efficacy. These factors were chosen for inclusion, because all three had been proven as significant factors in determining the web-technology adoption behavior by prior research. The hypotheses related to the external variables and reasons for their inclusion are presented in detail later in this chapter.

Web portal usage in Higher Education

Web portals contain integrated information from diverse sources and provide them to their stakeholders. According to Warner (1999) and Winkler (2001) (as cited in Manouselis et al., 2009), the well-known internet search and navigation sites that provide a starting point for web visitors to explore and access information on the World Wide Web (WWW) had been initially termed as web portals. Nowadays, most of the organizational websites provide all necessary information integrated from multiple sources for their stakeholders. These websites work as gateways to information from multiple sources and can be termed as web portals. Like other organizations, the websites of most of the universities in the US work as gateways to all academic and related information for their stakeholders (i.e., students, faculty members, staffs, etc.). Universities offer many of the academic activities (i.e., registration, bill payment, online library etc.) online through their websites. Therefore the university websites can also be defined as university web portals. For the context of this dissertation both the terms ‘website’ and ‘web portal' are used interchangeably. A university web portal is the most visible resource and a reflection of what a university has to offer (Snider & Martin, 2012). It virtually presents the university to its stakeholders as well as to random viewers. Most of the university web portals provide the authentic users access to university email, learning management systems, university library systems, course registration, blog, chat, announcement, calendar, class schedule, weather, transport features etc.

The Web is a complex information medium and too contextual to evaluate in a purely objective or conclusive fashion (Mechitov, Moshkovich, Underwood, & Taylor, 2001). Development and maintenance of a web portal is expensive and time consuming (Bringula & Basa, 2011). In general, web portals present variety of information for the users which is also large in quantity. It is not easy to design web portals that are both easy to use and rich in information. Prior studies found that a large number of websites suffer from poor design and these websites are difficult to use (Sandvig & Bajwa, 2004). University web portals are not beyond these issues. During the initial stages of Internet technology adoption, the design and quality problems of web portals were not emphasized much. Today, web portals play a pivotal role in the dissemination and accumulation of information (Seethamraju, 2006). Web portals provide a virtual environment for their stakeholders to communicate and share information; hence, issues related to the design and quality of web portals are of high priority for research.

Little research has been conducted on website usage behavior. The prior website research has mostly focused on commercial websites. Analyses of commercial websites are not particularly useful in understanding the quality issues for academic sites because the purposes and requirements for the commercial websites are different than that of the academic websites (Mechitov et al., 2001). However, the findings of the prior studies on commercial websites help to get an understanding of the issues associated with website usage behavior in general. Literature reveals that, prior research has investigated a wide variety of factors influencing different kinds of web portal adoption behavior. But research in the context of factors influencing university web portal usage behavior is limited.

Marchionini (1997) opined that end-users are goal oriented and want to find the desired information in the website with minimum time and effort. Users tend to visit a wide range of sites and expect to navigate them proficiently without any prior training (Ratner, 2002). Aladwani and Palvia's (2002) review of academic literature and relevant trade press articles identified three dimensions of website quality: technical adequacy (i.e., ease of navigation, ease of access, support etc.), web content (i.e., usefulness of content, clarity of content, finding information, finding online help etc.) and web appearances (i.e., attractiveness, organization, proper use of graphics, colors and fonts etc.). They studied website quality from users' perspective and developed a scale for measuring website quality that focuses on four dimensions of websites: technical adequacy, specific content, content quality and appearance. In addition, Palmer's (2002) study revealed that information content is associated with successful websites. Udo and Marquis (2001) found download time, ease of navigation, use of graphics and interactivity were positively and significantly related to website effectiveness. They concluded that websites with short download time, easy navigation, appropriate use of graphics and high degree of interactivity are more likely to attract users. Seethamraju (2006) identified a six factor model to determine the perceived quality of any website. The six factors include: trust (security, privacy information etc.), personalization (customization and interactivity), accessibility (ease of access, ease of navigation, availability and speed of page loading), content quality (usefulness, completeness, accuracy), general information (search facilities, valid links and product details) and appearance (attractiveness, proper use of fonts and color). Pearson and Pearson (2008) found that, similar to technology adoption literature, ease of use and navigation are two critical components in determining website usability. Aljukhadar and Senecal (2009), found that ease of use, information, and interactivity are the prominent factors in driving users' attitude and behavioral intentions toward using websites. In one of the few studies on web- portals, Bringula and Basa, (2012) noted that information content of web portals significantly affect the web portal usability.

There has been relatively little research that has addressed users' attitude toward university websites. Mechitov et al. (2001) conducted a comparative analysis of students' perceptions of thirteen university websites to determine the principal criteria that students use in forming positive or negative perceptions about academic websites. They found overall entertainment value (i.e., virtual campus tour, pictures of campus with audio/video effects student organizations etc.) and ease of access to information and certain design issues are the most important factors that influence students' perception toward university websites. Their findings also revealed that the features that students disliked most about the university websites are little information availability, complexity of finding necessary information, low speed and not enough graphics or entertainment. Their findings emphasized the importance of developing a systematic approach to the design and development process of university websites. Sandvig and Bajwa (2004) conducted an exploratory study on university websites to find out the web-users perceptions of website effectiveness in terms of findings information, satisfaction with navigation (information retrieval) methods etc. They found a significant relationship between perceptions of ease of finding information and website effectiveness. Tolentino (2011) conducted a study on the faculty acceptance of university web portals using TAM. She noted that the faculty members have full intention to continue using the university web portal. Her findings confirmed that PU determines faculty members' behavioral intention (BI) of using university web portals. Atkinson and Kydd's (1997) study revealed that graduate students reported ease of use as the most significant measure of website use for course work purposes.

Though the currents university students are known as a part of the Internet generation, it is misleading to believe that all students arriving on college campuses are technology savvy (Henshaw, 2008). Kaminski, Seel, and Cullen (2003) pointed out that recent observations suggest a remarkable range in students' knowledge about information technology concepts and in their software skills. Some students are lacking in information technology concepts and software skills whereas some are highly skilled. Some are very confident about Internet use, others are not. It is obvious that those who are confident in using the Internet are more comfortable in browsing than those who are hesitant about Internet use. This indicates that, self-confidence is also very important in dealing with web portals. This indicates, together with the web portal related issues, perceived self-efficacy of students is also an important factor to consider in determining the students attitude toward university web portal. From the findings of the prior studies discussed above, it is apparent that, several factors were found significant in determining users' attitudes toward university web portals.

To learn more about students' university web portal usage behavior, in the third phase of this dissertation, a study was conducted to examine the influence of different external factors on students' attitudes and behavioral intentions toward using university web portals. As mentioned earlier, prior research has demonstrated that several factors may affect website use behavior. Many of these studies suggested examining the influence of human factors like ease of use (i.e. Aljukhadar &Senecal, 2009; Bringula &Basa, 2012; Hart, Chaparro & Halcomb, 2008, Ryan &

Rao, 2008) and attitude (Aljukhadar & Senecal, 2009, Bringula &Basa, 2012) toward using the web portal. However, no common conclusion had been drawn about which specific factors affect students' attitude toward university web portal. Considering the factors that were mostly claimed as significant by prior research, the dissertation examined the effect of three external variables: web portal quality, perceived self-efficacy and facilitating conditions on students' attitudes toward university web portals. Therefore Study 3 of this dissertation offered an extension of the original TAM by adding these three external variables. It examined the validity of the extended TAM in determining the students' attitude toward university web portal. The hypotheses related to the external variables are presented later in this chapter. The study was conducted with an expectation that the findings would contribute to the web portal usage literature by providing better understanding and explanation of the influences of the external factors on university web portal usage behavior.

Theoretical Overview

The theoretical base of all three studies of this dissertation was grounded on TAM framework. This part of the dissertation elaborates on the theoretical foundation and constructs of TAM, development of TAM over time as well as the use of TAM in prior IT adoption literature.

Research in users' intention and technology adoption has continued to develop over time. Various theories have been developed including the theory of reasoned action (Ajzen & Fishbein, 1980), theory of planned behavior (Ajzen, 1991), social cognitive theory, (Bandura, 1982, 1977, 1986) technology acceptance model (Davis, 1989), innovation diffusion theory (Rogers, 2003) etc. and many of them have received wide acceptance. Based on these theories, researchers have conducted several studies and examined variables related to individual beliefs and intentions regarding the acceptance and continued use of any new IT (Bhattacherjee, 2001).

This dissertation utilizes TAM to determine the users' web-technology adoption behavior in higher education settings. TAM is based on Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975,) and Theory of Planned Action (TPB) (Ajzen, 1991). To understand TAM clearly, a brief explanation of TRA and TPB is presented before going into TAM discussion.

Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975)

Attitude, beliefs and intentions have long played a role in social psychology literature as predictors of behavior (Ajzen & Fishbein, 1980). In 1975, Fishbein and Ajzen, in their book; *Belief, attitude, intention and behavior: An introduction to theory and research* introduced the TRA to explain the relationship between *attitudes* and *behaviors* (see Figure 2.1).

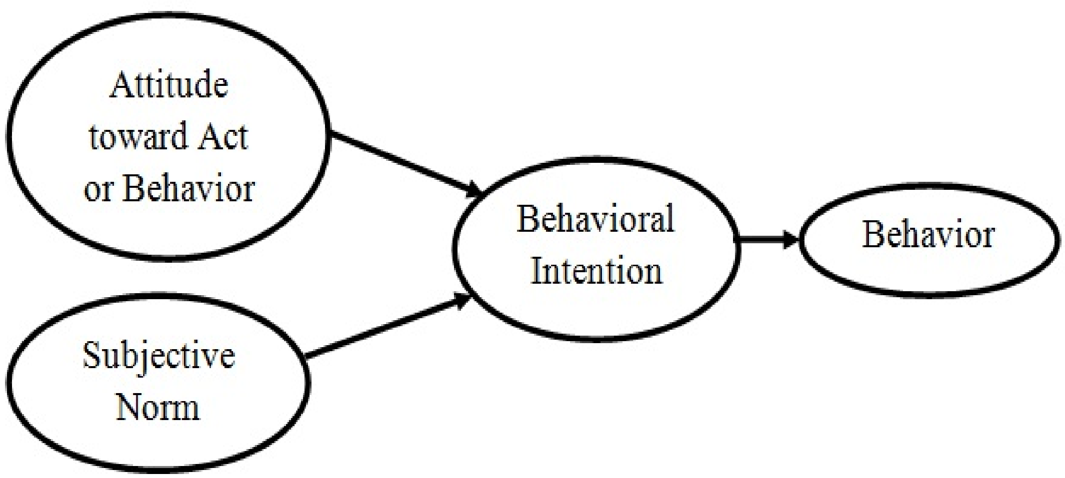

Figure 2.1 Origin of Technology Acceptance Model: Theory of Reasoned Action (Fishbein & Ajzen, 1975)

TRA describes how users' beliefs and attitudes are related to individuals' behavioral intention. It claims that the *attitude* and *subjective norms* are the two determinants of a person's intention to behave in a certain way. Attitude is a person's positive or negative beliefs about performing a specific behavior. Fishbein and Ajzen (1975) defined *attitude* as an individual's overall positive or negative evaluations of a particular behavior after the evaluation of the perceived consequences of an act. *Subjective norms* are defined as a person's belief that most of his or her important others think that he or she should/ should not perform that behavior (Fishbein & Ajzen, 1975). TRA states that attitude, together with subjective norm determine a person's behavioral intention. The second important element of TRA is that a person's behavioral intention guides the individual behavior. This indicates that only when individuals have intentions to perform certain behavior, they may do it. The theory was based on the assumptions that humans are rational and able to use information available to them to make reasonable behavioral decisions. As stated by Ajzen and Fishbein (2004), the degree to which attitudes and subjective norms determine intentions and the importance of each can vary among population groups and specific behavior being studied (Romano & Netland, 2008). TRA has been widely accepted across many disciplines as a compact and accurate means to predict behaviors under volitional control.

Though TRA was popular among the researchers, it was criticized by some researchers including Ajzen that it was deficient in explaining behavior especially of people who have little or feel they have little power over their behaviors (Sharma & Kanekar, 2007). To consider this issue, Ajzen later extended the TRA and developed a new theory, which was named Theory of Planned Behavior (TPB).

Theory of Planned Behavior (TPB) (Ajzen, 1991)

Behavior can be deliberate and planned. TRA is related with voluntary behavior, but TPB predicts deliberate behavior. To predict the behavioral intentions and behaviors that are not under volitional control, Ajzen extended the TRA by adding a new construct “perceived behavioral control (PBC)” which resulted in a new theory called “Theory of Planned Behavior (TPB)” (Ajzen, 1991) (see Figure 2.2). PBC is defined as people’s perceptions of their ability to perform a given behavior. Ajzen and Madden (1986) defined PBC as people’s beliefs regarding the ease or difficulty of performing a future behavior or action. Ajzen’s (1991) conceptualization about TPB is based on research concerning self-efficacy (Bandura, Adams & Beyer, 1977, Bandura, Adams, Hardy & Howell, 1980).

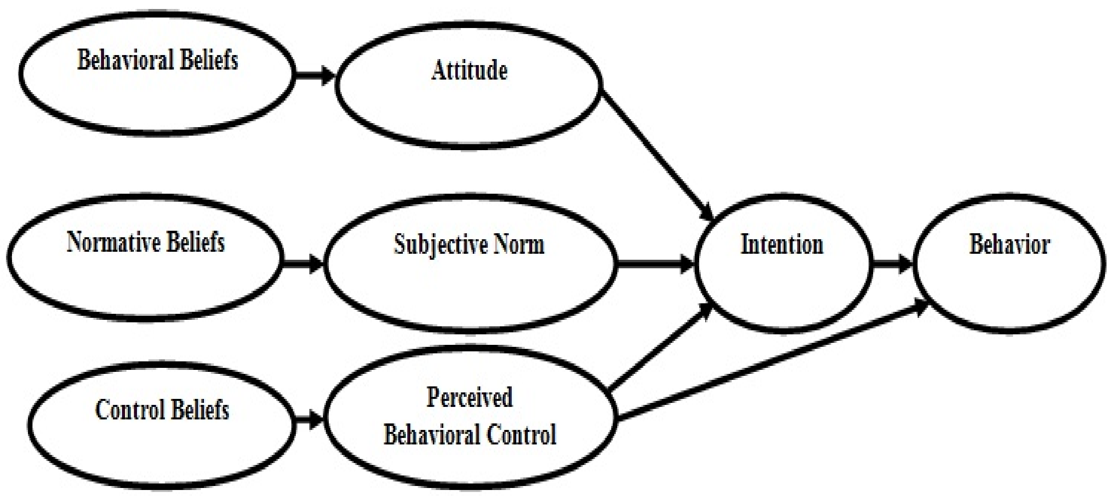

Figure 2.2 Origin of Technology Acceptance Model: Theory of Planned Behavior (Ajzen, 1991, p. 182)

TPB is similar to Bandura’s (1977, 1982) concept of self-efficacy, which is defined as individual’s confidence in their ability to perform a particular behavior. TPB claims a person’s attitude, subjective norms and PBC influence the person’s behavioral intention. Additionally, three salient beliefs (behavioral, normative, and control) have influence on attitudes, subjective norms, and perceived behavioral control respectively (Ajzen, 1991). As a general rule, the more favorable the attitude and subjective norm, and the greater the PBC, the stronger the person's intention will be to perform the behavior in question. Finally, the behavioral intention leads his or her actual behavior. Originally, Ajzen (1985) indicated that PBC component had no direct path to actual behavior. Later, Ajzen and Madden (1986) found that PBC had both direct and indirect (through BI) effects on behavior. As a result, PBC had been shown to directly affect the BI and the actual behavior itself (Ajzen, 1991) in the revised TPB. Ajzen and Madden (1986) found that the direct path from BI to actual behavior is preferable, when behavior is determined by factors beyond a person's control. Prior research across disciplines has found TPB to be accurate in predicting behavior not under volitional control of the individual.

Technology Acceptance model (TAM)

TAM is a specialized adaptation of TRA to technology implementation context (Wolski & Jackson, 1999). The stated purpose of TAM is to "provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified" (Davis et al., 2003, p.985). TAM is used to describe the antecedents to technology use (Davis et al., 1989). One of the key purposes of TAM is to provide a basis for tracing the impact of external factors on internal beliefs (Davis et al., 2003, p.985). TAM has five major constructs perceived usefulness (PU), perceived ease of use (PEOU), attitude toward the technology (ATT), behavioral intention to use the technology (BI), and the actual use of the technology (AU) (see Figure 2.3). As indicated in chapter 1, TAM determines the causal relationships among these five major constructs PEOU, PU, ATT, BI and AU. In TAM, two constructs, PU and PEOU, are treated as the fundamental determinants of users' acceptance of technology (Davis, 1989). TAM omits the subjective norm components of TRA because Fishbein and Ajzen (1975, p.304) acknowledged 'subjective norm' is one of the least understood aspects of TRA. TAM adopts the "beliefs" concepts of TRA in the form of PEOU and PU (Igbaria, Guimaraes & Davis, 1995a). It assumes that PEOU and PU predict the ATT which influences the BI. TAM offers that both PU and PEOU influence the AU of a technology through users' ATT and BI of using the technology in question. Similar to TRA, TAM postulates that AU is determined by BI. But TAM differs with TRA in that, TAM assumes that BI is jointly determined by ATT and PU.

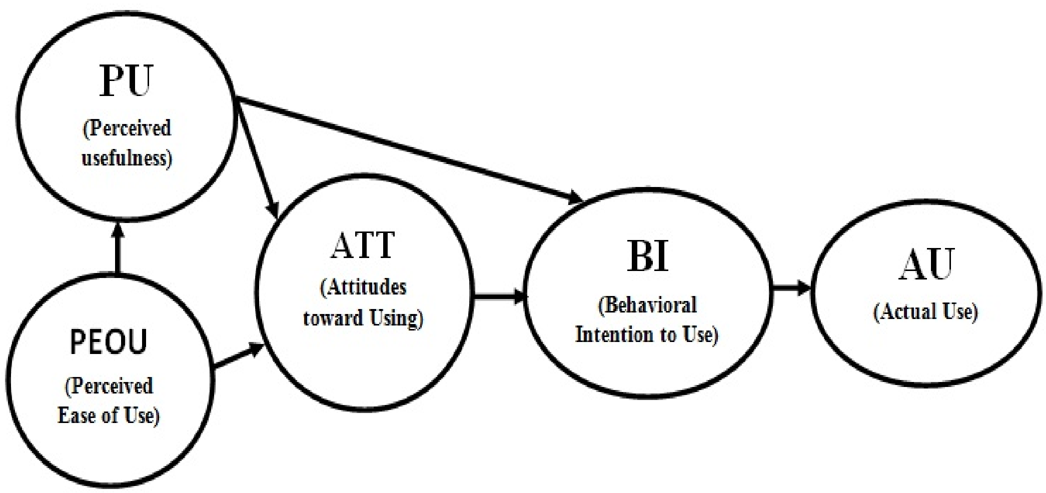

Figure 2.3 Baseline Model of the dissertation: Technology Acceptance Model (Davis, Bagozzi & Warshaw, 1989, p.985)

The five major constructs of TAM and the relationships between them can be elaborated as follows:

Perceived Ease of Use (PEOU). PEOU is one of the two fundamental constructs of TAM. Atkinson and Kydd (1997) indicated that PEOU is a form of intrinsic motivation factor. PEOU is defined as "the degree to which an individual believes that using a particular system would be free of physical and mental effort" (Davis 1986, p.82). TAM assumes that PEOU has a direct impact on perceived usefulness (PU) of the technology. If the users find the technology 'easy to use' they will consider the technology as a 'useful' technology. Davis et al. (1989) indicated, "to the extent that increased PEOU contributes to improved performance, as would be expected, PEOU would have a direct effect on PU" (p. 987). Therefore, PU= PEOU + External variables.

TAM also claims that PEOU influences the users' attitude toward using a technology. If users' find a technology is *easy to use*, than they develop a positive attitude toward the technology. Both of these claims were validated by extensive previous studies (Davis, 1993). However few studies presented different findings. For example, Brown, Massey, Montoya-Weiss, and Burkman, (2002) reported PEOU is significant determinant of PU but not a significant determinant of BI.

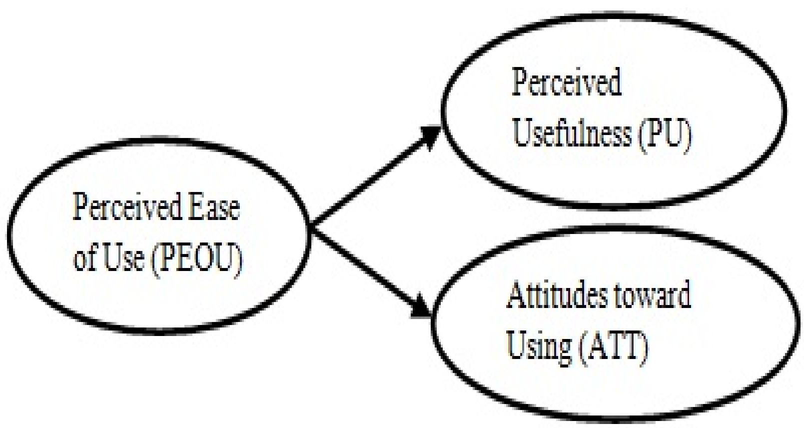

Figure 2.4 Proposed relationships of PEOU with PU and ATT

Based on the previous research concerning PEOU, the following four hypotheses were proposed and tested in this dissertation:

- The PEOU of LMS will have a significant positive effect on PU of LMS (H_8 of Study 2)
- The PEOU of LMS will have a significant positive effect on faculty members' ATT toward using LMS (H_9 of Study 2)

- The PEOU of the university web portals will have a significant positive effect on PU of university web portals (H_8 of Study 3)
- The PEOU of the university web portal influences the students' attitude (ATT) toward using the university web portal (H_9 of Study 3).

Perceived Usefulness (PU). PU is the second basic construct of TAM. Atkinson and Kydd (1997) indicated that PU is a form of an extrinsic motivation factor. PU is defined as, "the degree to which an individual believes that using a particular system would enhance his or her job performance" (Davis 1986, p.82). In other words, PU reflects beliefs or expectations about outcomes. TAM suggests that individuals will use a technology if they believe using it will result in positive outcomes. TAM claims PU influences both the ATT toward technology and the BI toward using the technology. If individuals perceive the technology as a useful one, they will develop positive attitudes toward it that will lead them to develop an intention to use the technology. Considering both PEOU and PU, TAM claims that the likelihood of technology use is high for users who believe that the technology is easy to use and using the technology will lead to improved job performance. The likelihood of technology use is low for users who perceive the technology as a difficult one and who are hesitant about its benefits.

Prior research indicated that PU is a critical determinant of user acceptance (AU) and its influence appears to increase as individuals become more experienced (Hu, Clark, & Ma, 2003). Seventy-one out of 72 prior studies involving the TAM indicated PU a significant predictor of BI and AU (Venkatesh et al., 2003). However, some studies found non-significant relationship between PU and BI (Brown et al., 2002). Venkatesh and Bala (2008) found that PU was the strongest predictor of BI at all four measurement times in their study. Gong et al. (2004) found that to facilitate users' (i.e., teachers') IT acceptance, it is critical to increase their PU and PEOU simultaneously. Several prior researches revealed significant influence of PEOU on PU (Amoako-Gyampah, 2004; Cheng, 2011; Davis, 1989; Davis et al., 1989; Mathieson, 1991; Taylor & Todd, 1995a; 1995b; Venkatesh & Davis, 2000,).

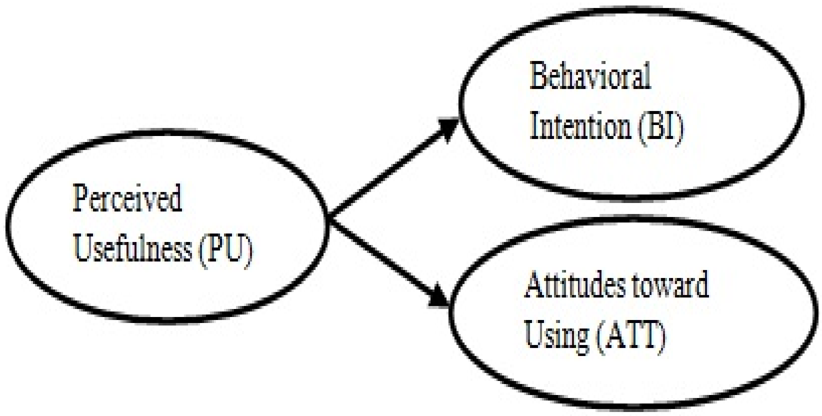

Figure 2.5 Proposed relationships of PU with BI, and ATT

Based on the findings of prior research concerning PU, the following four hypotheses were proposed and tested in this dissertation

- PU will have a significant positive effect on faculty members' ATT toward LMS use (H_{10} of Study 2)
- PU will have a significant positive effect on faculty members' BI to use LMS (H_{11} of Study 2)
- PU of university web portals has a significant positive effect on ATT toward using university web portals (H_{10} of Study 3)
- PU of university web portals has a significant positive effect on BI of using university web portals (H_{11} of Study 3)

Attitude toward Using (ATT). Attitude is defined as "the degree of a person's positive or negative feelings about performing the target behavior" (Davis et al., 1989, p.984). As mentioned earlier, according to TAM, attitude is determined jointly by PEOU and PU. TAM claims, people will develop a positive attitude toward a technology when they find the technology useful and easy to use. This claim is inspired by TRA's view that attitudes toward a behavior are determined by relevant beliefs (Davis et al., 1989).

There are some controversies among the researchers about including or removing the 'attitude' variable in intention theories. According to some researchers, attitude plays a partial mediating role between perceived usefulness (PU), and behavioral intention (BI) (Davis et al., 1989) and it has a weak direct link to PU; therefore, it should be omitted from the intention models. The literature review indicated that several prior studies did not include "attitude" in the intention models (Davis et al., 1989; Venkatesh & Davis, 2000). It was felt by many of the researchers that attitude was not significantly linked to technology use (Thompson, Higgins & Howell, 1991) and was removed from TAM. Chau (1996) argued that to keep TAM simplified, attitude should be removed. The fundamental role however, of attitude in shaping behavioral intension has been repetitively addressed by other social science researchers (Bagozzi, 1981; Dabholkar & Bagozzi, 2002; Muthitcharoen Palvia & Grover, 2011; Sheppard, Hartwick, & Warshaw, 1988; Shimp & Kavas 1984). Many recent research findings provided support for the role of attitude toward use (Lau &Woods, 2008) and toward behavioral intention to use (Teo 2010b) in the TAM framewrok. As indicated by Muthitcharoen, Palvia and Grover (2011) several researchers (i.e., Chau & Hu, 2007; Chen, Gillenson & Sherell, 2004; Jackson, Chow, & Leitch, 1997) support the idea of retaining attitude in TAM because they believe that attitude plays an important role in some settings and retaining it facilitates replication of previous studies. Therefore, this dissertation chose to preserve attitude as in the original TAM and attempts to examine the effect of attitude on behavioral intention and technology use.

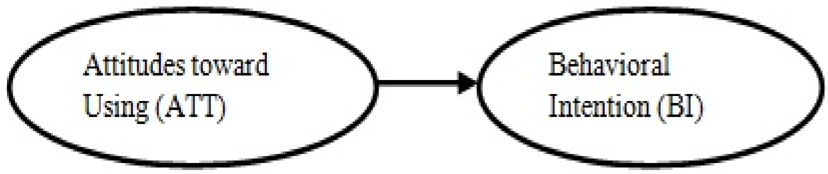

Figure 2.6 Proposed relationships between ATT and BI

Based on the previous research concerning ATT, the following two hypotheses were proposed and tested in this dissertation

- Faculty members' ATT toward using LMS will have a significant positive effect on their BI of using LMS (H_{12} of Study 2)
- Students' ATT has a significant positive effect on students' BI of using university web portals (H_{12} of Study 3)

Behavioral Intention (BI). Behavioral intention is a measure of the strength of one's willingness to try and exert while performing certain behavior (Ajzen, 1991). Davis (1989) defined BI as: the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior. TAM assumes that intention to use a particular technology is important in determining whether the user will actually use the technology. According to TAM the users' attitude toward using a technology and the perceived usefulness of the technology influence the users' behavioral intention of using the technology. Many of the prior research supported the close association between BI and AU.

Chau and Hu (2007) pointed out that BI to use a technology has long been used as a dependent variable rather than AU. Legris, Ingham and Colleretter (2003) conducted a meta-analysis of technology related studies and indicated that a majority of technology acceptance studies used BI as the dependent variable without measuring the AU of technology. Prior research found BI to be a valid predictor of AU, especially when the use of the technology is voluntary (Simon & Paper, 2007; Venkatesh et al., 2003).

This dissertation uses both the BI and AU constructs to determine the intention to use the technology as well as to determine the actual use of the web-technologies to be examined.

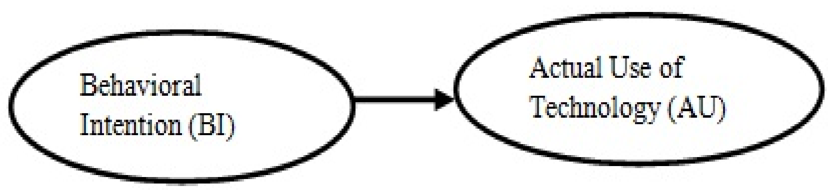

Figure 2.7 Proposed relationship between BI and AU

Based on the previous research concerning BI, the following two hypotheses were proposed and tested in this dissertation:

- Faculty members' BI toward using LMS will have a significant positive effect on their actual use (AU) of LMS (H_{13} of Study 2)
- Students' BI toward using university web portals will have a significant positive effect on their AU of university web portals (H_{13} of Study 3)

Actual Use (AU). Actual use (AU) is defined as: a behavioral response measured by the individual's action in reality" (Davis, 1989). According to TAM actual usage behavior (AU) is the outcome variable and a direct function of behavioral intention. TAM assumes that if an individual possesses a positive intention of using a technology only then will he or she use the technology.

Lee et al. (2003), in their meta-analysis of 101 TAM articles published from 1986 to 2003, summarized the relationships between major TAM variables (see Table 2.1).

Table 2.1

Relationships between major TAM variables (Adapted from Lee et al., 2003, p. 760)

	PEOU→ PU	PU → BI or AU	PEOU → BI or AU	BI→ AU
Significant	69	74	58	13
Non-significant	13	10	24	2
Not applicable	19	17	19	86
Total	101	101	101	101

Lee et al. (2003) revealed that both PEOU and PU are strong determinants of the dependent variable, BI or AU. Out of the 101 TAM studies analyzed, 74 studies showed significant relationship existed between PU and BI. These studies stated that users are willing to use a system that has critically useful functionality (e.g., Davis, 1989) and showed PU is a strong determinant of BI or AU. Fifty- eight studies showed significant relationships exist between PEOU and BI or AU; however 24 of the studies showed the relationship is non-significant. This indicates that PEOU is an unstable measure in predicting the BI or AU. Many of the studies used BI instead of AU as the dependent variable. PEOU was found as a strong antecedent of PU, as 69 of the studies showed significant relationships exists between PEOU and PU. Though

TAM has come a long way, the table shows some conflicting findings about the relationships among the TAM constructs which open doors to make future discoveries on TAM application.

Davis et al. (1989) compared TRA and TAM in how they measure an MBA student's relative facility with a word processor across two time periods and found TAM better explained the acceptance intention of the users than TRA. Mathieson (1991) directly compared TAM with TPB in predicting individuals' intention to use an IS and found that both models were strong in explaining users' technology intention, though the TAM explained slightly more variance in user intentions, but the difference was not large enough to conclude that one model is better than the other. But, Mathieson (1991) found that TAM explained attitude toward using an IS much better than TPB, and TAM is easier to use than TPB. Mathieson (1991) stated three main differences between TAM and TPB. TAM assumes that beliefs about usefulness and ease of use are always the primary determinants of use decisions, whereas TPB assumes beliefs are specific to each situation. TPB does not assume that beliefs that apply in one context also apply in other contexts; although some beliefs may generalize across contexts, others may not (Mathieson, 1991). Unlike TPB, TAM does not explicitly include any social variables. TAM only includes PEOU as behavioral control, whereas TPB taps the important control variables for each situation independently. Hubona and Cheney (1994) compared both TAM and TPB and also found that TAM offers a slight empirical advantage and is a much simpler, easier to use and a more powerful model to explain users' technology acceptance (Lee et al., 2003).

TAM is parsimonious (Taylor & Todd, 1995,a,1995b Venkatesh, 2000) and it has a strong foundation in psychological theory (Chau, 1996, Taylor & Todd, 1995a,1995b). TAM can be used as a guideline to develop a successful IS (Taylor & Todd, 1995a, 1995b, Venkatesh, 2000). TAM has been shown to be highly predictive of IT adoption, and it is the most widely employed model of IT adoption and use (Davis et al., 1989, Adams, Nelson & Todd, 1992, Venkatesh & Davis, 2000, Venkatesh & Morris, 2000, Venkatesh & Bala, 2008). Prior research supports the robustness of TAM across time, settings, populations and technologies (Venkatesh, 2000, 2006). Lee et al. (2003) stated, "TAM has been applied to different technologies (e.g. word processors, e-mail, WWW, GSS, Hospital Information Systems) under different situations (e.g., time and culture) with different control factors (e.g., gender, organizational type and size) and different subjects (e.g. undergraduate students, MBAs, and knowledge workers), leading its proponents to believe in its robustness" (p. 753). TAM has been tested and has proved successful in predicting 40% of the system use (Legris et al., 2003). As of September 2013, Google Scholars listed the number of citations for the two journal articles that introduced TAM (Davis, 1989; Davis et al., 1989) at 17016 and 9396, respectively.

Development of TAM over time

Lee et al. (2003) conducted a meta-analysis of 101 TAM articles published by leading IS journals and conferences in the past 18 years (1986-2003) to trace TAM's history, to investigate its findings and to predict its future route. The study found that TAM has progressed continually and has been elaborated by researchers. The model has resolved many of its limitations by introducing new external variables within it. Also, the study found that TAM has been applied to different environments, systems, tasks and subjects. Therefore, over time, TAM has changed its original form. Lee et al. (2003) documented these developments by dividing the TAM progress into four periods: introduction, validation, extension and elaboration.

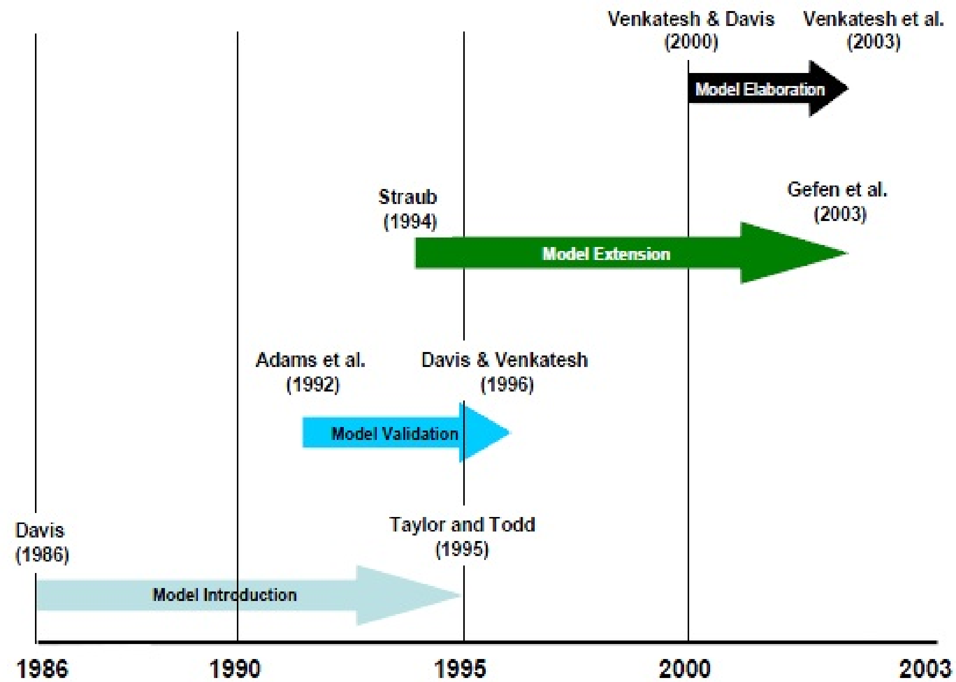

Figure 2.8 Chronological progress of TAM research (adapted from Lee, Kozar & Larsen, 2003, p.755)

Model introduction period. Soon after introducing the information systems into organizations, researchers conducted several studies on determining the factors that affect users' beliefs and attitudes toward information systems usage decision. TAM evolved from TRA to provide an explanation of determinants of computer acceptance behavior (Davis et al., 1989). Later, researchers replicated TAM with other technologies (i.e., word processors, graphics, spreadsheets, e-mail and v-mail, text editor, different mailing systems), longitudinal situations (i.e., replicated the previous study) and research settings and justified it as parsimonious and theoretically justified (Adams et al., 1992, Davis, 1993, Sambamurthy & Chin, 1994, Subramanian, 1994).

The other stream of the researchers compared TAM with the relevant theories (i.e. TRA, TPB, decomposed TPB etc.). It was found that TAM could successfully predict IS acceptance behavior under different technologies and different situations. In addition, in determining user acceptance of computer technology, TAM is simpler, easier to use, and more powerful comparative to TRA. (Igbaria, Zinatelli, Cragg, Cavaye, 1997; Lee et al., 2003).

Model validation period. During this period, researchers (Adams et al., 1992, Segars & Grover, 1993, Szajna, 1994) conducted validation studies of TAM's original instruments and confirmed that TAM instruments were powerful, consistent, reliable and valid to accurately measure the users' acceptance behavior under different situations, technologies and tasks (Lee, et al., 2003).

Model extension period. During this period, researchers attempted to extend the TAM by adding different external variables (i.e. individual, organizational and task characteristics). Several studies were conducted and the causal relationship among beliefs and their antecedent factors were determined (Chin & Gopal, 1995).

Model elaboration period. TAM literature was widely enriched during this period. TAM was elaborated in two key ways: to develop the next generation TAM that synthesizes the previous effects, and to resolve the limitations raised by previous studies (Lee et al., 2003). Studies conducted during this period defined the external variables of PU (i.e. social influence and cognitive instruments like job relevance, image, quality, and result demonstrability by Venkatesh & Davis, 2000) and PEOU, such as anchor (computer self-efficacy, perceptions of external control, computer anxiety, and computer playfulness) and adjustments (perceived enjoyment and objective usability) by Venkatesh (2000), (Lee et al., 2003). TAM studies were also conducted under voluntary and mandatory situations (Venkatesh & Davis, 2000). Within the studies conducted so far, general support was found for the validity of the application of TAM to the study of users' attitude toward technology.

To enhance the explanatory and predictive power of TAM, several attempts had been made. Taylor and Todd (1995a) proposed a decomposed version of TPB by integrating the theory of planned behavior to TAM. Venkatesh and Davis (2000) tested an extended TAM referred to as TAM2 using longitudinal data collected regarding four different systems at four organizations, that explains PU and usage intentions in terms of social influence and cognitive instrumental processes. The extended model was strongly supported and both social influence processes and cognitive instrumental processes significantly influenced users' acceptance. Referred to as TAM3, Venkatesh and Bala (2008) presented a complete integrated network of the determinants of IT adoption and use. Many researchers integrated variables from the innovation diffusion theory (Rogers, 2003) to TAM. Thus, the basic TAM has been extended and tested over time and improvement in explanatory power of these models has been reported by a number of researchers. However, IS researchers have maintained their interest in basic TAM due to its parsimony and replicability (Lai & Li, 2005). Lee et al. (2003) presented a list of ISs that were tested using TAM from 1986 to 2003. Table 2.2 Summary of Information Systems used in TAM studies from 1986-2003 (adapted from Lee et al. 2003).

Lee et al. (2003) reported that during this time period, 20% of the TAM studies used communication systems (e-mail, v-mail, FAX, Dial-up systems etc), 28% used general purpose systems (Windows, PC or microcomputer, WWW or e-commerce, Workstation, Computer Resource Center, Groupware etc) 27% used office systems (Word processor, Spreadsheet, Presentation software, Database programs, Groupware etc.) and 25% used specialized business systems (Computerized model, Case Tools, Hospital IS, DSS, GSS, GDSS, Expert Support System etc.) as target IS for their studies.

Table 2.2

Summary of Information Systems (ISs) used in TAM studies from 1986-2003 (adapted from Lee et al., 2003, p. 759)

Type	No. of IS	ISs of Each Category	References
Communication Systems	25 (20%)	E-mail (13)	Karahanna & Straub (1999),Straub (1994)
		V-mail (6)	Karahanna & Limayem (2000)
		FAX (1)	Straub (1994)
		Dial-up Systems(1)	Subramanian (1994)
		Others (e.g. Cellular) (4)	Kwon & Chidambaram (2000)
General Purpose Systems	34 (28%)	Windows (1)	Karahanna, Straub & Chervany (1999)
		PC (or Microcomputer) (9)	Igbaria, Ivari & Maragahh (1995b), Agarwal & Prasad (1999)
		WWW(or e-commerce) (17)	Gefen & Straub (2000)
		Workstation (3)	Lucas & Spitler (1999, 2000)
		Computer Resource Center(2)	Taylor & Todd (1995a,1995b)
		Groupware (2)	Lou, Kuo & Strong (2000)
Office Systems	33 (27%)	Word processor (16)	Adams et al. (1992), Hubona & Geitz (1997)
		Spreadsheet (7)	Methieson(1991),Venkatesh & Davis (1996)
		Presentation S/W (6)	Doll, Hendrickson & Deng(1998), Hendrickson, Massey & Cronan (1993)
		Database programs (2)	Szajna (1994), Doll et al. (1998)
		Groupware (2)	Malhotra & Galletta (1999),Lou et al (2000)
Specialized Business Systems	30 (25%)	Computerized Model (1)	Lu, Yu & Lu (2001)
		Case Tools (4)	Xia & Lee (2000), Dishaw & Strong (1999)
		Hospital IS (Telemedicine) (5)	Lu & Gustafson (1994), Rawstorne, Jayasuriya & Caputi(2000)
		DSS, GSS, GDSS (7)	Sambamuthy & Chin (1994), Vreede, Jones, & Mgaya(1999).
		Experts support system (2)	Gefen & Keil (1998), Keil, Beranek & Konsynski(1995)
		Others (e.g. MRP) (11)	Gefen (2000)

Recently, researchers used TAM to investigate various WWW contexts including web browsers (Morris & Dillon, 1997), the use of websites (Lederer, Maupin, Sena, & Zhuang, 2000; Lin & Lu, 2002; van der Heijden, 2003), web retailing (Chen et al., 2002; O_cass & Fenech, 2003), online purchase intentions (van der Heijden, Verhagen, & Creemers, 2003), etc. in predicting acceptance of technology (Ngai, Poon & Chan, 2007).

TAM has received empirical support from many prior studies conducted across disciplines(i.e. Agarwal & Karahanna, 2000; Chau,1996; Davis, 1989; Davis et al., 1989; ;Gefen, 2003; Gefen & Straub, 1997; Gefen, Karahanna,& Straub, 2003; Hubona & Cheney, 1994; Hendrickson, Glorfeld, & Cronan, 1994); Karahanna, Agarwal, & Angst, 2006; Karahanna et.al.,1999; King & He,2006; Lu, Chun-Sheng, Chang,, & Yao, 2003; Segars & Grover, 1993; Venkatesh et al., 2007, 2003; Venkatesh & Brown, 2001; Venkatesh & Davis, 1996, 2000; Wang, Wang, Lin, & Tang, 2003; .

Shortcomings of prior TAM studies and research directions

Though TAM has been well accepted and used, there are some limitations in its application. Dishaw and Strong (1999) pointed out that TAM is closely linked to business context. They stated that, to further explore the nature and specific influence that may alter users' intention to use technology, it is important to examine the validity of TAM under different usage environment. Lee et al. (2003) stated that one of the major problems with TAM research was that researchers were not expanding the TAM. They found it important to focus on several less explored areas for TAM expansion like further understanding on: factors contributing to PEOU and PU, determinants of beliefs, examination of different IS, different users systems and work environments, and examination regarding the differences between mandatory and voluntary usage. Legris et al., (2003) indicated that non-inclusion of external variables in TAM is a major shortcoming of TAM. Smarkola (2007) and Teo (2009) also suggested examination of examine additional external variables that have potential to influence attitude toward technology use within the framework of TAM. Davis (1993) suggested the future research should consider the role of additional variables within TAM. Lee et al.'s (2003) suggestions for future research also included developing a greater understanding of factors contributing to PEOU and PU was needed.

Another most cited limitation of TAM studies is the tendency to examine only one information system with a homogenous group of subjects, thus raising the generalization problem of any single study (Lee et al., 2003). Inappropriate selection of sample is also a limitation of prior TAM research. For example, in determining the information systems usage in real work environments, a large number of TAM studies used undergraduate and graduate student samples (Lee et al., 2003). As the students are not always appropriate to represent the knowledge-workers in real working environment, the generalizability of these studies is deteriorated. Many of the TAM studies did not classify whether they conducted the studies under mandatory, voluntary or assumed voluntary situation of information system usage.

Considering all the issues mentioned above, it can be said that, the IS research efforts using TAM framework to date have been mixed and inconclusive. Therefore, to further examine the TAM's validity in determining the users' attitude toward technology in higher education settings, this dissertation attempted to conduct three separate TAM studies to examine the voluntary usage behavior of three different web-technologies in higher education settings.

At the first phase of this dissertation, a TAM study was conducted which examined the faculty attitude toward the Blackboard learning management system. The study used original TAM framework with the five major constructs in it as the theoretical framework. It used TAM framework in coding data and conducted a content analysis of the open-ended data collected from 36 faculty members. It provided an innovative and useful way of organizing and analyzing the open-ended data using the TAM framework to determine richer information with a smaller number of subjects.

In the second and third phase of this dissertation, two separate studies were conducted each of which used an extended TAM framework by adding three external variables. Study 2 examined faculty attitude toward the Canvas learning management system and Study 3 examined students' attitude toward university web portals. Using quantitative research approach, Study 2 and Study 3, both, examined the relationship among the three external variables and the five basic TAM constructs. The validity of the proposed extension of TAM in determining users' web technology adoption behavior was examined in both of the studies.

By using different research methods, testing different web-technologies and examining the technology attitude of different users groups, this dissertation attempted to further investigate the TAM's strength in determining the users' technology acceptance behavior under different technologies, conditions and situations. Such variability in types of technologies and users was expected to add to the potential generalization of the findings of this dissertation.

External Factors, proposed extension of TAM and the Research hypotheses

Since the introduction of TAM, a number of studies introduced external variables into TAM and investigated whether they affect the five major TAM constructs PU, PEOU, ATT, BI or AU and their relationships. The most frequently referred external variables that affect the five major TAM constructs and their relationships are system quality (e.g. Igbaria et al.,1995b), training (e.g. Igbaria, Guimaraes, & Davis, 1995a), compatibility, computer anxiety, self-efficacy, enjoyment, computing support and experience (e.g Chau, 1996, Lee et.al 2003). Hong,

Hong, Thong and Tam (2002) identified two categories of variables, individual differences and system characteristics can have significant effect on users' intention and use of IT (i.e. digital libraries). Cheng (2011) proposed an extended TAM to examine the antecedents and consequences for employees' acceptance of the e-learning system within financial services organizations and found four types of determinants: individual, system, social and network externality factors have impact on users' beliefs in affecting e-learning acceptance and usage.

In this dissertation, an extended TAM was proposed by adding three external factors (system quality, perceived self-efficacy and facilitating conditions) in the basic TAM framework. In prior research, all of these three external factors had been found significant in determining users' attitude toward technology use. Therefore they were chosen to be included in the extended TAM. The dissertation examined how these three external variables impact the two fundamental TAM constructs PEOU and PU, which consecutively impact the dependent variables ATT, BI and AU of TAM.

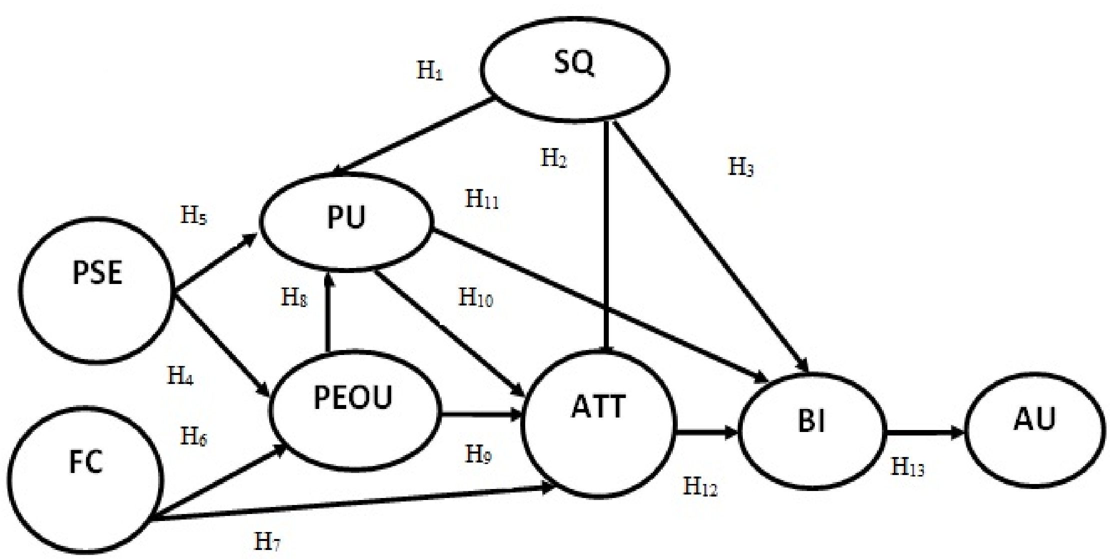

Figure 2.9 Extended Technology Acceptance Model (TAM) as proposed

The three external variables tested in this dissertation and the reasons for their inclusion are stated below:

System quality

"System quality in the Internet environment, measures the desired characteristics of an e-commerce system (i.e. LMS, website etc.). Usability, availability, reliability, adaptability and response time (e.g. download time) are examples of qualities that are valued by users of an e-commerce system" (Delone & Mclean, 2003, p.24). In Davis's (1993) words, "TAM provides a foundation for further research on why users accept or reject information technology and how to improve user acceptance by the judicious choice of system design features" (Davis, 1993, p.484). There are several reasons why many of the ISs are not used or are not used as frequently as they might be. System quality is one of them. The external variable 'system quality' is derived from Delone and Mclean's (2003) updated information systems success model. They referred to 'system quality' as the overall quality of the system (i.e. website, LMS) that affects the end user and the way they interact and use the system and proposed "System Quality" directly affects the behavioral intention to use the system (BI).

Generally, people like to use a system which is easy to use. If users of an IS find it hard to get access, they tend to perceive it as difficult to use and will not intend to use it. People complain about a system when they find the quality of the system is poorer than their expectations. Nickerson (1999) found functionality, accessibility-availability, start-stop hassle, system dynamics and response time, work-sessions interrupts, training and user aids, documentation, command languages, consistency and integration, user conceptualization of system etc. as the major complaints expressed by the users and potential users of interactive systems. Davis (1989) cited a number of prior studies (i.e., Benbasat & Dexter, 1986; Bewley, Roberts, Schoit & Verplank, 1983; Dickson, DeSanctis, & McBride, 1986) and pointed out the importance of research on how usefulness and ease of use can be influenced by various externally controllable factors, such as the functional and interface characteristics of the system. Also, Wixom and Todd (2005) found that information and system quality influenced PU and PEOU. Kim and Leet's (2007) model validation study for evaluating LMSs found system quality and design issues are important in determining the LMSs effectiveness. They conducted an exploratory factor analysis of 81 validation items developed through the literature review and extracted a model with two principal constructs. The constructs were focused on the quality and design issues of the system. Factor I was termed as *Instruction Management/ Screen Design/Technology* (i.e. suitability of design in screen and system, easiness of course procedure, interoperability of system, appropriateness of multimedia use etc.) and Factor II was termed as *Interaction / Evaluation* (i.e. flexibility of interaction, variety of communication and test types, user accessibility etc.). Dong Hee (2009a, 2009b) found that perceived system quality significantly affect PU and ATT. Cheng (2011) found a significant effect of system factors (system functionality and system interactivity) on e-learning system acceptance through PEOU and PU. Jeong (2011) used an extended TAM framework and explored e-library usage and acceptance behavior among the Korean elementary students. The study findings highlighted the importance of system quality in determining the users' e-library acceptance behavior. The study revealed that system quality positively influences both PEOU and PU of e-library system use. Also, it found that the interface characteristics (i.e. terminology, screen design and navigation) influences PU via PEOU of e-library systems use and system characteristics directly influences PU and system quality positively influences both PU and PEOU of e-library system use.

Therefore, this dissertation found it important to include 'system quality' as an external variable in the extended TAM and to examine its impact on PU, BI and ATT.

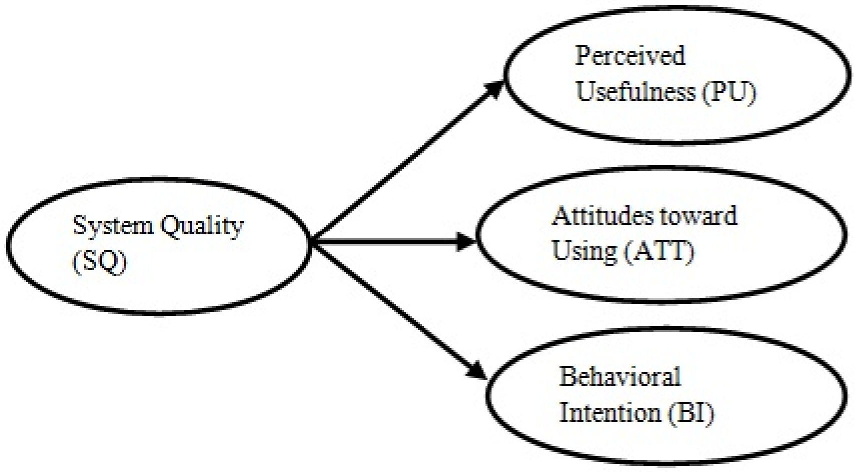

Figure 2.10 Proposed relationships of SQ with PU, ATT and BI

Based on the previous research concerning SQ, the following six hypotheses were proposed and tested in this dissertation.

- System Quality (SQ) of LMS has a significant positive effect on the perceived usefulness (PU) of LMS (H_1 Study 2)
- SQ of LMS has a significant positive effect on faculty members' attitudes (ATT) toward using LMS (H_2 Study 2)
- SQ of LMS has a significant positive effect on faculty members' behavioral intention (BI) of using LMS (H_3 Study 2)
- Website Quality (WQ) has a significant positive effect on PU of university web portals (H_1 Study 3)
- WQ has a significant positive effect on students' attitude (ATT) toward university web portals (H_2 Study 3)

- WQ has a significant positive effect on students' behavioral intention (BI) to use university web portals (H_3 Study 2)

Perceived Self-efficacy (PSE)

Technology has its impact in every facet of life. Nowadays, technology is not for a special group of people but for everyone. However, in almost every sector, some people are comfortable with technology, while others are not. Common sense says those who consider technology too complex and believe that it is not possible for them to learn will prefer to avoid the technology and are less likely to use them. But, social cognitive theory claims that beliefs about outcome may be insufficient to influence behavior if individuals doubt their capabilities to successfully undertake behaviors (Bandura, 1977, 1982, 1986). Perceived self-efficacy (PSE) originates from social learning and outcome expectation theories. PSE refers to "people's beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives" (Bandura, 1991, p.257). Bandura suggests that perceived self-efficacy plays an important role in affecting motivation (i.e. PEOU and PU) and behavior (i.e. technology usage behavior) (Bandura, 1977, 1982, 1986). Bandura (1977) argues that self-efficacy in addition to outcome expectations must be considered in determining the technology usage behavior. Bandura's (1977) argument emphasizes the impact of the individuals' cognitive state on outcomes and the importance of understanding both self-efficacy and outcome expectations (Igbaria & Iivari, 1995). Though TAM assumes that individuals will use technology if they believe it will result in a positive outcome, it does not explicitly consider how individuals' expectations of their capabilities influence their behavior (Igbaria & Iivari, 1995). The PU construct of TAM reflects only the beliefs (or expectations) about outcomes (Davis, 1989, Davis et.al, 1989). So, researchers found it important to examine the effect of self-efficacy (the belief that one has the ability to perform particular action) in users' technology behavior. PSE as an external construct is studied frequently with respect to the social cognitive theory (Taylor & Todd, 1995a, Venkatesh, 2000).

Compeau and Higgins (1995) reported that self-efficacy has a significant impact on usage. Taylor and Todd (1995a) found that self-efficacy indirectly affects students' IT usage behavior. Prior IS research based on TPB has found the impact of self-efficacy on PEOU (Venkatesh et. al. 2003). Gong et al. (2004) examined an extended TAM for adoption of web based learning and revealed that PSE has both a strong direct and indirect effect on BI, and it can enhance users PEOU significantly. The study suggested considering self-efficacy of the learners in promoting the application of IT in the education sector. Saade and Kira (2009) reported the effect of self-efficacy as a mediator of PEOU of an LMS. Also, prior research has found self-efficacy's effect on intentions to use a new system as an internal factor in facilitating conditions and part of perceived behavioral control (Taylor & Todd, 1995a). Ngai et al. (2007) suggested examining self-efficacy as an external factor in determining the users' LMS adoption behavior as future research directions. Cheng (2011) found computer self-efficacy and Internet self-efficacy significantly affects PEOU of e-learning systems.

Therefore, this dissertation investigates the role of both outcome expectations and self-efficacy in technology adoption behavior. As Bandura (1986) stated, increased level of self-efficacy leads to improved performance, it is expected that individuals with high PSE will perceive the system to be easy and useful due to the effect of self-efficacy on the degree of effort, the persistence and the level of learning which takes place. Conversely, those individuals who are not confident about their capabilities are easily discouraged by failure. Therefore this dissertation investigates the relationship among PSE, PEOU, and PU. More specifically, it extends the TAM by incorporating PSE as the external factor affecting PEOU and PU and usage of technology.

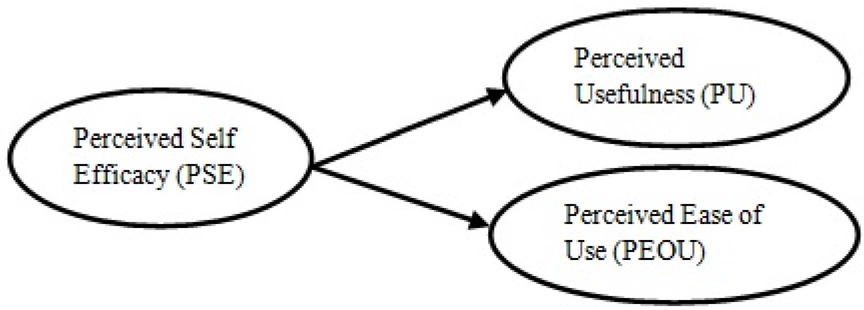

Figure 2.11 Proposed relationships of PSE with PU, and PEOU

Based on the previous research concerning PSE, the following FOUR hypotheses were proposed and tested in this dissertation

- Faculty members' perceived self-efficacies (PSE) have significant positive effects on their perceived ease of use (PEOU) of LMS (H_4 Study 2)
- Faculty members' PSEs have significant positive effects on their PU of LMS (H_5 Study 2)
- Students' PSE has a significant positive effect on PEOU of university web portals (H_4 Study 3)
- Students' PSE has a significant positive effect on PU of university web portals (H_5 Study 3)

Facilitating conditions

Facilitating Conditions are perceived enablers or barriers in the environment that influence a person's perception of ease or difficulty of performing a task (Teo, 2010a). Facilitating conditions could also be defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system". (Venkatesh et al., 2003, p.453). In an IS context, "the provision of support for users of PCs may be one type of facilitating condition that can influence system utilization. By training users and assisting them when they encounter difficulties, some of the potential barriers to use are reduced or eliminated" (Thompson et.al, 1991, p.129).Venkatesh and Bala (2008) elaborated it as "facilitating conditions are related to individuals' control beliefs regarding the availability of organizational resources and support structures to facilitate the use of a system" (p.278).

Prior research has shown evidence that FC influences ATT and PEOU (Ngai, et.al 2007). Igbaria (1990) found a high level of technical support to be responsible for promoting more positive attitudes toward computer use. Taylor and Todd (1995a) examined students' IT usage behavior of a computer resource center and found that resource facilitating conditions (time, money and other relating to technology compatibility issues that may constrain usage) have had significant indirect effect on IT usage behavior.

Groves and Zemel (2000) found that users' supports (skills training, information or materials available and administrative support) were rated as very important factors which influenced the use of instructional technologies in teaching. Ngai et al.'s (2007) study revealed a direct effect of technical support on the PEOU and PU of WebCT and an indirect effect on ATT. Weaver et al. (2008) found that faculty members require assistance with the technical and administrative tasks associated with using LMS and suggested that the various forms of support for academic staffs with using the technology could be the only way to encourage more use. Teo's (2010a) study concluded that FC influences teachers' beliefs about PEOU of technology. He indicated his finding " is comparable with those of Venkatesh and Davis's (2000) and Lim and Khine's (2006), who found that issues related to the support structure (a core concept within the facilitating conditions construct) are largely encapsulated within the perceived ease of use construct" (Teo, 2010a, p.75). Venkatesh (2000) theorized that the role of facilitating conditions will continue to be strong in determining the PEOU, even with increasing experience of the users with the system. Consistent with Venkatesh's (2000) findings, Venkatesh and Bala (2008) also found that facilitating condition (termed as 'perceptions of external control') was a significant predictor of PEOU at all four points of their measurements. Venkatesh, Thong and Xu (2012) found FC has a significant direct effect on AU. However, McGill and Klobas (2009) did not found any influence of facilitating conditions on LMS utilization.

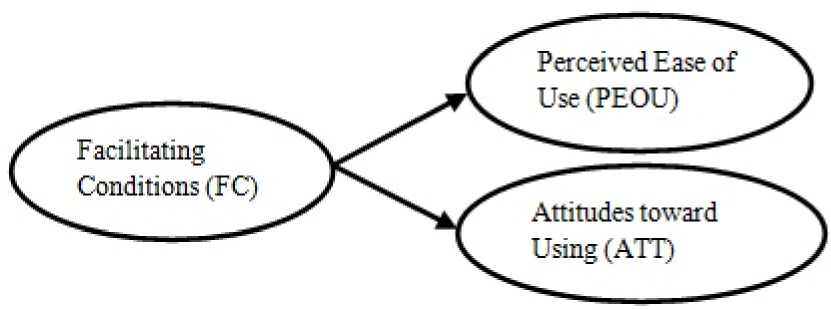

Figure 2.12 Proposed relationships of FC with PEOU and ATT

Based on the previous research concerning FC, the following FOUR hypotheses were proposed and tested in this dissertation:

- FC has a significant positive effect on faculty members' PEOU of LMS (H_6 Study 2)
- FC has a significant positive effect on faculty members' attitude (ATT) toward using LMS (H_7Study 2)
- FC has a significant positive effect on PEOU of university web portals (H_6 Study 3)
- FC has a significant positive effect on students' attitude (ATT) toward university web portals (H_7 Study3)

Summary

The foregoing TAM literature review indicated that though several studies have been conducted on determining users' attitude toward different kinds of technologies, the studies presented varying, and sometimes contradicting views. A large number of thorough and significant studies among them had indeed been conducted mainly in business settings, but as yet, limited research has been done in higher education settings. Therefore, this dissertation aimed to contribute to the less explored/unexplored areas of web-technology adoption literature as well as to TAM literature in higher education settings. Based on the literature, the dissertation conducted a three phased research consisted of three studies, one completed in each phase. Study 1used the original TAM framework to determine the Blackboard usage behavior of university faculty members, whereas Study2 and Study 3 generated a hypothesized extended TAM based on original TAM framework and examined if the hypothesized model could explain the users' attitudes toward web-technology adoption in higher education settings. Study 2 examined faculty attitude toward Canvas usage and Study 3 examined students' attitude toward university web portal usage. By examining the end-users web-technology adoption behavior, this dissertation intended to present better understanding of what factors affect users' attitude toward web-technology adoption behavior in higher education settings and how higher education institutions can ensure increased use of web-technologies by end-users.

CHAPTER 3.MANUSCRIPT 1 FACULTY ATTITUDES TOWARD LEARNING MANAGEMENT SYSTEMS (LMS): AN ANALYSIS USING TECHNOLOGY ACCEPTANCE MODEL (TAM)

Introduction

Currently, educational institutions spend tens to hundreds of thousands of dollars for Learning Management Systems (LMSs) to facilitate the teaching/learning activities (O'Leonard & Bersin, 2006). A LMS is a technological infrastructure that accomplishes the following: (a) it delivers and manages instructional content, (b) it identifies and assesses individual and organizational learning or training goals, (c) it tracks the progress toward meeting those goals, and, (d) it facilitates data collection that is useful for supervising the learning process of an organization as a whole (Szabo & Flesher, 2002). LMSs utilize synchronous and asynchronous technologies to facilitate access to learning materials and administration (Black, Beck, Dawson, Jinks & Meredith, 2007). Provided that universities make a considerable investment on LMSs, it is important to ensure that end-users, especially faculty members, adopt the technology that is readily available to them.

Prior research indicates that LMSs are available across a number of universities and colleges; where upwards of 90% of all institutions have purchased rights to LMSs (e.g., Hawkins & Rudy, 2007). Some of the widely known LMSs present in the market today are Moodle, WebCT, Learn.com, KrawlerLMS, Joompla LMS, ATutor, Blackboard, and Canvas. Through the use of LMSs, higher education institutions offer multiple learning environments including: interactive learning, online learning, distance learning, hybrid/ blended learning etc. for their students (Falvo & Johnson, 2007, Vovides, Sanchez-Alonso, Mitropoulou, & Nickmans, 2007). Despite widespread availability, prior research also suggests LMS is a powerful technology that has yet to reach its full potential (Watson & Watson, 2007) across educational institutions.

Various issues are currently impeding the full and centralized utilization of LMSs. As an example, many instructors use LMSs simply as a delivery mechanism for the students (e.g., posting grades), and they do not use the integrated functionalities (i.e. discussion board, online quizzes, links etc.) (Garrote, & Pettersson, 2007; Vovides et al., 2007). Also, prior research has found that LMS features like discussion forums, chat and email, are underutilized by teachers and students (Nelson, 2003; Garrote & Pettersson, 2007). In addition to not fully utilizing the various features of LMSs, Weaver, Spratt and Nair (2008) found that faculty perceives an increased workload associated with using LMSs. Specifically, the study revealed that 70% of faculty experienced software, technical, and support related problems when they incorporated LMSs in their teaching. Most of the technical and support related problems are driven by the fact that faculty members are not participating in training sessions for LMSs. Garrote and Pettersson (2007) noted that lack of motivation to spend the necessary time and effort to learn and participate in LMS training, is among the more common restricting factors in the utilization of LMS by the faculty members. Finally, faculty members have considerable autonomy and independence on deciding on the technology to use in their teaching activities (Gong, Xu & Yu, 2004), and most universities do not require faculty members to utilize LMSs, despite the considerable financial investment.

Given the availability of LMSs across universities doesn't directly correlate with, or predict utilization of the system by faculty members; this begs the question of *why* some faculty members do not utilize LMS technology. Therefore, the purpose of this study is to: (a) gain a better understanding of the extent to which faculty members utilizes LMS at the campuses included in this study, (b) to identify any barriers that may prevent faculty from utilizing the technology, and (c) to understand the factors that will increase the utilization Blackboard across faculty members.

Drawing from the exploratory research questions, the specific contribution this study makes to the literature is helping to address the fact that despite ubiquitous implementation of LMSs across campuses, faculty members are not fully implementing LMS into their courses. The slow adoption of LMSs by faculty members is a critical concern, since faculty members are the key users of LMSs, and given the considerable financial investment that universities spend on LMSs. In addition, this study made a contribution to the literature by focusing on the utilization of LMSs by faculty members. That is, a number of prior studies have examined students' attitudes toward, and utilization of different types of LMSs in the market. However, only a few of the studies (e.g., Ball & Levy, 2008 ; Liaw, Huang & Chen, 2007; Samarawichkrema & Stacey, 2007;Sumner & Hostetler, 1999; Weaver et. al., 2008) were conducted in higher education settings using faculty members as participants. Subsequently, less is known about the faculty experience with LMS.

In order to gain an understanding of the LMS utilization across faculty members, this article draws from Davis's (1989) Technology Acceptance Model (TAM) to identify *how* faculty attitudes toward LMSs impacts their adoption (and subsequent utilization) of the system. Based on the TAM framework, this study examines the nature of attitude under conditions of non-mandatory use of technology. It conducts a content analysis of open-ended data using the TAM framework, which has not often been done previously. Specifically the present study concentrates on analyzing faculty attitudes towards a particular LMS (Blackboard). In order to gain a better understanding of *why* faculty members utilize or choose not to utilize Blackboard, this study explored several factors including the identification of the strengths and weaknesses of LMS (Blackboard) from the faculty members' perspective. Also, data were gathered that allowed the author to gain insight from the faculty members regarding the initiatives that can be taken to ensure improved acceptance of Blackboard.

Finally, a recent meta- analysis of 101 articles that incorporated the TAM model (Lee, Kozar & Larsen, 2003), suggested that most of the previous studies have been quantitative in nature. Specifically, of the 101 studies, 86 were field studies, 12 of them were lab experiments, and only 3 of them were qualitative studies. This indicates that qualitative data analysis approach has not been frequently used in TAM studies. In summary, this paper makes 3 overall contributions to the literature including: (a) it investigates *why* faculty members do not utilize LMSs, despite universities making significant financial investments, (b) it focuses on faculty utilization of LMS, in lieu of student utilization, and (c) it uses a qualitative methodology; where most previous studies on LMSs have been quantitative in nature.

The current literature related to LMSs, and the constructs included in the TAM model are discussed in the next section of the study. The paper then describes how the study was conducted, including a description of the sample population. Next, the key research findings are presented. The paper closes with a set of recommendations regarding how to increase the utilization of a specific LMS, Blackboard, among faculty members.

Theoretical framework

Learning Management System (LMS)

" LMS is a self-contained webpage with embedded instructional tools that permit faculty to organize academic content and engage students in their learning" (Gautreau, 2011, p.2). The utilization of this web based software application or web based technology enables instructors to create and deliver content, monitor student participation, and assess student performance. LMSs have been studied by many researchers. Previous studies have mainly focused on one of three areas: (a) a comparative analysis of LMSs (i.e. Black et.al, 2007; Beatty & Ulasewicz, 2006; Carriere, Challborn & Moore & Nilbourg, 2005), (b) issues related to the functions and features of LMSs (i.e. Barron & Lyskawa 2001), or (c) the extraction of LMS evaluation criteria, (i.e. Kim & Leet, 2007, Samarawickrema & Stacey, 2007, Steel, 2007). For example, Weaver et al., (2008) surveyed students and faculty about the LMS use, and found that system quality is important to both the students and faculty. Their study revealed that students pay attention to the design, resourcefulness, and good interaction capacity of LMSs; in comparison, faculty members are more interested in the technical and administrative aspects of LMS. Gautreau (2011) cited the previous studies of Ayers and Doherty (2003), Jafari, McGee, and Carmean (2006) and Oliva and Pawlas (2005), and reported that:

> LMSs may assist faculty with managing courses and organizing content to engage students and decrease planning time, thus supporting the instructional process. Despite the benefits of incorporating an LMS, many faculty members do not adopt technology as a teaching tool (p.2).

Leveraging previous studies, this article explores issues related to the functions and features of LMSs. However, this theme was investigated by considering how faculty members' attitudes influence their perception of the functionality of the system. This article leverages the TAM model to study the factors that are thought to impact the faculty member's attitude toward using LMSs, including Blackboard.

Technology Acceptance Model (TAM)

Why TAM? This study utilizes the Technology Acceptance Model (TAM) (See Figure 3.1) developed by Davis (1989) to examine the extent to which it offers a useful framework for analyzing the faculty members' attitudes toward LMSs. TAM is the most influential, commonly employed, and highly predictive model of IT adoption (Davis, Bagozzi, & Warsaw, 1989, Adams, Nelson & Todd, 1992, Venkatesh & Davis, 2000, Venkatesh & Morris, 2000, Lee, et al., 2003, Venkatesh & Bala, 2008). Research in users' attitude and technology adoption has continued to develop over time. To examine users' intention and technology acceptance behavior various theories including, theory of reasoned action (Ajzen & Fishbein, 1980), theory of planned behavior (Ajzen, 1991), social cognitive theory, (Bandura, 1982, 1977, 1986) technology acceptance model (Davis, 1989), and innovation diffusion theory (Rogers, 2003) have been used in previous research. Although there are other theories that can be used to explain technology adoption, the TAM model was chosen for this study for several reasons. First, TAM has been applied to explain or predict individual behaviors across a broad range of end-user computing technology, and user groups (Davis et al., 1989). Secondly, TAM was selected because the objective of the paper is to identify the general attitudes of faculty members across multiple disciplines toward Blackboard (i.e., a specific LMS). TAM provides a quick and inexpensive way to gather general information about individuals' perceptions of a system, and it can be used to measure general levels of satisfaction of users with diverse interests (Mathieson, 1991). Prior research has found TAM is empirically strong and powerful (Lee et al., 2003), parsimonious (Davis et al., 2003, Venkatesh, 2000, Taylor & Todd, 1995a, 1995b), theoretically justified (Davis et al., 2003), and the model most often applied to study IT adoption/utilization

(Davis et al., 1989, Adams et al., 1992, Venkatesh & Davis, 2000, Venkatesh & Morris, 2000, Venkatesh & Bala, 2008).

Origin and Constructs of TAM. TAM was originated from Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA). TRA describes how social norms, users' beliefs and attitudes are related to individuals' intentions to perform. TAM is a specialized adaptation of TRA that can be applied to understand and evaluate technological implementation (Wolski & Jackson, 1999). TAM describes the users' technological adoption behavior in different environmental settings. TAM assumes that an individual's technological acceptance behavior is determined by a number of factors. Two major factors are Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). Atkinson and Kydd (1997) indicated that PEOU is a form of intrinsic motivation factor, whereas PU is a form of an extrinsic motivational factor.

PEOU is defined as "the degree to which a person believes that using a particular technology would be free from effort" (Davis et al., 2003, p. 320). The construct reflects the amount of effort that would be required relative to the person's perceived capabilities. For example, the PEOU of Blackboard reflects the degree to which a faculty member believes that Blackboard is easy to use. PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis et al., 1989, p.320). PU is the degree to which a faculty member believes that using Blackboard would make his or her academic work easier and would facilitate his academics activities. As depicted in Figure 1, Davis found a causal influence of "perceived ease of use" of the technology on "perceived usefulness" of the technology. This inference suggests the faculty member's perceptions of the technology will positively influence their attitude towards the technology. Also, TAM claims that if users find a technology useful to them, they develop a positive attitude toward the technology which shapes their intention to use the technology. According to this inference, TAM postulates that if the faculty members find the technology useful to them (e.g., it helps them manage assignments given to students), they will develop a positive attitude toward the technology which shapes their intention to use it. Hu, Clark & Ma (2003) stated that PU is a critical determinant of user acceptance, and its influence appears to increase as individuals become more experienced.

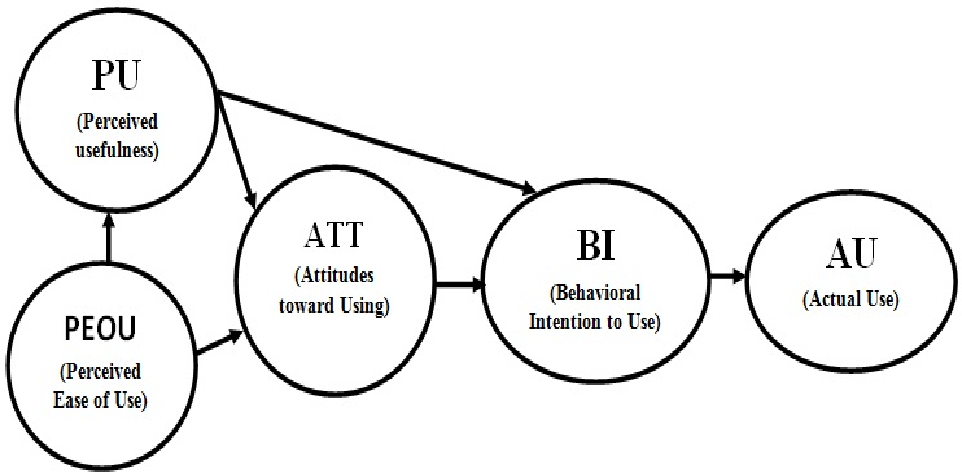

Figure 3.1. Technology Acceptance Model (TAM) (Davis, Bagozzi & Warshaw, 1989, p.985)

After the PEOU and PU constructs, the next construct that is present in the TAM model is Attitude Towards Using (ATT). The construct is defined as "an individual's positive or negative feeling about performing the target behavior (e.g., using a system)" (Davis et al. 1989, p. 984). The TAM model suggests users formulate a positive attitude toward the technology when they perceive the technology to be both helpful, and easy to use (Davis et. al, 1989). The construct ATT postulates that to the extent that a faculty member's perceives the technology is easy to use and helpful, they will have a positive attitude about the technology. That is, TAM implies that end-users formulate a positive attitude toward the technology if they perceive the technology to be useful and easy to use (Davis et al., 1989). Further, TAM postulates that the faculty members' positive or negative attitudes toward using Blackboard are directly impacted by their perceptions of the usefulness (PU) and ease of use (PEOU) of Blackboard. In other words, to the extent that a faculty member perceives Blackboard easy to use and useful, he or she will have a positive attitude (ATT) toward using it.

The fourth construct in the TAM model, Behavioral Intention (BI), is defined as the degree to which a person has formulated conscious plans to perform, or not perform some specified future behavior (Davis, 1989). In other words, this construct measures the end-user's intentions, which are directly influenced by ATT, that is, the attitude towards the technology. BI is a critical construct to understand because it impacts the Actual Use (AU) of the system (Venkatesh & Davis, 2000). As it relates to Blackboard, BI states the conscious intention of the faculty members to use or not the technology. It has been found in previous research that BI is the strongest predictor of actual use (AU) of the technology (Davis, et al., 1989). Specifically, BI has been found to be a valid predictor of AU, especially when the use of the technology is voluntary (Venkatesh, Morris, Davis & Davis, 2003, Simon & Paper, 2007).

Method

Participants

The participants in the study consisted of individuals with teaching responsibility, that is, faculty members and graduate teaching assistants at a large Southeastern university. The university adopted Blackboard as its LMS in Fall 2004; however it is not mandatory for all faculty members to utilize Blackboard. Faculty members have the flexibility to use none, some, or all of the available features within Blackboard. In addition, faculty members have the option for utilizing other software over and beyond Blackboard. The setting in which the data were collected is ideal as faculty are not mandated to utilize Blackboard. Regarding the training available for Blackboard, the university has an information technology office which offers various Blackboard training sessions to the instructors for no fee.

During Spring 2011, an electronic survey (see Appendix B) was conducted among the faculty members of the university. A convenience sample of five colleges at the university was selected, and a total of 100 individuals with teaching responsibility (e.g., faculty, instructors, graduate students) were invited to participate in the study. The five colleges included: College of Education, College of Business, College of Engineering, College of Science and Mathematics, and College of Human Sciences. These colleges were selected as the author knew individuals that had teaching responsibility during the semester the data was collected. An e-mail invitation including the survey Web-link was sent to the participants. The e-mail included a short paragraph about the purpose of the study. No identifiable information was collected from the respondents. Survey participation was voluntary and anonymous. No incentives were offered to the potential respondents to fill in the survey. Data were collected for approximately one month, at the end of the semester. Although no official email reminders were sent to the faculty invited to participate in the study, most faculty members were given a verbal reminder to complete the survey.

Of the 100 individuals invited to participate in the survey, 36 individuals with teaching responsibility completed the study. The survey response rate of 36% was fairly consistent with the survey response rate of several of the LMS studies included in a meta-analysis conducted by Cook, Heath, and Thompson (2000). In that review, an average response rate of 56 electronic surveys from 39 studies was reported at 34.6%.

Specific demographics of the respondents included: 17 males (47%) and 19 females (53%) between the ages of 27 to 75 years old. Related to “types of teaching responsibility”, there were 5 professors, 12 associate professors, 13 assistant professors, 3 instructors, and 3 graduate teaching assistants. Although the instructor "types" varied, each of the respondents that completed the survey had the authority to decide if they wanted to utilize Blackboard within their course. Specific to disciplines, 12 of the respondents (33%) were from the College of Education, 11 (31%) were from the College of Business, 8 (22%) were from the College of Engineering, 4 (11%) were from the College of Science and Mathematics, and 1 (3%) respondent was from the College of Human Sciences. The demographics of the respondents are presented in Table 3.1.

Table 3.1
Demographics (Age, gender, academic field and academic rank)

Gender	Total	Percent
Male	17	47%
Female	19	53%
Total	36	100%

Age Range	Total	Percent
25-30	3	8%
30-39	14	39%
40-49	8	22%
50-59	5	14%
60-69	5	14%
70 +	1	3%
Total	36	100%

Academic Field	Total	Percent
College of Education	12	33%
College of Business	11	31%
College of Engineering	8	22%
College of Science and Mathematics	4	11%
College of Human Science	1	3%
Total	36	100%

Academic Rank	Total	Percent
Professor	5	14%
Associate Professor	12	33%
Assistant Professor	13	36%
Instructor	3	8%
Graduate Teaching Assistant	3	8%
Total	36	100%

Measures

In order to facilitate data collection, the survey was conducted over the web. The specific measures included on the survey were Part A: “Demographics”, Part B: “Perceptions of LMS (i.e., specifically Blackboard)”, and Part C: “Features of LMS”.

Part A. Demographics. The following demographics were collected from the survey respondents:

- Age
- Gender
- Academic rank
- Academic field

Part B. Perceptions of LMS (i.e., Blackboard). The following open-ended questions were utilized to measure perceptions of LMS:

- Identify the three main reasons of your using or not using Blackboard for teaching purposes.
- Describe the extent to which you perceive Blackboard to be clear and understandable
- Describe the level of skills that are required to use Blackboard
- What are the strengths of Blackboard?
- What are the weaknesses of Blackboard?
- What would you recommend to improve or modify in Blackboard to ensure more usability and acceptance of Blackboard by the faculty members?

Non-directive questions were selected to ensure that the responses were relatively broad (Hammersley & Atikson, 1983). The respondents were provided unlimited space in the reply text boxes to allow the opportunity for unconstrained replies. The participants were allowed to structure their responses in accordance to their unique frame of references using the terminology they apply in everyday conversations. The first five questions provided the major content of the research analyses, including the first question which tapped one of the key research questions; that is, the reasons for LMS utilization by faculty, or lack thereof. The last question was intended to give the respondents an opportunity to offer recommendations about the LMS (i.e., Blackboard).

Part C. Features of LMS. In addition, to the open-ended questions, two closed-ended questions were included on the survey to collect more specific information about the different features of Blackboard, and their relative importance to the respondents. The first closed-ended question asked about the types of courses for which the faculty members use Blackboard. The second close-ended question asked about the specific features of Blackboard; this question was included to identify the features within the LMS that had the highest utilization among the course instructors.

Research Strategy

The study conducted a content analysis (Krippendorff, 2004) in order to analyze the open-ended data collected across the survey responses. As defined by Krippendorff (2004), the content analysis is a research technique best used for making replicable and valid inferences from data to their context. The content analysis approach was used in accordance to Krippendorff (2004), because the purpose of the study was to use a specific theory, Technology Acceptance Model (TAM), to make inferences about faculty attitudes toward a specific context: learning management system (i.e., Blackboard). Of the three types of content analysis (conventional, directed and summative) that exist, the directive content analysis (Hsieh & Shannon, 2005) approach was utilized. This content analysis approach enabled the author to draw from the five constructs of TAM as predefined codes, and analyze the data. The ultimate goal was to prove/disprove TAM in explaining the faculty attitude toward learning management system. The directed content analysis approach (also termed as "deductive content analysis") was chosen because it was found more appropriate than other qualitative approaches for analyzing the data collected for this study.

The directive content analysis approach begins with a predefined theory (i.e., TAM). Next, codes are defined before and during data analysis. Finally, codes are derived from theory or relevant research findings (i.e., in this study, codes are derived from theory) (Hsieh & Shannon, 2005). The rationale in leveraging the directive content analysis approach in this study was, to utilize the TAM framework to identify how faculty members believe LMS can be used within their respective courses.

Reliability

The crude agreement index and Krippendorff's alpha (Krippendorff, 2004) were utilized to assess the inter-coder reliability. The coding process was simple. According to Krippendorff (2004), units are wholes that are distinguished and treated as independent elements. In this study, units were defined on the basis of categorical distinctions. Using thematic unitizing (Krippendorff, 2004), the comments that reference similar aspects were grouped together. If an answer addressed more than one issue the answer content was separated. The categorization of comments by theme was conducted separately and blindly by the author. In total, 36 survey scripts were reorganized and were ready for coding. In order to use as a guideline for coding, the author prepared a list (Code list) which included the definitions of five TAM constructs (PEOU, PU, ATT, BI, AU) and two example responses for each construct. The code list is presented in Table 3.2. A copy of this list was given to each of the coders to use as a guideline in coding survey scripts. Three coders: knowledgeable of the TAM framework and trained in quantitative research methods, were recruited to code the statements. They were not involved in this research or data collection process before.

Table 3.2
Set of definitions of TAM constructs

Perceived Ease of Use (PEOU)	"The degree to which a person believes that using a particular technology would be free of effort" (Davis 1989, p.320). The construct reflects the amount of efforts that would be required relative to the person's perceived capabilities, in terms of being able to use the technology to accomplish the intended functions.
Perceived Usefulness (PU)	"The degree to which a person believes that using a particular system would enhance his/her job performance" (Davis 1989, p.320).
Attitude towards using (ATT)	Individual's positive or negative feeling about performing the target behavior (e.g., using a system) (Davis 1989).
Behavioral Intention (BI)	The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior (Davis 1989).
Actual System Use (AU)	A person's actual use of the technology (Davis 1989).

When the coders completed the initial stage of coding, the crude agreement index (that is total number of agreement/ total number of statements) was computed to be 69%. At this stage, the coders were allowed to discuss about the respondents' comments if they had any differences in their views. It was found that, the coders were synonymously using PEOU and PU in coding the statements. Disagreements were also found among the coders about classifying some of the statements as ATT or BI. After the discussion, the coders came to an agreement, and revised their coding accordingly, which increased the crude agreement index to76%.

As a second measure, Krippendorff's alpha (Krippendorff, 2004) was also employed to test the reliability of the coding process. According to Krippendorff (2004), the alpha produces a uniform reliability standard for a wide variety of data, it is applicable to any number of coders, and it reflects a scientifically rigorous index of coder agreement. Krippendorff's alpha was computed to be 0.6714, whereas for tentative conclusions the minimum alpha level that should be reached is 0.667 (Krippendorff, 2004). Thus, the coding of the respondents' statements can be considered internally consistent.

Results

The first objective of the study was to identify the faculty attitudes toward LMS use. It was addressed through investigating the survey responses using the TAM framework. The study revealed that, collectively, the attitudes of Blackboard users' and non-users' follow specific patterns. The faculty members who use Blackboard, and those who do not, held varied beliefs about its use, effectiveness, and limitations.

The survey included two closed-ended questions and these were worded such that the respondents could select more than one category. In one question faculty members were asked to identify for which *type of course(s)* (online courses, on-campus courses, hybrid courses, or do not use at all) they used Blackboard. Thirty-five faculty members answered the question and one skipped the question. From the survey responses it was revealed that 86% of the respondents use Blackboard to teach on-campus courses, while the others use it for online courses (17%), for hybrid courses (17%), and a small number of faculty members do not use Blackboard at all (11%). The full sets of results are included in Table 3.3.

Table 3.3
Purpose of using Blackboard

Features	Frequency	Percent
To teach On-Campus courses	30	86%
To Teach Online courses	6	17%
To teach hybrid courses	6	17%
Do not use at all	4	11%

Note: 35 of the total 36 respondents answered the question.

In addition, the survey asked the respondents to report the features of Blackboard; where the goal of this question was to identify the most *frequently used features*. This question gave the respondents options to select more than one answer options. The results indicated that document uploading (86%), grade book (66%) and assignments (tutorials, tests, quizzes) (54%) are the most-frequently used features. The least used features include question pools (used in texts and surveys) (14%), digital dropbox (8.6%) and lecture hall or office hours (8.6%). The full sets of results are included in Table 3. 4.

Table 3. 4
Most frequently used and Least used features of Blackboard

Most frequently used features	Percent	Least used features	Percent
Document uploading	86%	Question pools (used in texts and surveys)	14%
Grade book	66%	Digital dropbox	8.6%
Assignments (tutorials, tests, quizzes)	54%	Lecture hall or office hours	8.6%

Perceptions of the users

Important commonalities were found among the attitudes of the faculty members who use Blackboard. As such, the remaining results are representative of the faculty members that utilize Blackboard within their classes. Examples of issues classified into the five TAM constructs are provided in Table 3.5.

Table 3.5

Representative comments of the LMS (Blackboard) users

Construct	Users' comments
Perceived Ease of Use (PEOU)	"..By using Blackboard it saves me class time. Without it I would waste more time passing back grades/papers" "I think that it's much easier for me to upload notes rather than email them to students or make copies for them…"
Perceived Usefulness (PU)	"Ease, speed, paper/printing reduction. Students can receive their grades within hours of turning something in without having to wait until the next class period to get it back". "Blackboard provides a way to share information with students that is accessible 24 / 7. It's also a nice way to store class files in a way that is accessible from any web-capable computer".
Attitude towards using (ATT)	"Quicker and easier I can communicate with all students simultaneously. The students are computer competent so they understand the value of using Blackboard for courses". "I have been using the system for quite long time and do not have problem navigating the system".
Behavioral Intention(BI)	"It is a big educational online tool. This tool should be used on a daily basis to understand its features" "I have been going in and trying to learn the system. I think it is fairly easy to understand and use".
Actual Use(AU)	"I put 100% of my materials on Blackboard, but administer exams outside of Blackboard." "I put all of my lectures, assignments, and grades on blackboard. That is the only thing that I use it for."

Perceived ease of use of Blackboard (PEOU). From the survey responses it is revealed that, faculty find Blackboard an easy and helpful tool to facilitate their teaching activities. The main attractions of Blackboard, as reported by the faculty included: ease of use, ease of communication, ease of distributing documents, user friendliness, confidentiality, and accessibility for document retrieval. Faculty members also reported that the clarity and functionality of Blackboard also influenced their perceived ease of utilization. According to one faculty respondent, anyone with the basic computer and Internet skills can use it. That is, *"Homework, handouts, calendar, student presentations and papers (students' upload) are quicker and easier. It allows me to do things I might not have done."*

Perceived usefulness of Blackboard (PU). After analyzing the open-ended responses from the survey respondents it was revealed that those who use Blackboard mentioned that using Blackboard saves time, and makes their teaching activities easier. Some of the most useful features of Blackboard reported by them included: calculation of grades online, distribution of materials (e.g., a reading assignment, quizzes), and communication with all students simultaneously through Blackboard (e.g., chat room, discussion board). In sum, the faculty members perceive Blackboard to be a very useful tool. For example, one respondent stated: "It saves a lot of time spent on photocopying, using Excel to calculate the grade, and emailing."

Attitude toward using Blackboard (ATT). From the open-ended survey responses, it seems apparent that since faculty members perceive Blackboard to be advantageous for their teaching activities, they possess a positive attitude toward it. The users believe, with minimum technical skills, they can easily use Blackboard which helps them develop a positive attitude toward Blackboard. As an example, one respondent stated: "If you can operate a laptop, you can work with Blackboard". It explains that both PEOU and PU of Blackboard determine the faculty members' attitude toward using Blackboard. A Blackboard user expressed his satisfaction as "I use it and it works fine."

Behavioral Intention (BI). Faculty members' behavioral intention to use Blackboard varies according to their perceived usefulness of Blackboard (PU) and attitude (ATT) toward it. That is behavioral intention is not absolute (either you use Blackboard or not); rather behavioral intention is on a continuum, where some faculty members use more or less of the Blackboard capabilities. Faculty members who find Blackboard as a useful tool possess a positive attitude toward it, which leads them to develop an intention to use it in the future as well. They use most of the features of Blackboard. In comparison, some of the faculty members only use specific features of Blackboard, such as, uploading documents, and grading. Typically, those faculty members have a less positive attitude about Blackboard, and they have no intentions to utilize the full capabilities of Blackboard. Lastly, some faculty members possess negative attitudes toward Blackboard and do not intend to utilize Blackboard. Instead, they use their own webpages or other online means. They have no stated intention to use Blackboard in the future. For example, a respondent mentioned: "Did not have time to explore Blackboard. I am doing fine with other means of support."

Actual use of Blackboard (AU). Drawing from the survey responses, the respondents' behavioral intention (BI) largely influences their decision to use or not to use Blackboard. As it is not mandatory for the faculty members to use Blackboard, only those who have high intention (BI) to use (AU) it, do so. It was also found that some of the tech-savvy faculty members do not use it, because they find their own web-page or web-tools better than Blackboard. For example, one respondent stated: " I use my own personal class web pages." Some of the faculty members are not willing to learn how to operate Blackboard, because they believe Blackboard keeps changing its features and they think it is not worth learning the changing features again and again. In a respondent's words, "It is difficult to keeping up with revisions." However, those who use Blackboard are positive about the changing features of Blackboard and they are enthusiastic in learning the new features. This indicates that the extent of Blackboard use depends on the faculty members' level of intention to use it or not.

The summarization of the survey responses and categorization of them into TAM constructs resulted in a LMS (i.e. Blackboard) acceptance model as depicted in Figure 3.2.

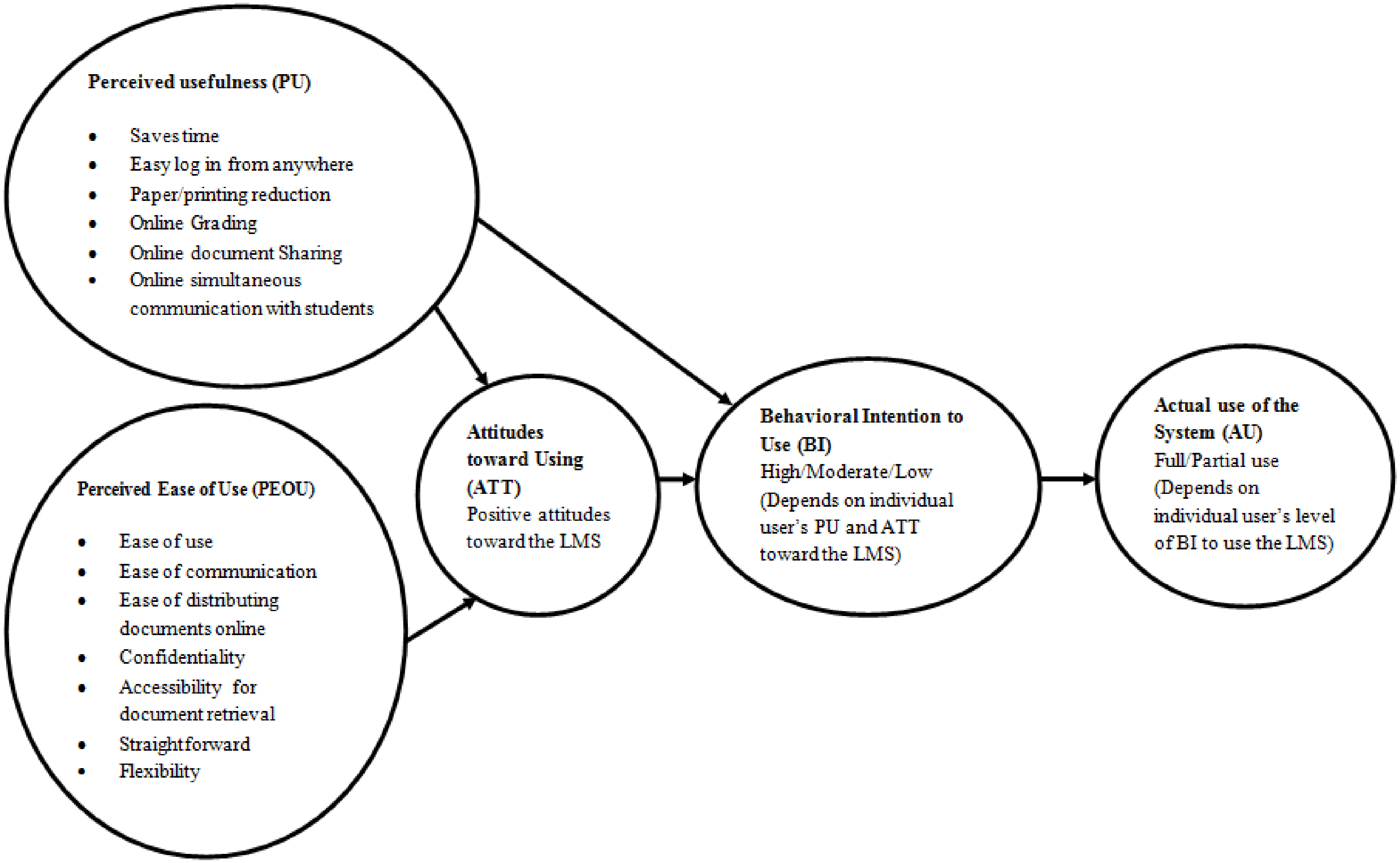

Figure 3.2 LMS acceptance Model

Perceptions of non-users

The study revealed that the responses of the non-users also had some commonalities. Out of the 36 respondents four were non-users. Survey results also revealed that 85% of the total respondents were limited users who use Blackboard for grading purposes only. The non-users and the limited users stated many of the issues as weaknesses of Blackboard. For example, poor communication, slow response, poor interface, complex design, etc. The “perceived weaknesses” (i.e. “slow response”, “lack of flexibility”, “cumbersome” etc.) and the “perceived difficulty of using the system” (i.e., “exceedingly high complexity”,” time consuming”, “frustrating”, “not clear or reliable”) negatively influenced their attitudes toward Blackboard. As a result of the negative attitude developed towards Blackboard (e.g., “Blackboard is quite ridiculous”) , this results in negative behavioral intentions (e.g., “there are other options available online for free that I can use…”).

The responses indicated that the non-users are comfortable with the traditional way of teaching and they are not willing to switch to a new system. Examples of some representative comments of the non-users classified into the TAM constructs (in a negative way) by the coders are presented in Table 3.6. From the survey responses, it was evident that the attitude of the non-users and limited users of Blackboard also followed a specific pattern, which can also be explained by the TAM framework in a negative way. It could be called “LMS Non-acceptance Model”, as depicted in Figure 3.3

Table 3.6

Representative comments of the LMS (Blackboard) non-users and limited users

TAM Constructs (In negative terms)	Non-users and Limited users' comments
Perceived Ease of Use (PEOU) as Perceived Difficulty of use (PDOU)	"Exceedingly high complexity- duplicity of functions, constantly flipping back and forth between screens, unnecessary rigor" "The interface of Blackboard is difficult to manipulate and organize. In other words, you cannot move objects or write text on the Blackboard page in the same way as using Microsoft Word."
Perceived Usefulness (PU) as Perceived Weaknesses (PW)	"Not clear or reliable" "Time consuming, convoluted, continuously having to reload due to system crashes, etc".
Attitude towards using (ATT) (Negative attitude toward using)	" It is terrible" "The Blackboard is very convoluted - it isn't designed in an intuitive fashion - I teach web design and computer applications for adobe software systems so I am quite adept in computer programming - but blackboard is quite ridiculous"
Behavioral Intention(BI) (Negative intention to use)	"There are other options available online for free that I can use to disseminate the information to the students". "Did not have time to explore blackboard. I am doing fine with other means of support provided by my institution"
Actual Use(AU) (No use)	" I use my own personal class web pages" "Just don't use it"

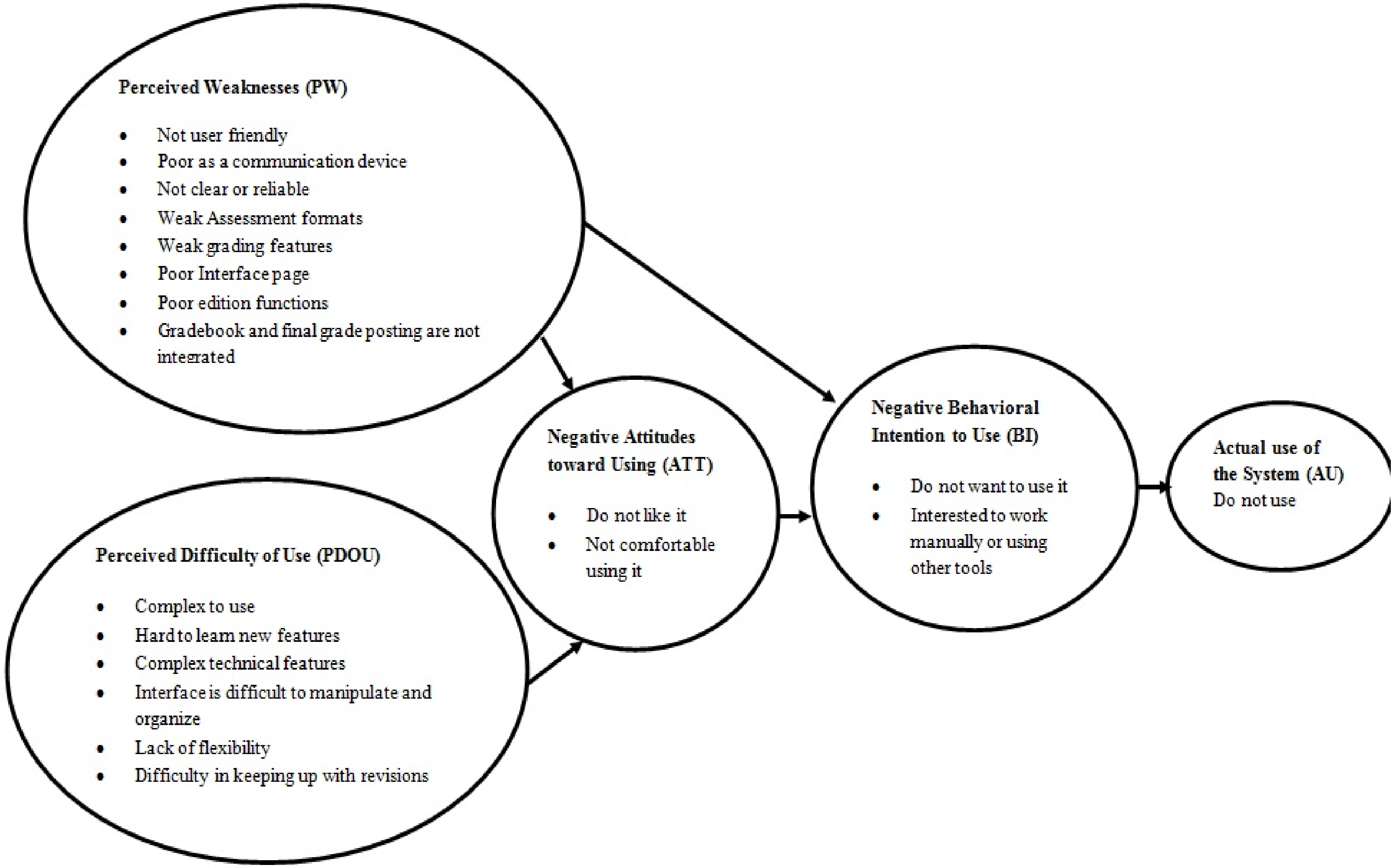

Figure 3.3. LMS non-acceptance model

Strengths and weaknesses of LMS: Faculty views

The second objective of the study was to investigate the strengths and weaknesses of LMS from the respondents' view. The responses of the "strengths" and "weaknesses" questions included redundant information that was provided in Question 1 (mention the three main reasons of your using or not using Blackboard). Therefore, the redundant information was considered and counted only once for coding. Frequency counts were conducted to understand the relative emphasis given to particular issues by the respondents.

Strengths. The respondents identified five different strengths of Blackboard. The most frequently mentioned strength was the online communication feature (39%) of Blackboard. Table 3.7 provides a frequency count of all of the strengths mentioned by the respondents.

Table 3.7
Most frequently mentioned Strengths of LMS (Blackboard)

Features	Frequency	Percent (%)
Online communication with students	11	39%
Online resource distribution /Reduced paperwork	9	32%
Straightforward, user friendly features	6	21%
Online Grade posting features	5	18%
Speed	1	3.6%

Note: 28 respondents answered the question

Weaknesses. The respondents identified four different weaknesses of Blackboard. While several weaknesses were reported (within the 4 categories), the most common weakness was Blackboard's speed and connectivity (29%) issues. Table 3.8 provides a frequency count of all weaknesses mentioned by the respondents.

Table 3.8

Most frequently mentioned weaknesses of LMS (Blackboard)

Features	Frequency	Percent
Speed and Connectivity issues	9	29%
Blackboard features issues	8	26%
Grading, Quiz and Test settings issues	6	19%
Interface and Design issues	5	16%

Note: 31 respondents answered the question

Recommendations offered by the respondents

The third objective of the study was to provide subjective assessments of faculty members concerns and recommendations toward Blackboard.

Design issues

Related to recommendations on how Blackboard can be improved, the majority of respondents (89%) identified "design issues" as the area that required the most improvement. Most of these concerns were about the poor interface design; where many stated that the interface is cumbersome and not user friendly. As a respondent mentioned, "...it would be nice if the layout/interface were more flexible and attractive." In addition to the design, some respondents reported having concerns with the complexity of Blackboard's features. Specific examples included poor quiz and assignment settings, inability to email individual students from Blackboard, the gradebook function was reported as difficult to manipulate (e.g., weighting assignments differently), and it was reported that the system ran slow when documents (e.g., research articles) were uploaded.

Design Issues Recommendation. The respondents believe a more simplified Blackboard with clear interface and user-friendly features would ensure increased use of Blackboard.

System issues

Twelve respondents (67%) focused on the problems associated with the system issues of Blackboard. Expressing their dissatisfaction with Blackboard, six participants mentioned that Blackboard is not compatible with all browsers, and six complained about the incompatibility of Blackboard with other software. Frequent system crashes and slow response time were two other issues they mentioned. According to the respondents all these issues need careful attention to encourage more use of Blackboard.

System Issues Recommendation. Blackboard should be upgraded or modified to ensure compatibility with various Internet browsers and software.

Training and awareness issues

Six (33%) out of a total 18 respondents mentioned their concerns about lack of appropriate training and awareness. In a respondent's words, "train faculty members and explain them the green side of it." According to the respondents, training and workshops would help the faculty members to get introduced with the Blackboard interface and its features and to learn how to work with Blackboard.

Training Recommendation. Faculty suggested organizing department wide regular training and workshop sessions to build Blackboard awareness among the faculty members.

Table 3.8 provides a frequency count of all of the major recommendations made by the respondents.

Table 3.9

Most frequently mentioned recommendations for LMS (Blackboard)

Issues	Frequency	Percent
Design issues	16	89%
System issues	12	67%
Training and awareness issues	6	33%

Note: 18 respondents answered the question.

In sum, three sound recommendations (see Table 3.8) were made from those faculty members that utilize Blackboard and that includes: improving the functionality and design of Blackboard (e.g., provide email options), ensure Blackboard is compatible with various (Internet) browsers and software packages, and provide training and increase awareness of Blackboard among faculty members, and others with teaching responsibility (e.g., Graduate Teaching Assistants).

Conclusion

This descriptive study provided insight into common views of faculty members about Blackboard learning management system. The TAM framework provided a generalizable approach leveraged to evaluate the faculty's attitude toward LMSs; specifically Blackboard. The analysis suggested that utilizing the TAM framework provides a practical way of organizing the open-ended information. In addition, the TAM framework is not unique to any specific field/organization. Therefore, the research framework presented here offered a generalizable approach to assess the users' attitude toward any kind of technology. What is unique about the study is the interpretation of the issues identified within each TAM construct and the initiatives to take to make improvements for Blackboard. In sum, the study provided evidence that the TAM framework holds promise for both scholars and technology developers. In particular, when used to guide the understanding of users' attitudes toward technology, the framework can help identify key attitudes that shape behavioral intentions as well as the actual usage of the technology in question.

The findings of the study helped to understand the problems associated with the specific features of Blackboard and what needs to be done to address the negative beliefs of the users and to ensure increased use of Blackboard. Based on the findings, the following conclusions were drawn. In analyzing the responses, it was apparent that many of the faculty members had difficulty working with Blackboard. This indicates that Blackboard should be redesigned to better accommodate the end-users. As an example, Blackboard should be upgraded to make it compatible with other software and with all browsers. The respondents also mentioned that Blackboard is slow, and in many instances it frequently shuts down. This suggests the technical and system issues are other areas that need careful attention.

Secondly, there is an opportunity for more training to occur on Blackboard, especially for the end-users that are either not familiar or comfortable with Blackboard, or those that use only select features of Blackboard (i.e., posting grades). As 33% of the respondents recommended to focus on Blackboard training and awareness issues, it appears the workshops and training programs that the university currently offers are not adequate to support all faculty members' needs and expectations. Offering extensive awareness programs, workshops and training sessions would help faculty members to become familiar with and skilled in using Blackboard. In addition, prior to offering Blackboard training programs, it would be help to conduct a needs analysis to better understand the individual training needs of the end-users.

The study found that, almost 85% of the Blackboard users use Blackboard for grading purposes only. This indicates that the faculty members are either not well aware of, or not interested in using the other features of Blackboard. Even if they are aware of these features, they do not know how to use them; nor, do they understand how these features could benefit or ease their teaching activities.

In general, given that universities are making considerable financial investments in the purchase of rights to LMSs, it is in the university's best interest to ensure that the system is widely utilized across faculty. In addition, periodic evaluation of LMS performance should be done, so that the decision-makers know in which areas faculty members are facing problems in working with LMS, and how to improve them to ensure more acceptance of LMS and higher faculty satisfaction with the performance of LMS.

The study has some limitations. The present research collected data only through an electronic survey and it is based on a single LMS example. It is acknowledged that, the surveys alone provide limited information and the findings therefore may not include all perspectives (Hammond & Wiriyapinit, 2005; Gilead, 2006). To cross-validate the data, future studies may employ more than one approach of data collection (i.e., interview, focus group study etc.). Conducting a quantitative study to confirm the casual relationships among the constructs of the LMS acceptance model would also be a future research direction. Follow-up studies can be conducted to track improvements of faculty pedagogical LMS use and instructional practices. A comparative study among different LMSs would also be an important area for future investigation. Moreover, discipline wide study could be conducted in the future to determine the LMS use across multiple disciplines.

CHAPTER 4.MANUSCRIPT 2 A STRUCTURAL EQUATION MODELING OF AN EXTENDED TECHNOLOGY ACCEPTANCE MODEL FOR FACULTY ACCEPTANCE OF LEARNING MANAGEMENT SYSTEMS (LMSs)

Introduction

The rapid development and expansion of the Internet since the 1990s has created the need for linking traditional learning to emerging Internet-based learning functionalities (Ramini, 2012). To keep themselves competitive in the marketplace, universities develop online learning programs as well as supplement their traditional programs by incorporating online features in them. Nowadays, universities embrace different types of Internet technologies into their academic programs. Learning Management System (LMS) is one of them. LMS can be defined as "a self-contained webpage with embedded instructional tools that permit faculty to organize academic content and engage students in their learning" (Gautreau, 2011, p.2). LMSs are also referred to as "learning platforms", "distributed learning systems", "course management systems". "Content management systems", "portals" and "instructional management systems" which combine a range of courses and pedagogical tools to provide a means of designing, building and delivering online learning environments as well as facilitating face-to-face teaching (Coates, James & Baldwin, 2005). The Internet has provided significant incentives for universities to develop LMSs to support both online and traditional campus based learning platforms. By including computer and Internet in the learning process and by offering multiple teaching learning tools, LMSs increase communications among students and teachers and improve the speed and effectiveness of the educational processes.

Eugene and Robert (2000) stated that, almost half of new information technologies that are introduced in the marketplace each year fail. Prior research has revealed that, the value of information technology innovations (i.e. LMS) lies more in the effective and efficient usage of it, than in the technology itself (Kremers & Van Dissel, 2000). Nowadays, educational institutions make considerable investments on LMSs to facilitate their teaching-learning processes. However, the expected benefits from these investments are realized only when the LMSs are accepted and used by their intended users. To this end, issues like (i) to what extent LMSs are used? (ii) What are the reasons behind using or not using LMSs? (iii) How can we ensure more pedagogical usability of LMSs? arise, which have extensive practical as well as theoretical importance. To answer these questions, it is increasingly important to (a) evaluate the users' perceptions and understanding of the factors that influence the effective use of LMS and to (b) determine the underlying causal relationships among the factors. To do so, a well-defined framework is essential.

This study attempts to explore a model to understand faculty attitudes toward LMSs. The study utilizes Davis's (1989) Technology Acceptance Model (TAM) as a baseline and offers an extended TAM in determining the faculty acceptance of LMSs. By conducting an empirical study among university faculty members, the paper examines the nature of faculty attitude under conditions of non-mandatory use of LMSs. Based on the findings, it reports on the validity of the proposed extension of Davis's (1989) TAM. TAM is chosen to use in this study because, in information systems / information technology acceptance research, it is one of the most influential research models. Due to its robustness and parsimony (Venkatesh & Davis, 2000), it has been extensively used to examine the users' acceptance of various types of computer and Internet technologies.

According to Davis , Bagozzi, & Warshaw, 1989, the goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified" (Davis , Bagozzi, & Warshaw, 1989, p.985).

Prior research has proven TAM as the most influential, commonly employed, and highly predictive model of IT adoption (Adams, Nelson & Todd, 1992; Davis, et al., 1989; Lee, Kozar, & Larsen, 2003,; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000, Venkatesh & Morris, 2000).

This study delves deeply to the TAM research by applying it in the education sector. Also, the dearth of literature focusing upon the effect of external variables on original TAM framework is addressed in this study. Based on the prior literature, this paper extends the TAM framework by including and examining the influence of three external variables on the original TAM constructs. This study expects to illustrate the faculty attitude toward LMS and its impact on LMS usage in the higher education sector, which is currently a research area of crucial importance. Also, the study anticipates that, knowledge about factors that affect the LMS usage pattern of university faculty members will assist the educational institutions to better understand what initiatives to take to improve the faculty acceptance of LMSs in higher education settings.In the next sections of the paper, a brief narrative on the technology acceptance model and its constructs is presented. Following this, a short review of prior TAM based research on LMSs, the proposed external variables to be included in TAM, the reasons behind their inclusion and the research hypotheses are presented. Then, description of the study sample, data collection measures and procedures are discussed. The next section covers data analysis using Structural

Equation Modeling (SEM) and Analysis of Moment Structures (AMOS) and reports an interpretation of the data analysis. The last section of the paper discusses the findings, implications and limitations of the study**.**

Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is based on Ajzen and Fishbein's (1980) Theory of Reasoned Action (TRA). According to TRA, an individual's intention to perform a behavior is a function of his/her attitude toward the act or behavior and social norms. An individual's attitude predicts his/her intention and intention shapes the actual behavior. TAM suggests, Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are the two fundamental determinants of user acceptance of technology (Davis,1989). PEOU is defined as "the degree to which a person believes that using a particular technology would be free from effort" (Davis 1989, p.320). PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p.320). TAM claims that PU will be influenced by PEOU: others things being equal, the easier a technology to use, the more useful it can be. When users' find a technology "easy to use", then they perceive the technology as a "useful one". TAM offers the causal relationships of these two fundamental constructs: PEOU and PU with three other constructs "attitude toward using (ATT)", "behavioral intention to use (BI)" and "actual use (AU)". ATT is defined as "an individual's positive or negative feeling about performing the target behavior (e.g., using a system)" (Fishbein & Ajzen 1975, p.216). According to TAM, both PEOU and PU influence the users' attitude toward using a technology. It claims that if users find a technology useful and easy to use than they develop a positive attitude toward this technology. The fourth construct in the TAM, BI, is defined as the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior (Davis, 1989). TAM claims, PU and ATT directly influences BI. If users find a specific technology as a useful one (PU) then they develop a positive intention of using it. Similarly users' positive attitude toward a specific technology leads them developing an intention to use this technology. TAM suggests users BI shapes their actual use of the technology (AU). If users have intention to use a specific technology then they use it.

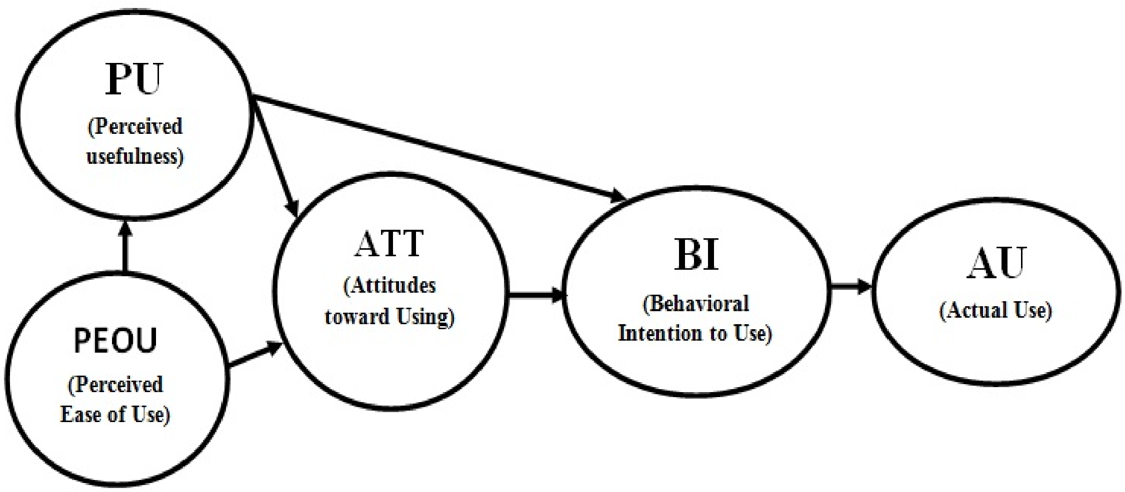

Figure 4.1. Technology Acceptance Model (TAM) (Davis, Bagozzi & Warshaw, 1989, p.985)

Though TAM is a widely accepted and used framework, a recent meta-analysis of TAM framework stated that, non-inclusion of external variables in TAM is a limitation of this framework (Legris, Ingham & Collerette, 2003). To address this issue, researchers have elaborated Davis's (1989) work, by adding external variables in the original TAM framework and examining the influences of those variables in technology usage.

Another limitation of TAM, as mentioned by Venkatesh and Davis (1996), is:while being very powerful in helping us predict acceptance, one of the limitations of TAM is that it

> does not help understand and explain acceptance in ways that guide development beyond suggesting that system characteristics impact ease of use….In order to be able to explain user acceptance and use, it is important to understand the antecedents of the key TAM constructs, perceived ease of use and usefulness" (p. 472-473).

Sometimes users find the system to be too difficult to use, therefore, they do not use it (Venkatesh, 1999). Though many empirical tests of TAM revealed PU and PEOU have consistently been strong determinants of usage intentions and usage (Venkatesh & Davis, 1996, 2000), little research has been done to know the determinants of these two key constructs: PEOU and PU. Moreover, research on TAM's application in education is limited, though it has been designed to study technology acceptance decisions across different organizational settings and users' population (Teo, Lee & Chai, 2008). To overcome the limitations, examining TAM's implication in the education sector and exploring the determinants of PEOU, PU are important. This paper expects to contribute to the TAM literature by attempting to examine an extended TAM by including additional key determinants (external variables) of PEOU and PU, and to reveal their effects (if any) on the faculty usage of LMSs.

Study Context

Internet based LMSs have matured during the past decade and have been supporting distance, face-to-face and hybrid/blended learning (Connolly, MacArthur, Stansfield, & McLellan, 2007; Conrey & Smith 2007; DeNeui & Dodge 2006; El Mansour & Mupinga 2007; Vaughan 2007). To offer the internet based learning facilities, universities have been using different LMS platforms like Moodle, Blackboard,WebCT, Desire2Learn etc. The current study focuses on Canvas: a recently introduced LMS in the marketplace. Instructure Inc. an educational software company based in Sandy, Utah (US) founded in 2008, launched Canvas to post-secondary institutions in February 2011. Together with the standard features of LMSs, Canvas provides advanced options like learning outcomes, peer review, migration tools, e-portfolios, screen sharing and video chat etc. Canvas is currently used by more than 300 colleges, universities and school districts (www.instructure.com). The philosophy behind building Canvas in the words of Instructure Inc. is "put technology on the side of the individuals who can use it to chart the future of learning." According to Instructure.com, they built Canvas on the basis of what the users wanted in an LMS and they have continued to grow it through the users' feedback and suggestions.

Review of LMSs Research

The Internet and traditional classroom teaching methods are not mutually exclusive, but an extra dimension in education which can facilitate the faculty members' tasks while benefiting the students as well (Volery & Lord, 2000). The combination of e-learning and face-to-face teaching increases accessibility, flexibility and choices for interactivity (Rosenberg, 2001). LMS provides tools and functions like course management tools, online group chats and discussions, documents (lecture materials, homework and assignments etc.), power points, video clips uploading, grading and course evaluations to support teaching and learning. However, there is an increasing concern regarding the quality of the interface and the ways in which tasks are completed in teaching using LMSs. Freire, Arezes, Campos, Jacobs and Soares (2012) stated that, the definition of the term "usability" varies according to the area in which it is being studied. In the view point of ergonomics, the term "usability" can be defined as "the capacity a system has to offer to the user in carrying out of his tasks, in an effective efficient and satisfactory manner"(Freire et al., 2012, p.1039). The authors stated that, to evaluate the LMSs' usability “the users’ perspective”, not anymore “the systems perspective”, is the main point to look at (Freire et al., 2012).

Prior studies on LMS usage have both similarities and contradictions among their findings. Many of the prior studies about use of LMSs have found that, not all the functions of LMSs were equally used by the users, some functions are used more frequently than the other functions (Akpinar, Bal & Simsek, 2004; Grant, 2004; Woods, Baker & Hopper, 2004). Selim (2003) found that usefulness and ease of use turned out to be good determinants of the student acceptance and use of a course website as an effective and efficient learning technology. Lee, Cheung, and Chen (2005) investigated university students’ Internet-based learning medium adoption behavior, they included perceived enjoyment as an intrinsic motivator in addition to perceived usefulness and perceived ease of use into the TAM and found that perceived usefulness and perceived enjoyment had an impact on both students’ attitude toward and students’ intention to use Internet-based learning medium. Pituch and Lee (2006) conducted a study on college students’ e-learning usage. They reported that system characteristics were important determinants to perceived usefulness, perceived ease of use, and use of an e-learning system. Saadé, Nebebe, and Tan (2007) found that PU has significant effect on university students’ attitude toward Multimedia learning Environments (MMLS). Their study also revealed that students’ attitudes affect their behavioral Intention to use MMLS. Weaver, Spratt and Nair (2008) reported that in using LMS, system quality is important to both the students and faculty. Park (2009) revealed that both e-learning self-efficacy and subjective norm play an important role in affecting attitude (students) towards e-learning and behavioral intention to use e-learning.

Literature shows, a number of prior TAM based LMS studies have explored students’ acceptance of and intention to use LMS (i.e., Selim, 2003, Lee, Chaung & Cheng, 2005, Park, 2009). The less covered area in LMSs research is the faculty perspectives of LMS usage, more specifically, what faculty members think about LMSs and what factors affect their LMS usage behaviors. This study focuses on this largely unexplored area with an expectation that understanding the factors that affect the faculty LMS usage can shed light on the development, selection, training, maintenance and investments on such systems.

Research Model and Research Hypotheses

Utilizing the original TAM as the core framework, this study proposes an extension of it by incorporating three external variables within it. In order to provide a better understanding to the exploration of LMS acceptance amongst faculty members, object oriented factor “System quality”, personal factor “perceived self-efficacy” and environment based factor “facilitating conditions” are incorporated in the original TAM as anchors (external variables) that determine the faculty perceptions about the system (i.e. LMS). The proposed model is depicted in Figure 4.2.

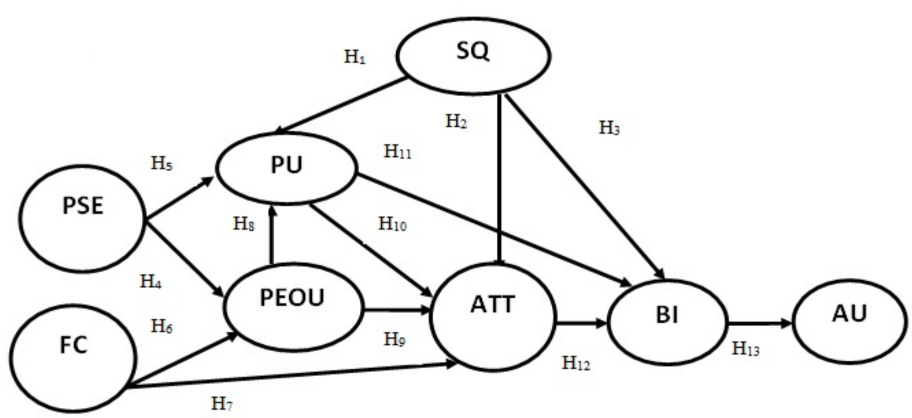

Figure 4.2. Proposed research model for faculty acceptance of LMSs

The rationale for adding and examining these three specific external variables in the TAM is that existing TAM research reported that through PEOU and PU, these three variables significantly affect the technology (i.e. LMS) usage behavior. This study attempts to explore their effect on LMS usage behavior. Brief definitions of the proposed external constructs are presented below. Also, the inferences of the proposed three factors as antecedents of usage in the LMS context and related hypotheses are further detailed.

System Quality (SQ)

SQ in the Internet environment measures the desired characteristics (usability, availability, reliability, adaptability, and response time) of an e-commerce system (i.e. LMS) (Delone & Mclean, 2003). Here in this study, SQ measures the quality related to the functions, speed, features, contents, interaction capability of LMS. Prior research found SQ's significant effect on PU (Andersson, 2006, Condie & Livingston, 2007; Dong Hee 2009a;2009b; Hong, Thong, Wong & Tam, 2002); Pituch & Lee 2006; Russell, Bebell & O'Connor, 2003, Wang & Wang, 2009;Wixom & Todd, 2005). Studies also reported SQ's significant positive effect on ATT (i.e. Dong Hee, 2009a, 2009b) and on BI (i.e. Delone & Mclean, 2003). Based on prior literature findings, three hypotheses are formulated about the relationship of SQ with PU, ATT and BI. The theme behind these hypotheses is, if a system has all the expected characteristics in it, then users will (i) find it as a useful system (ii) develop a positive attitude toward the system and also (iii) develop a positive intention to use the system. All these hypotheses are supported by prior literature.

H_1: System Quality (SQ) of LMS has a significant positive effect on the perceived usefulness (PU) of LMS

H_2: SQ of LMS has a significant positive effect on faculty members' attitudes (ATT) toward using LMS

H_3: SQ of LMS has a significant positive effect on faculty members' behavioral intention (BI) of using LMS

Perceived Self-efficacy (PSE)

PSE can be defined as "an individual's judgment of his or her capability to organize and execute the courses of action required to attain designated types of performances. It is not concerned with the skills one has, but with the judgments of what one can do with whatever skills one possesses" (Bandura, 1986, p.391). Here in Canvas / LMS usage context, PSE indicates a faculty member's judgment or the confidence of his/her own capability of operating/ navigating/ working with Canvas. In general, users with higher perceived self-efficacy develop stronger perceptions of PEOU and PU of a system. In contrast, if an individual perceives himself/ herself as less capable of using a system (i.e. LMS) than he/she will find the system as 'less useful' and 'difficult to use'. Prior research reported that higher PSE helps forming a positive perception of PEOU of a system (Grandon, Alshare, & Kwan, 2005; Martinez, 2006; Ong & Lai, 2006; Ong, Lai, &Wang, 2004; Pituch & Ya-Ching, 2006; Roca, Chiu & Venkatesh & Davis, 1996; Ya-Ching, 2006; Yuen & Ma, 2008). Also, a number of recent studies revealed PSE's significant positive effect on PU (Compeau & Higgins, 1995, Compeau, Higgins & Huff., 1999, Ong, et.al., 2004, Ong & Lai, 2006). Drawings on these two hypotheses are made which were supported by prior literature:

H_4: Faculty members' perceived self-efficacies (PSE) have significant positive effects on their perceived ease of use (PEOU) of LMS

H_5: Faculty members' PSEs have significant positive effects on their PU of LMS

Facilitating Conditions (FC)

FCs are environmental factors (Ngai, Poon & Chan, 2007) that can be stated as "perceived enablers or barriers in the environment that influence a person's perception of ease or difficulty of performing a task" (Teo, 2010a). Venkatesh and Bala (2008) elaborated it and stated that "FCs are related to individuals' control beliefs regarding the availability of organizational resources and support structures to facilitate the use of a system". FCs are environmental factors (Ngai, et.al. 2007) . Here in LMS context, FCs indicates the availability of the related resources i.e technical help, internet infrastructure, hardware, software, training, online help to work with Canvas. Previous studies (e.g. Venkatesh, Morris, Davis & Davis, 2003, Teo, 2010a) suggested FC is a key belief that influences user adoption of technology. A number of prior studies found FC's significant effects on PEOU (i.e. Ngai, et. al., 2007; Teo, 2010a, Teo, Lee & Chai, 2007) and on ATT (i.e., Igbaria, 1990; Ngai, et. al.;2007; Teo, 2010a). Therefore, the current study assumes that FC will have positive effects on the PEOU and ATT. Two hypotheses are made about the relationship of FC with PEOU and PU.

H_6: FC has a significant positive effect on faculty members' PEOU of LMS

H_7: FC has a significant positive effect on faculty members' attitude (ATT) toward using LMS.

Hypotheses related to five original TAM constructs

Applying the arguments claimed by TAM (Davis, 1989) regarding the technology adoption behavior and considering the prior TAM based research findings; this paper offered the following hypotheses for LMS usage

H_8: The PEOU of LMS will have a significant positive effect on PU of LMS

H_9: PEOU of LMS will have a significant positive effect on Faculty members' ATT toward using LMS

H_{10}: PU will have a significant positive effect on faculty members' ATT toward LMS use

H_{11}: PU will have a significant positive effect on faculty members' BI to use LMS

H_{12}: Faculty members' ATT toward using LMS will have a significant positive effect on their BI of using LMS

H_{13}: Faculty members' ATT toward using LMS will have a significant positive effect on their actual use (AU) of LMS.

Method

This study was Institutional Review Board (IRB) approved. Data were collected through a web based survey from the individuals with teaching responsibilities (faculty members and graduate teaching assistants) from two universities in the US. Using a purposive sampling method, two universities were selected on the basis of their similarity in the institutional characteristics and LMS adoption background. Both of the universities selected were public, land grant, research universities in the USA that use Canvas as their LMSs. Both of the universities had been using Blackboard before they adopted Canvas as their LMS. Both of the universities had Blackboard and Canvas available for their faculty members for at least a year, before started using Canvas exclusively. One of these universities started using Canvas exclusively from Fall 2011 and the other one from Spring 2013. In both of the universities, faculty members have the flexibility to use none, some, or all of the available features of Canvas. Also, they are allowed to use any other software over and beyond Canvas in facilitating their teaching-learning activities.

Participants

In total, 560 individuals completed the survey with an average response rate of 24%. As it was not possible to know who uses Canvas and who does not, email invitations were sent to the faculty members and GTAs irrespective of whether they use Canvas or not. However, those who do not use Canvas did not participate in the survey. Therefore, the response rate was low, because it was the percentage of the total faculty members and GTAs (both Canvas users and non-users) to whom the survey invitations were sent. Out of the 560 respondents 298 (53.21%) were male and 262 (46.79%) were female. Most of the respondents (30.18%) were at the age range of 51-60. Among the rest of the respondents, 22.32% were at age range of 31-40, 19.29% were at 41-50, 15.36% were at 30 or less, 11.96% were at 61-70, 89% were at 70 and up. A majority of the respondents were Associate Professors (27.3%), Assistant Professors (19.3%) and Professors (18.6%). The rest 34.8%, were GTAs (13.8%), Lecturers (7.7%), Instructors (7.1%) and others (6.1%). The academic disciplines represented include, Liberal Arts (18.4%), Education (13%), Science and Mathematics (11.4%) Engineering (11.3%), Forestry (11.1%), Business (8%), Agriculture (5.7%), Architecture (6.1%), Human Sciences (6.8%), Nursing (3.2%), Pharmacy (1.8%), Veterinary Medicine (2.3%) and others (.7%). One respondent (.2%) did not mention his academic discipline. Out of all respondents 39.3% have been using Canvas for more than a year, 37.3% for 6 months to one year and 23.4% for less than 6 months. The detailed descriptive statistics of the respondents' demographics are presented in Table 4.1.

Table 4.1.
Demographics (Gender, Age, Academic Rank, Academic Field, Experience)

Gender	Total	Percent
Male	298	53.21%
Female	262	46.79%
Total	560	100%

Age Range	Total	Percent
30 or less	86	15.36%
31-40	125	22.32%
41-50	108	19.29%
51-60	169	30.18%
61-70	67	11.96%
70 and up	5	0.89%
Total	560	100%

Academic Rank	Total	Percent
Graduate Teaching Assistant	77	13.75%
Instructor	40	7.14%
Lecturer	43	7.68%
Assistant Professor	108	19.29%
Associate Professor	153	27.32%
Professor	104	18.57%
Other	35	6.25%
Total	560	100.00%

Academic Field	Total	Percent
Agriculture	32	5.70%
Architecture	34	6.10%
Business	45	8.00%
Education	73	13.00%
Engineering	63	11.30%
Forestry and Wildlife Sciences	62	11.10%
Human Science	38	6.80%
Liberal Arts	103	18.40%
Nursing	18	3.20%

Pharmacy	10	1.80%
Science And Mathematics	64	11.40%
Veterinary Medicine	13	2.30%
Others	4	0.70%
%Did not mention	1	0.20%
Total	560	100%

Canvas Use	Total	Percent
Less than 6 months	131	23.40%
6 months to 1 year	209	37.30%
More than an year	220	39.30%
Total	560	100%

Measures

The survey questionnaire was composed of a total of 28 measurement scales on eight constructs (SQ, PSE, FC, PEOU, PU, ATT, BI, and AU). The measurement scales were adapted from previously studied and validated measures (Davis, 1989, Matheison, 1991, Moore & Benbasat, 1991,Taylor & Todd 1995a,Venkatesh & Davis, 1996) (see Table 4.2). However, to reflect the characteristics of LMS usage, the measurement items were restated wherever necessary. The Participants gave their opinion to each of the total 25 statements of the SQ, PSE, FC, PEOU, PU, ATT and BI constructs on a seven point Likert scale ranging from 1 being "Strongly Disagree" to 7 being "Strongly Agree". The three items of AU construct were measured on a 7 point Likert-type scale with the end points from 1 to 7, 1 being 'not used at all' and 7 being 'Extremely frequent use'.

Table 4.2
Measurement Items

Construct	Items	Adapted from	Measurement Scale
System Quality (SQ)	4	Liaw S.(2008)	Likert Scale→1 to 7
Perceived Self-efficacy (PSE)	3	Liaw S.(2008)	(1 being "Strongly disagree" and 7 being "strongly agree")
Facilitating Conditions (FC)	3	Teo (2010a); Thompson, Higgins & Howell (1991); Venkatesh, et. al.(2003).	
Perceived Ease of Use (PEOU)	4	Venkatesh & Davis (2000)	
Perceived Usefulness (PU)	4	Venkatesh & Davis (2000)	
Attitude toward Using (ATT)	4	Compeau & Higgins (1995); Ngai et. al.,(2007).	
Behavioral Intention to use (BI)	3	Liaw (2008)	
Actual Use (AU)	3	Malhotra & Galletta, (1999)	Likert Scale→1to 7 (1 being "Not use at all" and 7 being "extremely frequent use")
Total	28		

Procedure

In Spring 2013, a web based survey was conducted among the faculty members of these two universities to collect data for the proposed model's empirical assessment. The email list of the faculty members were collected from the university websites. The department contact persons were contacted to get the email lists of the Graduate Teaching Assistants (GTAs) of the respective departments. A few of them responded and provided the email lists of the GTAs. An email invitation including the survey link was directly sent to the participants (faculty members and GTAs) in the last week of January 2013. Later, two reminder emails were sent to fill-in the survey, one in the last week of February 2013 and another in last week of March 2013. Data collection continued from January- April, 2013. Survey participation was voluntary and no incentives were offered to the participants. To ensure that the participants respond without being concerned with social expectations, data collection was anonymous and no identifiable information was collected.

The web based software Qualtrics.com was used to collect data. There were three parts in the survey (see Appendix C). The first part of the survey includes the survey information letter, approval letter from IRB, the risks, benefits, data privacy and security related issues and consent agreement of participating in this survey. The second part includes the questions related to Canvas usage and issues associated with it and the third part includes the demographic information. The survey items were randomized to avoid potential order effects. To ensure honest responses irrespective from the respondents' demographics, the demographic information (age, gender, academic rank and academic field) was asked at the last part of the survey questionnaire.

Instrument Validation

Two content experts examined the survey items and suggested minor modifications. Following the experts' suggestions, the items were revised. Later, to determine the adequacy and understandability of the survey items, the survey questionnaire was pilot-tested within a group of 10 faculty members. The group responded to the survey using the web link sent to them through email. Based on the feedback from the pilot test, the questionnaire was refined and revised and the final questionnaire was developed.

Reliability analysis

Cronbach's alpha reliability test was conducted to test the internal consistency of the indicators of each of the eight constructs. The reliability statistics (see Table 4.3) shows the alpha coefficients for all eight scales are above .70 (ranges from .870 to .963), suggesting that the items have relatively high internal consistency (Hair, Anderson, Tatham & Black, 1998).

Table 4. 3

Reliability Statistics of Measurement Items

Scale	Items	Items retained	Cronbach's Alpha
SQ (System Quality)	4	4	.870
PSE (Perceived Self-efficacy)	3	3	.930
FC (Facilitating Conditions)	3	3	.883
PEOU (Perceived ease of use)	4	4	.934
PU (Perceived Usefulness)	4	4	.963
ATT (Attitude toward using)	4	4	.963
BI (Behavioral Intention)	3	3	.898
AU (Actual Use)	3	3	.875

Data Analysis

Following Anderson and Gerbing's (1988) recommendations, a two-step approach for Structural Equation Modeling (SEM) has been used for data analysis. At the first step, a Confirmatory Factor Analysis (CFA) was conducted to develop the measurement model. To examine the causal relationships among all constructs, the proposed structural model was tested using SEM. A software program called Analysis of Moment Structures (AMOS) and part of the Statistical Package for the Social Sciences (SPSS) software (Arbuckle, 2007) were used to conduct the CFA and SEM. SEM was chosen to use because it simultaneously analyses the paths in the model and tests the goodness of fit of the model.

Data were collected from 650 participants. For CFA studies five subjects per variable (Loehlin, 1998, Marsh, Balla, & McDonald, 1988) and for SEM studies 10 participants for each free parameter (Hoe, 2008) are suggested by researchers' set guidelines. So the sample size (n=650) was sufficient to conduct CFA and SEM of the proposed model with 28 parameters in it. CFA was employed to measure the construct validity of the instrument used in the study. SEM techniques using AMOS graphics were employed to evaluate the fit of both the measurement and structural components of the proposed model.

As suggested by Kline (2005) five steps: (i) model specification, (ii) model identification, (iii) data preparation and screening, (iv) estimation of model and (v) model re-specification (if necessary) were followed while conducting SEM. To assess the model's overall goodness of fit, nine model-fit measures from three categories (Absolute fit indices, Incremental fit indices and Parsimonious fit) indices were used. The study reports Chi Square statistics (CMIN), Relative Chi-square, Root Mean Squared Error of Approximation (RMSEA), Standardized Root Mean Residual (SRMR), Comparative Fit Index (CFI), Incrimental Fit Index (IFI), Normed Fit Indices (NFI), Tucker Lewis Index (TLI), and Akaike Information Criterion (AIC). Though CMIN is sensitive to large samples, all other fit indices used in this study are less sensitive to sample size.

Data Screening and Normality test

Descriptive analysis of the data and their distribution were conducted. No missing data were found since the survey software (Qualtrics.com) prevented to record any partially completed survey. Both univariate and multivariate normality of data were tested before conducting CFA and SEM. The skewness and kurtosis of the data ranged from -1.516 to + 0.07 and from -1.414 to 2.55 respectively. The skewness and kurtosis indices did not exceed [3] and

[10], so the data for this study were considered as univariately normally distributed (Kline, 2005). Using Madria's coefficient (1970) or Critical Ratio (c.r value), multivariate normality was assessed. Bentler (2005) suggested that, the c.r value >5.00 is indicative of non-normally distributed data. With Kurtosis of 371.666 and c.r value of 80.084 the data indicates that multivariate normality assumption was violated (See Table 4.4). Therefore, Bollen-Stine bootstrap method was used instead of Maximum Likelihood Estimation method for inference of exact measurement and structural model (Byrne, 2009).

Table 4.4

Assessment of normality (Group number 1)

Variable	min	max	skew	c.r.	kurtosis	c.r.
PEOU1	1	7	-0.765	-7.388	-0.161	-0.778
AU1	1	7	0.07	0.673	-1.414	-6.83
AU2	1	7	-1.135	-10.967	-0.188	-0.909
AU3	1	7	-0.406	-3.927	-1.352	-6.53
BI1	1	7	-1.426	-13.773	2.098	10.136
BI2	1	7	-0.689	-6.652	-0.355	-1.713
BI3	1	7	-1.516	-14.644	2.55	12.318
ATT1	1	7	-1.21	-11.692	0.911	4.4
ATT2	1	7	-0.68	-6.567	-0.504	-2.433
ATT3	1	7	-0.773	-7.47	-0.3	-1.448
ATT4	1	7	-0.839	-8.101	-0.254	-1.225
PU1	1	7	-0.677	-6.541	-0.345	-1.667
PU2	1	7	-0.547	-5.285	-0.701	-3.387
PU3	1	7	-0.694	-6.701	-0.293	-1.416
PU4	1	7	-1.033	-9.979	0.517	2.499
PEOU2	1	7	-0.47	-4.543	-0.744	-3.593
PEOU3	1	7	-0.704	-6.802	-0.407	-1.968
PEOU4	1	7	-0.465	-4.49	-0.883	-4.267
PSE1	1	7	-1.033	-9.983	0.443	2.14
PSE2	1	7	-0.913	-8.822	0.14	0.675
PSE3	1	7	-0.62	-5.991	-0.271	-1.309
FC1	1	7	-0.761	-7.351	0.042	0.204
FC2	1	7	-0.775	-7.488	-0.086	-0.418
FC3	1	7	-0.896	-8.657	0.34	1.644
SQ1	1	7	-1.036	-10.006	0.204	0.987
SQ2	1	7	-1.018	-9.838	0.178	0.859
SQ3	1	7	-0.992	-9.582	0.303	1.462
SQ4	1	7	-0.765	-7.387	-0.306	-1.479
Multivariate					**281.589**	**81.288**

The overall LMS usage was measured using eight constructs and 28 variables. Table 4.5 presented the means and standard deviations of all of the constructs and items. As shown in

Table 4.5 the mean scores of all the items ranged from 4.23 to 5.56 (neutral to agree) and the standard deviations of the scores ranged from 1.36 to 2.23, indicating that on average faculty members are neutral or agreed on the statements.

Table 4.5

Mean and Standard Deviation of the measurement Constructs and Items

Constructs and Items	Mean	SD	Constructs and Items	Mean	SD
System Quality (SQ)	4.93	1.48	Perceived Usefulness (PU)	4.74	1.68
SQ1	4.91	1.60	PU1	4.67	1.67
SQ2	5.09	1.47	PU2	4.53	1.78
SQ3	4.96	1.60	PU3	4.66	1.68
SQ4	4.77	1.26	PU4	5.08	1.59
Perceived Self Efficacy (PSE)	4.98	1.51	Behavioral Intention (BI)	5.25	1.48
PSE1	5.14	1.49	BI1	5.46	1.39
PSE2	5.02	1.50	BI2	4.74	1.69
PSE3	4.79	1.52	BI3	5.56	1.36
Facilitating Conditions(FC)	5.27	1.51	Attitude toward Using (ATT)	4.92	1.70
FC1	5.18	1.53	ATT1	5.28	1.56
FC2	5.31	1.52	ATT2	4.69	1.77
FC3	5.33	1.49	ATT3	4.85	1.72
Perceived Ease of Use(PEOU)	4.59	1.61	ATT4	4.85	1.75
PEOU1	4.88	1.50	Actual Use (AU)	4.94	2.10
PEOU2	4.56	1.59	AU1	4.54	1.97
PEOU3	4.68	1.65	AU2	5.52	2.09
PEOU4	4.23	1.69	AU3	4.75	2.23

Confirmatory Factor Analysis (CFA)

CFA was used to test the factorial structure of the hypothesized eight factor measurement model (Figure 4.3). All these factors were allowed to correlate. Each of the 28 measures was allowed to load only on the main factor of interest not on any other factors. The CFA was conducted using the data collected from the sample of 560 participants.

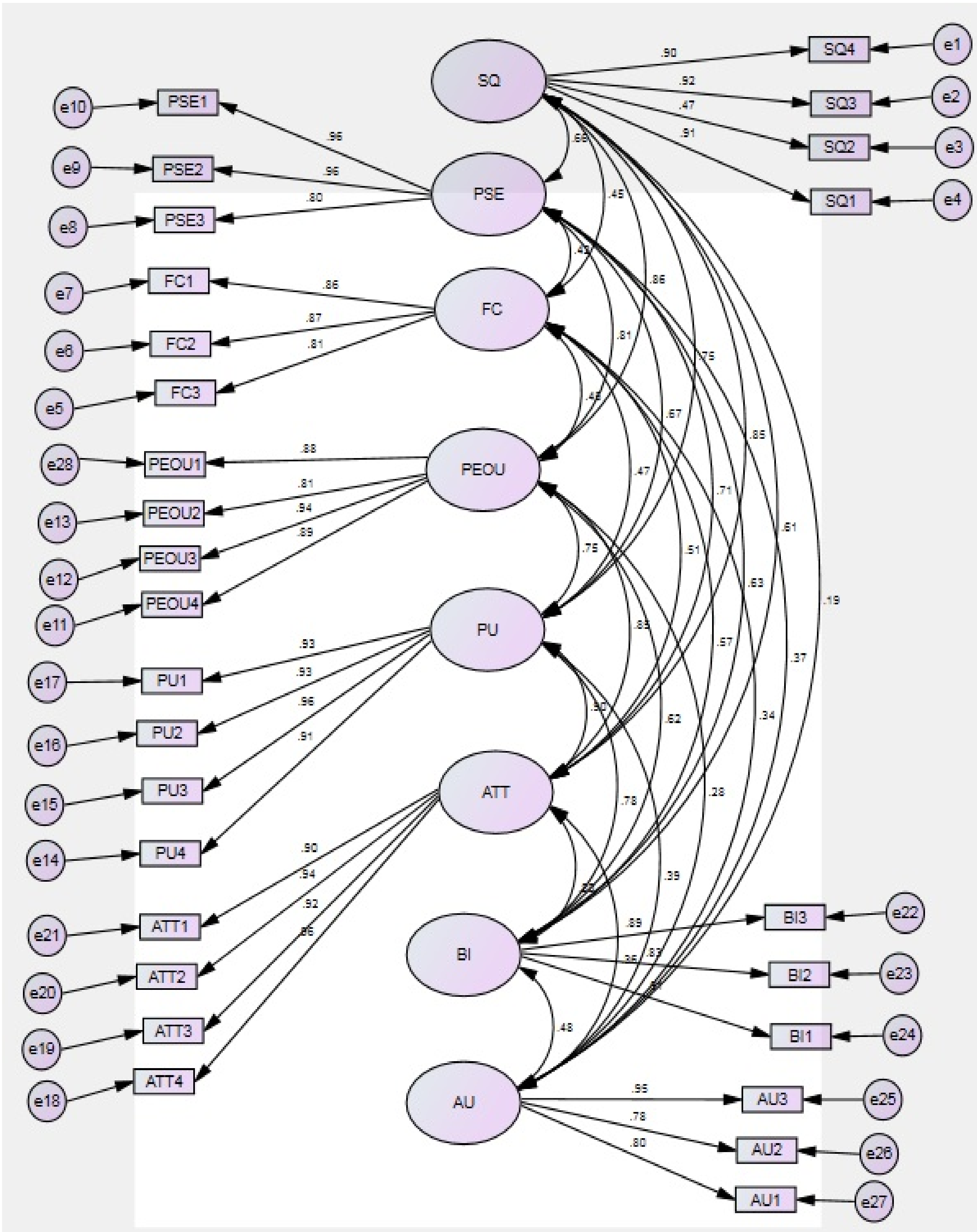

Figure 4.3 The hypothesized eight factor CFA model for faculty attitude toward LMSs

Bivariate Correlations and factor loadings

To investigate the linearity between the observed variable, bivariate pearson correlation coefficient was computed. All of the inter-item correlation values of the indicators of each of the eight constructs were significant and in medium to high levels ranging from (.42 to .92) (Cohen, 1988) (See Table 4.6). It indicated that the items and constructs were interrelated to each other and the linearity assumption between indicator and latent variables were not violated.

Table 4.6

Correlation Matrices

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
SQ1	1																											
SQ2	.429**	1																										
SQ3	.840**	.450**	1																									
SQ4	.808**	.416**	.847**	1																								
PSE1	.586**	.326**	.597**	.592*	1																							
PSE2	.556**	.300**	.558**	.557*	.919**	1																						
PSE3	.537**	.299**	.548**	.534*	.765**	.762**	1																					
FC1	.426**	.275**	.405**	.406*	.403**	.388**	.405**	1																				
FC2	.335**	.218**	.311**	.309*	.294**	.262**	.295**	.746**	1																			
FC3	.299**	.269**	.280**	.297*	.328**	.328**	.362**	.682**	.720**	1																		
PEOU1	.684**	.394**	.692**	.701*	.717**	.727**	.630**	.437**	.326**	.378**	1																	
PEOU2	.550**	.365**	.536**	.566*	.645**	.658**	.558**	.316**	.185**	.263**	.775**	1																
PEOU3	.739**	.370**	.732**	.735*	.729**	.722**	.634**	.417**	.299**	.321**	.817**	.783**	1															
PEOU4	.777**	.351**	.726**	.741*	.657**	.646**	.614**	.434**	.323**	.318**	.765**	.702**	.847**	1														
PU1	.652**	.294**	.619**	.608*	.607**	.576**	.544**	.425**	.341**	.349**	.629**	.502**	.655**	.619*	1													
PU2	.642**	.319**	.635**	.621*	.627**	.593**	.547**	.417**	.334**	.337**	.644**	.535**	.671**	.636*	.863**	1												
PU3	.655**	.306**	.635**	.622*	.612**	.573**	.546**	.435**	.345**	.349**	.631**	.517**	.656**	.637*	.893**	.906**	1											
PU4	.697**	.317**	.681**	.650*	.626**	.588**	.574**	.437**	.377**	.374**	.647**	.521**	.690**	.645*	.844**	.828**	.871**	1										
ATT1	.691**	.297**	.687**	.659*	.587**	.555**	.552**	.450**	.390**	.372**	.652**	.517**	.680**	.636*	.791**	.768**	.802**	.837**	1									
ATT2	.755**	.367**	.752**	.736*	.667**	.636**	.608**	.451**	.352**	.351**	.734**	.603**	.800**	.748*	.772**	.787**	.784**	.792**	.826**	1								
ATT3	.697**	.360**	.686**	.655*	.627**	.597**	.572**	.448**	.385**	.388**	.670**	.530**	.712**	.674*	.799**	.799**	.809**	.823**	.852**	.866*	1							
ATT4	.795**	.395**	.759**	.759*	.675**	.640**	.610**	.488**	.395**	.390**	.726**	.604**	.790**	.755*	.782**	.785**	.791**	.818**	.857**	.922*	.879**	1						
BI1	.487**	.297**	.473**	.437*	.537**	.498**	.484**	.464**	.407**	.389**	.482**	.375**	.506**	.468*	.625**	.627**	.656**	.705**	.693**	.615*	.686**	.652**	1					
BI2	.532**	.292**	.509**	.495*	.551**	.528**	.559**	.440**	.385**	.386**	.556**	.436**	.574**	.566*	.670**	.688**	.686**	.695**	.684**	.705*	.731**	.699**	.755**	1				
BI3	.529**	.315**	.499**	.491*	.548**	.513**	.485**	.479**	.440**	.447**	.496**	.395**	.524**	.496*	.601**	.598**	.634**	.709**	.683**	.623*	.686**	.667**	.834**	.694**	1			
AU1	.225**	.065	.222**	.211*	.339**	.365**	.355**	.301**	.283**	.330**	.321**	.183**	.265**	.220*	.365**	.348**	.363**	.384**	.319**	.318*	.354**	.328**	.413**	.420**	.411**	1		
AU2	.158**	.074	.154**	.152*	.282**	.309**	.246**	.206**	.187**	.215**	.234**	.164**	.214**	.163*	.332**	.317**	.314**	.329**	.301**	.272*	.310**	.272**	.377**	.382**	.384**	.584*	1	
AU3	.160**	.055	.143**	.149*	.305**	.326**	.298**	.272**	.255**	.270**	.274**	.187**	.241**	.172*	.334**	.320**	.325**	.341**	.309**	.301*	.330**	.299**	.367**	.408**	.369**	.764*	.748**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Tabachnick and Fidell (2007) suggested that loading above 0.71 are excellent, 0.63 very good, 0.55 good, 0.45 fair, and 0.32 poor. Here in this study, all indicators significantly loaded onto the respective factors. The loadings were fair to excellent ranging from 0.473 to .962 (see Table 4.7).

Table 4.7

Factor Loadings/ Standardized regression weights coefficients

Items	←	Factors	Loading	Items	←	Factors	Loading
SQ1		SQ	0.909	PU1		PU	0.927
SQ2		SQ	0.473	PU2		PU	0.931
SQ3		SQ	0.925	PU3		PU	0.959
SQ4		SQ	0.904	PU4		PU	0.913
PSE1		PSE	0.96	ATT1		ATT	0.897
PSE2		PSE	0.955	ATT2		ATT	0.945
PSE3		PSE	0.802	ATT3		ATT	0.922
FC1		FC	0.86	ATT4		ATT	0.962
FC2		FC	0.869	BI1		BI	0.914
FC3		FC	0.811	BI2		BI	0.832
PEOU1		PEOU	0.883	BI3		BI	0.886
PEOU2		PEOU	0.813	AU1		AU	0.799
PEOU3		PEOU	0.944	AU2		AU	0.779
PEOU4		PEOU	0.889	AU3		AU	0.953

Also, the unstandardized parameter estimates and the critical ratios for all 28 items were significant (See Table 4.8) which supported the items and their relationships with their relative latent constructs.

Table 4.8

Unstandardized parameter estimates of the 28 item measurement model (8 correlated factors)

Item		Factor	Estimate (Unstandardized Estimates)	Standard error of estimates	Critical Ratio (C.R.)	P
SQ4	<---	SQ	1			
SQ3	<---	SQ	0.939	0.026	35.669	***
SQ2	<---	SQ	0.525	0.044	11.969	***
SQ1	<---	SQ	0.982	0.029	34.165	***
FC3	<---	FC	1			
FC2	<---	FC	1.095	0.048	22.588	***
FC1	<---	FC	1.093	0.049	22.402	***
PSE3	<---	PSE	1			
PSE2	<---	PSE	1.172	0.041	28.442	***
PSE1	<---	PSE	1.171	0.041	28.634	***
PEOU4	<---	PEOU	1			
PEOU3	<---	PEOU	1.039	0.029	36.385	***
PEOU2	<---	PEOU	0.866	0.033	26.07	***
PU4	<---	PU	1			
PU3	<---	PU	1.111	0.026	42.985	***
PU2	<---	PU	1.141	0.029	38.993	***
PU1	<---	PU	1.067	0.028	38.481	***
ATT4	<---	ATT	1			
ATT3	<---	ATT	0.939	0.021	45.643	***
ATT2	<---	ATT	0.995	0.019	51.565	***
ATT1	<---	ATT	0.828	0.02	40.916	***
BI3	<---	BI	1			
BI2	<---	BI	1.169	0.045	26.264	***
BI1	<---	BI	1.057	0.034	31.349	***
AU3	<---	AU	1			
AU2	<---	AU	0.764	0.033	22.848	***
AU1	<---	AU	0.742	0.031	23.737	***
PEOU1	<---	PEOU	0.888	0.029	30.967	***

* This value was set at 1.00 to set the metric for estimation purpose.

*** P <.001

Model fit was assessed using the combination of several fit indices (Hair, Black, Babin, Anderson and Tatham, 2006) from different categories :absolute fit indices, incremental fit indices and parsimonious fit indices . Results of the CFA are shown in Table 4.9.

Table 4.9
Fit Indices of the Proposed Measurement Model

	Recommended Level of Fit	Proposed Measurement Model
Absolute fit indices		
Chi-Square	not significant at p<0.05	1076.694, df=322, p=0.000
Relative Chi-Square (CMIN/DF)	2~5, <5 (Bentler,1990)	3.344
RMSEA (Root Mean Square of Error Estimation)	<=0.06, (Joreskog & Sorbom,1993)	0.06
SRMR (Standardized Root Mean Residual)	<=.80 (Teo, 2012)	0.0431
Incremental fit indices		
CFI (Comparative Fit Index)	>=.95 (Hu &Bentler,1999) or >=.90, (Browne & Cudeck, 1992)	0.958
IFI (Incremental fit index)	>.90 (Bentler,1990)	0.958
NFI (Normed Fit Index)	>=.95 good, .90 to .95 acceptable (Bentler,1990)	0.941
TLI (Tucker Lewis Index)	>=.90 (Marsh, Hau & Wen,2004)	0.95
Parsimonious fit Index		
AIC (Akaike Information Criterion)	Smaller value better fit	1244.694

Except for χ^2, all fit indices reached recommended level of fit: (χ^2 = 1076.694, df = 322, p <.001, CMIN/DF= 3.344, RMSEA = 0.06, SRMR = 0.0431, CFI= 0.958, IFI= . 958, NFI= 0.941, TLI= .95, AIC= 1244.694). Since χ^2 is sensitive to large sample size, with a large sample of 560 participants, it was not unusual to get a significant value. Also, for sample size greater than 250, significant χ^2value is acceptable (Hair et.al. 2006). So the significant χ^2 value is acceptable for this study. The ratio of chi-square to the number of degrees of freedom is also reported and met the recommended level of fit. Since the fit indices met the recommended level of fit, indicating that the model fits the data well, no further revision was made. The CFA results provided strong support for the reliability and the original eight factors structure of the measurement items (28 items measuring eight latent constructs) in evaluating the faculty attitude toward LMS use.

Structural Equation Modeling (SEM)

This study was intended to simultaneously examine the direct and indirect relationships among the constructs of the proposed model. SEM has the ability to do this. Moreover SEM is popular for its easy and wide applicability in modeling multivariate relations (Byrne, 2009). Therefore SEM with AMOS 18(Arbuckle, 2007) was employed to test fit between the hypothesized structural model (see Figure 4.4) and the data obtained.

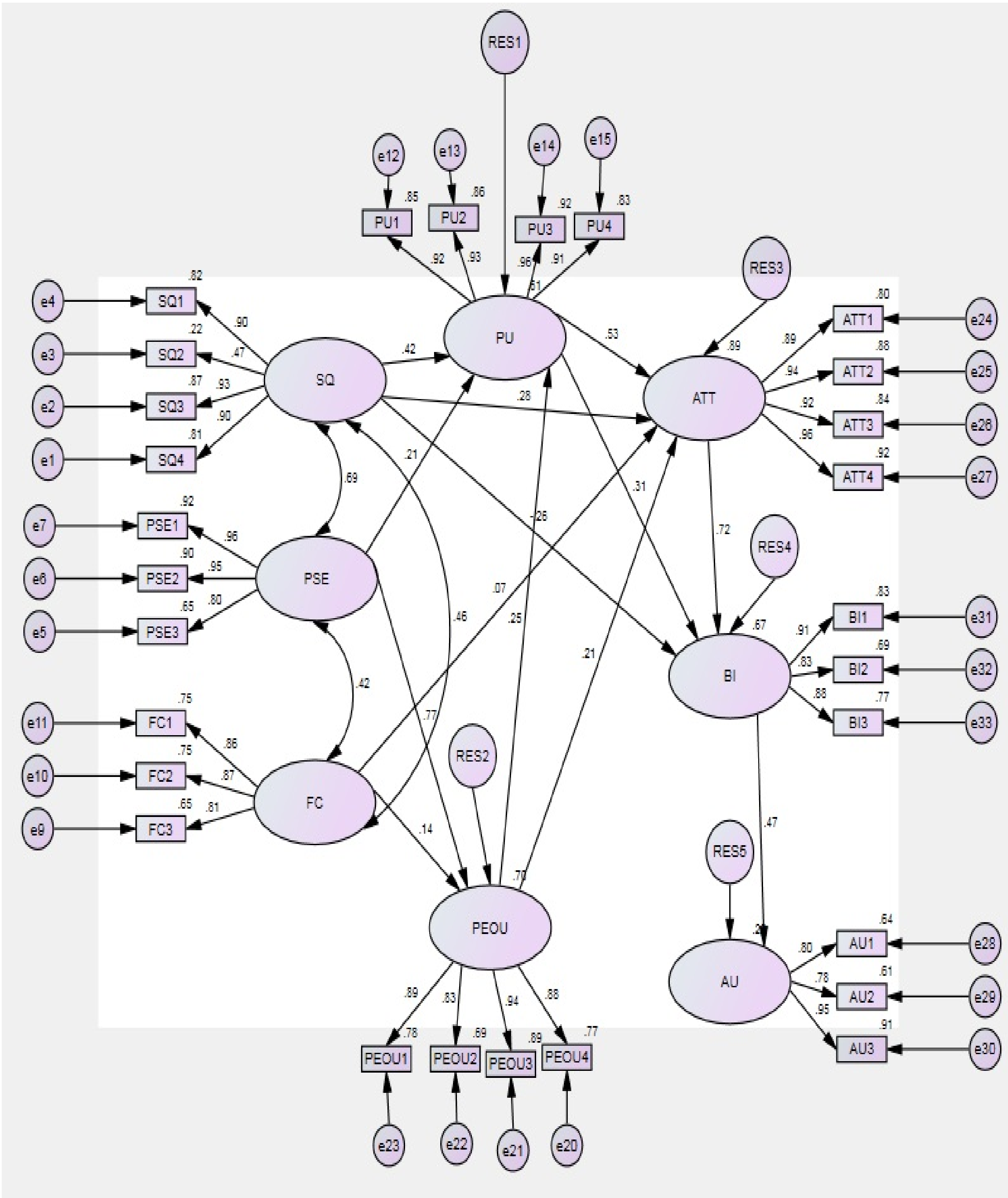

Figure 4.4. Hypothesized structural model of Faculty attitude toward LMSs (Canvas)

Relationships among the latent constructs (Bivariate Correlations)

The linearity of the eight latent constructs was tested by computing the bivariate Pearson correlation coefficient. The bivariate relationships indicated that all of the variables were significantly correlated with each other at the 0.01 level. The correlations among the latent constructs ranged from .191 to .885 (See Table 4.10). Since none of these correlations was larger than .90; no multicollinearity existed among the latent variables (Hair et.al, 2006).

Table 4.10
Correlations among the eight latent constructs

	SQ	PSE	FC	PEOU	PU	ATT	BI	AU
SQ	1							
PSE	.625**	1						
FC	.417**	.404**	1					
PEOU	.776**	.772**	.407**	1				
PU	.691**	.657**	.440**	.709**	1			
ATT	.758**	.678**	.467**	.768**	.885**	1		
BI	.573**	.611**	.515**	.589**	.758**	.783**	1	
AU	.191**	.373**	.319**	.266**	.398**	.368**	.479**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Following Hair et al's (2006) recommendation, a variety of fit indices from various categories (Absolute fit indices, Incremental fit indices and Parsimonious fit indices) was used. The results indicated the fit indices for the research model as: χ^2 = 1436.851, *df*= 334, *p* <.001, CMIN/DF= 4.302, SRMR= 0.077, CFI= 0.938, IFI= .938, NFI= 0.921, TLI= .93, RMSEA =0.077, AIC= 1636.851. Except for the χ^2 and RMSEA, all the fit indices met the recommended level of acceptable fit. Though all the path coefficients demonstrated significance (p<.05), the path between SQ and BI was shown statistically significant in opposite direction (see Table 4.11). In particular, in the proposed model it was hypothesized that SQ will have a significant positive effect on BI. But the SEM results showed a significant path from SQ to BI with a negative regression weight, which indicates if SQ goes up, BI goes down and vice versa. Since this relationship is unusual and makes no practical sense, the path was removed from the model and the model was revised.

Table 4.11

The Estimation for Regression weights of the hypothesized model

			Estimate	S.E.	C.R.	P	Std. Regression Wgt
PEOU	<---	PSE	0.927	0.05	18.391	***	0.766
PEOU	<---	FC	0.176	0.039	4.509	***	0.143
PU	<---	SQ	0.414	0.043	9.717	***	0.419
PU	<---	PSE	0.241	0.074	3.266	0.001	0.207
PU	<---	PEOU	0.239	0.055	4.371	***	0.249
ATT	<---	PU	0.5	0.03	16.402	***	0.527
ATT	<---	PEOU	0.188	0.024	7.748	***	0.206
ATT	<---	SQ	0.265	0.027	9.832	***	0.283
ATT	<---	FC	0.076	0.025	3.09	0.002	0.067
BI	<---	ATT	0.67	0.085	7.905	***	0.724
BI	<---	PU	0.272	0.064	4.282	***	0.31
BI	<---	SQ	-0.223	0.047	-4.703	***	-0.257
AU	<---	BI	0.594	0.057	10.474	***	0.473
SQ4	<---	SQ	1				0.902
SQ3	<---	SQ	0.947	0.027	35.725	***	0.931
SQ2	<---	SQ	0.525	0.044	11.92	***	0.473
SQ1	<---	SQ	0.979	0.029	33.389	***	0.905
PSE3	<---	PSE	1				0.804
PSE2	<---	PSE	1.163	0.041	28.354	***	0.95
PSE1	<---	PSE	1.168	0.041	28.788	***	0.961
FC3	<---	FC	1				0.807
FC2	<---	FC	1.096	0.049	22.251	***	0.866
FC1	<---	FC	1.103	0.05	22.219	***	0.864
PU4	<---	PU	1				0.91
PEOU4	<---	PEOU	1				0.878
ATT1	<---	ATT	1				0.892
ATT2	<---	ATT	1.2	0.032	37.21	***	0.94
ATT3	<---	ATT	1.134	0.033	34.742	***	0.917
ATT4	<---	ATT	1.207	0.031	39.508	***	0.96

AU1	<---	AU	1				0.797
AU2	<---	AU	1.031	0.051	20.366	***	0.778
AU3	<---	AU	1.35	0.058	23.299	***	0.953
BI1	<---	BI	1				0.912
BI2	<---	BI	1.11	0.041	27.086	***	0.831
BI3	<---	BI	0.94	0.031	30.203	***	0.878
PEOU1	<---	PEOU	0.9	0.03	30.059	***	0.885
PEOU2	<---	PEOU	0.893	0.034	26.33	***	0.829
PEOU3	<---	PEOU	1.052	0.03	34.577	***	0.944
PU3	<---	PU	1.111	0.026	42.082	***	0.957
PU1	<---	PU	1.067	0.028	37.638	***	0.925
PU2	<---	PU	1.142	0.03	38.186	***	0.929

The revised model was tested again. It showed a good fit comparative to the proposed model, but not at an acceptable level (χ^2 = 1436.823, *df*= 335, *p* <.001, CMIN/DF= 4.34, SRMR= 0.713, CFI= 0.937, IFI= .937, NFI= 0.92, TLI= .929, RMSEA =0.077, AIC= 1636.851). The modification indices indicated adding a path from SQ to PEOU would notably improve the values of the fit indices. In practical, it makes sense that if LMS maintains a high quality than it will be easier to use. Therefore, if the quality of LMS goes up than faculty members will perceive it as an easier system to use. So the suggested change was made by adding a path from SQ to PEOU. The fit indices (χ^2 = 1205.409, *df*= 334, *p* <.001, CMIN/DF= 3.609, SRMR= 0.0593, CFI= 0.951, IFI= .951, NFI= 0.934, TLI= .945, RMSEA =0.068, AIC= 1405.409) except for χ^2 and RMSEA indicated a good model fit. After this modification was made, the path from FC to PEOU became statistically insignificant (p >.05) (seeTable 4.12).

Table 4.12
The estimation of regression weight after 2ndModification

			Estimate	S.E.	C.R.	P	Standardized Regression weights)
PEOU	<---	PSE	0.53	0.042	12.596	***	0.432
PEOU	<---	FC	0.019	0.032	0.587	0.557	0.015
PEOU	<---	SQ	0.583	0.036	16.074	***	0.562
PU	<---	SQ	0.43	0.066	6.526	***	0.428
PU	<---	PSE	0.281	0.065	4.361	***	0.237
PU	<---	PEOU	0.184	0.083	2.218	0.027	0.19
ATT	<---	PU	0.504	0.03	16.791	***	0.526
ATT	<---	PEOU	0.186	0.037	5.024	***	0.2
ATT	<---	SQ	0.253	0.039	6.486	***	0.263
ATT	<---	FC	0.071	0.024	3.009	0.003	0.062
BI	<---	ATT	0.418	0.066	6.289	***	0.458
BI	<---	PU	0.327	0.064	5.15	***	0.374
AU	<---	BI	0.59	0.056	10.56	***	0.475
SQ4	<---	SQ	1				0.903
SQ3	<---	SQ	0.939	0.026	35.5	***	0.924
SQ2	<---	SQ	0.526	0.044	11.984	***	0.474
SQ1	<---	SQ	0.983	0.029	34.103	***	0.91
PSE3	<---	PSE	1				0.802
PSE2	<---	PSE	1.172	0.041	28.362	***	0.954
PSE1	<---	PSE	1.172	0.041	28.627	***	0.962
FC3	<---	FC	1				0.81
FC2	<---	FC	1.096	0.049	22.398	***	0.869

FC1	<---	FC	1.095	0.049	22.252	***	0.861
PU4	<---	PU	1				0.913
PEOU4	<---	PEOU	1				0.889
ATT1	<---	ATT	1				0.896
ATT2	<---	ATT	1.203	0.031	38.483	***	0.945
ATT3	<---	ATT	1.135	0.032	35.751	***	0.921
ATT4	<---	ATT	1.209	0.03	40.78	***	0.963
AU1	<---	AU	1				0.798
AU2	<---	AU	1.031	0.05	20.448	***	0.779
AU3	<---	AU	1.35	0.058	23.42	***	0.953
BI1	<---	BI	1				0.915
BI2	<---	BI	1.106	0.04	27.414	***	0.833
BI3	<---	BI	0.943	0.03	30.967	***	0.884
PEOU1	<---	PEOU	0.888	0.029	30.972	***	0.883
PEOU2	<---	PEOU	0.865	0.033	26.051	***	0.813
PEOU3	<---	PEOU	1.039	0.029	36.386	***	0.944
PU3	<---	PU	1.111	0.026	42.952	***	0.959
PU1	<---	PU	1.067	0.028	38.423	***	0.927
PU2	<---	PU	1.142	0.029	38.973	***	0.931

One possible reason for this insignificant path could be the operational definition of the term ‘facilitating conditions’ which explained the concept in terms of technical help and support in general for all sorts of technology use not specific to LMS use. Another reason could be facilitating conditions do not affect the ease of use of technology which is indicated in some prior research findings. (i.e. Karahanna & Straub 1999, Thompson et al., 1991). Therefore, this insignificant path was removed from the model and the model was tested again. After the third modification, the SEM results showed the fit indices (except for χ^2) of the model met the acceptable cut-off values (χ^2 = 1205.745, *df*= 335, *p* <.001, CMIN/DF= 3.599, SRMR= .0595, CFI= 0.951, IFI= .951, NFI= 0.934, TLI= .945, RMSEA =0.068, AIC= 1403.745 Also the results indicated that the structural model fits the data fairly well. The χ^2value showed statistically significant value; however it is acceptable with a large data set of 560 samples (Hair et al, 2006). So, the third revised model was chosen to be the final model (See Figure 4.5). The fit indices considered to test the models are depicted in Table 4.13.

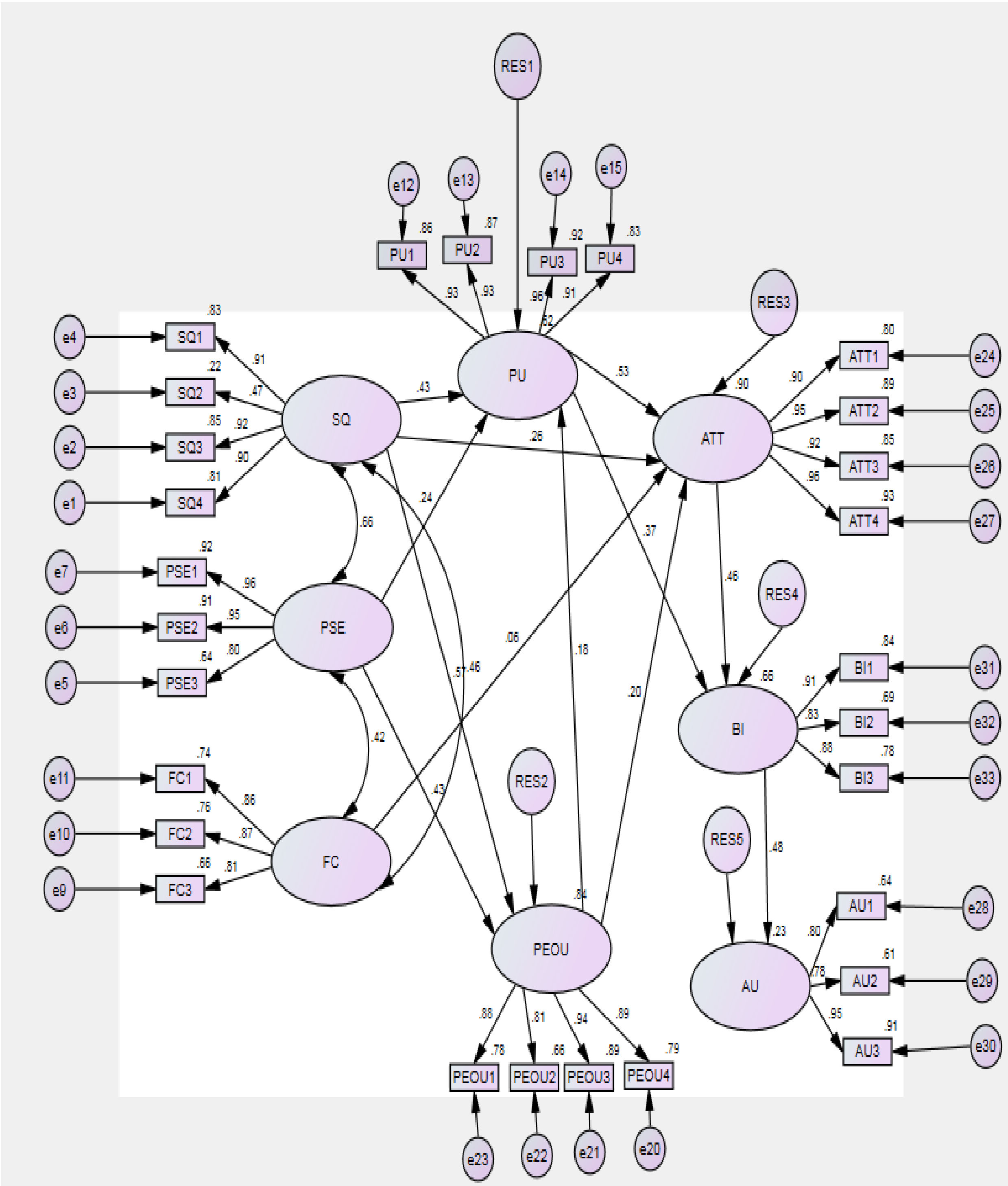

Figure 4.5. The structural model for f faculty attitudes toward LMSs

Table 4.13

Fit Indices of the Proposed Measurement Model

	Recommended Level of Fit	The proposed structural model	1st Modification Path SQ to BI removed	Modified2_AddSQtoPEOU	Modified3_Delete FC to PEOU
Absolute fit indices					
Chi-Square	Significant at p<0.05	1436.851 df=334, p=0.000	14533.823 df=335, p=.000	1205.409 df=334, p=.000	1205.745 df=335, p =.000
Relative Chi-Square (CMIN/DF)	2~5 , <5, (Bentler,1990)	4.302	4.34	3.609	3.599
RMSEA (Root Mean Square of Error Estimation)	<=0.06 (Joreskog &Sorbom,1993)	0.077	0.077	0.068	0.068
SRMR (Standardized Root Mean Residual)	<=.80 (Teo, 2012)	0.0719	0.713	0.0593	0.0595
Incremental fit indices					
CFI (Comparative Fit Index)	>=.95 (Hu &Bentler,1999) or >=.90 (Browne & Cudeck,1992),	0.938	0.937	0.951	0.951
IFI (Incremental Fit Index)	>=.90 (Bentler,1990)	0.938	0.937	0.951	0.951
NFI (Normed Fit Index)	>=.95 good, .90 to .95 acceptable, >.90 (Bentler,1990)	0.921	0.92	0.934	0.934
TLI (Tucker Lewis Index)	>=.95 Or >=.90 (Marsh, Hau, & Wen, 2004)	0.93	0.929	0.945	0.945
Parsimonious fit Index					
AIC (Akaike Information Criterion)	Smaller value better fit	1636.851	1651.823	1405.409	1403.745

Overall, the model fitted the data well and showed a high predictive power in determining the ATT toward LMS, BI to use LMS and AU of LMS by the faculty members. The estimation for regression weights of the third re-specified model (final model) is presented in the Table 4.14.

Table 4.14
The estimation of regression weight of the final model

			Estimate	S.E.	C.R.	P	Standardized Regression weights
PEOU	<---	PSE	0.534	0.042	12.809	***	0.435
PEOU	<---	SQ	0.588	0.035	16.726	***	0.567
PU	<---	SQ	0.434	0.066	6.575	***	0.432
PU	<---	PSE	0.284	0.065	4.401	***	0.239
PU	<---	PEOU	0.178	0.083	2.149	0.032	0.184
ATT	<---	PU	0.504	0.03	16.791	***	0.526
ATT	<---	SQ	0.253	0.039	6.451	***	0.263
ATT	<---	FC	0.071	0.024	3.019	0.003	0.062
ATT	<---	PEOU	0.186	0.037	5.042	***	0.2
BI	<---	ATT	0.418	0.067	6.286	***	0.458
BI	<---	PU	0.327	0.064	5.15	***	0.374
AU	<---	BI	0.59	0.056	10.559	***	0.475
SQ4	<---	SQ	1				0.903
SQ3	<---	SQ	0.939	0.026	35.467	***	0.924
SQ2	<---	SQ	0.526	0.044	11.988	***	0.474
SQ1	<---	SQ	0.983	0.029	34.101	***	0.91
PSE3	<---	PSE	1				0.802
PSE2	<---	PSE	1.172	0.04	28.36	***	0.954

				1	8		
PSE1	<---	PSE	1.172	0.041	28.631	***	0.961
FC3	<---	FC	1				0.81
FC2	<---	FC	1.097	0.049	22.4	***	0.869
FC1	<---	FC	1.095	0.049	22.244	***	0.861
PU4	<---	PU	1				0.913
PEOU4	<---	PEOU	1				0.889
ATT1	<---	ATT	1				0.896
ATT2	<---	ATT	1.203	0.031	38.478	***	0.945
ATT3	<---	ATT	1.135	0.032	35.747	***	0.921
ATT4	<---	ATT	1.209	0.03	40.776	***	0.963
AU1	<---	AU	1				0.798
AU2	<---	AU	1.031	0.05	20.448	***	0.779
AU3	<---	AU	1.35	0.058	23.42	***	0.953
BI1	<---	BI	1				0.915
BI2	<---	BI	1.106	0.04	27.413	***	0.833
BI3	<---	BI	0.943	0.03	30.966	***	0.884
PEOU1	<---	PEOU	0.887	0.029	30.95	***	0.883
PEOU2	<---	PEOU	0.866	0.033	26.061	***	0.813
PEOU3	<---	PEOU	1.039	0.029	36.396	***	0.944
PU3	<---	PU	1.111	0.026	42.953	***	0.959
PU1	<---	PU	1.067	0.028	38.424	***	0.927
PU2	<---	PU	1.142	0.029	38.973	***	0.931

Hypotheses testing results

The SEM results revealed that all of the three proposed external variables (SQ, PSE and FC) have significant effect on faculty attitudes toward LMS use. Out of the proposed 13 hypotheses, 11 were supported. The results indicated that, the first external construct SQ significantly affects PU and ATT. Therefore hypotheses H1 and H_2 were supported. However, no significant effect of SQ on BI was found, so hypothesis H_3 was rejected. Also, the results revealed a new significant path from SQ to PEOU with a regression weight of .567 indicating that SQ significantly affects PEOU. As expected, the second external construct PSE was found to be significant determinant of PEOU and PU. Thus, both of the proposed hypotheses (H_4 and H_5) regarding PSE's effect on PEOU and PU were supported. The SEM results found no significant effect of the third external construct FC on PEOU. Therefore hypothesis H_6 was rejected. FC was found to be significant determinant of ATT, supporting hypotheses H_7. Also, all the proposed hypotheses ($H_{8,}$ $H_{9,}$ $H_{10,}$ $H_{11,}$ $H_{12,}$ and $H_{13)}$ indicating the relationships among the original TAM constructs were significant. Hence, the study results revealed that, PEOU has significant positive effects on PU and ATT (supporting hypotheses H_8 and H_9 respectively) , PU has significant positive effect on ATT and BI (supporting hypotheses H_{10} and H_{11} respectively), ATT has significant positive effect on BI (supporting hypothesis H_{12}) and BI has significant positive effect on AU (supporting hypothesis H_{13}).

The influences of each of the exogenous variables on the endogenous variables were assessed as well. To do so, the standardized total effects, direct and indirect effects associated with each of the eight variables were tested. Table 4.15 shows the results of the hypotheses tests including the regression weights of each of the 11 significant paths as well as the regression weight of the new significant path from SQ to PEOU.

Table 4.15

Hypotheses Testing Results

Hypotheses		Path	Support	Regression weight
$H_{1:}$	System Quality (SQ) has a significant positive effect on PU of the LMS	SQ→PU	Yes	0.432**
$H_{2:}$	SQ has a significant positive effect on faculty attitude (ATT) toward LMS	SQ→ATT	Yes	0.263**
$H_{3:}$	SQ has a significant positive effect on faculty members' behavioral intention (BI) to use LMS	SQ→BI	No	_
New path	*SQ has significant positive effect on PEOU of Canvas*	*SQ→PEOU*	Yes	0.567**
$H_{4:}$	Perceived self-efficacy (PSE) has a significant positive effect on PEOU of LMS	PSE→PEOU	Yes	0.435**
$H_{5:}$	PSE has a significant positive effect on PU of LMS	PSE→PU	Yes	0.239**
$H_{6:}$	Facilitating conditions (FC) has a significant positive effect on PEOU of LMS	FC→PEOU	No	_
H_7	FC has a significant positive effect on faculty attitude (ATT) toward LMS	FC→ATT	Yes	0.062**
$H_{8:}$	PEOU has a significant positive effect on PU of LMS	PEOU→PU	Yes	0.184*
$H_{9:}$	PEOU has a significant positive effect on ATT toward using LMS	PEOU→ATT	Yes	0.20**
$H_{10:}$	PU has a significant positive effect on ATT toward using LMS	PU→ATT	Yes	0.53**
$H_{11:}$	PU has a significant positive effect on BI to use LMS	PU→BI	Yes	0.31**
$H_{12:}$	ATT has a significant positive effect on BI to use LMS	ATT→BI	Yes	0.72**
$H_{13:}$	BI has a significant positive effect on AU of LMS	BI→AU	Yes	0.47**

*P<.05, ** P<.001

Each of these regression weights represents the determinant's direct effect on the respective endogenous variable. For example, .432, .239 and .184 are the respective direct effect of SQ, PSE and PEOU on PU. That means, one full standard deviation increase in SQ would increase PU by .432 standard deviations, while holding the other variables PSE and PEOU fixed or constant. All these regression weights (ranging from .184 to .567) of the significant paths are considered to be medium to large as recommended by Cohen (1988). All three exogenous variables (SQ, PSE and FC) were found statistically significant determinants of the five endogenous variables (PEOU, PU, ATT, BI and AU). The endogenous variable PU was found to be significantly determined by three variables SQ (β = .432, p <.001), PSE (β = .239, p <.001) and PEOU (β = .184, p <.05), resulting in an R^2 of .62, which means that the SQ, PSE and PEOU jointly accounted for 62% of the variance in PU. Similarly, PEOU was significantly determined by PSE (β = .435, p <.001) and SQ (β = .567, p <.001) resulting in an R^2 of .84, indicating 84% of the variance of PEOU is explained by FC and PSE. ATT was significantly determined by SQ (β = .263, p <.001), FC (β = .062, p <.05), PU (β = .53, p <.001) and PEOU (β = .20, p <.001) resulting in an R^2 of .704 indicating 70.4% of the variance in ATT is explained by these four (SQ, FC, PU and PEOU) variables. BI was found to be significantly determined by PU (β = .31, p <.001) and ATT (β = .72, p <.001), resulting in an R^2 of .66, which means that PU and ATT accounted for 66% of the variance in BI. Finally AU was significantly determined by BI (β = .47, p <.001), resulting in an R^2 of .23 which indicates that 23% of the variance in AU is accounted by BI (See Figure 4.6).Therefore, the results indicated that the extended technology acceptance model had high predictive power in determining the faculty member's LMS usage behavior.

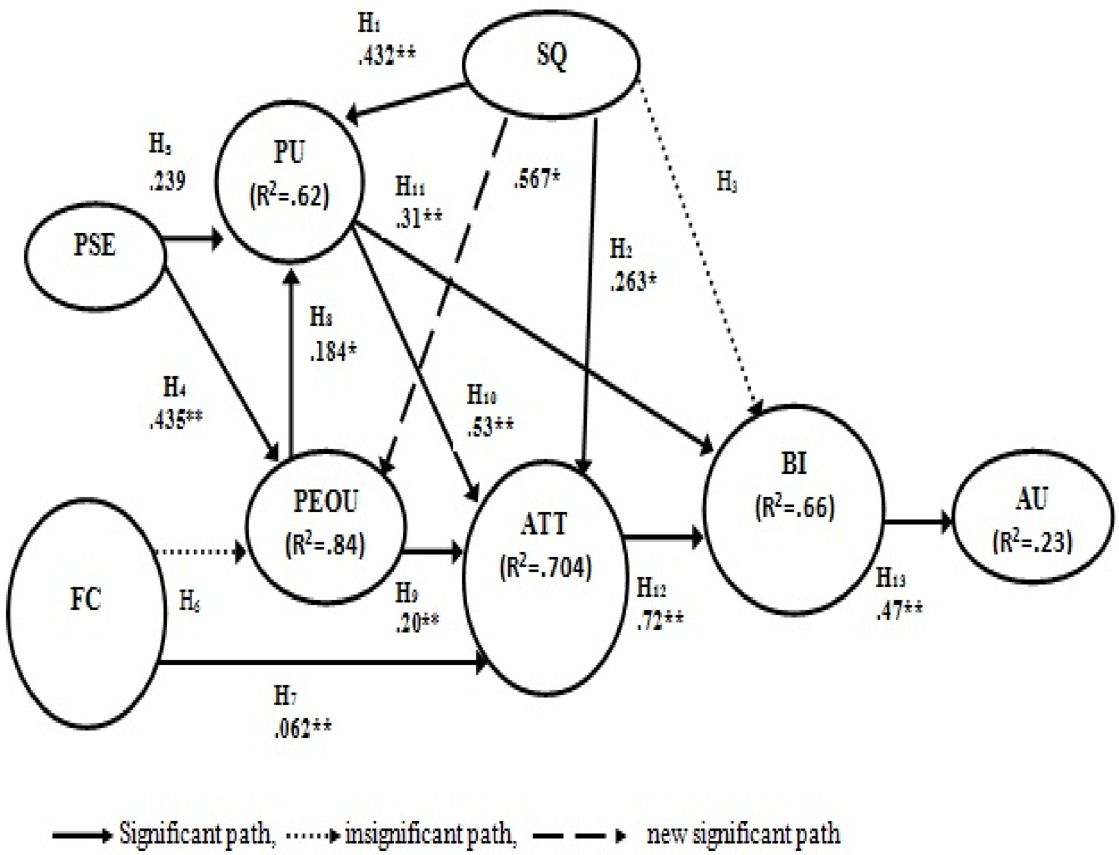

Figure4.6. Results of the structural model for faculty attitudes toward LMS

Discussion and Conclusion

This study examined the validity of an extended TAM in determining faculty attitudes toward LMS usage. The study proposed that PSE, SQ and FC as three external constructs of TAM and claimed that they are salient determinants of faculty attitudes toward LMS usage. The proposed model was empirically tested by collecting data from 650 faculty members from two universities in the US. Results generally supported the proposed model with minor revisions and confirmed the significant influence of PSE, SQ and FC in influencing LMS usage by faculty members in higher educational institutions.

Theoretical Implications

The study results add to the TAM literature by providing important insights on the influences of external factors in original TAM constructs. The study results revealed that that object-based factor 'system quality (SQ)' and personal belief oriented factor 'perceived self-efficacy (PSE)' have strong influences on the both of the two fundamental TAM factors: PEOU and PU. They jointly explained 84% of the total variance of PEOU. Similarly, together with PEOU, they jointly explained 62% of the total variance of PU. Also, results found that, SQ had significant positive effect on ATT. These indicated that both SQ and PSE are the two dominant external factors that influence faculty members LMS usage behavior. Environmental factor 'facilitating conditions (FC)' was also found to be a significant determinant of ATT. Though FC's influence was not very strong, together with PEOU, PU and SQ, it contributed in explaining 90% of the total variance of ATT. Similar to prior research, the study results revealed ATT's significant effect on BI and BI's significant effect on AU. Therefore all three external factors are found to be important and considerable factors that influence faculty members' MS usage behaviors.

Similar to prior research findings, this study found SQ's significant effect on PEOU and on PU with medium effect of .567 and .431 respectively. This indicates that faculty members give emphasis on the quality issues (i.e., interface, features, functions, contents, navigation speed, interaction capability etc.) of LMS. If the LMS maintains high quality, than faculty members find it useful and easy to use and develop positive attitude toward using it. This finding supports Kim and Leet's (2007) findings where they reported that several system issues like: suitability of design in screen and system, easiness of course procedure, interoperability of system, easiness of instruction management and appropriateness of multimedia use, flexibility of interaction and test, learner control, variety of communication and test types and user accessibility as important LMS features that benefit LMS users the most.

Consistent with prior research findings, (i.e., Liaw, 2002), the second external construct perceived self-efficacy was found to be significant determinants of PEOU and PU. This indicates faculty members with higher self-efficacy find LMS useful and easy to use comparative to faculty members with lower self-efficacy. In other words, faculty members who are confident about their LMS using skills perceive LMS as a useful technology to use and experience lower complexity using it. Consequently, confident faculty members use LMS more than the less confident ones.

The study results found that, the third external variable facilitating condition had a weak positive effect on ATT and had no effect on PEOU. It partially supports Teo's (2010a) findings where he reported that FC had significant positive effects on ATT and PEOU. It could be possible that faculty members develop positive attitudes toward LMS if adequate facilitating conditions (i.e., favorable technical facilities, guidance, personal and group assistance etc.) are available. However, only adequacy of FCs does not ensure that faculty members will develop a better perception about the ease of use. Another possible explanation can be, if LMS quality is really high and faculty members have high self-efficacy than they do not care about the availability of facilitating conditions (facilities, training etc.) for using LMS.

Supporting existing research that reported strong relationships among PU, PEOU and ATT, this study results revealed the significant effects of PU and PEOU on ATT. Similarly the positive effect of ATT on BI and positive effect of BI on AU are also supported. Behavioral intention to use LMS is directly influenced by perceived usefulness and attitude toward using LMS and indirectly influenced by perceived ease of use through perceived usefulness. These findings support Davis's (1989) claim. As explained by Davis (1989), at first, users check on the tasks that a technology can perform for them. If users are satisfied with that than they considers the level of ease or difficulty associated with its operation. In terms of LMS usage, first faculty members look at the usefulness of it for them and then they evaluate how easy or difficult it is to work with the LMS. If they find it easy they develop a positive intention of using it. Finally behavioral intention to use LMS influences the actual use of LMS. A high intention to use LMS results in increased use of LMS. Hence, all original TAM constructs significantly predicted intention to use LMS and actual use of LMS. This provides further support for the validity of TAM in explaining users' attitudes toward technology.

Davis (1989) suggested that future TAM research must address how external variables affect original five TAM constructs. This study contributes to the TAM literature by demonstrating the significant effects of external variables (in addition to the five original TAM variables) that are salient in determining faculty attitude toward technology (i.e., LMS). It reported the significant effects of three external variables (i.e. systems quality, perceived self-efficacy and facilitating conditions) on the original TAM constructs and concluded that all of these three factors are the important external determinants of the actual use of LMS . Therefore, this study enriches the understanding of the importance of these three factors in determining LMS usage behavior.

Also it provides important implications to increased use of LMS. This study reported the predictive ability and applicability of TAM in determining technology adoption in higher education context. Thus this study contributes to the TAM literature by revealing the applicability of TAM in educational settings beyond its original applicability on business context. This study enriched the TAM based LMS research by revealing the faculty views of LMS usage; whereas the prior studies mainly focused on students' perspective. Also, this study was focused on Canvas, a new LMS: Canvas, which came in market in 2011. No TAM based empirical study to date has been done on Canvas. As Canvas is a rising LMS in market, further research should be conducted to explore its usability. By enriching the literature providing interesting findings and insights, the findings of this study would help practitioners to undertake further research on the unexplored areas of this new LMS.

Practical Implications

The results provide important issues to be considered to ensure increased use of LMS in higher education.

The study found that system quality is a strong salient factor that shapes faculty member's LMS use. Since attitude has a very strong effect on intention to use, it is important to ensure that faculty members possess positive attitudes toward the LMS they are using. Therefore, LMS designers and university policy makers should concentrate more efforts on the quality improvement of LMS to make it more usable to the faculty members. User-friendliness, easy accessibility and reliability are other important areas to focus on. The interface, features, functions, contents, navigation speed, interaction capability etc., of the LMS should be periodically monitored and improved according to the faculty members need. To maintain better quality, a continuous quality improvement process should be conducted which will collect feedback from the LMS users about the quality issues, problems and recommendation for improvement and will plan for LMS improvement actions accordingly. It is important periodically collect information from the LMS user (i.e.

faculty members' and students) about their experiences with LMS usage, problems they are facing and their recommendations about improvement of LMS.

The study reveals self-efficacy as another significant and salient factor in determining users' acceptance of LMS. Therefore, improving users' self-efficacy is an important area to focus on. To make faculty members more confident in using LMS, periodic training programs and extended online help options should be offered. These would help them get more hands-on experiences, gain improved skills and become more competent in using LMS. Another important item is that, generally decisions about adoption of a new technology (i.e. LMS) in any educational settings are made by the top executives. End-users (i.e., Faculty members) of the technology are usually not included in this decision making process. Hence, a gap exists between the users' expectations and the benefits that are offered by the technology. This happens for LMS adoption as well. Sometimes faculty members do not know much about the capabilities of the LMS that has been adopted. Therefore, it is important to include faculty members in the LMS adoption decision process, so that they feel connected and confident. Moreover, once a new LMS is adopted, it is important to inform the faculty members about the features, usefulness, and technical issues of it so that they can gain an in-depth understanding of the features of the LMS. Extensive training programs about how to use the LMS should be offered so that faculty members feel confident about using the system to enrich their teaching process.

The study results revealed that facilitating conditions has a small significant effect on ATT indicating that the environmental factors, as well, influence faculty members' LMS usage. Therefore, to improve faculty use of LMSs, university authorities should ensure the availability of proper facilitating conditions necessary for using LMS. To this end, arranging more flexible and department wide LMS training sessions, supporting participating in training are important steps that could be taken. Ensuring availability of up-to-date and user-friendly technical facilities could also enhance faculty members' LMSs usage.

CHAPTER 5.MANUSCRIPT 3 STRUCTURAL EQUATION MODELING OF AN EXTENDED TECHNOLOGY ACCEPTANCE MODEL FOR STUDENT ACCEPTANCE OF UNIVERSITY WEB PORTALS

Introduction

For over the past two decades, the use of internet technology in educational activities has resulted in significant changes and improvements in the education sector. Colleges and academic communities in the United States first introduced their websites in the mid 1990s (Masrek, 2007). By adding enhanced design graphics, sophisticated technical and interactivity features these websites have been improved, advanced and matured over time. By now, most of the universities have developed their own web portals. These web portals work as gateways to various information and services from multiple sources. Generally, these web portals have multiple interlocked pages which present contents like academics, information about colleges and departments, school email, admission, registration, payments, course management system, library system, live transportation information, and campus news etc. The main purpose of these web portals is to virtually convey necessary information to the students as well as to the faculty members and employees of the universities and to provide them option to conduct academic and related activities online.

In general, development and maintenance of web portals are expensive and time consuming (Bringula & Basa, 2011). To achieve the optimal use of web portals, it is imperative that the design and functions of the web portals satisfy users' expectations. This is true for university web portals as well. The main audiences of university web portals are generally young, computer literate and innovative (Mechitov, Moshkovich, Underwood, & Taylor, 2001) Internet generation students. The Educause Center for Applied Research (ECAR) 2008 survey revealed that undergraduate students reported that they spend an average of 19.6 hours per week online for work, school or recreational activities (Salaway, Caruso, & Nelson, 2008). These students have growing expectations and new demands on university web portals. The design, contents and features of typical university web portals are not always sufficient to serve them. It is not always easy to meet all the expectations of the Internet generation students and satisfy all their information needs through university web portals, unless these are sophisticated and up-to-date according to the students' requirements. Students tend to care about design, appearance, information availability, the ease of finding specific information, system quality in terms of technical issues, links to pages, speed, connectivity etc. To address students' expectations, universities spend millions on redesigns and maintenance of university web portals which students say are inadequate and lack basic services. These raise the importance of exploring students' perceptions of their university web portals, what they appreciate and what they dislike about the web portals and finally what makes a university web portal attractive and more acceptable to its students. Despite their critical importance, there has been relatively little research devoted to cover these issues. The core focus of prior website research has been on large commercial websites which are typically developed and maintained by business corporations (Mechitov et al., 2001). Very few studies focused on academic websites (i.e., Bringula & Basa, 2011; Masrek, 2007; Mechitov et al., 2001; Meyer & Jones, 2012; Wilson &Meyer, 2009). Existing research on university websites has focused mainly on potential students' view of university websites in regards to the college search process, admission process, or faculty views of university web portals (Bringula & Basa, 2011). Some of them are comparative studies (i.e. Mechitov et al., 2001; Meyer, 2008), some focused on one of the specific features of the university websites: homepages (i.e., Meyer, 2008), department website, (i.e., Zengin, Arikan, Dogan, 2011), web based learning (i.e. Gong, Xu & Yu, 2004; Lau & Woods, 2009; Liaw, Huang & Chen, 2007; Park,2009). Thus, exploring students' perception and attitudes toward university web portals and the underlying factors that affect their attitudes seem an important area to research, which is the focus of this study. Taking a holistic view, this study focuses on a university web portal as a whole. It proposes an extension of Davis's (1989) Technology Acceptance Model (TAM) to determine students' attitude toward university web portals. This study seeks to understand the factors that affect students' usage of university websites by examining the validity of a proposed extension of the original TAM framework.

This study aims to contribute to the literature by examining the effect of additional user-related variables on the original TAM constructs and hence extending the TAM. The study has potential to inform on the use of university web portal by students. Through a better understanding of the students' attitudes and the factors that affect their attitudes toward using university web portals, higher educational institutions will be better placed to develop, modify and upgrade university web portals, make them more useful to the students and ensure increased student usage of the university web portals.

The next section of this paper presents a brief description of original TAM. Following this, a summary review of literature on users' attitude toward web portals in general as well as toward university web portals is presented to explain the basis of the proposed extension of TAM. The proposed external constructs and the research hypotheses are presented last. The method section outlines the institutional context, sample and data collection process. The research assessments are reported in the results and analysis section. Finally, the discussion section summarizes the results and outlines the implication of the findings of the study, its limitations and contribution to the literature.

Research Paradigm (proposed model and hypotheses development)

Technology acceptance model (TAM): originally proposed by Davis in 1986, is a well-known model related to technology acceptance. TAM was derived from Ajzen and Fishbein's (1980) theory of reasoned action (TRA). TAM suggests users formulate a positive attitude towards the technology when they perceive the technology to be useful and easy to use. This positive attitude of users determines the actual usage of technology by the users (Davis1989).

TAM is concerned with predicting and explaining users' technology acceptance behavior and has been widely used in literature (Davis, Bagozzi & Warshaw, 1989). According to TAM proponents, users' actual technology usage behavior (AU) is influenced directly or indirectly by four main factors- (i) perceived usefulness of the technology (PU) , (ii) perceived ease of use of the technology (PEOU) , (iii) attitude toward using the technology (ATT) and (iv) behavioral intention to use the technology (BI) (see Figure 5.1).

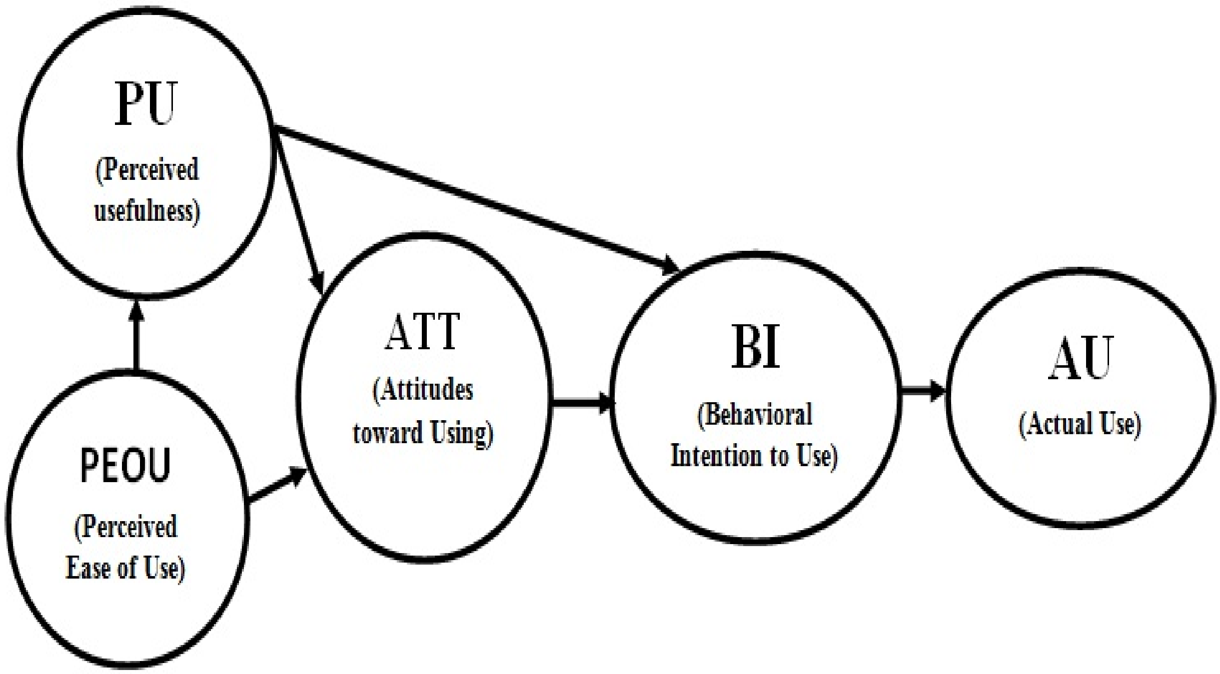

Figure5. 1. Technology Acceptance Model (Davis, Bagozzi &Warshaw, 1989)

TRA describes how individuals' intentions to perform are influenced by their beliefs and attitudes. TAM adopts TRA's belief concept and explains it using two variables: perceived usefulness (PU) and perceived ease of use (PEOU). Following TRA's logic, TAM claims that technology attitude (ATT) is a function of two fundamental beliefs about using the technology: PEOU and PU. TAM suggests behavior intention (BI) of using a technology is directly determined by attitude toward using the technology (ATT). Finally, users' BI directly predicts their actual use of technology (AU). TAM appears to be able to account for 40% to 50% of user acceptance (Park, 2009). Though TAM has been extensively tested and validated among end-users in the business settings, its application in educational research is limited (Teo, Lee & Chai, 2008; Teo, 2008).

Proposed model

Depending on the nature of technology to be examined, prior studies included different types of external variables in TAM framework and found significant relationships between these variables and the five major TAM constructs. In the current study, an extended technology acceptance model (see Figure 5.2) is offered by proposing three external variables: "Web portal Quality" (WQ), "Perceived Self-Efficacy" (PSE), and "Facilitating Condition" (FC) that influence the PEOU and PU of the university web portal. The proposed model (see Figure 5.2) suggests relationships among eight latent variables (three proposed external variables and five core TAM constructs) to determine students' usage of university web portals.

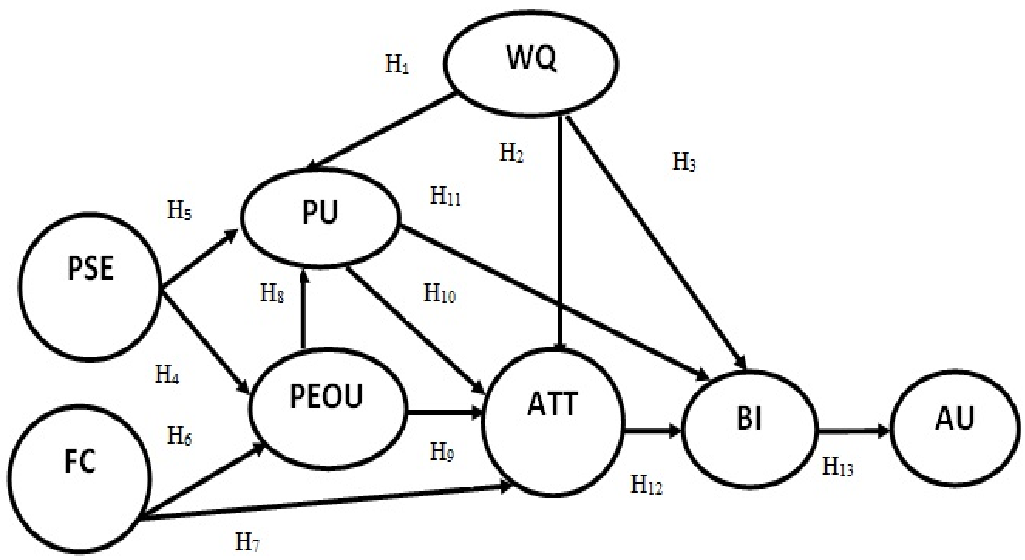

Figure 5.2. Proposed research model for students' acceptance of university web portals

System (web portal) quality. The variable "System Quality" is derived from Delone and Mclean's (2003) updated Information Systems (IS) success model. They referred to 'system quality' as the overall quality of the system (i.e., web portal) that affects the end user and the way they interact and use the system. As Delone and Mclean (2003) defined, system quality in the Internet environment measures the desired characteristics (usability, availability, reliability, adaptability, and response time) of an e-commerce system (i.e., web portal). McKinney, Kanghyun, and Zahedi (2002) suggested system quality considers performance characteristics, functionality and usability among others. Prior empirical studies provided evidence that system quality significantly affect end users' system usage behavior. Delone and Mclean (2003) consider "system quality" to be an important dimension of system success itself. Their updated IS success Model claims "System Quality" directly affects the "intention to use" of any system. DongHee (2009) found that perceived system quality significantly affect PU and ATT. Masrek (2007) found that service quality and system quality are significantly correlated with university web portals users' satisfaction. Bringula and Basa's (2011) study reported that, information content as a web portal design-related factor is a significant predictor of faculty web portal usability. Different factors such as: quality information (Aljukhadar & Senecal, 2009; Bringula & Basa,2012; Palmer, 2002), relevance (Pearson & Pearson, 2008), depth and breadth (Ruffini,2001), accuracy (Seethamraju, 2006, Sinduja & Dastidar, 2009), information content (Palmer, 2002, Sinduja & Dastidar, 2009) and high usability (Tarafdar & Zhang,2005) are indicated as critical factors of a successful website by prior research. Ruffini (2001) argued that the information design, graphics and visual elements (i.e., color, text etc.) of websites are directly related to intended users. Yoo and Jin (2004) suggested developing a dynamic homepage is necessary for the university to capture its users' attention and meet their information needs. Tarafdar and Zhang (2005) found that users lose satisfaction with the website if it is slow and takes long time to access online information. Scott (2006) reported that an effective college or university website fundamentally requires three things: focus on visitors' needs, a distinct personality of the website, and clear goals. However, as indicated by Meyer and Jones (2011), Eduventures (2007) assessed more than 500 adult student evaluations of college and university websites and found only 59% of the respondents indicated that the information provided in the websites was satisfactory. Chiou, Lin, and Perng (2010) conducted a review of the website evaluation literature from 1995 to 2006 and compiled an extensive list of factors that have been evaluated, from “ease of navigation” (49 studies) to “content relevance and usefulness” (44 studies). They found that approximately one-third (34%) of all links (e.g., admissions, choosing a major, registration) in the homepages were related to students and their needs but those websites were messy and difficult to navigate. Considering the study findings discussed above, the current study examines the effect of website quality on students’ university web portal usage. It includes a construct: “Web portal Quality” (WQ) in the proposed TAM and examines its effect on PU, ATT, and BI. Three hypotheses are proposed:

H_1: WQ has a significant positive effect on PU of university web portals

H_2: WQ has a significant positive effect on students’ attitude (ATT) toward university web portals

H_3: WQ has a significant positive effect on students’ behavioral intention (BI) to use university web portals

Perceived Self-efficacy (PSE). PSE is originated from social learning and outcome expectation theories. Bandura (1986, 1997) defined self-efficacy as an individual's judgment of his or her capability to organize and execute the courses of action required to attain designated types of performances. Bandura (1986) stated increased level of self-efficacy leads to improved performance. According to Social Cognitive Theory (SCT) (Bandura, 1977, 1978, 1986, Campeau & Higgins, 1995) self-efficacy is a major factor that affects individual use of technology. Bandura (1977) claims that self-efficacy must be considered to understand users’ behavior. Lee, Kozar and Larsen (2003) stated that skilled individuals can perform the necessary work more effectively. Prior studies revealed that a high level of computer self-efficacy directly or indirectly contributes toward a high degree of information technology acceptance and usage

(Boyle & Ruppel, 2004, Brown, 2002; Keenan & Lee, 2006; Yi &Hwang, 2003). Regarding web portal usage, direct or indirect contributing effects of web self-efficacy on web portal usage were reported by a number of prior studies (Kurniawan, Ellis, & Allaire, 2002, Roca, Chiu, & Martinez, 2006). Atikson and Kydd's (1997) study reported that undergraduate and graduate level students' ability to work with computer was strongly and positively associated with website use. Zhang, Prybutok and Huang (2006) found that users' skills and experiences were correlated with the users' e-service satisfaction as well as the intention to use websites. Therefore this study includes PSE as an external variable and focuses on examining the effect of computer and web self-efficacy on PEOU and PU of university webportal. In the context of this study, an argument is proposed that, students' PSE or one's belief in his/her capabilities to use computer as well as internet influences his/ her actual use of university web portals. Accordingly, the study offers the following hypotheses:

H_4: PSE has a significant positive effect on PEOU of university web portals

H_5: PSE has a significant positive effect on PU of university web portals.

Facilitating Conditions (FC). As stated by Teo (2010a), FCs are perceived enablers or barriers in the environment that influence a person's perception of ease or difficulty of performing a task. In other words, FC is the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system (i.e., web portal). A number of prior studies examined and found significant effect of FC on technology usage behavior. To mention a few, FC was found to have significant effect on attitude toward technology (i.e., Igbaria, 1990, Ngai, Poon & Chan, 2007; Teo, 2010a), technology utilization (i.e. Thompson, Higgins & Howell, 1991) and PEOU of the technology (Teo, 2010a). This study proposes two hypotheses related to the effect of FC on PEOU and ATT.

H_6: FC has a significant positive effect on PEOU of university web portals

H_7: FC has a significant positive effect on students' attitude (ATT) toward university web portals.

Five Core TAM constructs. The first construct: Perceived Ease of use **(**PEOU) refers to 'the degree to which a person believes that using a particular technology will be free of effort' (Davis 1989, p.320). Prior research has found that ease of use (i.e., ease of navigation) is a critical component of website usability and it influences website usability (Becker, 2005; Palmer, 2002; Pearson & Pearson, 2008; Ruffini, 2001; Seethamraju, 2006; Sindhuja & Dastidar, 2009;Tarafdar & Zhang, 2007; Zaharias & Poylymenakou, 2009). Atikson and Kydd's (1997) reported PEOU as an intrinsic motivational factor of technology use and they found that PEOU was the most significant factor in determining the students' use of websites for educational purposes. The second construct: Perceived Usefulness (PU) is defined as 'the degree to which a person believes that using a particular system would enhance his/ her job performance' (Davis 1989, p.320). According to Atikson and Kydd (1997), PU is related to an individual's extrinsic motivation to use any technology and they found extrinsic motivations were highly associated with students' frequent web use for extrinsic purposes (i.e., using web instead of library research for course purposes). TAM (Davis, 1989) claims if a person finds a technology useful then they develop a positive attitude toward using the technology. Attitude toward using (ATT) is the third construct of the original TAM. ATT is defined as "an individual's positive or negative feelings about performing the target behavior (i.e., using a system/ technology)" (Fishbein & Ajzen 1975, p.216). If a person believes that behaving a particular way (i.e., using a system) will result in a positive outcome then he/she will develop a positive attitude toward performing that way. Various prior studies found the effect of users' attitude on their ultimate use of technologies.

(i.e., Teo, 2010). The fourth construct: Behavioral Intention (BI) is "the measure of the strength of one's intention to perform a specified behavior" (Fishbein & Ajzen 1975, p.288). TAM claims that BI of using a specific technology is influenced by a person's attitude toward using (ATT) this specific technology. The fifth construct, Actual Use (AU) is defined as "a behavioral response measured by the individual's action in reality" (Davis, 1989, p. #). TAM claims that user's BI of using or not using a specific technology shapes his/her actual use of this specific technology (AU). Prior research found that BI predicts AU (i.e., Simon & Paper, 2007; Venkatesh, Morris, Davis & Davis, 2003). As claimed by TAM, the following hypotheses are formulated regarding the core TAM constructs.

H_8: PEOU has a significant positive effect on PU of university web portals

H_9: PEOU has a significant positive effect on ATT toward using university web portals

H_{10}: PU has a significant positive effect on ATT toward using university web portals

H_{11}: PU has a significant positive effect on BI of using university web portals

H_{12}: ATT has a significant positive effect on BI of using university web portals

H_{13}: BI has a significant positive effect on AU of university web portals.

Data and Methodology

The study was IRB approved. The generalized population consisted of all of the students enrolled in any graduate, undergraduate or certification in any doctoral intensive public university in USA. Using a convenient sampling approach, data were collected from one of the largest four-year public universities in the southeast. The sample selection was limited to a total of 635 students. Students who were registered for courses taught by the faculty members known to the author were surveyed. Students' email lists were collected from the faculty members. The survey link was emailed to the students. Students' participation was voluntary. The students received an e-mail invitation to participate in the survey that included a direct link to the survey. Students who choose to participate were directed to an informed consent page on which indicated their consent to participate. On average it took about 10 -15 minutes to complete the survey.

Procedures

Data were collected through an online survey using the web-based survey software: Qualtrics.com. The survey had three parts (See appendix D). The first part includes the survey information letter which details the information about the institutional review board's (IRB) approval of conducting the survey and the risks, benefits, data privacy and security related issues and consent agreement of participating in this survey. The second part includes the questions related to web portal use and issues associated with it, and the third part includes the demographic information (age, gender, level of education and college). Demographic information is asked at the end of the survey, to ensure honest responses from the respondents irrespective of their demographics. The data collection was anonymous and no identifiable elements of the respondents are asked in the surveys. This ensures the participants to respond without being concerned with social expectations. To avoid any potential order effect, the survey items were randomized.

Participants

A total of 429 useful responses were collected resulting in a 68% response rate. Out of these 196 (45.7%) are male and 231 (53.8%) are female and two (0.5%) did not mention their gender. Almost half of the respondents (214) are in the age range of 21-25 (49.9%).

The respondents include 266 (62.15%) undergraduate students and 162 (37.85%) graduate students, one of the respondents did not report level of education. Thirty-four percent of the respondents are from College of Education, 24.71% are from College of Business, 15.38% are from College of Human Science and College of Liberal Arts, 12.12% are from College of Engineering, 7.46% are from college of Science and Mathematics and 5.36% are other colleges. The educational level of the respondents ranges from Sophomore (6.5%), Junior (30.3%), senior (25.2%), Masters program (18.4%) to Doctoral program (19.3%).One participants (0.2%) did not report educational level. The demographics of the respondents are presented in Table 5.1.

Table 5.1.
Demographics (Gender, Age, Major, Level of Education)

Gender	Total	Percent
Male	196	45.7%
Female	231	53.8%
Did not Mention	2	0.5%
Total	429	100%

Age Range	Total	Percent
20 or less	92	21.4%
21-25	214	49.9%
26-30	53	12.4%
31-35	30	7.0%
36-40	16	3.7%
Above 40	22	5.1%
Did not mention	2	0.5%
Total	429	100%

Academic Field	Total	Percent
College of Education	149	34.73%
College of Business	106	24.71%
College of Human Science and College of Liberal Arts	66	15.38%
College of Engineering	52	12.12%
College of Science And Mathematics	32	7.46%
Others	23	5.36%
Did not mention	1	0.23%
Total	429	100%

Level of Education	Total	Percent
Sophomore	28	6.5%
Junior	130	30.3%
Senior	108	25.2%
Masters	79	18.4%
Doctoral	83	19.3%
Did not mention	1	0.2%
Total	429	100%

Measures

The survey questionnaire consisted of 33 Likert-scale items about the students' perception of their university web portal. The Likert-Scale items are used to measure the eight constructs of the hypothesized TAM. The measurement scales for all the eight constructs (WQ, PSE, FC, PEOU, PU, ATT, BI, and AU) are adapted from prior studies (see Table 5.2) many of which already have established reliability and validity (Davis, 1989, Matheison, 1991, Moore & Benbasat, 1991, Taylor & Todd 1995a, Venkatesh & Davis, 1996). However, the items are re-worded to make them relevant to the specific context of the web portal use. The WQ, PSE, FC, PEOU, PU, ATT and BI constructs are measured on a seven point Likert-type scales from 1 being "Strongly disagree" to 7 being "Strongly agree". AU construct is measured on a 7 point Likert-type scale with the end points from 1 to 7, 1 being 'not used at all' and 7 being 'Extremely frequent use'.

Table 5.2
Measurement Items

Construct	No of items	Adapted from	Measurement Scale
Web portal Quality (WQ)	4	Liaw S.(2008)	Likert Scale→1 to 7 (1 being "Strongly disagree" and 7 being "strongly agree")
Perceived Self-efficacy (PSE)	3	Liaw S.(2008)	
Facilitating Conditions (FC)	4	Thompson, Higgins & Howell (1991)	
Perceived Ease of Use (PEOU)	6	Malhotra & Galleta (1999)	
Perceived Usefulness (PU)	6	Malhotra & Galleta (1999)	
Attitude toward Using (ATT)	4	Masrom (2007)	
Behavioral Intention to use (BI)	3	Taylor & Todd (1995a), Liaw (2008)	
Actual Use (AU)	3	Malhotra & Galleta (1999)	Likert Scale→1to 7 (1 being "Not use at all" and 7 being "extremely frequent use")
Total	33		

Instrument Validation

Before collecting data, an expert-panel of two faculty-members reviewed the survey items and suggested only a few minor modifications to improve the items. The items were revised as suggested by the expert-panel. To determine the understandability of the survey items by the prospective participants, a pilot group of twenty students were emailed the survey link. The pilot-test feedback ensured that the survey items were clear and understandable to the respondents.

Reliability analysis

To test the internal consistency of the indicators of each construct, reliability test was conducted. Cronbach's alpha reliability was calculated on each of the eight scales. The reliability statistics (see Table 5.3) shows the alpha coefficient for all eight scales (except AU, which is .656) are above .70, suggesting that the items have relatively high internal consistency (Hair, Anderson, Tatham & Black, 1998). Nunnally (1976) recommended Cronbach's alpha of 0.6 is sufficient to be acceptable value for research purpose, so the reliability statistics for AU (0.656) is acceptable as well.

Table 5. 3
Reliability Statistics

Scale	Items	Items retained	Cronbach's Alpha
WQ (Web portal Quality)	4	4	.827
PSE (Perceived Self-efficacy)	3	3	.864
FC (Facilitating Conditions)	4	4	.702
PEOU (Perceived ease of use)	6	6	.944
PU (Perceived Usefulness)	6	6	.939
ATT (Attitude toward using)	4	4	.924
BI (Behavioral Intention)	3	3	.862
AU (Actual Use)	3	3	.656

Data Analysis

To test the degree to which the indicators represent the constructs they are intended to measure, a Confirmatory factor analyses (CFA) was conducted. Later, Structural Equation Modeling (SEM) techniques using Analysis of Moment Structures graphics (AMOS 18; Arbuckle, 2007) was employed to evaluate the fit of both of the measurement and structural components of the proposed model.

Researchers suggest, a guideline of five subjects per variable in studies conducting CFA (Loehlin, 1998, Marsh, Balla, & McDonald, 1988). To conduct a SEM study, Hoe (2008) suggests 10 participants for every free parameter estimated. Therefore, the proposed model with 33 parameters would require at least 165 participants for conducting the CFA and at least 330 participants for conducting SEM. Therefore, the sample size in this study (n=429) is sufficient to conduct CFA and SEM.

Generally, in CFA and SEM analyses, several measures are used to evaluate the fit of models to the observed correlation matrices (Hu & Bentler, 1995). Since, Chi Square Statistics (CMIN) is sensitive to large samples; this paper reported the fit indices less sensitive to sample size as well as the Chi Square statistics. Relative Chi Square (CMIN/DF), Root Mean Squared Error of Approximation (RMSEA), SRMR (Standardized Root Mean Residual), Incremental Fit Indices (IFI), Comparative fit Indices (CFI), Normed Fit Index (RFI), Tucker Lewis Index (TLI), Parsimonious fit Index (AIC) were used to evaluate the model.

Data Screening

To be considered as a complete response, the respondents were required to answer all of the Likert-type items (33 items). The survey software (Qualtrics.com) prevented submission of uncompleted survey, so no missing data was found. Before conducting the CFA, univariate and multivariate normality assessments were conducted in AMOS (Table 5.4).

Table 5.4 Assessment of Normality

Assessment of normality (Group number 1)

Variable	min	max	skew	c.r.	kurtosis	c.r.
BI3	1	7	-0.54	-4.567	0.28	1.182
BI2	1	7	-0.604	-5.104	0.321	1.358
BI1	1	7	-0.619	-5.231	0.372	1.573
AU3	1	7	-0.599	-5.063	-0.489	-2.069
AU2	2	7	1.087	9.195	0.417	1.763
AU1	2	7	-1.567	-13.254	1.239	5.237
ATT4	1	7	-0.956	-8.083	1.231	5.204
ATT3	1	7	-0.721	-6.094	0.464	1.964
ATT2	1	7	-0.739	-6.247	0.684	2.893
ATT1	1	7	-0.976	-8.251	1.676	7.084
PEOU1	1	7	-0.921	-7.785	0.865	3.656
PEOU2	1	7	-0.568	-4.8	0.07	0.298
PEOU3	1	7	-0.928	-7.846	0.906	3.83
PEOU4	1	7	-0.745	-6.3	0.894	3.781
PEOU5	1	7	-0.954	-8.067	1.203	5.088
PEOU6	1	7	-0.811	-6.858	0.773	3.269
PU6	1	7	-0.517	-4.367	0.062	0.263
PU5	1	7	-0.37	-3.129	-0.133	-0.561
PU4	1	7	-0.527	-4.454	0.081	0.341
PU3	1	7	-0.703	-5.945	0.478	2.023
PU2	1	7	-0.598	-5.058	0.689	2.911
PU1	1	7	-0.509	-4.308	0.605	2.56
FC1	1	7	0.224	1.897	-0.63	-2.666
FC2	1	7	-0.368	-3.115	0.231	0.977
FC3	1	7	-0.786	-6.647	0.493	2.084
FC4	1	7	-0.393	-3.32	0.278	1.177
PSE1	1	7	-1.387	-11.726	2.466	10.425
PSE2	1	7	-1.533	-12.961	3.097	13.094
PSE3	1	7	-1.061	-8.972	0.989	4.182
WQ1	1	7	-1.065	-9.008	1.243	5.255
WQ2	1	7	-0.687	-5.806	-0.125	-0.529
WQ3	1	7	-0.757	-6.404	0.543	2.295
WQ4	1	7	-0.74	-6.26	0.777	3.284
Multivariate					371.666	80.084

According to Kline (2005), the skewness and kurtosis indices should not exceed [3] and [10] to ensure univariate normality of data. The Skewness (-1.567 to + 1.087) and Kurtosis (-0.63 to +3.097) of the data indicated that the responses are not fairly normally distributed and the data did not meet the univariate normality assumption (See Table 5.4) **.**

Mardia's (1970) normalized estimate of multivariate kurtosis: Critical Ratio (c.r value) is calculated to be 80.084. Bentler (2005) suggested that, the c.r value >5.00 is indicative of data that are non-normally distributed. The data indicates, the multivariate normality assumption is violated (kurtosis= 371.666, c.r value = 80.084). Since the data did not meet the univariate and multivariate normality assumptions Bollen-Stine bootstrap method was used instead of Maximum Likelihood Estimation method for inference of exact measurement and structural model (Byrne, 2009).

The mean and standard deviations of the constructs and items measuring the overall web portal usage attitude ranges from 3.28 to 6.28 and from 1.15 to 1.67, respectively (See Table 5.5). These suggest wide spread responses among the participants. The mean for all constructs (except FC) are above 5 which indicate that students on average agreed on the statements. For FC, the mean is 4.82 which indicate students have differentiated view (ranging from neutral to strongly agree) on their perception about the facilitating conditions provided by the university regarding the web portal use.

Table 5.5

Mean and Standard Deviation of all Constructs and Items

Constructs and Items	Mean	SD	Constructs and Items	Mean	SD
Web portal Quality (WQ)	5.31	1.34	Perceived Usefulness (PU)	5.21	1.29
WQ1	5.48	1.29	PU1	5.14	1.22
WQ2	5.00	1.54	PU2	5.17	1.27
WQ3	5.45	1.29	PU3	5.53	1.23
WQ4	5.32	1.26	PU4	5.15	1.34
Perceived Self Efficacy (PSE)	5.86	1.23	PU5	5.05	1.33
PSE1	5.96	1.17	PU6	5.22	1.36
PSE2	6.01	1.17	Behavioral Intention (BI)	5.47	1.24
PSE3	5.60	1.35	BI1	5.64	1.16
Facilitating Conditions(FC)	4.82	1.35	BI2	5.28	1.33
FC1	3.54	1.67	BI3	5.48	1.24
FC2	5.01	1.31	Attitude toward Using (ATT)	5.59	1.23
FC3	5.79	1.15	ATT1	5.80	1.15
FC4	4.97	1.26	ATT2	5.42	1.27
Perceived Ease of Use(PEOU)	5.54	1.23	ATT3	5.62	1.23
PEOU1	5.75	1.17	ATT4	5.54	1.28
PEOU2	5.35	1.23	Actual Use (AU)	5.01	1.34
PEOU3	5.45	1.33	AU1	6.28	1.22
PEOU4	5.63	1.17	AU2	3.28	1.39
PEOU5	5.51	1.24	AU3	5.48	1.40
PEOU6	5.55	1.22			

Confirmatory Factor Analysis (CFA)

CFA of the measurement model. Before estimating the path coefficient of the hypothesized structural model, a CFA was conducted for the hypothesized eight factor measurement model (Figure 5.3). The CFA was performed using the sample of 429 participants to examine the factorial structure of the hypothesized eight factor instrument with 33 items.

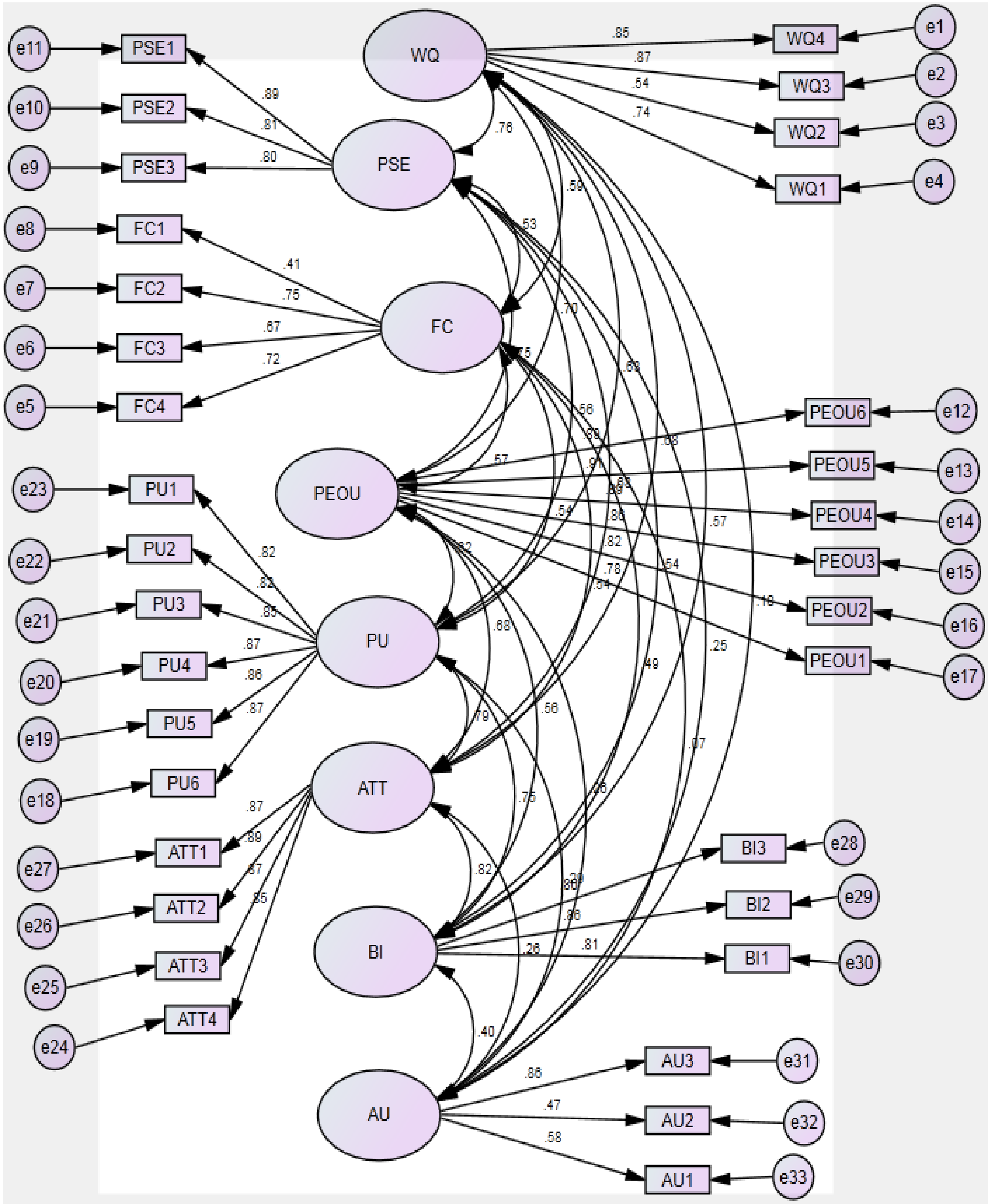

Figure 5.3. The hypothesized eight factor CFA model for students' acceptance of university web portals

Bivariate Correlations and factor loadings. The bivariate Pearson correlation coefficient was computed to investigate the linearity between the observed variables. All the correlations among items were significant which indicate that the constructs and items were unique as well as interrelated with one another. The correlation coefficients range from .034 to .834 (Table 5.6) indicated that the linearity assumptions between indicator and latent variables were not violated. The significant correlations among the eight latent variables suggest that they are interrelated to each other. However, the correlations were not so high as to suggest that they are all measuring the same construct.

Table 5.6

Correlation Matrices

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
WQ1	1													
WQ2	.460**	1												
WQ3	.621**	.488**	1											
WQ4	.604**	.422**	.760**	1										
PSE1	.549**	.344**	.557**	.553**	1									
PSE2	.532**	.250**	.471**	.451**	.749**	1								
PSE3	.483**	.341**	.612**	.582**	.693**	.618**	1							
FC1	.140**	.153**	.167**	.135**	.178**	.138**	.211**	1						
FC2	.259**	.255**	.336**	.350**	.336**	.270**	.417**	.389**	1					
FC3	.299**	.275**	.343**	.345**	.367**	.295**	.357**	.215**	.502**	1				
FC4	.297**	.324**	.387**	.448**	.313**	.205**	.332**	.253**	.526**	.485**	1			
AU1	.047	-.021	.035	.028	.153**	.149**	.066	-.016	.037	.029	.039	1		
AU2	.099*	.144**	.101*	.063	.058	.013	.069	.052	.012	-.014	.083	.269**	1	
AU3	.181**	.102*	.167**	.074	.213**	.212**	.101*	.032	.024	.071	.034	.493**	.407**	1
PEOU1	.337**	.243**	.404**	.420**	.522**	.437**	.480**	.150**	.308**	.353**	.328**	.142**	.088	.229**
PEOU2	.488**	.311**	.534**	.568**	.547**	.478**	.556**	.234**	.376**	.340**	.389**	.089	.100*	.187**
PEOU3	.485**	.299**	.558**	.582**	.580**	.479**	.596**	.228**	.378**	.367**	.346**	.099*	.073	.156**
PEOU4	.447**	.326**	.527**	.532**	.585**	.537**	.573**	.158**	.356**	.373**	.348**	.130**	.063	.229**
PEOU5	.485**	.285**	.532**	.549**	.566**	.523**	.578**	.203**	.338**	.364**	.338**	.138**	.051	.239**
PEOU6	.486**	.296**	.550**	.531**	.573**	.507**	.624**	.190**	.385**	.419**	.353**	.128**	.061	.179**
PU1	.451**	.392**	.510**	.500**	.487**	.384**	.473**	.234**	.330**	.341**	.363**	.121*	.151**	.245**
PU2	.452**	.339**	.475**	.453**	.462**	.397**	.457**	.187**	.315**	.332**	.354**	.135**	.142**	.250**
PU3	.424**	.280**	.440**	.458**	.482**	.420**	.450**	.170**	.348**	.310**	.384**	.162**	.100*	.218**
PU4	.444**	.348**	.424**	.432**	.392**	.345**	.416**	.220**	.301**	.268**	.346**	.152**	.179**	.243**
PU5	.393**	.357**	.390**	.426**	.349**	.286**	.389**	.266**	.334**	.251**	.385**	.065	.153**	.161**
PU6	.448**	.322**	.430**	.465**	.360**	.352**	.417**	.216**	.299**	.250**	.363**	.093	.096*	.169**
BI1	.354**	.268**	.335**	.367**	.391**	.357**	.336**	.169**	.349**	.304**	.336**	.219**	.151**	.253**
BI2	.408**	.305**	.450**	.418**	.415**	.374**	.413**	.186**	.266**	.205**	.322**	.208**	.208**	.313**
BI3	.373**	.231**	.384**	.385**	.345**	.351**	.365**	.134**	.240**	.267**	.327**	.183**	.104*	.258**
ATT1	.507**	.287**	.466**	.464**	.546**	.500**	.466**	.107*	.343**	.366**	.348**	.154**	.059	.212**
ATT2	.539**	.324**	.504**	.514**	.498**	.467**	.494**	.172**	.334**	.300**	.357**	.139**	.160**	.189**
ATT3	.477**	.299**	.401**	.428**	.477**	.459**	.432**	.145**	.295**	.312**	.329**	.119*	.109*	.179**
ATT4	.554**	.365**	.577**	.606**	.555**	.480**	.553**	.194**	.369**	.339**	.401**	.091	.121*	.182**

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
PEOU1	1																		
PEOU2	.671**	1																	
PEOU3	.600**	.742**	1																
PEOU4	.755**	.721**	.749**	1															
PEOU5	.706**	.724**	.787**	.834**	1														
PEOU6	.685**	.720**	.794**	.785**	.827**	1													
PU1	.447**	.537**	.530**	.516**	.563**	.548**	1												
PU2	.418**	.543**	.533**	.491**	.544**	.519**	.787**	1											
PU3	.399**	.456**	.489**	.426**	.487**	.486**	.674**	.692**	1										
PU4	.385**	.512**	.468**	.437**	.471**	.466**	.723**	.712**	.722**	1									
PU5	.366**	.445**	.426**	.389**	.433**	.408**	.644**	.649**	.740**	.767**	1								
PU6	.388**	.445**	.438**	.397**	.439**	.427**	.655**	.678**	.756**	.747**	.835**	1							
BI1	.405**	.378**	.385**	.376**	.365**	.419**	.517**	.496**	.612**	.548**	.545**	.557**	1						
BI2	.405**	.451**	.450**	.380**	.420**	.451**	.558**	.533**	.510**	.551**	.506**	.554**	.686**	1					
BI3	.358**	.367**	.376**	.380**	.397**	.421**	.508**	.480**	.533**	.468**	.463**	.522**	.647**	.697**	1				
ATT1	.473**	.494**	.541**	.496**	.503**	.543**	.583**	.557**	.611**	.582**	.540**	.585**	.631**	.643**	.596**	1			
ATT2	.440**	.561**	.554**	.491**	.537**	.528**	.571**	.597**	.597**	.625**	.566**	.601**	.546**	.623**	.570**	.768**	1		
ATT3	.452**	.480**	.470**	.442**	.467**	.472**	.584**	.570**	.633**	.622**	.580**	.644**	.626**	.607**	.590**	.786**	.775**	1	
ATT4	.498**	.617**	.634**	.571**	.616**	.601**	.605**	.565**	.567**	.567**	.542**	.566**	.500**	.596**	.512**	.715**	.786**	.701**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

All loadings and correlations among the latent variables were significant. Using the rules of Tabachnick and Fidell (2007), all the factor loadings (ranges from 0.41 to .91) are considered fair to excellent. All indicator variables significantly load on the expected latent variable as well (See Table 5.7).

Table 5.7
Factor Loadings/ Standardized regression weights coefficients

Items ← Factors		**Loading**	**Items ← Factors**		**Loading**
WQ1	WQ	0.74	PU1	PU	0.82
WQ2	WQ	0.54	PU2	PU	0.82
WQ3	WQ	0.87	PU3	PU	0.85
WQ4	WQ	0.85	PU4	PU	0.87
PSE1	PSE	0.89	PU5	PU	0.86
PSE2	PSE	0.81	PU6	PU	0.87
PSE3	PSE	0.80	ATT1	ATT	0.87
FC1	FC	0.41	ATT2	ATT	0.89
FC2	FC	0.75	ATT3	ATT	0.87
FC3	FC	0.67	ATT4	ATT	0.85
FC4	FC	0.72	BI1	BI	0.81
PEOU1	PEOU	0.78	BI2	BI	0.86
PEOU2	PEOU	0.82	BI3	BI	0.80
PEOU3	PEOU	0.86	AU1	AU	0.58
PEOU4	PEOU	0.89	AU2	AU	0.47
PEOU5	PEOU	0.91	AU3	AU	0.86
PEOU6	PEOU	0.89			

The unstandardized parameter estimates and the critical ratios for all 33 items are significant at .001 level (See Table 5.8). These values support a priori hypothesis of the relationships between the assigned items and their latent constructs.

Table 5.8
Parameter estimate of the 33 item measurement model (8 correlated factors)

Item		Factor	Unstandardized Estimate	Standard error of estimates	Critical Ratio (C.R)	P
WQ4	<---	WQ	1*			
WQ3	<---	WQ	1.042	0.048	21.702	***
WQ2	<---	WQ	0.782	0.067	11.68	***
WQ1	<---	WQ	0.887	0.051	17.308	***
FC4	<---	FC	1*			
FC3	<---	FC	0.852	0.073	11.606	***
FC2	<---	FC	1.084	0.087	12.509	***
FC1	<---	FC	0.756	0.102	7.407	***
PSE3	<---	PSE	1*			
PSE2	<---	PSE	0.87	0.048	18.162	***
PSE1	<---	PSE	0.964	0.048	20.292	***
PEOU6	<---	PEOU	1*			
PEOU5	<---	PEOU	1.04	0.035	29.913	***
PEOU4	<---	PEOU	0.946	0.034	27.575	***
PEOU3	<---	PEOU	1.059	0.04	26.568	***
PEOU2	<---	PEOU	0.924	0.039	23.531	***
PEOU1	<---	PEOU	0.81	0.04	20.157	***
PU6	<---	PU	1*			
PU5	<---	PU	0.967	0.033	29.121	***
PU4	<---	PU	1.005	0.043	23.49	***
PU3	<---	PU	0.906	0.04	22.743	***
PU2	<---	PU	0.884	0.043	20.643	***
PU1	<---	PU	0.85	0.041	20.568	***
ATT4	<---	ATT	1*			
ATT3	<---	ATT	0.985	0.042	23.206	***
ATT2	<---	ATT	1.047	0.043	24.294	***
ATT1	<---	ATT	0.932	0.04	23.555	***
BI3	<---	BI	1*			
BI2	<---	BI	1.152	0.059	19.408	***
BI1	<---	BI	0.948	0.052	18.142	***
AU3	<---	AU	1*			
AU2	<---	AU	0.539	0.075	7.237	***
AU1	<---	AU	0.585	0.073	8.051	***

* This value was set at 1.00 to set the metric for estimation purpose.

*** p<.001

As suggested by Hair, Black, Babin, Anderson and Tatham, (2006) the hypothesized eight factor CFA model (Figure 3) was assessed using fit indices from various categories: absolute fit indices, parsimonious fit indices and incremental fit indices. Result indicated that the model fits the data well. The modification indices (Table 5.9) showed, by correlating the error variances between some of the items within the same constructs slightly increases the goodness of the fit indices. However, it has been a cautioned practice in literature (Joreskog & Sorbom, 1989; MacCallum, Roxnowski & Necowitz, 1992). The modification indices provided by AMOS suggested adding three error variances between (i) PU5 and PU6 (e18 and e19), (ii) PU1 and PU2 (e22 and e23) and (iii) PEOU1 and PEOU4 (e14 and e17). The items were re-checked. It was found that some of the items asked similar and related issues, and most likely, the items were scored by the respondents without discriminating among the specific intent of each item. Therefore, the reasons behind the correlations could be the wordings of the items. However, the correlation between these items were not so high (.835, .787, and .755 respectively) as to suggest that they all are measuring the same thing. So, it was decided to ignore adding the suggested correlations. All other factors showed good fit. So no further revision was made.

Table 5.9 Modification Indices

Covariances: (Group number 1 - Default model)

			M.I.	Par Change				M.I.	Par Change				M.I.	Par Change				M.I.	Par Change
e33	<-->	WQ	5.957	-0.093	e21	<-->	e29	17.888	-0.114	e13	<-->	e14	5.831	0.037	e6	<-->	e19	6.568	-0.085
e30	<-->	PU	6.176	0.068	e20	<-->	e28	7.767	-0.080	e12	<-->	BI	4.838	0.042	e6	<-->	e16	4.127	-0.067
e30	<-->	FC	7.691	0.086	e20	<-->	e26	5.350	0.053	e12	<-->	e31	4.021	-0.064	e6	<-->	e12	5.077	0.061
e30	<-->	WQ	6.868	-0.072	e19	<-->	PU	8.331	0.076	e12	<-->	e15	5.472	0.048	e5	<-->	PSE	7.411	-0.097
e29	<-->	FC	4.876	-0.073	e19	<-->	e32	4.432	0.094	e11	<-->	e28	4.838	-0.059	e5	<-->	WQ	8.920	0.107
e28	<-->	e32	4.237	-0.103	e19	<-->	e23	22.308	-0.124	e11	<-->	e27	7.567	0.055	e5	<-->	e32	4.102	0.122
e27	<-->	BI	8.289	0.057	e19	<-->	e22	21.831	-0.126	e11	<-->	e26	4.122	-0.043	e5	<-->	e10	7.115	-0.097
e27	<-->	PSE	4.498	0.047	e18	<-->	AU	5.443	-0.103	e11	<-->	e21	9.008	0.068	e4	<-->	ATT	11.386	0.091
e27	<-->	WQ	5.126	-0.051	e18	<-->	PEOU	4.903	-0.055	e11	<-->	e18	11.426	-0.080	e4	<-->	PSE	5.121	0.075
e27	<-->	e32	10.971	-0.125	e18	<-->	e25	9.369	0.072	e11	<-->	e17	4.956	0.055	e4	<-->	WQ	5.232	-0.075
e27	<-->	e30	7.051	0.060	e18	<-->	e23	24.093	-0.127	e10	<-->	FC	4.717	-0.068	e4	<-->	e17	4.146	-0.069
e26	<-->	e32	7.862	0.112	e18	<-->	e22	10.831	-0.087	e10	<-->	e32	6.820	-0.121	e4	<-->	e10	17.552	0.143
e26	<-->	e30	10.360	-0.077	e18	<-->	e19	63.614	0.201	e10	<-->	e25	4.482	0.052	e4	<-->	e9	10.272	-0.128
e25	<-->	PU	8.423	0.071	e17	<-->	WQ	11.977	-0.096	e10	<-->	e24	6.238	-0.068	e3	<-->	FC	4.465	0.114
e25	<-->	PEOU	5.518	-0.054	e17	<-->	e30	6.115	0.068	e10	<-->	e15	6.545	-0.068	e3	<-->	e32	6.359	0.203
e25	<-->	WQ	12.236	-0.086	e17	<-->	e26	4.738	-0.052	e10	<-->	e14	4.011	0.043	e3	<-->	e21	7.417	-0.121
e25	<-->	e30	9.864	0.077	e17	<-->	e25	7.543	0.068	e10	<-->	e11	9.899	0.074	e3	<-->	e19	6.635	0.121
e25	<-->	e29	5.238	-0.060	e16	<-->	PEOU	6.057	-0.061	e9	<-->	AU	7.582	-0.150	e3	<-->	e4	5.374	0.137
e25	<-->	e27	8.000	0.056	e16	<-->	e27	6.948	-0.058	e9	<-->	PEOU	5.391	0.071	e2	<-->	e30	8.086	-0.079
e24	<-->	BI	4.596	-0.050	e16	<-->	e26	6.107	0.058	e9	<-->	PSE	12.336	-0.109	e2	<-->	e29	7.538	0.082
e24	<-->	PEOU	13.531	0.093	e16	<-->	e21	5.405	-0.057	e9	<-->	WQ	6.725	0.084	e2	<-->	e25	10.687	-0.081
e24	<-->	WQ	19.711	0.119	e16	<-->	e20	6.964	0.068	e9	<-->	e31	7.528	-0.131	e2	<-->	e9	10.941	0.109
e24	<-->	e30	10.502	-0.087	e16	<-->	e17	4.051	0.054	e9	<-->	e27	7.666	-0.074	e1	<-->	AU	6.927	-0.123
e24	<-->	e27	6.010	-0.053	e15	<-->	e31	4.030	-0.078	e9	<-->	e12	11.314	0.087	e1	<-->	e31	7.672	-0.114
e24	<-->	e26	10.832	0.075	e15	<-->	e24	4.452	0.054	e8	<-->	PU	4.280	0.118	e1	<-->	e27	4.130	-0.047
e24	<-->	e25	9.280	-0.072	e15	<-->	e17	25.589	-0.133	e8	<-->	e27	9.395	-0.143	e1	<-->	e24	10.790	0.089
e23	<-->	PU	7.858	-0.076	e15	<-->	e16	7.067	0.068	e8	<-->	e21	4.817	-0.115	e1	<-->	e15	4.402	0.056
e23	<-->	PEOU	8.818	0.076	e14	<-->	e29	6.819	-0.058	e8	<-->	e19	8.026	0.157	e1	<-->	e10	5.643	-0.067
e23	<-->	e26	4.890	-0.052	e14	<-->	e17	24.684	0.104	e7	<-->	e30	7.077	0.098	e1	<-->	e8	4.418	-0.121
e23	<-->	e24	7.268	0.072	e14	<-->	e15	5.545	-0.047	e7	<-->	e28	4.040	-0.080	e1	<-->	e5	11.145	0.122
e22	<-->	PEOU	7.373	0.071	e13	<-->	e32	4.344	-0.073	e7	<-->	e9	8.506	0.126	e1	<-->	e3	5.480	-0.113
e22	<-->	e30	4.377	-0.059	e13	<-->	e31	4.572	0.066	e7	<-->	e8	11.290	0.252	e1	<-->	e2	4.507	0.056
e22	<-->	e23	68.152	0.227	e13	<-->	e30	5.630	-0.050	e6	<-->	e29	10.783	-0.119					
e21	<-->	PSE	13.309	0.092	e13	<-->	e27	4.835	-0.038	e6	<-->	e27	7.762	0.078					
e21	<-->	e30	18.118	0.108	e13	<-->	e16	7.587	-0.055	e6	<-->	e22	4.413	0.073					

The fit indices for the proposed model are depicted in Table 6. The CFA results supported the original eight factor structure of the 33 measurement items used for this study to evaluate students' university web portal usage behavior.

Table 5.10

Fit Indices of the Proposed Measurement Model

	Recommended Level of Fit	Proposed Measurement Model
Absolute fit indices		
Chi-Square	not significant at $p<0.05$	1172.947, df=467, p=0.000
Relative Chi-Square (CMIN/DF)	2~5, (Bentler,1990)	2.512
RMSEA (Root Mean Square of Error Estimation)	<=0.06, (Joreskog & Sorbom,1993)	0.059
SRMR (Standardized Root Mean Residual)	<=.80 (Teo, 2012)	0.0429
Incremental fit indices		
CFI (Comparative Fit Index)	>.90 (Browne & Cudeck, 1992)	0.934
IFI (Incremental Fit Index)	>.90 (Bentler,1990)	.935
NFI (Normed Fit Index)	>=.95 good, .90 to .95= acceptable (Bentler,1990)	0.896
TLI (Tucker Lewis Index)	>=.90 (Marsh, Hau & Wen,2004)	0.926
Parsimonious fit Index		
AIC (Akaike Information Criterion)	Smaller value better fit	1360.947

Structural Equation Modeling (SEM)

To test the fit between the hypothesized model and the data obtained, a structural equation modeling was conducted. SEM was employed because it is the most widely and easily applied methods for modeling multivariate relations and for simultaneously examining direct and indirect effects among constructs (Byrne, 2009). The hypothesized structural model (See Figure 5.4) was tested using SEM with AMOS 18 (Arbuckle, 2007) following the five basic steps of conducting SEM approach (Kline, 2005): (i) model specification, (ii) model identification, (iii) data preparation and screening, (iv) estimation of model and (v) model re-specification, if necessary.

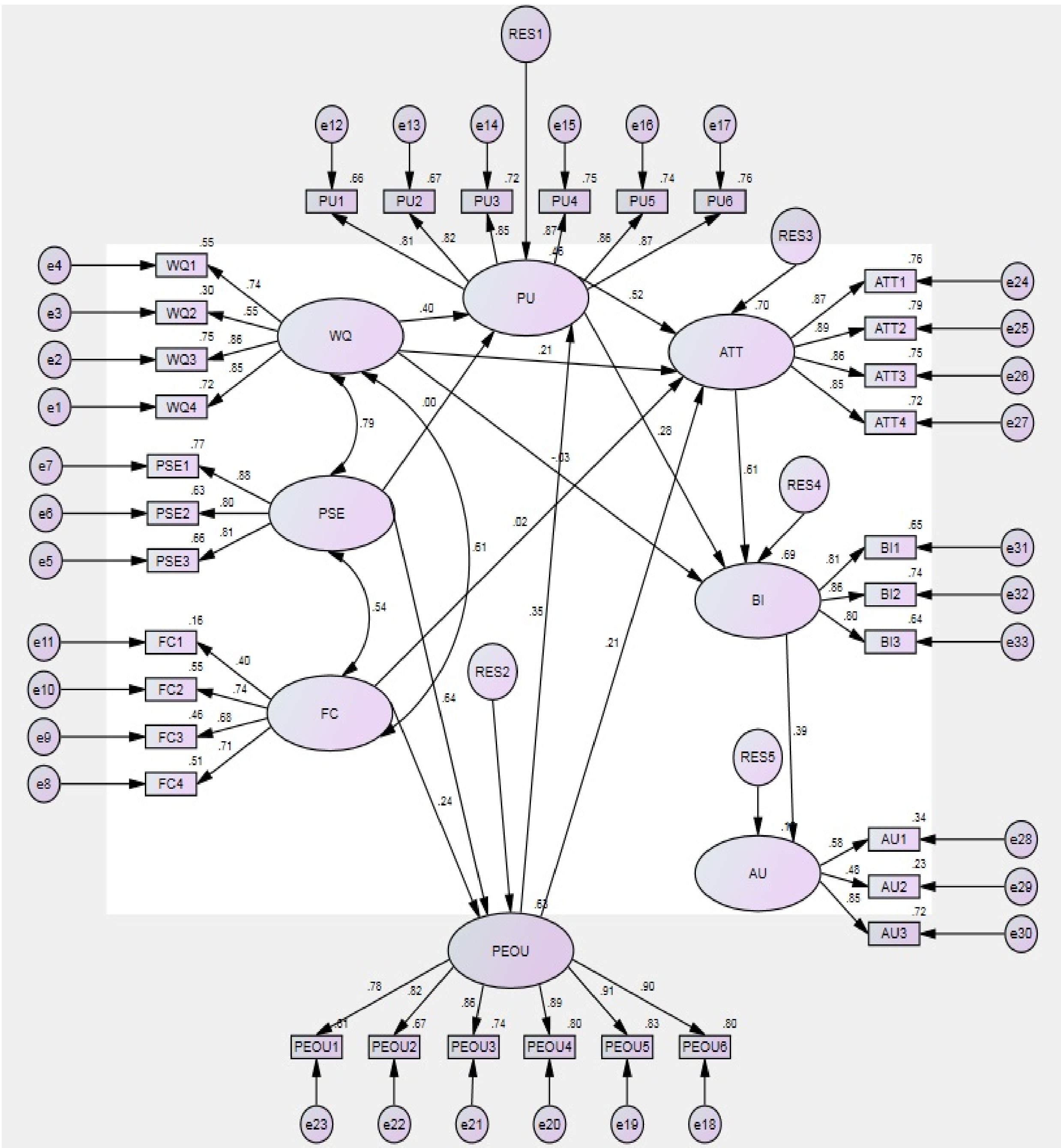

Figure 5.4. Hypothesized structural model for students' acceptance of university web portals

Bivariate Correlations among the latent constructs. The bivariate Pearson correlation coefficient was computed to investigate the linearity between the eight latent constructs. All the correlations among the eight constructs (except correlation between FC and AU) were found significant at the 0.01 level. The correlation ranged from .139 to .740 (see Table 5.11). The correlations were not so high as to suggest that they all are measuring the same construct. These bivariate correlations supported testing of the proposed hypotheses (Fraizer, Tix & Barron, 2004).

Table 5.11

Correlations among the eight latent constructs

	WQ	PSE	FC	AU	PEOU	PU	BI	ATT
WQ								
PSE	.650**							
FC	.452**	.426**						
AU	.139**	.165**	.056					
PEOU	.614**	.690**	.474**	.194**				
PU	.581**	.522**	.455**	.235**	.597**			
BI	.490**	.473**	.386**	.311**	.510**	.677**		
ATT	.614**	.615**	.428**	.206**	.653**	.740**	.733**	

**. Correlation is significant at the 0.01 level (2-tailed).

The initial model (see Figure 4) was tested which revealed fit indices: χ^2 = 1220.623, *df*= 479, *p* <.001, CMIN/DF= .2548, SRMR= 0.0464, CFI= 0.931, IFI = .931, NFI= 0.892, TLI= .924, RMSEA =0.060, AIC= 1450.623, indicating a good model fit. However, all of the path coefficients did not demonstrate statistical significance (see Table 5.12).

Table 5.12

The Estimation for Regression weights of the hypothesized Model

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Standardized Coefficients
PEOU	<---	PSE	0.632	0.053	11.96	***	0.636
PEOU	<---	FC	0.294	0.062	4.729	***	0.243
PU	<---	WQ	0.369	0.075	4.953	***	0.397
PU	<---	PSE	-0.002	0.087	-0.022	0.982	-0.002
PU	<---	PEOU	0.32	0.063	5.045	***	0.352
ATT	<---	PU	0.526	0.05	10.433	***	0.522
ATT	<---	PEOU	0.192	0.045	4.227	***	0.209
ATT	<---	WQ	0.197	0.052	3.812	***	0.210
ATT	<---	FC	0.019	0.056	0.343	0.731	0.017
BI	<---	ATT	0.573	0.07	8.178	***	0.614
BI	<---	PU	0.262	0.061	4.275	***	0.279
BI	<---	WQ	-0.025	0.047	-0.527	0.598	-0.028
AU	<---	BI	0.293	0.053	5.555	***	0.387
WQ4	<---	WQ	1				0.847
WQ3	<---	WQ	1.044	0.049	21.32	***	0.863
WQ2	<---	WQ	0.794	0.068	11.739	***	0.548
WQ1	<---	WQ	0.899	0.052	17.328	***	0.743
PSE3	<---	PSE	1				0.810
PSE2	<---	PSE	0.848	0.047	18.156	***	0.796
PSE1	<---	PSE	0.939	0.046	20.459	***	0.877
FC3	<---	FC	0.865	0.074	11.628	***	0.676
FC2	<---	FC	1.078	0.087	12.348	***	0.741
FC1	<---	FC	0.742	0.103	7.233	***	0.399
FC4	<---	FC	1				0.714
PU1	<---	PU	1				0.814
PU2	<---	PU	1.043	0.052	19.916	***	0.818
PU3	<---	PU	1.05	0.05	21.065	***	0.849
PU4	<---	PU	1.166	0.054	21.707	***	0.866
PU5	<---	PU	1.156	0.054	21.476	***	0.860
PU6	<---	PU	1.194	0.054	21.986	***	0.874
PEOU6	<---	PEOU	1				0.896
PEOU5	<---	PEOU	1.042	0.035	29.708	***	0.912
PEOU4	<---	PEOU	0.959	0.034	28.253	***	0.894
PEOU3	<---	PEOU	1.053	0.041	25.988	***	0.862
PEOU2	<---	PEOU	0.926	0.039	23.453	***	0.821
PEOU1	<---	PEOU	0.835	0.039	21.25	***	0.779

ATT1	<---	ATT	1				0.871
ATT2	<---	ATT	1.129	0.044	25.797	***	0.891
ATT3	<---	ATT	1.057	0.044	24.292	***	0.864
ATT4	<---	ATT	1.078	0.046	23.377	***	0.847
AU1	<---	AU	1				0.579
AU2	<---	AU	0.937	0.122	7.652	***	0.477
AU3	<---	AU	1.686	0.218	7.716	***	0.851
BI1	<---	BI	1				0.807
BI2	<---	BI	1.222	0.062	19.625	***	0.860
BI3	<---	BI	1.06	0.059	18.004	***	0.800

The SEM results indicated, three out of the 13 proposed hypotheses were not significant. Therefore, the three insignificant paths: (i) path from PSE to PU, (ii) path from FC to ATT and (iii) path from WQ to BI were removed one by one according to their *p* value. These three modifications resulted in a better model fit: χ^2 = 1221.002, *df* = 482, p <.001, CMIN/DF= 2.533, SRMR= 0.0465, CFI= 0.931, IFI= .931, NFI= 0.892, TLI= .925, RMSEA =0.060, AIC= 1445.002). The fit indices for all the models considered are depicted in Table 5.13.

Table 5.13

Fit *Indices of the Proposed Measurement Model*

	Recommended Level of Fit	Hypothesized structural model	1st Remove insignificant path PSE→PU	2nd Remove insignificant path FC→ATT	3rd Remove insignificant path WQ→BI
Absolute fit indices					
Chi-Square	not significant at $p<0.05$	1220.623 df=479, p=0.000	1220.623 df= 480, p=0.000	1220.741 df = 481, p=0.000	1221.002, df= 482, p= 0.000
Relative Chi-Square (CMIN/DF)	2~5 , <5, (Bentler,1990)	2.548	2.543	2.538	2.533
RMSEA (Root Mean Square of Error Estimation)	<=0.06 (Joreskog & Sorbom,1993)	0.060	0.060	0.060	0.060
SRMR (Standardized Root Mean Residual)	<=.80 (Teo, 2012)	0.0464	0.0464	0.0465	0.0465
Incremental fit indices					
CFI (Comparative Fit Index)	>=.95 (Hu &Bentler,1999) or >=.90 (Browne & Cudeck, 1992)	0.931	0.931	0.931	0.931
IFI (Incremental Fit Index)	>=.90 (Bentler,1990)	.931	.931	.931	.931
NFI (Normed Fit Index)	>=.95 good, .90 to .95 acceptable, >.90 (Bentler,1990)	0.892	0.892	0.892	0.892
TLI (Tucker Lewis Index)	>=.95 Or >=.90 (Marsh, Hau, & Wen, 2004)	0.924	0.924	0.924	0.925
Parsimonious fit Index					
AIC (Akaike Information Criterion)	Smaller value better fit	1450.623	1448.623	1446.741	1445.002

The modification indices indicated that by adding covariance between e12 to e13 and between e16 and e17 of the PU construct would slightly improve the values of the fit indices. By looking at the items it seemed that the wording of these items were very close to each other and probably the respondents did not notice clearly the small differences of the items and took a generalized approach to rate the items or participants might respond to the items based on social desirability or response acquiescence. However, the correlation between them were not too high to treat them as unique (.39 and .41 respectively). As it did not make substantial theoretical as well as statistical sense to add covariances between these error terms and it was decided not toadd these to the model. So the third modified model was chosen to be the final model (see Figure 5). The estimation for regression weights of the re-specified model (after deleting three insignificant paths- final model) is presented in the Table 5.14.

Table 5.14
The Estimation for Regression weights after deleting the three insignificant paths (Final Model)
Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Standardized Coefficients (Std Regression weights)
PEOU	<---	PSE	0.631	0.053	11.962	***	0.636
PEOU	<---	FC	0.295	0.062	4.757	***	0.244
PU	<---	WQ	0.368	0.055	6.645	***	0.396
PU	<---	PEOU	0.319	0.052	6.182	***	0.351
ATT	<---	PU	0.53	0.05	10.507	***	0.525
ATT	<---	PEOU	0.196	0.043	4.573	***	0.214
ATT	<---	WQ	0.202	0.047	4.288	***	0.215
BI	<---	ATT	0.557	0.064	8.754	***	0.598
BI	<---	PU	0.257	0.061	4.241	***	0.273
AU	<---	BI	0.294	0.053	5.555	***	0.387
WQ4	<---	WQ	1				0.847
WQ3	<---	WQ	1.044	0.049	21.319	***	0.863
WQ2	<---	WQ	0.794	0.068	11.741	***	0.548
WQ1	<---	WQ	0.899	0.052	17.318	***	0.743
PSE3	<---	PSE	1				0.810
PSE2	<---	PSE	0.848	0.047	18.157	***	0.796
PSE1	<---	PSE	0.939	0.046	20.457	***	0.877
FC3	<---	FC	0.864	0.074	11.625	***	0.676
FC2	<---	FC	1.077	0.087	12.346	***	0.741
FC1	<---	FC	0.743	0.103	7.241	***	0.400
FC4	<---	FC	1				0.714
PU1	<---	PU	1				0.814
PU2	<---	PU	1.043	0.052	19.91	***	0.818
PU3	<---	PU	1.05	0.05	21.063	***	0.850
PU4	<---	PU	1.166	0.054	21.704	***	0.866
PU5	<---	PU	1.156	0.054	21.477	***	0.861
PU6	<---	PU	1.194	0.054	21.983	***	0.874
PEOU6	<---	PEOU	1				0.896
PEOU5	<---	PEOU	1.042	0.035	29.705	***	0.912
PEOU4	<---	PEOU	0.959	0.034	28.252	***	0.894
PEOU3	<---	PEOU	1.053	0.041	25.989	***	0.862
PEOU2	<---	PEOU	0.926	0.039	23.455	***	0.821
PEOU1	<---	PEOU	0.835	0.039	21.25	***	0.779
ATT1	<---	ATT	1				0.871
ATT2	<---	ATT	1.129	0.044	25.819	***	0.892

ATT3	<---	ATT	1.058	0.043	24.318	***	0.865
ATT4	<---	ATT	1.078	0.046	23.373	***	0.847
AU1	<---	AU	1				0.579
AU2	<---	AU	0.937	0.122	7.652	***	0.477
AU3	<---	AU	1.687	0.219	7.715	***	0.851
BI1	<---	BI	1				0.807
BI2	<---	BI	1.224	0.062	19.623	***	0.861
BI3	<---	BI	1.06	0.059	17.993	***	0.800

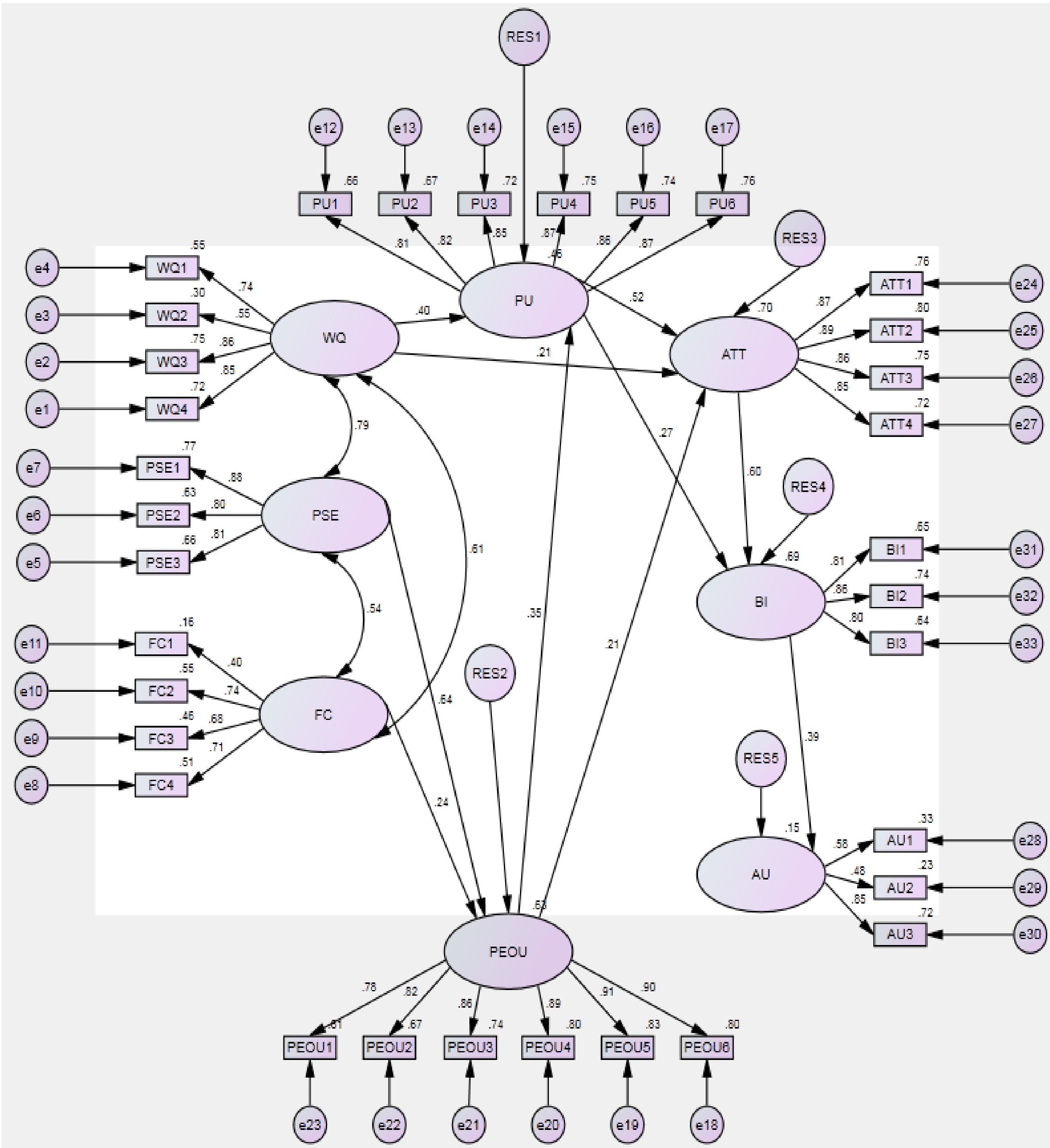

Figure 5.5 The structural model for students' attitude toward university web portal usage

Hypotheses testing results

Based on the final model (see Figure 5), out of the thirteen proposed hypotheses, 10 were supported and three were not (see Table 9). The SEM result indicated that, the three proposed external variables have significant effect on the original TAM variables.

It was revealed that, WQ has a significant positive effect on the PU of the web portal ($\beta = .40$, $p < .001$) and the students' attitude toward using (ATT) the university web portal ($\beta = .21$, $p < .001$) supporting hypothesis H_1 and H_2 respectively. It indicates, if the web portal quality (WQ) is high, students perceive the web portal as a useful one and develop a positive attitude toward it. However the SEM result shows, WQ has no significant effect on students' behavioral intention (BI) of using the university web portal rejecting hypothesis H_3. Similarly result shows external variable students perceived self-efficacy (PSE) has a significant positive effect on PEOU ($\beta = .64$, $p < .001$) but it does not have any significant effect on PU of the university web portal. Therefore, hypothesis H4 is supported but hypothesis H_5 is not. These findings revealed, students with high PSE find it easy to use the web portal. The SEM results indicated that the third external variable facilitating conditions (FC) has a significant positive effect ($\beta = .24$, $p < .001$) on the perceived ease of use (PEOU) of the web portal but FC does not have any significant effect on students' attitude (ATT) toward using the university web portal. Therefore hypothesis H_6 was supported and H_7 was not. The study findings regarding the external variable and their relationships with the original TAM constructs were mostly consistent with prior research in technology adoption. Also, SEM results indicated the relationships within all original TAM constructs were significant.Therefore hypotheses H_8 , H_9, H_{10}, H_{11}, H_{12}, and H_{13} were supported. The regression weights of all these path coefficients are presented in Table 5.15.

Table 5.15

Hypothesis testing results

Hypotheses		Path	Support	Regression weight
$H_{1:}$	Web portal Quality (WQ) has a significant positive effect on PU of university web portal	WQ→PU	Yes	0.40**
$H_{2:}$	WQ has a significant positive effect on students' attitude (ATT) toward university web portal	WQ→ATT	Yes	0.21**
$H_{3:}$	WQ has a significant positive effect on students' behavioral intention (BI) to use university web portal	WQ→BI	No	-
$H_{4:}$	Perceived self-efficacy (PSE) has a significant positive effect on PEOU of university web portals	PSE→PEOU	Yes	0.64**
$H_{5:}$	PSE has a significant positive effect on PU of university web portals	PSE→PU	No	-
$H_{6:}$	Facilitating conditions (FC) has a significant positive effect on PEOU of university web portals	FC→PEOU	Yes	0.24**
H_{7}	FC has a significant positive effect on students' attitude (ATT) toward university web portals	FC→ATT	Not	-
$H_{8:}$	PEOU has a significant positive effect on PU of university web portals	PEOU→PU	Yes	0.35**
$H_{9:}$	PEOU has a significant positive effect on ATT toward using university web portals	PEOU→ATT	Yes	0.21**
$H_{10:}$	PU has a significant positive effect on ATT toward using university web portals	PU→ATT	Yes	0.52**
$H_{11:}$	PU has a significant positive effect on BI to use university web portals	PU→BI	Yes	0.27**
$H_{12:}$	ATT has a significant positive effect on BI to use university web portals	ATT→BI	Yes	0.60**
$H_{13:}$	BI has a significant positive effect on AU of university web portal	BI→AU	Yes	0.39**

** *P*<.001

Three exogenous variable (WQ, PSE and FC) and five endogenous variables (PU, PEOU, ATT, BI, AU) were tested in the overall model. All three exogenous variables were found significant determinants of the endogenous variables. The endogenous variable PU was found to be significantly determined by two variables WQ (β = .40, p <.001) and PEOU (β = .35, p <.001), resulting in an R^2 of .460, which means that the WQ and PEOU accounted for 46% of variance in PU. Similarly, PEOU was significantly determined by FC (β = .24 , p <.001) and PSE (β = .64 , p <.001), resulting in an R^2 of .632, indicating 63.2% of the variance of PEOU is explained by FC and PSE. ATT was significantly determined by PU (β = .52 , p <.001), WQ (β = .21 , p <.001) and PEOU (β = .21 , p <.001) resulting in an R^2 of .704 indicating 70.4% of the variance in ATT is explained by these three (WQ, PU and PEOU) variables. BI was found to be significantly determined by PU (β = .27, p <.001) and ATT (β = .60, p <.001), resulting in an R^2 of .690, which means that PU and ATT jointly accounted for 69% of the variance in BI. Finally AU was significantly determined by BI (β = .39, p <.001), resulting in an R^2 of .15 which indicates that 15% of the variance in AU is accounted by BI (See Figure 6).

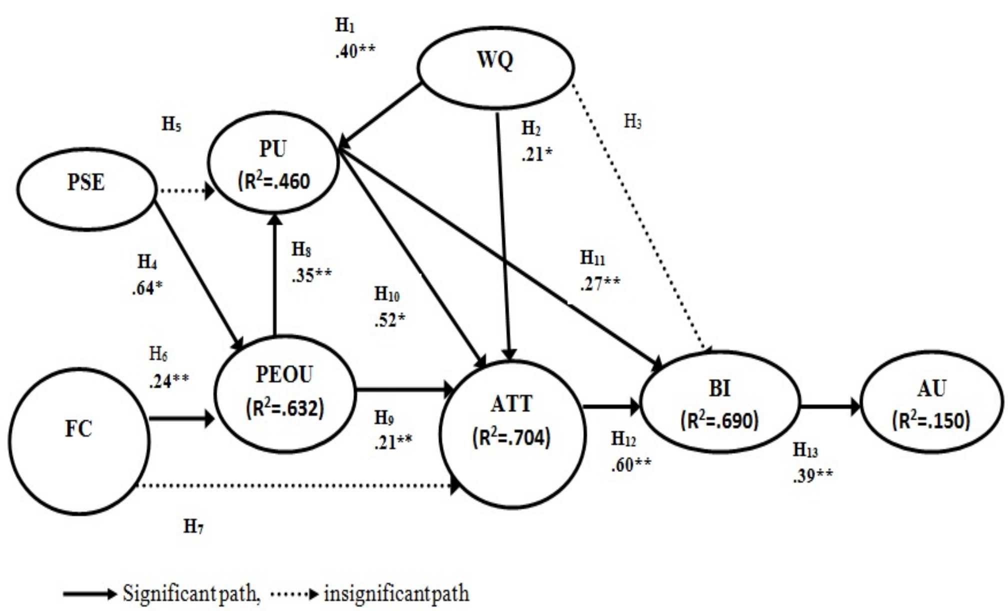

Figure5.6 Results of the Structural model for students' attitude toward university web portal usage

The regression weights (standardized coefficients) of each of the significant paths are presented in Table 9. The regression weights represent the direct effect that a determinant has on an endogenous variable. For example, .40 and .35 are the regression weights for the respective direct effect of WQ and PEOU on PU. In other words, .40 standard deviations is the increase that would be observed in PU, given one full standard deviation increase in WQ, while holding the other variable PEOU fixed or constant. Cohen (1988) recommended regression weights with values less than 0.1 are considered small, those around 0.3 are medium and values with 0.5 or more are considered large. Following Cohen's (1988) recommendations, the regression weights of all the significant paths ranges from medium to large (0.21 to .64). The results indicates PSE, is a strong determinant of PEOU (β = .64, p <.001), PU is a strong determinant of ATT (β = .52, p <.001), and ATT is a strong determinant of BI (β = .60, p <.001).

Discussion and Conclusion

The purpose of this study was to examine the appropriateness of an extended TAM in determining students' attitude toward university web portals. Based on the proposed model, I explored the effect of three external factors: web portal quality, perceived self-efficacy and facilitating conditions on the five original TAM constructs. The results of the study offer help in understanding students' attitude toward university web portals and the factors that affect their university web portal usage behavior.

The CFA results provided strong support for the internal consistency and structural reliability of the measurement items in determining students' attitude toward university web portals usage. Overall, the structural model provided a good fit to the data and supported ten of the thirteen proposed hypotheses. According to the results of goodness of fit tests, the proposed model well represented the data. The results of the study indicated that, the extended TAM (with WQ, PSE and FC incorporated in the basic TAM framework) had high predictive ability in explaining students' university web portal usage.

Similar to prior studies (i.e., Lee, Cheung & Chen, 2005; Park, 2009; Saade, Nebebe & Tan, 2007) this study confirmed the appropriateness of TAM in understanding and explaining the technology usage behavior (i.e., university web portals). The results indicated, the external variable WQ significantly influences PU and ATT which is consistent with prior research findings. If the university web portal maintains high quality, students find it useful and develop positive attitude toward it. It implies that increased WQ of university web portal was associated with increased PU as well as with students' positive attitudes (ATT) toward the web portal. But, the result indicated WQ did not have any direct influence on students' behavioral intention (BI) of using university web portal. The possible reason could be, students intend to use university web portal to conduct some basic activities (i.e. course registration, fee payment, assignments submission etc.) online because, for doing so, the university requires them to log-in to the university web portal. In these cases, as students have no more options to choose from, the quality of the web portal does not affect their intention of using or not using the university web portal.

The results revealed that perceived self-efficacy (PSE) has a significant positive influence on perceived ease of use (PEOU) This findings is consistent with prior findings (i.e., Wang, & Wang, 2009). It indicates that if the students have high self-efficacy on using university web portal than they find it as an easy one to use. This could be justified by Bandura's (1986) theory where he stated higher self-efficacy results in a more active learning process. Students who have higher self-efficacy on using web portal find it easier and they are more likely to use the web portal. However, the result indicated PSE has no significant effect on PU, which is inconsistent with some prior research (i.e., Liaw, 2002). Future follow-up studies should be conducted to investigate the precise relationship between these two constructs.

The results also revealed that the external factor facilitating conditions (FC) had no statistically significant direct effect on students' attitude (ATT) toward university web portal usage. A possible explanation could be because the university already has a developed web portal and students use it at least to a minimum extent, hence it doesn't matter whether the facilitating conditions are available or not, being students of the university, they have a positive attitude toward the university web portal. As expected, result indicated that, FC affects the PEOU of university web portal. If required FC (i.e., availability of technical help, availability of related resources and facilities, internet connections, speed, information technology infrastructure, training, online help etc.) are available, students find the web portal an easy one to use, because immediate help is available in case they face any problem or get stuck on navigating the web portal.

The study revealed that PEOU influences ATT, which indicates that there is an indirect effect of FC on ATT through PEOU. These findings are consistent with Teo et al.,'s (2008) findings where they found no direct effect of FC on computer attitude but through PEOU. However, to gain more insights, future studies should examine the effect of FC on ATT in various context of university web portal usability.

Consistent with several prior studies, this study revealed significant relationships exist among the existing five TAM constructs (PEOU influences PU and ATT, PU influences ATT and BI, ATT influences BI and finally BI influences AU). If users find it easy to use the web portal, than they consider it as a useful web portal and develops a positive attitude toward it. The positive attitude of students positively influences their behavioral intention of using the university web portal which finally leads them to use it. The findings of this study illuminate the underlying relationships between the proposed external variables and the existing TAM variables. The findings are mostly consistent with prior studies and it revealed that together with PEOU, PU, ATT and BI, WQ, PSE and FC are important and significant factors in determining university web portal usage behavior of the students.

In this study, an extended TAM is validated to determine students' adoption of university web portal. The study results suggest, the extended TAM to be an appropriate model to explain students' attitudes toward university web portals by providing a conceptual depiction of what factors affect students' usage of university web portals. The study findings have significant implications on the appropriateness of relying on the extended TAM in determining university web portal acceptance behavior. First of all, the study results indicated web portal quality affects both PU and ATT toward web portal usage. Therefore it is necessary for the university to put more emphasis on quality improvement issues of the web portal so that students find it useful and keep positive attitudes toward it. Secondly, the study results indicated facilitating conditions affect the perceived usefulness of university web portal which in turn affect their attitude toward and behavioral intention to use the university web portal and finally behavioral intention affect the actual web portal usage. Therefore, offering proper training or orientation on university web portal usage and providing technical help are important in ensuring improved usage. These could address the issue of novice users who are willing to use the web portal but still not very familiar with it. This study also indicated that PU led to greater intention to use (BI) which is consistent with many prior studies (Anderson, 2006; Ma, Andersson & Streith,2005; Rogers & Finlayson, 2004; Zhao, 2007).Therefore, students' needs should be taken into serious consideration when developing university web portals. In general, website development is a continuous process. The website designers and related authorities should always give preference to the audiences' / users' demand and expectations and plan websites accordingly. To do so, it is important to know the users view of an existing web portals.

Limitations and Future Research

This study is conducted on web portal of one university only. Hence, the extent to which generalization could be possible is limited. In the future, the study could be replicated using a larger sample size to see if any significant change occurs. Self-reported instruments were used to collect data, so there could be a difference between what participants reported and what they actually did, which may affect the study results. Additionally, data were collected at single point in time. A longitudinal study could help identifying the experience effect on the usage behavior. Future studies might add other variables to the extended model and examine their power for university web portal usage. A comparative study among multiple university web portals would also be an important area for future investigation.

CHAPTER 6 SUMMARY, IMPLICATIONS AND CONCLUSIONS

This dissertation was designed to assess faculty members' and students' attitudes concerning their web-technology adoption behaviors in the higher education settings. Faculty and students' attitudes toward three web-technologies (two LMSs and a university web portal) were tested in three phases of this dissertation and each phase assessed one web technology. Within each phase, pertinent data were gathered to answer proposed research questions. To conduct the studies, Davis' Technology Acceptance Model (TAM) was utilized as the basic theoretical framework. A sequential mixed method approach was used to analyze data in the three phases. The findings of these three studies were reported in three manuscripts. The manuscripts were presented in chapter 3, 4 and 5 of this dissertation.

Summary of the studies

Study 1 utilized Davis' (1989) TAM as a theoretical framework to identify how faculty attitudes toward LMSs influence their adoption (and subsequent utilization) of the LMS. Study 1 represented an inductive exploratory approach and conducted a content analysis of the open-ended data collected from faculty members. The goals of this study were to gain insights and to get a better understanding of why faculty members use LMS (i.e. Blackboard), the factors that affect their decisions about using or not using LMS, and the recommendations they offer to improve LMS usage. This descriptive study provided a generalizable approach to assess faculty members' attitudes toward technology and reported their common views regarding the strengths, weaknesses and the factors that affect their decisions of using or not using Blackboard.

Study 2 and Study 3 represented deductive confirmatory approaches. Considering prior technology adoption literature and the findings revealed from Study 1, both Study 2 and Study 3 proposed an extension of the original TAM framework by adding three exogenous variables:

System Quality (SQ), Perceived Self Efficacy (PSE) and Facilitating Conditions (FC) within the original TAM framework. Study 2 examined the usefulness of the extended TAM in determining faculty attitudes toward Canvas Learning Management System in higher education settings. Study 3 examined the usefulness of the extended TAM in determining students' attitude toward university web portal usage.

Study 2 and Study 3, collected quantitative data. Both of the studies utilized Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) for data analysis. Results of Study 2 confirmed the validity of the extended TAM in determining faculty attitude toward Canvas. Also, results of Study 3 confirmed that the extended TAM has high predictive power in determining students' attitude toward university web portals. Therefore, both of the studies confirmed the validity of the proposed extension of the original TAM in determining users' web technology acceptance behavior in higher education settings. This indicated that, the quantitative studies (Study 2 and Study 3) provided overall support for the extended TAM and ensured that the facts revealed in Study 1 through the content analysis did indeed exist.

As indicated, the findings, implications and conclusions of the three manuscripts were discussed in Chapter 3, 4 and 5 respectively. In this chapter, a generalized conclusion on web technology adoption behavior in higher education settings is drawn based upon the results of the data analyses and findings of all three studies conducted for this dissertation. Also, a summary discussion of the findings of the three studies and the theoretical and practical implications of these findings are presented. Limitations of this dissertation and directions for future research are provided as well.

Theoretical Implications

The primary purpose of this dissertation was to present a theoretical framework and a conceptual model for web technology adoption behavior in the higher education sector. Another purpose was to assess the basic TAM framework and an extended TAM framework in explaining users' attitude toward technology in the higher education settings. The dissertation contributes to both higher education and Information Systems (IS) literature in the following ways:

First of all, TAM is an IS model. By implementing this model in higher education research, the findings of this dissertation contributed to both IS and higher education literature.

Literature shows that little research has been done on technology adoption behavior in higher education settings (Schwieso, 1993). All three studies discussed in this dissertation were focused on web technology adoption behavior in higher education setting. Therefore by providing insights about web technology adoption behavior in higher education settings, the findings of the studies contribute to the web technology adoption literature as well as to higher education literature.

Previous web technology adoption research focused either on students' views or on faculty views. This dissertation collected data from both faculty members and students. Therefore, it enriches the literature by depicting a picture of web-technology adoption behaviors of faculty members and students in higher education institutions.

All three studies were conducted on non-mandatory use of technologies. Thus, it provided insights on users' web technology adoption behavior in situations when users have the options to use, fully or partially, or not to use the web technologies.

In this dissertation, Davis's (1989) original TAM and an extended TAM were tested for three types of technologies. Study 1 used the original TAM framework in conducting a content analysis of open-ended data and revealed that TAM can be used for open-ended data analysis. The findings of the content analysis study (Study 1) suggested the influence of external issues on original TAM constructs. Study 2 and Study 3 operationalized these issues into three external constructs: System Quality (SQ), Perceived Self Efficacy (PSE) and Facilitating Conditions (FC) and examined their effect on original TAM variables. Study 2 and Study 3found these three external constructs as significant predictors in terms of what factors affect the original TAM constructs in determining web technology adoption behavior in higher education. The results of these studies confirmed the explanatory power of the original TAM and the extended TAM in determining users' attitudes toward web technologies. These results further validated the explanatory powers of the original TAM and the extended TAM in determining users' technology adoption behavior for different types of web technologies.

Neither qualitative researchers nor quantitative researchers have appreciated mixed method research approach. Rather, each group argued on the superiority of their own approach (Guba & Lincoln, 1994). Therefore, in prior Information Technology research, either a qualitative or a quantitative approach was used rather than utilizing both (Tashakkori & Teddlie, 1998). However, recently the mixed method approach has been valued by many scholars (Creswell & Plano Clark, 2007, Tashakkori & Tiddlie, 2003). This dissertation used a sequential mixed method approach for open-ended and close-ended data analysis. It utilized TAM for open-ended data analysis which had not frequently been done in prior research. Thus it opened the door to use TAM for open-ended data analysis. It examined an extended TAM for quantitative data as well. Therefore, this dissertation provides evidence of the applicability of TAM for both open-ended and quantitative data analysis. Moreover, this approach contributes to the literature by providing a bridge between the theory clarification and explanation to the empirical evidence.

Practical Implications

This dissertation explored the web-technology adoption behavior in higher education settings with an aim of providing important insights about what factors affect faculty members and students in deciding whether or not to use web technologies for their academic purposes. All three studies revealed interesting findings which have significant practical implications in common. From these findings, lessons can be learned and considered in deciding on the web technology adoption and maintenance issues in higher educational institutions. These findings revealed some important points to consider for the policy makers, web technology designers, faculty members and students to ensure increased use of web technologies for academic purposes in higher education settings.

This dissertation found system quality, self-efficacy, and facilitating conditions as significant factors that affect users' web technology adoption behavior in higher educational institutions. Also, perceived ease of use and perceived usefulness were found significant in determining web technology adoption behavior.

Study 1 revealed the everyday experiences of faculty members with Blackboard Learning Management System. The study described what features of Blackboard they like and dislike, the problems they face and the improvements to make to ensure increased use of Blackboard. Study 1 found that improvement was needed in interface design, functionalities, compatibility with all browsers and software packages, navigation speed etc. These findings indicated that users were concerned about the quality issues. Regarding quality issues of the web-technologies examined, Study 2 and Study 3 found that respondents generally were neutral (with an average score of

4.93 on a 7 point scale) about the quality issues of Canvas Learning Management System and somewhat satisfied (with an average score of 5.31 on a 7 point scale) about the quality issues of the university web portal. Therefore, these findings pointed to the need for improvement on the quality issues (i.e., interface, features, functions, contents, navigation speed, interaction capability etc.) of the web technologies in use. To this end, it is important to take initiatives to improve the quality of the web technologies to make them clear, faster and user friendly. Policy makers and web technology designers should periodically collect data from the users about their experience and expectations. Performance of web technologies in use should be periodically monitored and proper actions should be taken whenever required. Periodic improvement plans should be made and implemented to improve the performance of the web technologies on the basis of users' expectations and needs.

Findings of the studies indicated self-efficacy as a significant factor in determining users' acceptance of web technology adoption. The respondents rated themselves as either neutral or somewhat confident (4.98 for Canvas and 5.86 for the university web portal on a 7 point scale) about their ability to work with web technologies. This indicated that improving users' self-efficacy on web technology adoption is an important area to work on. To do so, university authorities should focus on providing users regular support, communication, online help and training on web technology use. Consistent and extensive training sessions would give users the opportunity to become skilled in using web technologies. These sessions would help novice users become familiar with and comfortable in utilizing at least the minimal features of the web technologies. Also, these sessions would help the users who are utilizing minimal features to feel confident in using the advanced features of the web technologies. Also, it is important to include faculty members and students in the entire decision making process regarding the web technology adoption in universities. By getting involved in the decision making process faculty members and students will be confident about the web technologies and use them more frequently to facilitate their academic activities.

Users should be notified if any changes or updates have been done on the features or interfaces of the web technologies. Proper directions, guidelines should be provided so that the users can get accommodated with the changes. Once a new technology is adopted in an institution, an orientation program should be arranged so that the users can get acclimated with the technology. The orientation programs should provide detailed information about the technology itself, availability of onsite and online trainings, help sessions etc. For example, in freshman orientation programs, a session could be designed toward introducing the newcomers with the available web technologies on campus (i.e., university web portal). Also, periodic training programs, online help and onsite help sessions should be available whenever needed. To maintain efficiency and better quality of university web portals, identifying information about students' expectations and the problems they face when using the web portal are important. Therefore, collecting periodic data from students would help web portal designers and university policy makers to decide on the initiatives to take to improve university web portals.

All three studies found that availability of proper facilitating conditions influences users' web technology adoption behaviors. The results indicated that the respondents of Study 2 were somewhat satisfied (5.27 on a 7 point scale) on average and the respondents of Study 3 were neutral (4.82 on a 7 point scale) on average about the facilitating conditions provided by the university. These findings indicated the importance of improving the existing facilities required for using web technologies in higher education settings. To this end, ensuring proper technological facilities, high internet speed, updated hardware and software are some important areas to focus on. Policy makers and technology staff should work together to identify the users' needs and dissatisfactions and take steps to reduce these. The information technology offices of universities should ensure providing high quality and frequently available technical supports to the users to gain positive perceptions from them. Also, these offices should be equipped with qualified staff and technical resources so that they can provide extensive support for a wide range of problems of the users.

Conclusions

Venkatesh and Bala (2008) indicated that since technology implementation costs and risks are very high, implementation of technology is becoming increasingly complex. Facing all of these complexities, educational institutions still provide sophisticated new technologies (i.e., web technology, mobile technology etc.) to benefit their stakeholders: students, faculty members and employees. However, Kremers and Van Dissel (2000) pointed out that, success of a technology depends more on the effective and efficient use of it rather than the technology itself. This said, understanding users' views about web technology adoption behavior is important to ensure maximum use of web technologies. Therefore, more efforts need to be taken to understand user views of web technology adoption behavior. This dissertation contributes to this understanding by examining users' web technology adoption behavior for three web technologies in higher education settings. Through empirical analysis, this dissertation revealed some common issues that act as barriers in web technology adoption. Based on the findings of the three studies conducted, this dissertation offered important recommendations to reduce the barriers and ensure improved use of web technologies in higher education institutions. Also, this dissertation provided the groundwork for future research in understanding how faculty members and students deal with web technologies in higher education settings.

Limitations

This dissertation has some limitations. Therefore, the results of this dissertation should be interpreted and accepted with caution considering the acknowledged limitations. All three studies discussed in this dissertation were non-experimental studies with single source self- reported survey measures collected through web based surveys. This raises the issue of common method bias. Convenient sampling method was used in collecting data and the response rate was low. The research took place in two universities and was concerned with only three web technologies. Therefore, interpretation and generalization of the results to overall population should be done with caution.

In prior research, the explanatory power of TAM ranged from 70% (Mathieson, 1991) to 40% to 50% (Lucas & Spitler, 1999) in explaining technology usage. In this dissertation, the explanatory power of the extended TAM was satisfactory for behavioral intention (66% for Study 2 and 69% for Study 3), but it was relatively low for actual usage (23% for Study 2 and 15% for Study 3). A possible reason for this could be, the items used to measure “Actual usage” were misleading for some specific time periods. The survey asked three questions about usage of web technologies “on average,” “in last month” and “in last week.” Data collection started from Spring semesters of the year in January. During December universities were closed and students or faculty members had lesser academic work compared to that of the rest of the months of the academic years. So, they became less engaged in academic activities as well as in using web technologies for academic purposes. Therefore, probably these reflected their answers which resulted in a lower usage rate than their actual average web technology usage rate throughout the year.

Future Research Directions

This dissertation offers important future directions for future researchers.

1. This dissertation was successful in using TAM for open-ended data analysis which has not been done often in past. However, it only examined one web technology using open-ended data. Using the same approach, web technology adoption behavior of other important web technologies could be examined by future researchers.
2. This dissertation validated the explanatory power of the extended TAM in explaining the web technology usage behavior in higher education settings. Therefore, future researchers could use the extended TAM in examining the web technology adoption behavior for some other types of web technologies and further validate the extended TAM. In addition, comparative studies on different web technologies using the extended TAM would be important areas to focus on.
3. Given the low explanatory power of the extended TAM in this dissertation, more work is needed to see the explanatory power of the extended TAM for some other web technologies and some other settings.
4. Future development of the extended TAM could be done by applying it to any new types of technology, to different types of users, different types of educational settings as well as industrial settings, different types of cultures. Examining the extended TAM in this way would provide further information about its generalizability issues.

5. This dissertation did not examine the effect of demographic variables. Therefore, future research could examine the effect of demographic factors on web technology adoption behavior

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APPENDICES

Appendix A

Approval Letters from Institutional Review Board

Institutional Review Board's First Approval Letter

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD for RESEARCH INVOLVING HUMANSUBJECTS

RESEARCH PROTOCOL REVIEW FORM

For Information or help contact THE OFFICE OF HUMAN SUBJECTS RESEARCH, 307 Samford Hall, Auburn University
Phone: 334-844-5966 e-mail: hsubjec@auburn.edu Web Address: http://www.auburn.edu/research/vpr/ohs/

Complete this form using Adobe Acrobat Writer (versions 5.0 and greater). Hand written copies not accepted.

1. PROPOSED START DATE of STUDY: Mar 21, 2011

PROPOSED REVIEW CATEGORY (Check one): ☐ FULL BOARD ☑ EXPEDITED ☐ EXEMPT

2. PROJECT TITLE: Faculty and Students attitudes towards technology use: An analysis using Technology Acceptance Model

3. Nafsaniath Fathema (PRINCIPAL INVESTIGATOR) | Doctoral Student (TITLE) | EFLT (DEPT) | 334-844-3086 (PHONE) | nzf0003@auburn.edu (AU E-MAIL)
4013 Haley Center, Auburn University, Auburn, AL-36849 (MAILING ADDRESS) | FAX | ALTERNATE E-MAIL

4. SOURCE OF FUNDING SUPPORT: ☑ Not Applicable ☐ Internal ☐ External Agency: ☐ Pending ☐ Received

5. LIST ANY CONTRACTORS, SUB-CONTRACTORS, OTHER ENTITIES OR IRBs ASSOCIATED WITH THIS PROJECT:
Not Applicable

6. GENERAL RESEARCH PROJECT CHARACTERISTICS

6A. Mandatory CITI Training

Names of key personnel who have completed CITI:
Nafsaniath Fathema ✓
Dr. Margaret Ross ✓

CITI group completed for this study: ☑ Social/Behavioral ☐ Biomedical

Protocol-Specific modules completed:
☐ Genetic ☐ Vet.'s Administration
☐ International ☐ Prisoner Research
☐ Public School Students ☐ Pregnant Women/Fetuses
Other

6B. Research Methodology

Please check all descriptors that best apply to the research methodology.

Data Source(s): ☑ New Data ☐ Existing Data

Will data be recorded so that participants can be directly or indirectly identified?
☐ Yes ☑ No

Data collection will involve the use of:
☐ Educational Tests (cognitive diagnostic, aptitude, etc.)
☑ Surveys / Questionnaires
☑ Internet / electronic
☐ Audio / Video / Photos
☐ Interview / Observation
☐ Physical / Physiological Measures or Specimens (see Section 6E.)
☐ Private records or files

The Auburn University Institutional Review Board has approved this document for use from 3/31/11 to 3/30/12
Protocol # 11-103 EX 1103

6C. Participant Information

Please check all descriptors that apply to the participant population.
☑ Males ☑ Females ☐ AU students

Vulnerable Populations
☐ Pregnant Women/Fetuses ☐ Children and/or Adolescents (under age 19 in AL)
☐ Prisoners
Persons with:
☐ Economic Disadvantages ☐ Physical Disabilities
☐ Educational Disadvantages ☐ Intellectual Disabilities

Do you plan to compensate your participants? ☐ Yes ☑ No

6D. Risks to Participants

Please identify all risks that participants might encounter in this research.
☐ Breach of Confidentiality* ☐ Coercion
☐ Deception ☐ Physical
☐ Psychological ☐ Social
☑ None ☐ Other

RECEIVED
MAR 11 2011

*Note that if the investigator is using or accessing confidential or identifiable data, breach of confidentiality is always a risk.

6E. Institutional Biosafety Approval

Do you need IBC Approval for this study? ☑ No ☐ Yes - BUA # Expiration date

FOR OHSR OFFICE USE ONLY

DATE RECEIVED IN OHSR: 3-11-11 by QB
DATE OF IRB REVIEW: 3/31/11 by KJE
DATE OF IRB APPROVAL: by
COMMENTS: no revisions

PROTOCOL # 11-103 EX 1103
APPROVAL CATEGORY: 45 CFR 46.101 (b)(2)
INTERVAL FOR CONTINUING REVIEW: 1 year

Approval Letter from Institutional Review Board's for the first modification of the research

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD for RESEARCH INVOLVING HUMAN SUBJECTS

REQUEST for PROTOCOL MODIFICATION

For information or help contact **THE OFFICE OF HUMAN SUBJECTS RESEARCH**, 307 Samford Hall, Auburn University
Phone: 334-844-5966 **e-mail:** hsubjec@auburn.edu **Web Address:** http://www.auburn.edu/research/vpr/ohs/index.htm

Complete this form using Adobe Acrobat Writer (versions 5.0 and greater). *Hand written copies are not accepted.*

1. **Protocol Number:** 11-103 Ext 1103 2. **IRB Approval Dates:** **From:** 3/20/12 **To:** 3/30/13

3. **Project Title:** Faculty and Students attitude toward Technology Use: An analysis using Technology Acceptance Model

4.

Nafsaniath Fathema	Doctoral Student	EFLT	(334)750 3086	nzf0003@auburn.edu
Principal Investigator	**Title**	**Department**	**Phone**	**AU E-Mail**
	4013 Haley Center, Auburn University, Auburn, AL			
PI Signature	**Mailing Address**			**Alternate E-Mail**
Margaret Ross	Margaret Ross	EFLT	334)844 3084	rossma1@auburn.edu
Faculty Advisor	**FA Signature**	**Department**	**Phone**	**AU E-Mail**

Name of Current Department Head: Sherida Downer **AU E-Mail:** Sheri@auburn.edu

5. **Current External Funding Agency:** Instructure.com (sponsoring incentives for the survey respondents')

6. **List any contractors, sub-contractors, other entities or IRBs associated with this project:**

7. **Briefly list** *(numbered or bulleted)* **the activities that occurred up to this point, particularly those that involved participants.**

Anonymous data collected through online survey
All electronic data were aggregated and kept password-protected
A part of the data analysis has been done and some more data analysis is going on.
Partial data analysis and interpretation have been documented and presented in a conference.

The Auburn University Institutional Review Board has approved this document for use from 5/28/12 to 3/30/13
Protocol # 11-103 EX 1103

8. **Describe the requested changes to your research protocol, with an explanation and/or rationale for each.**
(Additional pages may be attached if needed to provide a complete response.)

Two new electronic surveys will be conducted (one among the faculty members and one among the students) .These surveys will collect a second set of data from faculty members and students at the age of 19 years or above.
I am planning to give all the respondents (who will successfully complete the survey) a thank-you gift (electronic coupon) as an incentive.
#The thank-you gift's monetary value will be 10$ for all the respondents who will successfully complete faculty survey and $5 for all the respondents who will successfully complete the student survey.
A link will be added in the last page of each survey. The respondents will click the link which will direct them to a page, where they will get their thank-you electronic gift coupon. In this way the data will still be anonymous.
the rationale to do so is, as I am planning to use the data for my dissertation I need to collect data from a large group of respondents. After analyzing the initial survey responses, I realized that I should have added some more questions and reword some of the questions. Moreover the response rate was too low, so I thought adding a thank-you gift would ensure increased response rate.
#The new surveys (one for students and one for faculty members) are attached.

Received
MAY 25 2012
Research Compliance

1 of 2

Approval Letter from Institutional Review Board's for the final modification of the research

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD for RESEARCH INVOLVING HUMAN SUBJECTS

REQUEST for PROTOCOL RENEWAL

For Information or help completing this form, contact: **THE OFFICE OF HUMAN SUBJECTS RESEARCH**, 115 Ramsay Hall
Phone: 334-844-5966 **e-mail:** hsubjec@auburn.edu **Web Address:** http://www.auburn.edu/research/vpr/ohs/index.htm

Complete this form using Adobe Acrobat Writer (versions 5.0 and greater). *Hand written forms will not be accepted.*

1. **Protocol Number:** 11-103-Ex 1103
2. **Original IRB Approval Dates:** **From:** 3/20/2012 **To:** 3/30/2013
3. **Requested ONE YEAR MAXIMUM Renewal Period:** **From:** 3/30/2013 **To:** 3/30/2014
4. **PROJECT TITLE:** Faculty andStudent attitude toward technology use:An analysis usingTechnology Acceptance Model
5.

PRINCIPAL INVESTIGATOR	TITLE	DEPT	PHONE	AU E-MAIL
Nafsaniath Fathema	Doctoral Student	EFLT	334-750-0984	nzf0003@auburn.edu

PI SIGNATURE	MAILING ADDRESS	ALTERNATE E-MAIL
	nzf0003@auburn.edu	

FACULTY ADVISOR	SIGNATURE	DEPT	PHONE	AU E-MAIL
Margaret Ross	Margaret Ross	EFLT	334-844-3084	rossma1@auburn.ed

Name of Current Department Head: Sherida Downer **AU E-MAIL:** Sheri@auburn.ed

6. **Current External Funding Agency:** x
7. **List any contractors, sub-contractors, or other entities or IRBs associated with this project:**
8. **Briefly list** *(numbered or bulleted)* **the activities that occurred over the past year, particularly those that involved participants.**

The Auburn University Institutional Review Board has approved this document for use from 3/19/13 to 3/30/14
Protocol # 11-103 EX 1103

Anonymous data has been collected through online survey . Data collection is still going on.
Data analysis has been done partially and some more data analysis is going on.
Partial data analysis and interpretation have been documented and presented in a conference

Received
MAR 07 2013
Research Compliance

9. **Explain why you are requesting additional time to complete this research project.**

Additional data will be collected through the online surveys approved by IRB (under this protocol). Additional time is needed to collect, analyze and interpret newly collected data.

Appendix B

Survey Instrument with Information Letter and Consent page For Study 1

Survey Instrument with Information Letter and Consent page For Study 1

Faculty Attitude Towards Technology Use for Academic Purposes

Basic Information about the Survey

The purpose of this survey is to gather information about how you use technology for teaching purposes and what is your impression about the technological facilities available at your university.This survey is partly a research project to satisfy a requirement for a graduate course for my Ph.D study in Educational Psychology at Auburn University.

We all know that, Blackboard (www.blackboard.com),offers various web-based software products for teaching and learning activities.As a faculty member, you have the option of using/not using the Blackboard system for your teaching activities. I am interested in exploring your attitude towards the Blackboard system.Your careful and thoughtful answers will help me to know more about your use of the of Blackboard system.

Your responses will be kept completely confidential. All responses will be reported in a summary format so that no individual can be identified.

Please go to through the detailed information letter about the survey on page 2.HAVING READ THE INFORMATION, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT.

IF YOU DECIDE TO PARTICIPATE, PLEASE INDICATE YOUR CONSENT on the next page and take a few minutes to complete this survey.

Thank you for your time.

Nafsaniath Fathema

Faculty Attitude Towards Technology Use for Academic Purposes

Information Letter and Consent page

Educational Foundations, Leadership, & Technology
College of Education
Auburn University
4036 Haley Center, Auburn, Al 36849

INFORMATION LETTER
for a Research Study titled- "Faculty Attitudes Towards Technology Use: An Analysis using Technology Acceptance Model"

You are invited to participate in a research study to help me understand the faculty attitudes towards technology use. The university you are teaching in is utilizing different types of internet based technological facilities for the teaching/learning activities. 'Blackboard' is one of them. This study will explore the faculty attitudes towards using 'Blackboard' as a teaching/ learning resource. The study is being conducted by Nafsaniath Fathema, Doctoral student, in the Auburn University Department of Educational Foundations, Leadership, and Technology. You were selected as a possible participant because you are a Faculty and are age 19 or older.

What will be involved if you participate?
Your participation is completely voluntary. If you decide to participate in this research study, you will be asked to complete a brief online survey that asks you to share with me your perceptions of Blackboard use. Your total time commitment will be approximately 20 minutes.

Are there any risks or discomforts?
I do not anticipate any risks associated with completing this survey. If at any time you decide you do not want to complete the survey, you are free to stop without penalty.

Are there any benefits to yourself or others?
I believe there are several benefits to completing this survey:
1) This survey will provide you with a safe place to share your perceptions of the 'Blackboard use' by yourself. 2) You will be helping me to determine the teachers' attitude towards Blackboard use in teaching/ learning environment. These findings will help determining the path to maximize the technology usage in educational activities and ensure more advanced and facilitated teaching/ learning environment for the teachers and the students.

Will you receive compensation for participating?
Participation is completely voluntary and no compensation will be offered.

Are there any costs?
If you decide to participate, you will not incur any costs beyond your investment of time to complete the survey.

If you change your mind about participating, you can withdraw at any time by closing your browser window. If you choose to withdraw, your data can be withdrawn. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University or the Department of Educational Foundations, Leadership, and Technology.

Any data obtained in connection with this study will remain anonymous. You will not be asked to provide any identifying information (i.e., your name) and the server I use does not record computer IP addresses. Information collected through your participation may be published in professional journals and/or presented at professional meetings.

If you have questions about this study, please contact Nafsaniath Fathema by phone (334)-844-3086 or e-mail at nzf0003@auburn.edu

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.

The Auburn University Institutional Review Board has approved this document for use from March 31, 2011 to March 30, 2012. Protocol #11-103 EX 1103

Page 2

Faculty Attitude Towards Technology Use for Academic Purposes

HAVING READ THE INFORMATION ABOVE, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, PLEASE INDICATE YOUR CONSENT BELOW.

Nafsaniath Fathema
Investigator
February 22, 2011

*** Would you like to participate in this survey?**

- ◯ Yes
- ◯ No

Faculty Attitude Towards Technology Use for Academic Purposes

Demographics

*** Gender**

- ◯ Male
- ◯ Female

*** Age**

- ◯ Below 30
- ◯ 30 - 39
- ◯ 40-49
- ◯ 50-59
- ◯ 60-69
- ◯ 70+

*** What is your present academic rank?**

- ◯ Graduate Teaching Assistant
- ◯ Instructor
- ◯ Lecturer
- ◯ Assistant Professor
- ◯ Associate Professor
- ◯ Professor

Other (please specify)

*** What is your primary academic field?**

Faculty Attitude Towards Technology Use for Academic Purposes

Faculty Attitudes Towards Blackboard System

* How long have you been using computers? (in years)

* How long have you been using the internet? (in years)

You use the Blackboard system for teaching ----------

- [ ] Online courses
- [ ] On-campus courses
- [ ] Hybrid courses
- [ ] Do not use at all

* Which of the following features of Blackboard do you use for your teaching activities? (Check all that apply)

- [ ] Digital Drop box
- [ ] Gradebook
- [ ] Assignments (tutorials, tests, quizzes etc.)
- [ ] Uploading Documents -lecture notes, syllabus etc.(wordfile, powerpoint, pdf file,excel files, html documents, flash or other movie files)
- [ ] Question Pools (Used in texts and Surveys)
- [ ] Discussion Board
- [ ] Messages
- [ ] Lecture Hall or Office Hours
- [ ] Google Scholar
- [ ] None of the above

Other (please specify)

Page 5

Faculty Attitude Towards Technology Use for Academic Purposes

* Please mention the main reasons of your using / not using the Blackboard system for teaching purposes.

Please comment about the clarity and understandability of the features of the Blackboard system.

Please comment about the level of skills that are needed to use the Blackboard system.

What are the strengths of the Blackboard system?

What are the weaknesses of the Blackboard system?

What would you recommend to improve or modify in the Blackboard system to ensure more usability and acceptance by other faculty members?

* On average, for what percent of your teaching activities you use the Blackboard system?

Page 6

Faculty Attitude Towards Technology Use for Academic Purposes

What difficulties do you face in using the Blackboard system?

* Do you feel that using Blackboard makes you accomplish your teaching tasks quicker / easier ? in either case, why?

* All things considered,for teaching purposes I think ...

(SA-Strongly Disagree, D- Disagree, SDA-Slightly disagree, U- Undecided, SA- Slightly agree, A- Agree, SA- Strongly agree)

	SD	D	SDA	U	SA	A	SA
It is wise to use the Blackboard system	○	○	○	○	○	○	○
I have a generally favorable attitude towards the Blackboard system	○	○	○	○	○	○	○
It is pleasant to use the Blackboard system	○	○	○	○	○	○	○
It is a good idea to use the Blackboard system	○	○	○	○	○	○	○

Page 7

Appendix C

Survey Instrument with Information Letter and Consent page For Study 2

Survey Instrument with Information Letter and Consent page For Study 2

Default Question Block

Basic Information about the SURVEY

The purpose of this survey is to gather information about how you use technology for teaching purposes and what is your impression about the technological facilities available at your university.This survey is partly a research project to satisfy a requirement for a graduate course for my Doctoral study in Educational Psychology at Auburn University.

We all know that, the universities offer various web-based software products (Blackboard, Canvas etc.) for teaching and learning activities. These are generally known as Learning Management System (LMS).

As a faculty member, you have the option of using/not using the LMS (i.e CANVAS) for your teaching activities. I am interested in exploring your attitude toward CANVAS.Your careful and thoughtful answers will help me to know more about your use of CANVAS by the faculty members.
Your responses will be kept completely confidential. All responses will be reported in a summary format so that no individual can be identified.

Please go to through the detailed information letter about the survey on the next page. HAVING READ THE INFORMATION, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT.

IF YOU DECIDE TO PARTICIPATE, PLEASE INDICATE YOUR CONSENT on the next page and take a few minutes to complete this survey.

Thank you for your time.

Nafsaniath Fathema

Information Letter and Consent Page for FACULTY

Educational Foundation Leadership and Technology
College of Education
Auburn University
4036 Haley Center, Auburn, Al 36849

INFORMATION LETTER
for a Research Study titled"Faculty Attitudes Towards Technology Use: An Analysis using Technology Acceptance Model"

You are invited to participate in a research study to help me understand the faculty attitudes towards technology use. The university you are teaching in is utilizing different types of internet based technological facilities for the teaching/learning activities (i.e Blackboard, Canvas). This study will explore the faculty attitudes towards using CANVAS as a teaching/ learning resource.

The study is being conducted by Nafsaniath Fathema, Doctoral student, in the Auburn University Department of Educational Foundations, Leadership, and Technology.

You are selected as a possible participant because you are a Faculty member and are age 19 or older.

What will be involved if you participate?

Your participation is completely voluntary. If you decide to participate in this research study, you will be asked to complete a brief online survey that asks you to share with me your perceptions of Blackboard use. Your total time commitment will be approximately 10-15 minutes.

Are there any risks or discomforts?
I do not anticipate any risks associated with completing this survey. If at any time you decide you do not want to complete the survey, you are free to stop without penalty.

Are there any benefits to yourself or others?

I believe there are several benefits to completing this survey:

1) This survey will provide you with a safe place to share your perceptions of CANVAS by yourself.
2) You will be helping me to determine the teachers' attitude

An LMS is a self-contained webpage with embedded instructional tools that permit faculty to organize academic content and engage students in their learning (Laster, 2005). Example of LMSs are Blackboard, Canvas, WebCT etc.)

Please rate the extent to which you agree with each statement below

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
I am satisfied with the CANVAS functions							
I am satisfied with the Internet Speed							
I am satisfied with the CANVAS content							
I am satisfied with CANVAS interaction							

Please rate the extent to which you agree with each statement below

	Strongly Disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
I feel confident using CANVAS							
I feel confident operating CANVAS functions							
I feel confident using Online learning content in CANVAS							

Please rate the extent to which you agree with each statement below

	Strongly Disagree	Disagree	Somewhat disagree	Neutral	Somewhat Agree	Agree	Strongly agree
When I need help to use CANVAS guidance is available to me							
A specific person / group is available for assistance with any difficulties related with CANVAS use							
Specialized instruction concerning CANVAS use is available to me							

Please rate the extent to which you agree with each statement below

	Strongly Disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
My interaction with CANVAS is clear and understandable							
Interacting with CANVAS does not require a lot of my mental effort							
I find CANVAS to be easy to use							
I find it easy to get CANVAS to do what I want it to do							

Please rate the extent to which you agree with each statement below

	Strongly Disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
Using CANVAS improves my performance as a faculty member	○	○	○	○	○	○	○
Using CANVAS in my job increases my productivity	○	○	○	○	○	○	○
Using CANVAS enhances my effectiveness in my job	○	○	○	○	○	○	○
I find CANVAS to be useful in my job	○	○	○	○	○	○	○

Please rate the extent to which you agree with each statement below

	Strongly Disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
I think it is worthwhile to use CANVAS	○	○	○	○	○	○	○
I like using CANVAS	○	○	○	○	○	○	○
In my opinion, it is very desirable to use CANVAS for academic and related purposes	○	○	○	○	○	○	○
I have a generally favorable attitude toward using CANVAS	○	○	○	○	○	○	○

Please rate the extent to which you agree with each statement below

	Strongly Disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly Agree
I intend to use the functions and content of CANVAS to assist my academic activities	◎	◎	◎	◎	◎	◎	◎
I intend to use the functions and content of CANVAS as often as possible	◎	◎	◎	◎	◎	◎	◎
I intend to use the functions and content of CANVAS in the future	◎	◎	◎	◎	◎	◎	◎

Overall to what extent do you use CANVAS?

(Please check the most appropriate option)

◎ Not at all

◎ Once a week

◎ 2-3 times a week

◎ 4 -5 times a week

◎ 6 times a week

◎ 7 times a week

◎ More than once a day

To what extent did you use CANVAS last month?

Please check the most appropriate option

- Not at all
- 2
- 3
- 4
- 5
- 6
- To a great extent

To what extent did you use CANVAS last week?

Please check the most appropriate option

- Not at all
- 2
- 3
- 4
- 5
- 6
- To a great extent

How long have you been using Canvas?

- Less than 6 months
- 6 months to 1 year
- More than an year

Gender

- Male
- Female

What is your present academic rank?

- Graduate Teaching Assistant
- Instructor
- Lecturer
- Assistant Professor
- Associate Professor
- Professor
- Other (Please specify)

I am in

- College of Agriculture
- College of Architecture
- College of Business
- College of Education
- College of Engineering
- School of Forestry and Wildlife Sciences
- College of Human Science
- College of Liberal Arts
- School of Nursing
- School of Pharmacy
- College of Science and Mathematics
- College of Vaterinary Medicine
- Other (Please specify)

Which of the following age range you are in?

- 30 or less
- 31-40
- 41-50
- 51-60
- 61-70
- 71+

What are the strengths of CANVAS?

What are the weaknesses of CANVAS?

What would you recommend to include/ improve/ modify in CANVAS to ensure more usability and acceptance of CANVAS by the faculty members?

Appendix D

Survey Instrument with Information Letter and Consent page For Study 3

Survey Instrument with Information Letter and Consent page For Study 3

Information Letter and Consent Page

Educational Foundations, Leadership, & Technology
College of Education
Auburn University
4036 Haley Center, Auburn, Al 36849

INFORMATION LETTER

for a Research Study entitled "Students' attitudes toward technology use: An analysis using Technology Acceptance Model"

You are invited to participate in a research study to help us understand students' attitudes towards technology use.The primary aim of this study investigate students' attitudes toward using university websites.

This study is being conducted by Nafsaniath Fathema, doctoral student, in the Auburn University Department of Educational Foundations, Leadership, and Technology. You are selected as a possible participant because you are a student and are age 19 or older.

What will be involved if you participate?
Your participation is completely voluntary. If you decide to participate in this research study, you will be asked to complete a survey that asks you to share with me your perceptions of university website use. Your total time commitment will be approximately 10 minutes.

Are there any risks or discomforts?
I do not anticipate any risks associated with completing this survey. If at any time you decide you do not want to complete the survey, you are free to stop without penalty.

Are there any benefits to yourself or others?
I believe there are several benefits to completing this survey:
1) This survey will provide you with a safe place to share your individual perception of the website use.
2) Finally, you will be helping me to determine students' attitude toward university websites. These findings will help determining the path to maximize the website usage in educational activities and ensure more advanced and facilitated technological environment for the students.

Will you receive compensation for participating?
Participation is completely voluntary and no compensation will be offered.

Are there any costs?
If you decide to participate, you will not incur any costs beyond your investment of time to complete the survey. If you change your mind about participating, you can withdraw at any time by closing your browser window. If you choose to withdraw, your data can be withdrawn. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University or the Department of Educational Foundations, Leadership, and Technology.

Any data obtained in connection with this study will remain anonymous. You will not be asked to provide any identifying information (i.e., your name) and the server that is used does not save computer IP addresses. Information collected through your participation may be published in professional journals and/or presented at professional meetings.

If you have questions about this study, please contact Nafsaniath Fathema by phone (334)8443086 or email at nzf0003@auburn.edu

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board

Are you 19 years old or older?

- *Yes*
- *No*

AUBURN UNIVERSITY WEBSITE

The Auburn University website (AU website) has different online features like Blackboard, Canvas, school email (Tigermail), live transportation information (Transport Visualization System), student information system (tiger i), online library system, online course registration, online payments etc. It includes different contents like information about academic calender, colleges, programs, faculty list, admission,tax, parking facilities, financial aid, other facilities , campus news etc.

The purpose of this survey is to investigate students' perceptions and attitudes toward the AU website.

Please answer the following questions and share your views about the AU website.

Please rate the extent to which you agree with each statement below

	Strongly Disagree	*Slightly Disagree*	*Disagree*	*Neutral*	*Agree*	*Slightly Agree*	*Strongly Agree*
I am satisfied with the functions of the AU website (i.e AU email, course registration, Blackboard, Canvas etc.).							
I am satisfied with the Internet Speed.							
I am satisfied with the contents of the AU website.(i.e Campus news, AU bulletin etc.).							
I am satisfied with the interaction capability of the AU website.							

Please rate the extent to which you agree with each statement below

	Strongly Disagree	*Slightly Disagree*	*Disagree*	*Neutral*	*Agree*	*Slightly Agree*	*Strongly Agree*
I feel confident using the AU website.							
I feel confident operating the AU Website functions (i.e AU email, course registration, Blackboard, Canvas etc.).							
I feel confident that I can find information on the AU website (i.e Campus news, AU bulletin etc.).							

Please rate the extent to which you agree with each statement below

	Strongly Disagree	Slightly Disagree	Disagree	Neutral	Agree	Slightly Agree	Strongly Agree
Auburn University has provided training for me to use the different features of the AU website.							
There is technical help available if required while using AU website.							
Auburn University provides the equipment and facilities (e.g., Internet, computers, computer labs etc.) I need for using the AU website features.							
The Information and Communication Technology (ICT) infrastructure at Auburn University is available whenever I need it.							

HOW MANY TIMES during a week you use the AU website for logging in to i.e Blackboard/ Canvas, tigeremail, transport visualization system, Library systems etc. ?

- *Not at all*
- *Once a week*
- *2-3 times a week*
- *4-5 times a week*
- *6 times a week*
- *7 times a week*
- *More than once a day*

HOW MANY HOURS EVERY WEEK do you use the AU website?

- *Not at all*
- *Less than 5 hours*
- *Between 5 to 10 hours*
- *Between 11 to 15 hours*
- *Between 16 to 20 hours*
- *Between 21 to 25 hours*
- *More than 25 hours*

To what extent do you use the AU website?

- *Not at all*
- *2*
- *3*
- *4*
- *5*
- *6*
- *To a great extent*

Please rate the following statements

	Strongly Disagree	*Slightly Disagree*	*Disagree*	*Neutral*	*Agree*	*Slightly Agree*	*Strongly Agree*
Learning to use the AU website functions and content is easy for me.							
I find the AU website functions and content to be flexible to interact with.							
I find it easy to navigate the AU website to do what I want to do.							
It is easy for me to become skillful at using the AU website functions and content.							
I find the functions and content in the AU website easy to use.							
My Interaction with the AU website is clear and understandable.							

Please rate the following statements

	Strongly Disagree	Slightly Disagree	Disagree	Neutral	Agree	Slightly Agree	Strongly Agree
Using the functions and content of the AU website improves my task performance.							
Using the functions and content of the AU website enables me to accomplish tasks more quickly.							
I find using the functions and content of the AU website useful in my academic work.							
Using the functions and content of the AU website increases my productivity.							
Using the functions and content of the AU website enhances the quality of my academic work.							
Using the functions and content of the AU website would make it easier to do my academic work.							

Please rate the following statements

	Strongly Disagree	Slightly Disagree	Disagree	Neutral	Agree	Slightly Agree	Strongly Agree
I intend to use the functions and content of the AU website to assist my academic activities.							
I intend to use the functions and content of the AU website as often as possible.							
I intend to use the functions and content of the AU website when it becomes available in my school and at home.							

Please rate the following statements

All things considered, for academic and related purposes--------------

	Strongly Disagree	Slightly Disagree	Disagree	Neutral	Agree	Slightly Agree	Strongly Agree
I think it is worthwhile to use the functions and content of the AU website.							
I like using the functions and content of the AU website.							
In my opinion, it is desirable to use the functions and content of the AU website for academic and related purpose.							
I have a generally favorable attitude toward the AU website.							

What are the strengths of the AU website?

What are the weaknesses of the AU website?

If you have any additional comments you wish to make about the different features available in the AU website, please mention here

Gender

- *Male*
- *Female*

Which of the following age range you are in?

- *20 or less*
- *21-25*
- *25-30*
- *31-35*
- *36-40*
- *40+*

Education

- *Freshman*
- *Sophomore*
- *Junior*
- *Senior*
- *Masters Student*
- *Doctoral Student*
- *Non degree student*

I am in

- *College of Agriculture*
- *College of Architecture*
- *College of Business*
- *College of Engineering*
- *School of Forestry and Wildlife Sciences*
- *College of Human Science*
- *College of Liberal Arts*
- *School of Nursing*
- *College of Science and Mathematics*
- *College of Vaterinary Medicine*
- *College of Education*
- *Other (please mention)*

Your declared or intended major

Prepared by Nafsaniath Fathema