2011

Management Support And Faculty's Adoption Of Learning Management System Applying Technology Acceptance Model 3

Zhigang Li
University of Central Florida

MANAGEMENT SUPPORT AND FACULTY'S ADOPTION OF LEARNING MANAGEMENT SYSTEM: APPLYING TECHNOLOGY ACCEPTANCE MODEL 3

by

ZHIGANG LI
B.S. Lanzhou University, 1999
M.A. University of Central Florida, 2006

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the College of Education
at the University of Central Florida
Orlando, Florida

Fall Term
2011

Major Professor: Stephen A. Sivo

ABSTRACT

The purpose of this research study was to understand and identify the key factors that affect faculty's behavioral intention of using a learning management system. This research study adopted the Technology Acceptance Model 3 (TAM3) as the theoretical foundation and extended it by adding management support as an exogenous variable based on the recommendations from previous research studies. Technology Acceptance Model 3 is the latest iteration of Technology Acceptance Model – a widely adopted research framework for studying users' acceptance of technology. It provides a comprehensive network of determinants of technology adoption and use.

A survey questionnaire with 54 measurement items was used to measure the 15 construct variables proposed in the research model. Path analysis was performed on the data collected from 105 faculty members, who were teaching at a metropolitan university located in Taipei City, Taiwan. The goodness of fit indices indicated that the initial research model did not fit the data, and adjustments were made based on the suggestions from the modification indices. The revised research model had a much improved and more acceptable model fit than the initial research model.

The final results of this research study revealed a much more complex map of relationships among the construct variables than what was proposed in the initial research model. First, as evidenced by other researchers, perceived ease of use, perceived usefulness, subjective norm, and the interaction between subjective norm and voluntariness were significant determinants of behavioral intention. Second, subjective

norm, image, job relevance, the interaction between job relevance and output quality, and computer playfulness were the significant determinants of perceived usefulness. Third, computer playfulness, perceived enjoyment, and image were the only three significant determinants of perceived ease of use. Lastly, management support along with a list of other variables jointly determined perceptions of external control, subjective norm, image, job relevance, result demonstrability, and the interaction between job relevance and output quality.

To my wonderful wife, Yan Liu for her love, support, encouragement, and patience; my dad, Fengchun Li; and to the memory of my mom, Chengying Miao, I miss you.

ACKNOWLEDGMENTS

I would like to acknowledge and extend my heartfelt gratitude to my wonderful dissertation committee who has made the completion of this research study possible. Dr. Stephen Sivo, my dissertation chair, thank you for believing in me and tirelessly working me through this long journey. Your support, guidance and encouragement were the keystone of my accomplishment. Dr. Cheng-Chang "Sam" Pan, thank you for graciously being in my committee. Your kindness, thoughtful advice, and sincere friendship kept pushing me forward to this point. Dr. Glenda Gunter, thank you for your loving support and wisdom that made me a better researcher. Dr. David Boote, thank you for your trust, encouragement, and inspiration.

My wholehearted thanks to my dearest friend Dr. Cheng-Hsin Ku, who helped me form the research idea, provided me a research location, and assisted me with the data collection. This research would have not been possible without your help, and I cannot say thank you enough!

My special thanks to Dr. Richard Cornell, who convinced me to come to the United States for study, a decision that has changed my life. Thank you for making us a second home here in Orlando and you are forever our family.

My appreciation also extends to Dr. Haiyan Bai, for the constant guidance and support; Dr. Carine Strebel, for the advice and check-ins that kept me on track; my friend Dr. Ya-Chi Chien, for all the tips and tricks that helped me hit the deadlines; Dr. Lihua Xu, who helped me with data analysis.

Lastly, I'd like to thank Mr. Larry Jaffe, who has provided graduate assistantship and a wonderful workplace for me during my long journey of study.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

Introduction and Background of the Study

With the fast-growing development and application of information technology, more and more training is now being designed and delivered through computers and networks. In a research report prepared by Bonk (2002), "projections for the next decade indicates that the supply and demand for Web-based training will continue to escalate" (p. 191). According to the International Data Corp. (IDC), digital content and e-learning was to become a $4.9 billion industry by 2007 (Britt, 2004). Among all the applications of information technology in higher education, the learning management system (LMS) is one of the most noticeable applications (Ku, 2009).

A learning management system is a software application that is used for delivering instructional materials and administering, documenting, tracking as well as reporting learning activities (Ellis, 2009). It is often referred to as virtual learning environment, e-Learning system, course management system, or online education (Dobrzanski, Honysz, & Brytan, 2006). Learning management systems such as Blackboard, Moodle, and others have been widely adopted in the U.S. and European universities and are becoming an integral part of the teaching and learning process in those countries and regions (McGill & Hobbs, 2008; Parker, Bianchi, & Cheah, 2008; Pituch & Lee, 2006). Online education, when delivered through a learning management system, provides flexible learning schedules and convenient locations that help mitigate the time, space, and location restraints common in traditional education settings. It helps universities to reach out to students who they would have not been able to reach in the past (Burgess, 2003; Raajj & Schepers, 2008).

There has been a plethora of research studies in student adoption of technology in education and many of them argue that the success of an online learning system depends on student acceptance of such systems (Raajj & Schepers, 2008). Meanwhile, it is equally vital to study faculty members' acceptance in order to measure the success of such system. Researchers in the past have consistently noted that teachers play a central role in the effective adoption and use of technology in schools (Luke, Moore, & Sawyer, 1998; Mumtaz, 2000; Zhao & Cziko, 2001). More recently, Flosi (2008), Meli (2008), and Birch and Irvine (2009) also argued that faculty members are the key to the success of the integration of technology in classrooms. Without faculty members acting as a link, the software would not get to the students in the first place (Flosi, 2008).

Among the various models developed, the Technology Acceptance Model (TAM) has been widely accepted as a robust and parsimonious framework for predicting user acceptance and adoption of technology (Davis, 1989, 1993; Davis & Venkatesh, 1996; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). Although there have been a plethora of research studies that replicated and extended the TAM over the years, research on interventions that may lead to greater user acceptance and adoption of technology has been limited (Venkatesh & Bala, 2008). The latest advancement of TAM – Technology Acceptance Model 3 (TAM3) – was designed to address this issue by providing a comprehensive nomological network of the determinants of users' acceptance of technology (Venkatesh & Bala, 2008). This makes TAM3 an ideal framework to not only examine the factors that affect the acceptance of technology, but also to suggest actionable interventions for managers and system administrators to increase the adoption and use of technology.

Purpose of the Study

The purpose of the study was to investigate management support and faculty's adoption of the learning management system at Soochow University in Taipei City, Taiwan. The study examined the effects of the variables that were defined in Venkatesh and Bala's (2008) Technology Acceptance Model 3. This study also extended the Technology Acceptance Model 3 to investigate the effects of management support on the determinants of perceived ease of use and perceived usefulness.

Figure 1-1 illustrates the adapted TAM3 model and the newly introduced variable and relationships. In this diagram, boxes and arrows with solid lines represent the variables and relationships that were introduced in the original TAM3 (Venkatesh & Bala, 2008), whereas box and arrows with dotted lines represent the hypothesized variable and relationships that this research study was also going to investigate.

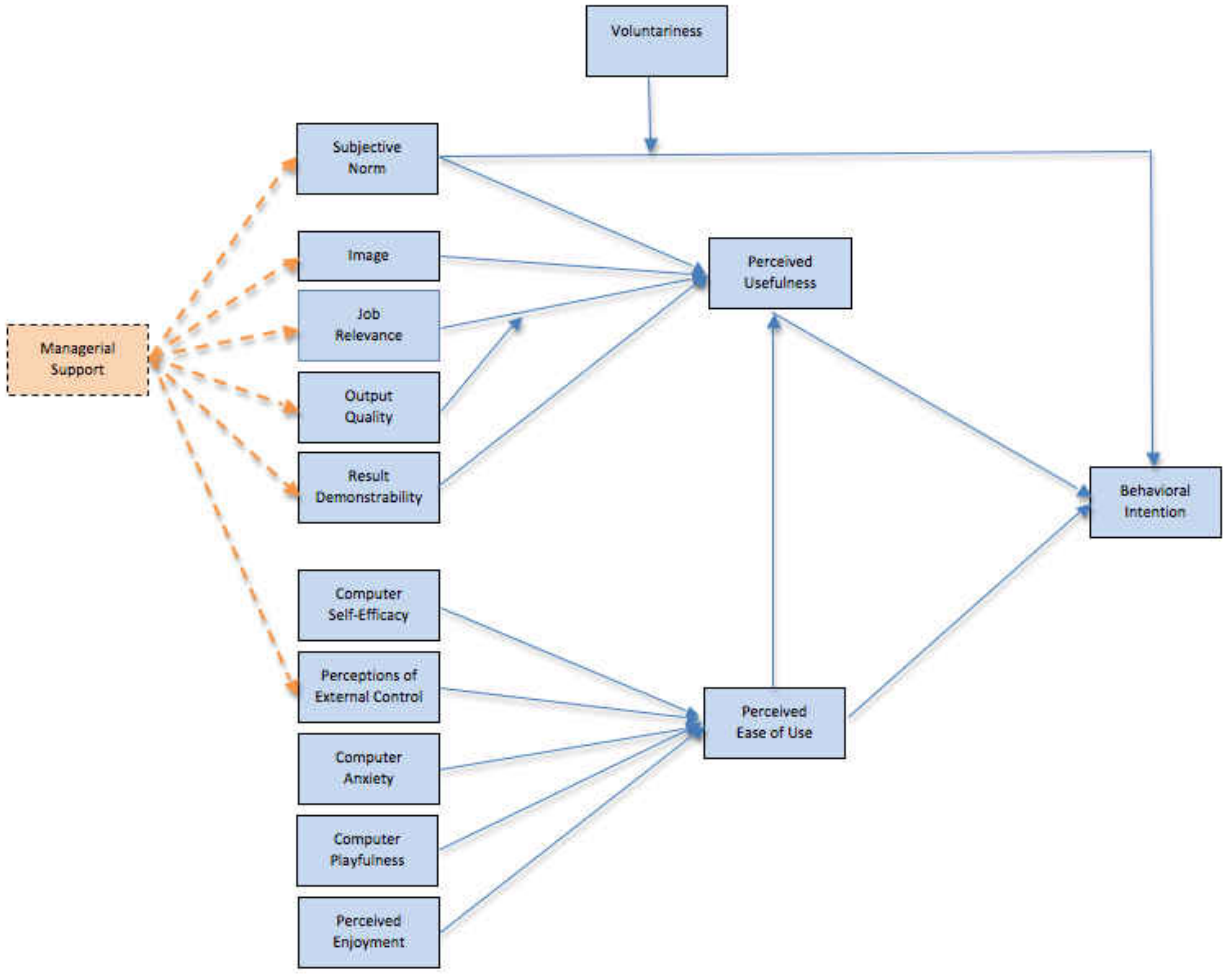


Figure 1-1 Extended Technology Acceptance Model 3 Hypothesized

This study was intended to investigate faculty members' behavioral intention of using a LMS. Since not all participants had experience with or were currently using the system, the actual usage and objective usability were left off of the original TAM3 model. Also, this study only used a one-time survey. Due to the fact that Venkatesh coded experience based on point of measurement, not the actual experience(Birch & Irvine, 2009), experience was not included in this study either.

Research Questions

The questions that were addressed in this research study are as follows:

1. How well do the Technology Acceptance Model 3 (TAM3) variables (perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and voluntariness) explain the faculty members' behavioral intention of using a LMS?
2. How well does management support affect the determinants of perceived usefulness (subjective norm, image, job relevance, output quality, and result demonstrability)?
3. How well does management support affect the perceptions of external control?

Relevance of the Study

This proposed correlational research study aimed to examine the factors affecting faculty's adoption of the learning management system in Soochow University located in Taipei City, Taiwan. Soochow University has adopted learning management systems since 2003. The adoption grew slowly and steadily from four courses in the first academic year to around 50 courses in the year of 2005/2006, and the course numbers jumped to over 100 in the year of 2008/2009. However, Soochow University offers more than 6,000 courses every academic year, which indicated that only a few faculty members adopted the LMS in their courses after six years of implementation.

Although there is a plethora of literature describing the issues of students' adoption of using LMSs, there have been few research studies that investigated a faculty's adoption of LMSs. Seven years since the initial adoption of the current LMS, a clear picture was still yet to be drawn at Soochow University about the experiences of the instructors' using the LMS. This study could provide administrators and instructional designers at Soochow

University an in-depth understanding of faculty members' perception about the system in use, which may help them to develop effective interventions to boost the adoption rate of the LMS. This study was also beneficial to the faculty members at Soochow University, as they may receive better service and support from the courseware development department and IT service to facilitate them with the adoption. Lastly, this research may also contribute to the existing body of literature on Technology Acceptance Model by validating and extending Venkatesh and Bala's (2008) work on TAM3.

Limitation of the Study

The limitations of the research study were:

1. The research study relied on a self-reported method to collect data, which may be potentially biased in nature.
2. The faculty's prior knowledge to the LMS varied. The faculty had disparate prior experience with the LMS, instructional technology and computer training.
3. The validity of the research relied on the honest responses of the participants.
4. The research study investigated the perception of a limited population on a specific learning management system that is used in Soochow University, so the result may not be generalizable to other academic institutions.
5. External and internal validity of the study were limited to the reliability of the instruments used in the study.

Assumptions of the Study

The assumptions of the study included:

1. The sample participants responded to the questionnaire honestly.
2. The sample participants' responses were based their own beliefs and knowledge.
3. The participants answered the questionnaire without the help of other individuals.
4. The homogeneity of the groups of participants and non-participants was confirmed.
5. Cost was not a factor for faculty members to adopt the learning management system at Soochow University.

Definition of Terms

The terms used in this study included:

1. Behavioral Intention: the strength of a user's intention to use a system (Ku, 2009).
2. Computer Anxiety: the degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers" (Venkatesh & Davis, 2000, p. 349).
3. Computer Playfulness: "the degree of cognitive spontaneity in microcomputer interactions" (Webster & Martocchio, 1992, p. 204).
4. Computer Self-Efficacy: the degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer (Venkatesh & Davis, 2000, p. 279).
5. Experience: knowledge or skills a user derived from using a system.
6. Image: "the degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Venkatesh, Morris, Davis, & Davis, 2003, p. 452).

7. Job Relevance: “an individual’s perception regarding the degree to which the target system is applicable to his or her job” (Venkatesh & Davis, 2000, p. 191) .
8. Latent Construct/Variable: “research construct that is not observable or measured directly, but measured indirectly through observable variables that reflect or form the construct” (Gefen, Straub, & Boudreau, 2000).
9. Learning Management System (LMS): a software application that is used for delivering instructional materials and administering, documenting, tracking as well as reporting learning activities (Ellis, 2009).
10. Management Support: “the degree to which an individual believes that management has committed to the successful implementation and use of a system” (Venkatesh & Bala, 2008, p. 296).
11. Output Quality: what tasks a system is capable of performing and the degree to which those tasks match people’s job goals (Venkatesh & Davis, 2000).
12. Perceived Ease of Use: ”the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989).
13. Perceived Enjoyment: “the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use” (Venkatesh, 2000, p. 351).
14. Perceived Usefulness: “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989).

15. Perceptions of External Control: the degree to which an individual believes that organizational and technical resources exist to support the use of the system (Venkatesh et al., 2003).
16. Result Demonstrability: "tangibility of the results of using the innovation" (Venkatesh & Davis, 2000, p. 192).
17. Structural Equation Modeling (SEM): a "multivariate technique combining aspects of multiple regression (examining dependence relationships) and factor analysis (representing unmeasured concepts with multiple variables) to estimate a series of interrelated dependence relationships simultaneously" (Gefen et al., 2000).
18. Subjective Norm: "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Venkatesh et al., 2003, p. 452).
19. Voluntariness: "the extent to which potential adopters perceive the adoption decision to be non-mandatory" (Venkatesh & Davis, 2000).

CHAPTER 2: REVIEW OF LITERATURE

Overview

This review of literature explains the theoretical background of this research study in four major areas: (1) background in online learning and learning management systems, (2) history and development of the Technology Acceptance Model, (3) recent research and applications of the Technology Acceptance Model, and (4) management support and its effect on technology acceptance. This chapter begins with a brief introduction of e-learning and learning management systems as well as their applications in higher education. The following section focuses on the Technology Acceptance Model, as it is adapted as the theoretical foundation of this research study. It also provides a chronological review of the development and evolution of the Technology Acceptance Model (TAM) over the past two decades. Being one of the most widely adopted research models, TAM has been applied in various research fields to study a great variety of information systems (Ku, 2009; Y. Lee, Kozar, & Larsen, 2003). The third section of this chapter reviews the adoption of TAM in different fields but with a particular emphasis on education. Lastly, literature in regards to management support and its effect on technology acceptance are reviewed to serve as a connection between TAM and management support.

E-Learning and Learning Management Systems

E-Learning

The Internet is one of the most fast growing and penetrated technology in the world. According to Internet World Stats (2010), the penetration rate of the Internet in North

America is as high as 77.4 percent of the population. Although varying greatly in terms of penetration rates, Asia altogether comprises 42 percent of the world's Internet users. Given the ubiquity of the Internet and the benefits it provides, it is obvious that educators would want to take advantage of it for educational purposes (Al-Busaidi & Al-Shihi, 2010).

There is no doubt about the proliferation of e-learning in recent years. The much-heated media debate is fading out quietly as e-learning is no longer a trend, but a fact. According to Global Industry Analysts (GIA), a market research company based in San Jose, CA, the e-learning market in the U. S. was $17.5 billion in 2007. The global e-learning market is going to reach $107.3 billion by 2015, according to GIA's "eLearning: A Global Strategic Business Report " (PRWeb, 2011). In a recent market analysis, Ambient Insight concludes that the worldwide market for self-pacing e-learning products and services reached $27.1 billion in 2009 and the revenues will reach $49.6 billion by 2014. The most breathtaking growth rate from 2009 to 2014 will come from Asia with an annual compound growth rate of 33.5% (Adkins, 2010).

Frequently interchanged with other terms such as online learning, distance learning, web-based learning and computer-based learning, e-Learning is an umbrella term that describes learning accomplished digitally over the Internet, a computer network, via CD-ROM, or satellite TV (WorldWideLearn, 2010). Online learning, by definition, refers to the learning that takes place partially or entirely through computer network, mostly the Internet (Means, Toyama, Murphy, Bakia, & Jones, 2009).

Although there have been debates and doubts over the effectiveness of online learning (Arafeh, 2004), recent studies and literature have shown that online learning has

stepped out of puberty and is starting to mature (ASTD, 2006). Literature has shown that e-learning has the potential to motivate students' participation and interaction in the classroom (Mahdizadeh, Biemans, & Mulder, 2008; Martins, Steil, & Todesco, 2004). It can also improve the speed and effectiveness of the educational process and communication among teachers and students (Cavus & Momani, 2009). Other research studies also showed high correlation between students' perceived social experience in an online learning environment and their level of learning and satisfaction (Richardson & Swan, 2003). A research study from Dziuban and Moskal (2001) indicated that the combination of web-based and face-to-face instruction provides "the best of both worlds" (p. 48). In fact, the U.S. Department of Education, Office of Planning, Evaluation, and Policy Development recently released a meta-analysis and review of online learning studies; the findings suggested that on average, students in online learning conditions performed better than those receiving only face-to-face instructions (Means et al., 2009). The study also revealed that (Means et al., 2009):

- Students in online condition spent more time on task than students in face-to-face condition.
- Online learning appeared to be an effective option in a wide range of academic and professional fields.

Learning Management Systems

Learning Management System (LMS) is a software system for the administration, documentation, tracking, and reporting of training events (Ellis, 2009). It often comprises a suite of tools for learning and online teaching activities (Cavus & Momani, 2009).

Courseware management systems (CMS), virtual learning environment (VLE), and learning content management systems (LCMS) are often considered as synonyms to LMS. However, some researchers consider CMS, VLE, and LCMS as systems that are generally used in academic settings to facilitate learning, and LMS as systems used for employee training in business settings (Daniels, 2009). In this research study, LMS is an umbrella term that refers to the systems used in both academic and business settings.

Despite the different definitions of LMS in the field, ASTD (Ellis, 2009) pointed out that a robust LMS should be able to:

- Centralize and automate administration
- Use self-service and self-guided services
- Assemble and deliver learning content rapidly
- Consolidate training initiatives on a scalable web-based platform
- Support portability and standards
- Personalize content and enable knowledge reuse

As reported in Learning Management Systems 2009 (Mallon, Bersin, Howard, & O'Leonard, 2009), LMSs represent a market at over $800 million in North America. Despite the distinct requirements between educational institutions and enterprise environments, both types of LMSs share some common features (Carliner, 2005):

- Manage and enroll learners
- Communicate with learners
- Track learner performance and generate reports

- Launch learning materials
- Web-based or blended course delivery

In the educational environment, most of the LMS products were created in late 1990s. Blackboard, which acquired Prometheus in 2001, WebCT in 2006, and Angel Learning in 2009, is among the most popular LMSs with a market share around 80% among universities in the U.S., and over 50% among all universities worldwide (Pishva, Nishantha, & Dang, 2010). In recent years, open source LMSs started to gain momentum in both academic and enterprise environments. Moodle and Sakai are the two popular ones among the open source LMSs. According to a recent survey from the Campus Computing Project, Moodle has registered significant gains in market share from 4.2 percent in 2006 to 16.4 percent in fall 2010. Sakai has also grown from 3.0 percent in 2006 to 4.6 percent in 2010. The report also highlighted the importance of mobile LMS applications even though they are still in the early phase of campus deployment (Green, 2010). In a report released by the Center of the International Cooperation for Computerization in the e-Learning Contents Conference 2006, the majority of the higher education institutions in Asia use domestically developed or open source LMSs (CICC, 2006).

The rapid growth of open source LMSs accompanied with the dynamic shift of LMS market share has stirred up the open source vs. proprietary debate. Although some people argue that open source LMSs have higher total cost of ownership (TCO) because of hidden costs, evidence from the University of North Carolina, Chapel Hill and the North Carolina Community College System has shown otherwise (Feldstein, 2010).

With the amount of available choices of LMSs on the market, one of the major problems facing administrators and instructors is how to choose an LMS system that best fits their needs. To alleviate this issue and help administrators and instructors make informed decisions, the Western Cooperative for Educational Telecommunications and the Centre for Curriculum, Transfer and Technology launched the EduTools website to assist higher education institutions in making decisions about their LMSs. EduTools provides independent reviews, side-by-side comparisons and consulting services to the e-learning community (EduTools, 2010). Other researchers proposed the idea of developing a specialized computer system to help with the evaluation and decision making of choosing an LMS (Cavus & Momani, 2009).

Faculty Members' Adoption of LMS

Like any other information systems, LMSs face the same challenge of user adoption. As Davis and colleagues (Davis, 1989) noted in one of the first TAM articles, an information system would not increase productivity or performance unless the technology is utilized. In education, faculty members and students have to adopt the LMS in order to take advantage of its full potential. Prior research has mostly emphasized the importance of students' adoption of LMSs such as WebCT or Blackboard (Ku, 2009; Pan, Gunter, Sivo, & Cornell, 2005; Pan, Sivo, Gunter, & Cornell, 2005; Yang, 2007), however, few research studies have investigated faculty members' adoption of LMSs.

Literature has shown that teachers and faculty members play an important role in the effective adoption and use of technology in schools (Luke et al., 1998; Mumtaz, 2000; Zhao & Cziko, 2001). Faculty members are essentially the bridge between the LMS and

students, since the LMS would not be able to reach the students without faculty members' adoption (Al-Busaidi & Al-Shihi, 2010; Flosi, 2008). Research findings also suggested that faculty members' attitude toward e-learning can significantly affect the outcome of e-learning (Piccoli, Ahmad, & Ives, 2001). To maximize the adoption from the faculty members, researchers have emphasized the importance of teachers' involvement in technology implementation (White & Myers, 2001). Other researchers addressed the need of usability evaluation from the faculty members during the selection of a LMS (Hayes, 2000).

In order to provide a comprehensive look into the factors that influence the faculty's adoption of LMS, Flosi (2008) and Al-Busaidi and Al-Shihi (2010) conducted separate research to investigate the issue. Both Flosi (Flosi, 2008) and Al-Busaidi and Al-Shihi (2010) opted to use the TAM as the theoretical foundation for their research.

In Flosi's (2008) research study, the researcher extended the TAM model by adding information security and privacy, time to implement and utilize, and social influence to the TAM. The researcher predicted that the three additional variables would affect the perceived usefulness and perceived ease of use, and thus affect the use of the LMS. However the research findings indicated that the three additional variables do not have significant effect on faculty's adoption of a LMS. Also contradictory to the majority of TAM research, the study did not find evidence that the perceived usefulness and perceived ease of use have a statistically significant impact on the adoption of a LMS. Figure 2-1 shows the extended TAM model for faculty's adoption of LMS by Flosi (2008).

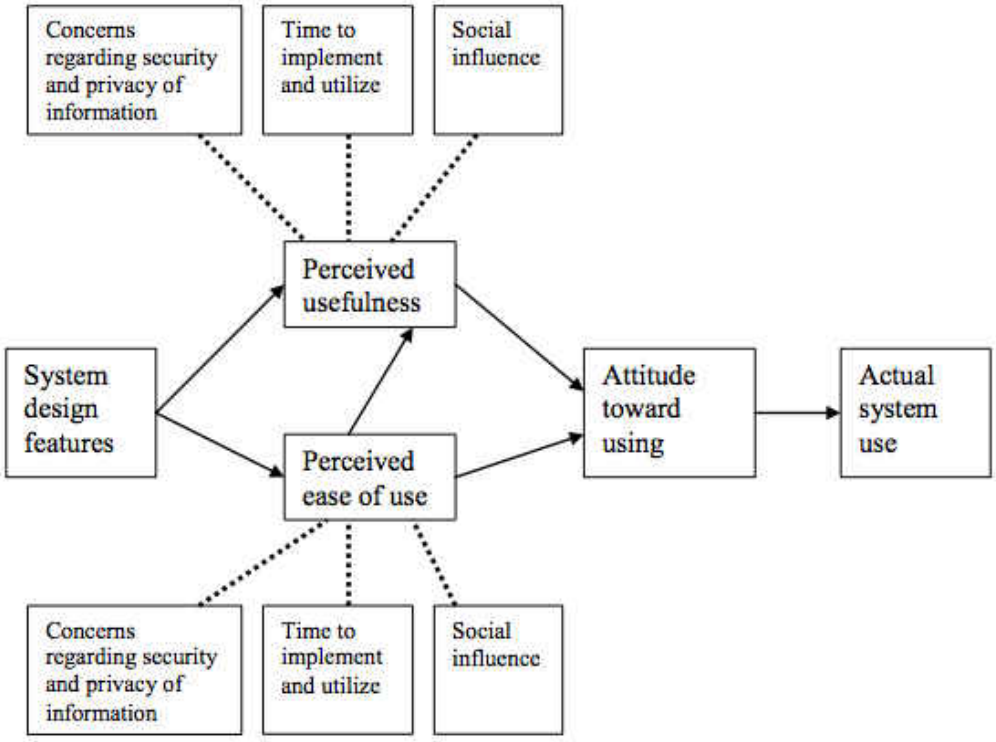


Figure 2-1Modified TAM for Faculty's Adoption of LMS by Flosi (2008, p. 10)

Based on previous research studies, Al-Busaidi and Al-Shihi (2010) proposed a TAM-based research model for researchers and practitioners to examine the factors that affect the faculty's adoption of LMS. They categorized the factors in three main areas: 1) instructor factors, 2) organization factors, and 3) technology factors. Although their model is yet to be verified with empirical investigations, the model provided a comprehensive framework for future researchers to evaluate the factors that impact the faculty's adoption of LMS. Figures 2-2 shows the proposed framework by Al-Busaidi and Al-Shihi and the factors within each category.

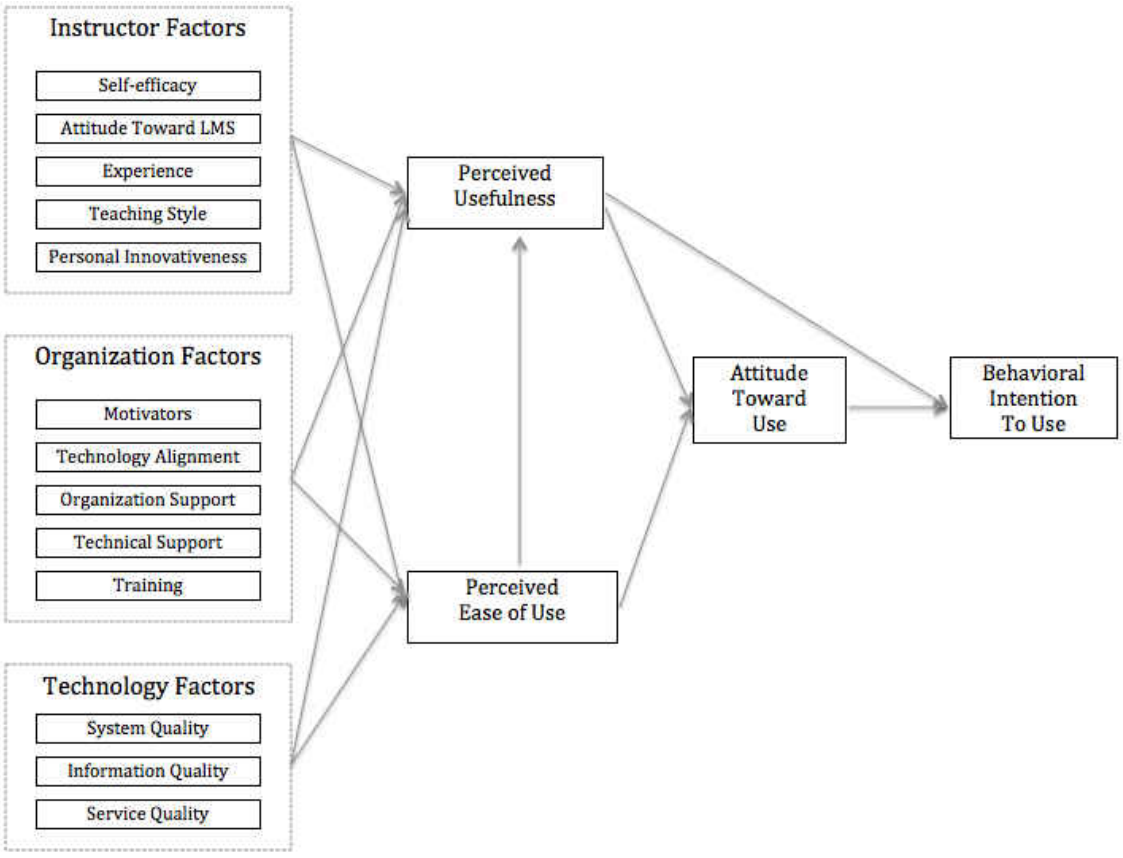


Figure 2-2 Proposed Instructor's LMS Acceptance Model by Al-Busaidi and Al-Shihi (2010, p. 6)

History of Technology Acceptance Model

It has been over twenty years since Davis (1986) first introduced TAM. During these years there have been changes, evolution, expansion, and iterations of TAM. Time has shown that TAM continues to be one of the most widely adopted theoretic models for research in technology acceptance (Y. Lee et al., 2003).

Among the many researchers who have contributed to the TAM research, Lee and colleagues (Y. Lee et al., 2003) conducted a review of literature and meta-analysis that

summarized the research studies related to the development of the TAM. In their literature review, Lee and colleagues (2003) organized the TAM research by chronological progress and divided it into four stages:

1. *Model introduction period.* During the model introduction period, researchers mainly focused on two types of research: 1) replicate TAM to verify if it is a parsimonious model, 2) compare TAM and the Theory of Reasoned Action to determine if TAM is superior to the model it derived from.

2. *Model validation period.* During the model validation period, researchers focused on the validation of the instruments that was used in TAM. As researchers (Straub, 1989) have suggested, robust instruments can enhance the value of research and promote cooperative research efforts by allowing sequential research to utilize the tested instrument.

3. *Model extension period.* During the model extension period, researchers focused on extending the initial TAM model by introducing new variables and investigate the boundary conditions of TAM.

4. *Model elaboration period.* During the model elaboration period, researchers worked on the development of the next generation TAM as well as resolution of some of the TAM problems.

As one of the most popular models for user acceptance of information technology, continuous effort has been made by researchers to further develop, advance, modify, extend, and apply TAM since 2003 when Lee and colleagues did the comprehensive review

of literature and meta-analysis of TAM. The following sections will review the key iterations of TAM model through a chronological timeline (see Figure 2-3).

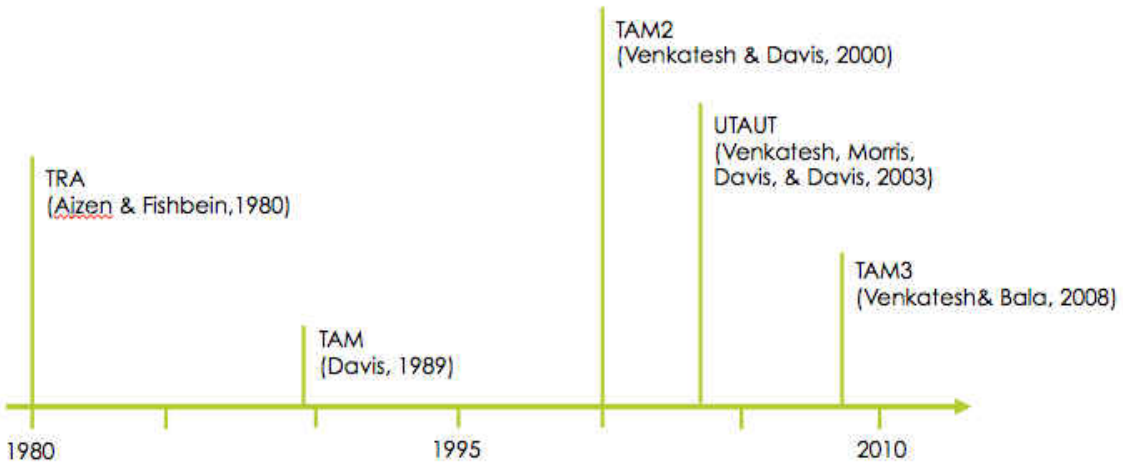


Figure 2-3 History of TAM

Theory of Reasoned Action

To talk about TAM, we will have to mention the Theory of Reasoned Action (TRA) that was first introduced by Ajzen and Fishbein back in 1975 to 1980. The Theory of Reasoned Action is a psychological theory based on a conceptual framework of beliefs, attitudes, intentions, and behaviors that seeks to explain human behaviors (Fishbein & Ajzen, 1975). It consists of three general constructs: behavioral intention (BI), attitude (A), and subjective norm (SN). The Theory of Reasoned Action assumes that a person's behavioral intention is determined by his or her attitude about the behavioral and subjective norm (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The theory (shown in Figure 2-4) can be depicted as a regression equation with estimated relative weights:

$$BI = A + SN$$

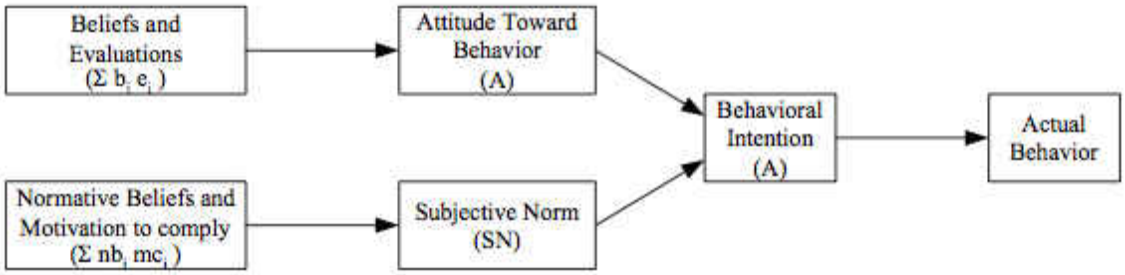


Figure 2-4 Theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975)

According to the TRA, attitude is defined as an individual's positive or negative feelings regarding the particular behavior and it is determined by the individual's beliefs about the consequences of the behavior. Subjective norm refers to an individual's perception of the importance of the particular behavior from the people who are important to the individual; it is determined by the individual's perceived expectations of specific referent groups and his or her motivation to comply with these expectations. Behavioral intention is defined as the measure of the strength of one's intention to perform a specified behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975).

The Theory of Reasoned Action is widely adopted and validated by social psychologists to predict and explain human behaviors across a wide variety of domains (Davis, 1989; Greene, Hale, & Rubin, 1997; Sparks, Shepherd, & Frewer, 1995). Since the TRA was "designed to explain virtually any human behavior" (Ajzen & Fishbein, 1980, p. 4), Davis (1989) decided that it "should therefore be appropriate for studying the determinants of computer usage behavior as a special case" (p. 4) and introduced the Technology Acceptance Model based on the TRA.

Technology Acceptance Model

Davis (1986) first introduced the Technology Acceptance Model (TAM) to explain the determinants of technology acceptance by the users. The Technology Acceptance Model is an adaptation of the TRA that was specifically tailored for modeling user acceptance (Davis, 1989) and it was one of the early attempts that applied psychological factors into information systems and technology adoption (Schepers & Wetzels, 2007). Davis (1989) suggests that the user's acceptance of information systems is determined by two major variables – perceived usefulness (U) and perceived ease of use (PEOU) – that influence an individual's attitude toward (A) an information system and ultimately affect the actual use (USE) of such system (Davis, 1989). Figure 2-5 below illustrates the variables and their relationships.

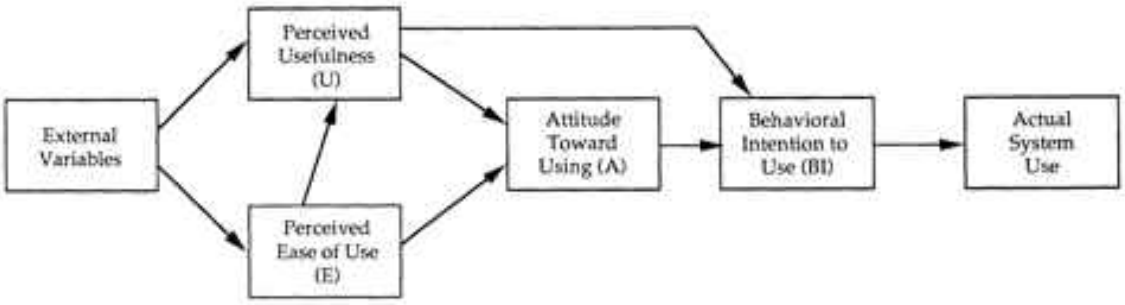


Figure 2-5 Technology Acceptance Model (Davis, 1989, p. 985)

In the following years after the introduction of the TAM, Davis and colleagues (Davis, 1989, 1993; Davis et al., 1989; Davis & Venkatesh, 1996) validated and refined it.

In a 1989 research, Davis focused on the refinement and improvement of the measures for perceived usefulness and perceived ease of use. Davis (1989) tested the

scales in two studies: one involved 120 users at an IBM facility and the other one involved 40 graduate students. The results revealed that "perceived usefulness was significantly correlated with both self-reported usage (r = .63) and self-predicted future usage (r = .85)" (Davis, 1989). The research also suggested that usefulness was more significantly linked to usage than ease of use.

In another research study Davis conducted in conjunction with Bagozzi and Warshaw (1989), the researchers compared the TAM and the TRA in an effort to better understand, predict and explain user acceptance of technology. Their findings further supported Davis' conclusion in previous research studies that perceived usefulness is a more significant determinant of intention of use than perceived ease of use. Their results also suggested that actual usage could be predicted fairly well from the users' behavioral intention (Davis et al., 1989).

In 1993 Davis applied the TAM model to study the effect of system design features on the users' acceptance of the information systems. The results once again showed that usefulness is significantly more influential on actual system usage than ease of use, which further underlined the importance of appropriate system functionalities (Davis, 1993).

In the 1996 iteration, Davis and Venkatesh removed attitude from the original TAM model due to empirical evidence from the 1989 (Davis et al.) study that attitude did not entirely mediate the effect of perceived usefulness on behavioral intention. Empirical data suggested that in a real life environment, people might use a technology without a positive attitude as long as it enhances productivity (Davis et al., 1989). In the study, Davis and

Venkatesh (1996) tested the intermixed structure of the questionnaire and found no significant effect on the level of reliability and validity of the measures.

Technology Acceptance Model 2

With over a decade of development, the TAM "has become well-established as a robust, powerful, and parsimonious model for predicting user acceptance" (Venkatesh & Davis, 2000, p. 187). Although evidence has suggested that perceived usefulness is much more influential than ease of use in determining usage (Davis, 1993), Venkatesh and Davis noticed in 2000 that there have been few research studies done in the past ten years to model the determinants of perceived usefulness. To better understand perceived usefulness and usage intentions in terms of social influence and cognitive instrument processes, Venkatesh and Davis (2000) introduced TAM2.

Compared to the TAM, TAM2 is a more elaborate and comprehensive model that focuses on the determinants of perceived usefulness. Built upon prior research, Venkatesh and Davis (2000) introduced five determinants that affect perceived usefulness – Subjective Norm, Image, Job Relevance, Output Quality, and Result Demonstrability – and two new moderators – Experience and Voluntariness. Figure 2-6 illustrates the variables and relationships introduced in the TAM2.

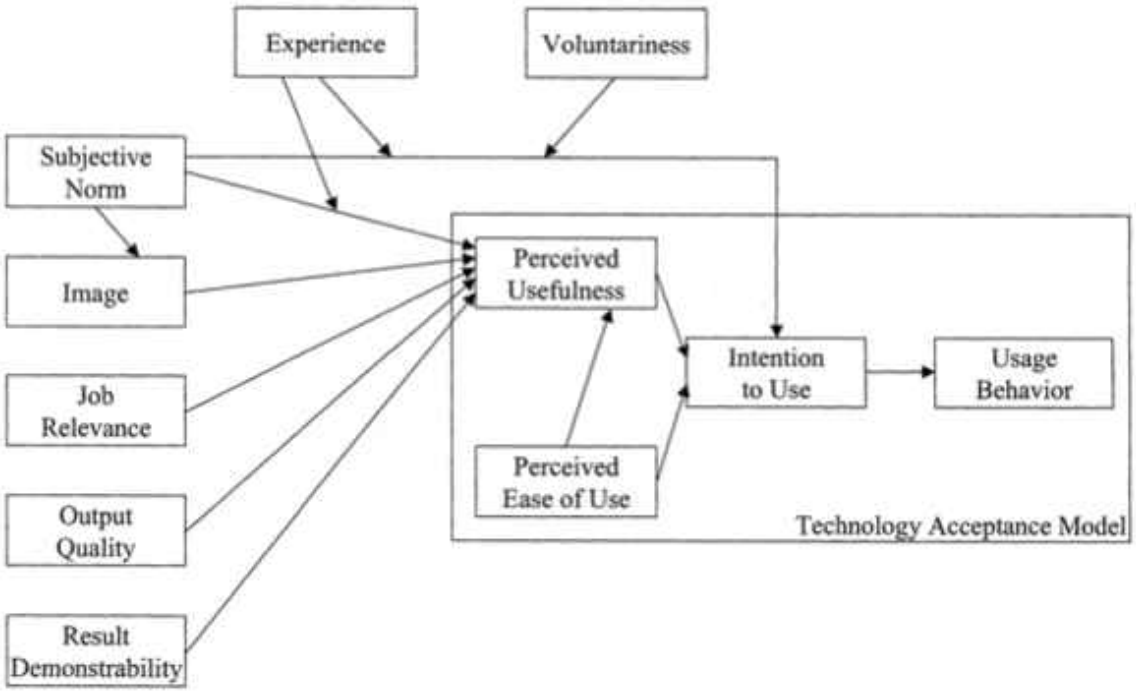


Figure 2-6 Technology Acceptance Model 2 (Venkatesh & Davis, 2000, p. 188)

To validate the constructs of the TAM2, four longitudinal studies were carried out from four different organizations regarding four different systems. The Technology Acceptance Model 2 was tested and the results indicated that the TAM2 explains about 40%-60% of perceived usefulness and 34%-52% of usage intention, which strongly supports the model as a valid advancement of the original TAM (Venkatesh & Davis, 2000). In addition to Venkatesh and Davis' own research, a study conducted by Chismar and Wiley-Patton (2002) also provided strong support for the TAM2 with the results explaining around 60% of perceived usefulness and intention to use.

In a meta-analysis of 22 TAM related research studies, Legris, Ingham, and Collerette (2003) concluded that the TAM has proven to be a useful and reliable theoretical model for understanding user acceptance of technology. However, Legris and colleagues also indicated that there are significant factors missing from the TAM models and called for

an integration of broader variables and the adoption of the innovation model (Legris et al., 2003).

The Unified Theory of Acceptance and Use of Technology

One of the most comprehensive reviews of literature on users' acceptance of new technology came from Venkatesh and colleagues (2003). Over the years, researchers have developed various models to explain the users' acceptance and usage of information systems from the information technology perspective, psychology perspective and sociology perspective. In many cases, researchers face the conundrum of picking a proper model for their research. To remediate this issue, Venkatesh and colleagues (2003) identified and synthesized eight models of information technology acceptance research – the Technology Acceptance Model, the Theory of Reasoned Action, the Theory of Planned Behavior (TPB), the Motivation Model, the Model of PC Utilization, the Innovation Diffusion Theory, the Social Cognitive Theory, and Combined TAM and TPB – and integrated them into a Unified Theory of Acceptance and Use of Technology (UTAUT). Figure 2-7 illustrates the UTAUT variables and their relationships.

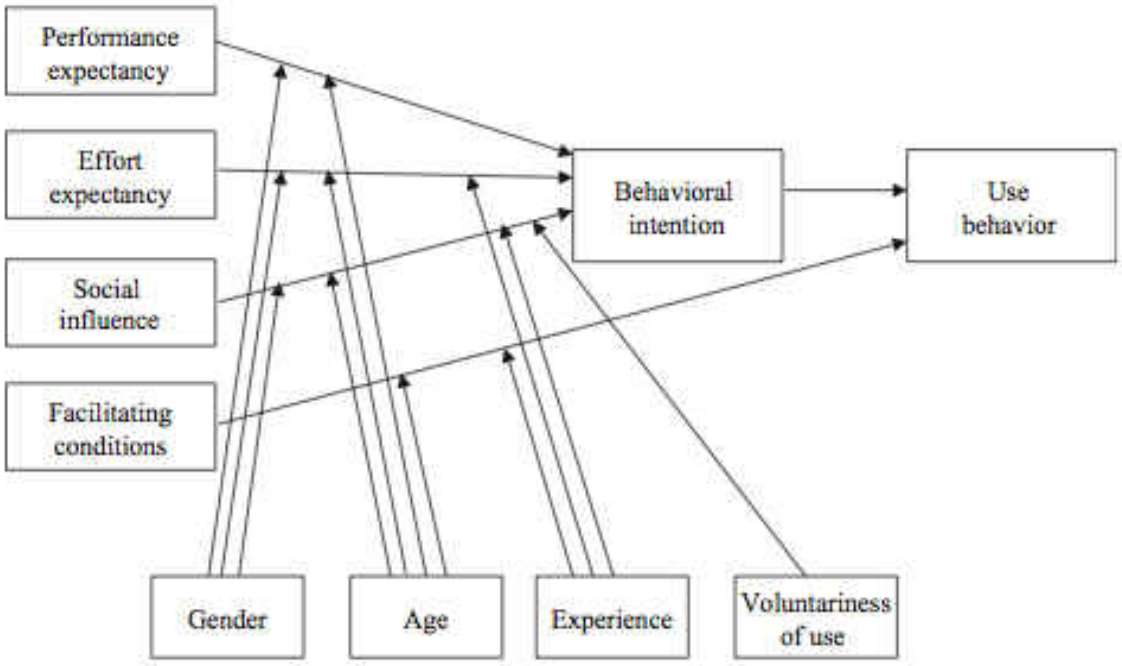


Figure 2-7 Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003, p. 447)

Table 2-1 Definitions of direct determinants in UTAUT (Venkatesh et al., 2003)

Variable	Definition
Performance Expectancy	The degree to which an individual believes that using the system will help attain gains in job performance.
Effort Expectancy	The degree of ease associated with the use of the system.
Social Influence	The degree to which an individual perceives that important others believe he or she should use the new system.
Facilitating Conditions	The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.

As illustrated above, there are four constructs in UTAUT that play significant roles as direct determinants of user acceptance: performance expectancy, effort expectancy, social influence, and facilitating conditions. The definitions of these constructs are presented in Table 2-1.

The Unified Theory of Acceptance and Use of Technology was set out to create a definitive model for user acceptance of information technology by combining the explanatory power of the individual models with key moderating influence (Venkatesh et al., 2003). Their results indicated that UTAUT outperforms the eight preceding models and explains 70% of the variance in user intentions (Venkatesh et al., 2003). Researchers from other fields also recommended UTAUT as a valid tool for studying technology acceptance (Birch & Irvine, 2009; Moran, Hawkes, & Gayar, 2010).

Technology Acceptance Model 3

The Technology Acceptance Model 3 (TAM3) is the latest development and advancement of the TAM. Having recognized that the previous TAM research has provided valuable insights on an individual's acceptance of information systems, Venkatesh and Bala (2008) shifted their focus to helping managers make informed decisions on interventions that would improve the acceptance and effectiveness of the use of information systems within an organization.

Both scholars and industry professionals suggest that managers need to develop and implement effective interventions to increase users' adoption and use of information systems (Brown, 2009; Jasperson, Carter, & Zmud, 2005). Although TAM may address why

users would not adopt an information system, it does not answer the how and what. As Lee, Kozar, and Larsen (2003) have discovered in their interviews with leading information system researchers, one of the shortcomings of the TAM is the lack of actionable guidance for the practitioners. In order to address this issues with the TAM and help managers with better decision making, Venkatesh and Bala (2008) combined the constructs from the TAM2 (Venkatesh & Davis, 2000) and the model of the determinants of perceived ease of use (Venkatesh, 2000), and proposed an integrated, comprehensive nomological network of the determinants of technology adoption and use. A complete representation of the TAM3 is shown in Figure 2-8.

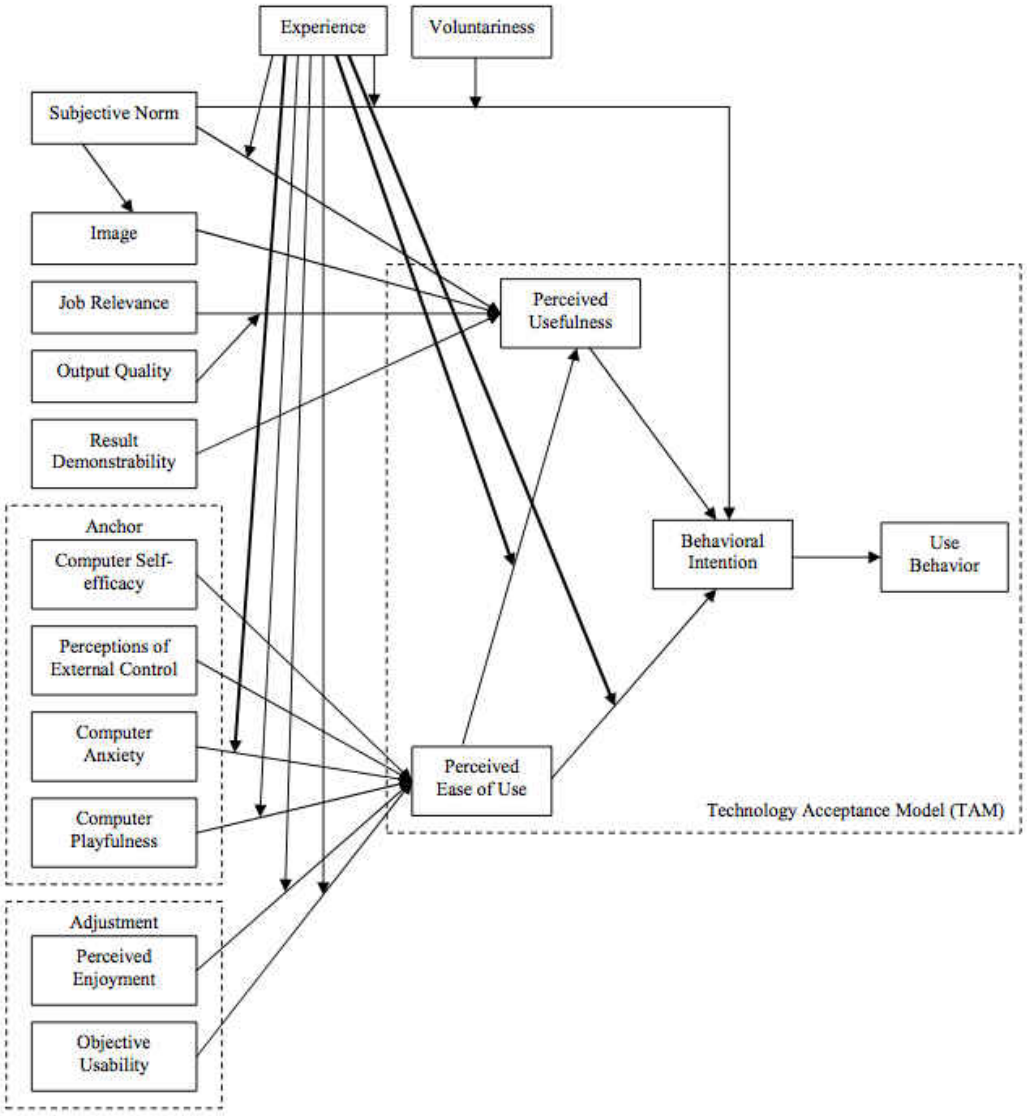


Figure 2-8 Technology Acceptance Model 3 (Venkatesh & Bala, 2008, p. 280)

Aside from TAM3, Venkatesh and Bala (2008) also proposed a research agenda focused on pre and post-implementation interventions that helps to enhance the users' adoption and use of information systems. Among the research agenda that Venkatesh and Bala (2008) have proposed, management support is one of the major pre-implementation interventions, as Venkatesh and Bala (2008) believe that management support would

influence the user's perceptions subjective norm and image, which are two important determinants of perceived usefulness.

Applications of Technology Acceptance Model

Since it was first introduced, the TAM has been applied in various research studies as a theoretical foundation to investigate user acceptance of information technology in various research fields. The following section will provide a quick glance through TAM-related studies in different areas with a focus on education.

Perhaps the most noticeable TAM-related studies are from Davis and Venkatesh. They developed, validated, and elaborated the TAM in various business settings (Davis, 1993; Davis & Venkatesh, 1996; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). In 1995, Igbaria and Iivari conducted a research study on the effect of self-efficacy and computer anxiety on the user's acceptance of computer technology. They surveyed users from the top 120 companies in Finland and their research findings strongly supported the conceptual model of the TAM (Igbaria & Iivari, 1995). Igbaria also did another research study with colleagues using data collected from New Zealand to test the factors that affect personal computing acceptance in small firms (Igbaria, Zinatelli, Cragg, & Cavaye, 1997). They found that perceived ease of use is a dominant factor for user acceptance in small firms in New Zealand. Also, contrary to prior research in large firms, internal support and internal training does not seem to affect the user's acceptance (Igbaria et al., 1997).

In another study, Mathieson, Peacock, and Chin (2001) investigated the influence of perceived user resources on the users' acceptance of technology. Mathieson and colleagues extended the TAM by adding perceived user resources to the model with both formative

and reflective measurements. Mathieson et al. (2001) collected data from members of the Institute for Management Accountants. Their findings suggested that perceived user resources affect the users' behavioral intention and perceived ease of use.

In a study of user acceptance at a large manufacturing company, Burton-Jones and Hubona (2005) tested the effect of staff seniority, age, and education level on the usage of an information system. The findings of Burton-Jones and Hubona's research indicated that individual differences such as age, education level, and seniority have significant effect on system usage.

One of the examples that shows the wide variety of TAM application is a research study from Chismar and Wiley-Patton (2002). Chismar and Wiley-Patton applied the TAM2 in the health care environment to study physicians' intentions of adopting internet-based health applications. Their results supported the TAM in perceived usefulness being a significant predictor of physicians' adoption of internet-based health applications. However, perceived ease of use failed to predict physicians' intentions of adopting internet-based health applications. Chismar and Wiley-Patton (2002) indicated that this may attribute to the fact that physicians are more pragmatic in accepting new technology. Also the variables of perceived ease of use may not be sufficient or as critical to the physicians.

The Technology Acceptance Model is widely used in education to investigate individual user's acceptance of a certain technology that is used for learning. Among them, students' acceptance of a learning management system is one of the popular topics. Studies have shown that usability affects students' learning outcome and the "cognitive outcomes of using CBI extended beyond the content of the specific software being used and the

subject being taught" (Ikegulu, 1998). Others argue that student acceptance of the learning management system largely determines the success of such system (Raajj & Schepers, 2008). Examining the factors that affect students' acceptance of the online learning system would be logical and necessary, and this is where TAM comes into play.

In 2003, Steol and Lee did a study on students' acceptance of WebCT – a popular learning management system widely used in North America, and found students' experience with the LMS greatly affects their perceived ease of use and perceived usefulness of the system and thus impacts students' intentions of using such system. Similar studies on WebCT were also conducted around the same time by Pan and colleagues (Pan, Gunter, et al., 2005; Pan, Sivo, et al., 2005). In addition to perceived ease of use and perceived usefulness, Pan and colleagues (2005; Pan, Sivo, et al., 2005) particularly investigated the effect of subjective norm and computer self-efficacy on the student's acceptance of WebCT. Their results revealed that subjective norm and computer self-efficacy have a direct effect on perceived ease of use and perceived usefulness (Pan, Gunter, et al., 2005; Pan, Sivo, et al., 2005). In another study regarding the WebCT system, Yang (2007) examined subjective norm, social presence, sociability, and computer efficacy as exogenous determinants in addition to the original constructs in TAM. Her findings verified the robustness of the TAM and suggested that these factors affect students' adoption of WebCT. More recently, Ku (2009) conducted research on the effect of perceived resources on the learner's acceptance of WebCT. Ku's (2009) research findings indicated that students' perceived resources on WebCT have a significant effect on both perceived ease of use and perceived usefulness.

Few researchers have studied faculty use of instructional technology like Meli (2008), who conducted a research study on the determinants influencing health information management (HIM) faculty's attitude and behavior toward the use of the e-HIM® Virtual Lab (V-lab). The V-lab system was developed by the American Health Information Management Association (AHIMA) to enhance workforce training of HIM students. In agreement with other researchers, Meli (Meli, 2008) also noted that the faculty is the "gatekeeper" to the adoption of the new technology (p. 3). The findings of Meli's research indicated that perceived ease of use and perceived usefulness can successfully predict a faculty's behavioral intention toward the use of V-lab (Meli, 2008). The findings were consistent with other TAM-based research and provided strong evidence of the TAM being a robust framework in predicting user acceptance of technology. Similar results were also shown in Siegel's research on a faculty's adoption of an online learning assessment management system named LiveText© (Siegel, 2008).

Outside of the United States, Lee (Y.-C. Lee, 2008) studied the role of perceived resources in online learning adoption in a university in Taiwan. Lee (2008) extended the TAM model with two groups of external variables that are related to perceived resources. The first group of variables is intra-organizational factors, which consist of internal computing support, internal computing training, and internal equipment accessibility. The second group of variables is extra-organizational factors, which consist of external computing support, external computing training, and external equipment accessibility (Y.-C. Lee, 2008). The results of Lee's study suggested that improvement of resources is necessary for students to better adopt the LMS. Not far from Lee, Raajj and Schepers (2008) conducted a research on learner's acceptance and use of a virtual learning environment in

China. Raajj and Schepers (2008) used the TAM2 as their theoretical foundation and extended it with subjective norm, personal innovativeness and computer anxiety. Their results indicated that personal innovativeness and computer anxiety have direct effects only on perceived ease of use; perceived usefulness has a direct effect on the usage of LMS; and perceived ease of use and subjective norm have only an indirect effect via perceived usefulness. Raajj and Schepers (2008) recommended that education program managers should address individual differences between the learners using the LMS.

Management Support

Previous research has shown that managers are important sources of interventions and are one of the most critical factors for the success of information systems (Jarvenpaa & Ives, 1991; Jasperson et al., 2005; Leonard-Barton & Deschamps, 1988; Liang, Saraf, Hu, & Xue, 2007). In a TAM-based research study, Igbaria and colleagues (Igbaria et al., 1997) suggested that management support ensures sufficient allocation of resources for the success of information systems. Their research data reveals that management support influences perceived ease of use and perceived usefulness directly; it also influences the actual usage indirectly through perceived usefulness (Igbaria et al., 1997).

Among all the TAM literature, few research studies have investigated the issue of culture and demand certainty as Phillips, Calantone, and Lee (1994) have done. Phillips and colleagues studied the behavior structure, demand certainty and culture in international technology adoption in China. According to their study, culture affinity has a significant and positive influence on international technology adoption. Their findings suggested that under the conditions of high cultural affinity and demand certainty, decision makers are

more receptive to new technologies. When the demand for new technology is established, priorities are formed to justify the adoption decision (Phillips et al., 1994).

Research studies have also indicated that managerial pressure has a positive effect on user's subjective norms, which helps to improve the adoption of technology (Jasperson et al., 2005; Marler, Fisher, & Ke, 2009). As suggested by Crant (2000), motivational states such as self-efficacy and contextual factors such as management support have a direct influence on proactive behaviors. It is suggested that managers should promote social exchange mechanisms, show care about an individual's growth, and help secure resources requested to promote the proactive behavior on the adoption of the technology (Marler et al., 2009). Direct involvement of managerial support in system development and implementation was also suggested to positively influence users' belief in job relevance, output quality, and result demonstrability of a system (Jasperson et al., 2005).

CHAPTER 3: METHODOLOGY

Introduction

This chapter focuses on the methodology of this research study and will explain in details: context and research design of the study, information regarding research participants, data collection instruments, data collection procedures, and lastly, statistical procedures used for data analysis.

Research Design

The current research was based on the non-experimental research design. Quantitative survey instruments were used to collect data from participants to examine faculty member's behavioral intention of adopting the LMS at Soochow University.

This correlational research study applied the TAM3 to investigate factors that influence the faculty's adoption of the LMS. This study examined the effects of the variables that were defined in TAM3 by Venkatesh and Bala (2008). This study also investigated the effect of management support on the determinants of perceived ease of use and perceived usefulness by extending TAM3.

Similar to what Venkatesh and Bala (2008) have done in their TAM3 research, structural equation modeling (SEM) was used to explore and measure the causal pathways among management support, perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and voluntariness.

This research study was designed to address the following questions:

1. How well do Technology Acceptance Model 3 (TAM3) variables (perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and voluntariness) explain faculty members' behavioral intention of using a learning management system (LMS)?
2. How well does management support affect the determinants of perceived usefulness (subjective norm, image, job relevance, output quality, and result demonstrability)?
3. How well does management support affect the perceptions of external control?

Participants

The target population of this study was the faculty members who were teaching at Soochow University. Soochow University was first established in Soochow City (Suzhou), China in 1900 by missionaries of the American Methodist Church. Soochow University expanded and thrived over the first half of the 20th century and survived the Japanese invasion of China during World War II. After the Chinese Civil War, Soochow University was reborn in Taiwan by Soochow University Alumni. To this day, Soochow University in Taiwan comprises of five graduate schools with five doctoral programs, 18 master's programs, and 22 undergraduate programs. There are currently more than 1200 faculty members employed in Soochow University. Among them, about one-third are full-time faculty members (Ministry of Education, Taiwan, 2010).

The participation of this research study was voluntary and there were no incentives for faculty members to participate in the research study. This research was conducted on a total number of 492 faculty members and teaching assistants. A total of 106 responses were received and among them, 105 were valid responses.

Instruments

The survey instruments of this research study were mostly adopted from TAM3 (Venkatesh & Bala, 2008) that have been proven to be reliable and valid by other researchers (Davis, 1993; Davis & Venkatesh, 1996; Ku, 2009; Mathieson et al., 2001; Pan, Sivo, et al., 2005; Venkatesh, 2000; Venkatesh & Davis, 2000). The questionnaire is comprised of six parts: (1) instruments for the original TAM constructs, (2) instruments for the determinants of perceived ease of use, (3) instruments for the determinants of perceived usefulness, (4) instruments to measure management support, (5) instruments to measure the moderator, and (6) demographic instruments. The following sections will explain each part in detail.

Instruments for original TAM constructs

The measurements for the original TAM constructs – perceived ease of use (PEOU), perceived usefulness (PU), and behavioral intention (BI), were adapted from TAM3 (Venkatesh & Bala, 2008). These items were first introduced in the original TAM studies by Davis (1989). The items have been tested and shown consistent reliability and validity in various studies (Davis, 1993; Davis & Venkatesh, 1996; Gefen et al., 2000; Ku, 2009; Pan, Gunter, et al., 2005; Pan, Sivo, et al., 2005; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). A total of 10 variables were measured on a seven-point Likert scale with 1 as

"Strongly Disagree," 2 as "Disagree," 3 as "Somewhat Disagree," 4 as "Neither," 5 as "Somewhat Agree," 6 as "Agree," and 7 as "Strongly Agree." A complete list of the instrument questions is included in Appendix E and Appendix F (Chinese translation).

Instruments for determinants of perceived ease of use

The instruments to measure the determinants of perceived ease of use (PEOU) – computer self-efficacy, perceptions of external control, computer playfulness, computer anxiety, and perceived enjoyment, were adapted from TAM3 (Venkatesh & Bala, 2008). Venkatesh and Bala (2008) adapted validated measurements from prior research studies to develop TAM3. These measurements have been shown valid by Compeau and Higgins (1995), Mathieson (Mathieson et al., 2001), Taylor and Todd (1995), Webster and Martocchio's (1992), and Venkatesh (2000). A total of 19 variables were measured on a same seven-point Likert scale as used in the previous instruments. A complete list of the instrument questions is included in Appendix E and Appendix F (Chinese translation).

Instruments for determinants of perceived usefulness

The instruments to measure the determinants of perceived usefulness (PU) – subjective norm, image, job relevance, output quality, and result demonstrability, were adapted from TAM3 (Venkatesh & Bala, 2008). These measurements were first adapted by Venkatesh (2000) from prior research studies and have shown evidence of reliability and validity (Davis, Bagozzi, & Warshaw, 1992; Moore & Benbasat, 1991; Taylor & Todd, 1995; Venkatesh & Davis, 2000). A total of 17 variables were measured on a same seven-point Likert scale as measured previously. A complete list of the instrument questions is included in Appendix E and Appendix F (Chinese translation).

Instruments to measure management support

The measurements of management support (MS) were adapted from Igbaria and colleagues' (1997) research on small firms in New Zealand. Their findings suggested that the measurements of management support possessed adequate reliability and discriminant validity (Igbaria et al., 1997). A total of 5 variables were measured on a same seven-point Likert scale as before. A complete list of the instrument questions is included in Appendix E and Appendix F (Chinese translation).

Instruments to measure the moderator

The moderator voluntariness (VOL) was measured with items adapted from TAM3 (Venkatesh & Bala, 2008). The items were first developed by Moore and Benbasat (1991) and have shown evidence of reliability and validity in various research studies (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000; Venkatesh et al., 2003). A total of 3 variables were measured on a same seven-point Likert scale as the previous instruments. A complete list of the instrument questions is included in Appendix E and Appendix F (Chinese translation).

Demographic instruments

Ten demographic questions adapted from Flosi (2008) were asked to gather background information of the participants. A complete list of the demographic questions can be found in Appendix E and Appendix F (Chinese translation).

Data Collection Procedure

Prior to data collection, all data collection tools including a research questionnaire, a consent form, and contact letters were translated from English to Traditional Chinese. Three colleagues who are native Chinese speakers reviewed the translated tools to verify the accuracy and appropriateness. Any necessary changes were then made based on the feedback from these three reviewers. Only the Chinese version of data collection tools was used in this research study.

Given the fact that not all participants were technology savvy and their accessibility to the computer and Internet may vary, the researcher decided to collect the data with a paper-based questionnaire to maximize the return rate. The Tailored Design Method (Dillman, 2007) was adopted to contact the participants for the collection of data.

Prior to the collection of the data, a pre-notice was distributed to the faculty members' email addresses at the end of November, 2010 to notify them that they should be expecting a survey from the researcher. The email explained the purpose of the research and its importance with detailed information. The email also thanked them in advance for participating in the research study.

About ten days after the delivery of the pre-notice email, the paper-based survey questionnaire along with the consent form were manually distributed to the faculty. The questionnaire contained detailed instruction on where the faculty members should return the survey. Because of the huge amount of the questionnaires and the location of the two campuses, the survey packages were sent out within the last three weeks in December, 2010.

Due to the winter break shortly after the questionnaire was delivered, a reminder was emailed to the faculty members shortly after the end of the fall 2010 semester to express appreciation for responding, and to indicate that if the completed questionnaire had not yet been mailed, it was hoped that it would be returned soon.

Two to three weeks after the first reminder letter was delivered; a second reminder was sent out to the faculty members to kindly remind them if they have not yet completed the questionnaire. The reminder encouraged them to complete the questionnaire and thanked them for their contributions to the study. Table 3-1 below shows the data collection procedure.

Table 3-1 Data Collection Procedure

Contact Letter	**Purpose**	
Pre-notice	To kindly notify the participants that they will be expecting the questionnaire in the following week.	Please see Appendix A & B for pre-notice Letter
Questionnaire	Questionnaire and consent form.	Please see Appendix C, D E & F for consent form and questionnaire
First Reminder	A Thank You/Reminder letter to express appreciation to those who responded and remind those who have not yet responded to fill out the survey.	Please see Appendix G & H for the first reminder letter
Second Reminder	A Thank You/Reminder letter to express appreciation to those who responded and remind those who have not yet responedd to fill out the survey.	Please see Appendix I & J for the second reminder letter

Data Analysis

The data collected from this research were first entered into an Excel spreadsheet and then verified and filtered. The data were then imported into IBM® SPSS® Statistics and SAS® for statistical analysis.

The causal relationships between the variables observed for the hypothesized research model were explored and analyzed using path analysis. Path analysis is often viewed as special case of structural equation modeling (SEM). Structural Equation Modeling is also known as covariance structure analysis, latent variable models, or structure modeling. It is a multivariate statistical procedure that combines aspects of multiple regression, path analysis and factor analysis (Schumacker & Lomax, 2004). Structural Equation Modeling allows the entire model to be tested simultaneously using a series of dependent relationships among measured variables and latent constructs as well as between the constructs (Schumacker & Lomax, 2004).

Venkatesh and Bala (2008) adapted instruments from various previous studies to develop TAM3. Although these instruments have been tested and have shown strong evidence of validity and reliability, few research studies have been done to replicate and verify Venkatesh and Bala's (2008) work. In this research study, two stages of statistical analysis have been performed:

1) At the first stage of the data analysis of this research study, internal consistency analysis was conducted to verify the reliability of the constructs of the proposed research model. Descriptive statistic procedures were also performed for the demographic information of the participants.

2) At the second stage of the analysis, the significance and strength of the relationships between the variables and latent constructs were measured via path analysis using SAS® for Windows® 9.1.3. The CALIS procedure was performed to generate the standardized coefficient beta (β) and the significant t value. Fit indices such as the goodness of fit index (GFI), standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA), Bentler's (1989) comparative fit index (CFI), and Bentler & Bonett's (1980) normed-fit index (NFI) were examined to determine the overall fitness of the proposed research model.

CHAPTER 4: RESULTS

Introduction

This chapter presents the statistical analysis results that were generated using IBM® SPSS® Statistics and SAS® for Windows®. The first section provides descriptive statistics of the participants' demographic information (i.e., gender, age, college, rank, year of teaching). The second section discusses the internal consistency regarding the instruments and the data collected. The third section focuses on the analysis of the hypothesized research model using path analysis. The fourth section attempts to answer the research questions using the results generated from path analysis. A summary section is provided at the end of the chapter to recap the findings of this research study.

The purpose of this research study was to investigate the effects of management support on faculty members' behavioral intention of using learning management system (LMS). Three research questions were explored in this study. These questions were:

1. How well do Technology Acceptance Model 3 (TAM3) variables (perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and voluntariness) explain faculty members' behavioral intention of using a LMS?
2. How well does management support affect the determinants of perceived usefulness (subjective norm, image, job relevance, output quality, and result demonstrability)?
3. How well does management support affect the perceptions of external control?

This research study incorporated a total number of 54 measurement items to measure the 15 construct variables proposed in the hypothesized research model. Figure 4-1 illustrates the construct variables and their corresponding measurement items. Due to negative wording, measurement items PEC4, RES4, CANX2, CANX3, CANX4, and CPLAY4 were reverse-coded prior to the analysis. The construct variables were then calculated as the sum of their corresponding measurement items.

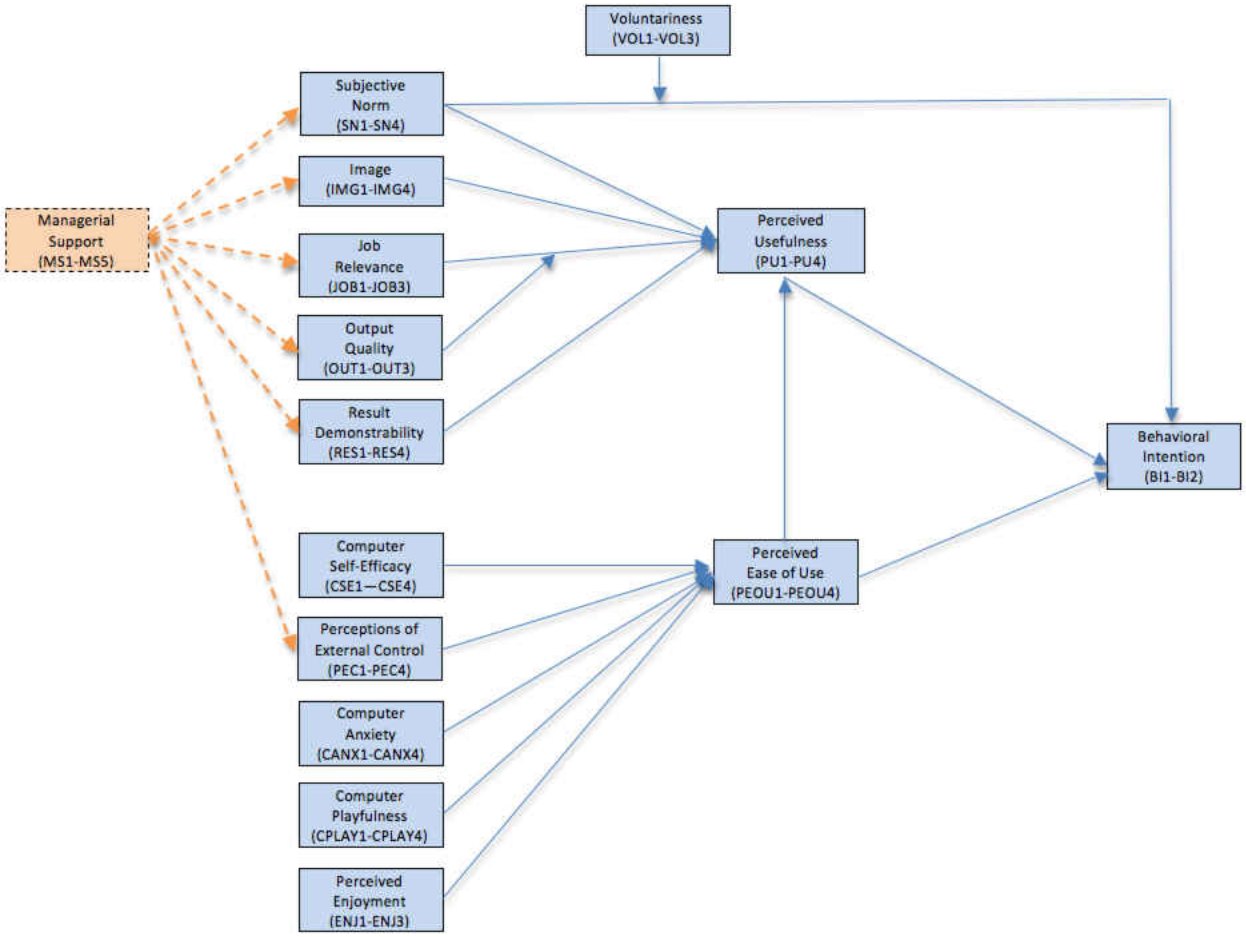


Figure 4-1 Construct Variables and Corresponding Measurement Items

Demographics

A total number of 105 participants were assessed in this research study, with a total return rate of 21.34%. The following sections explore the demographic information of the participants.

Gender

As shown in Table 4-1 below, there are 104 valid entries for gender information. The percentage for female participants is slightly higher than male participants. Figure 4-2 visually demonstrates the ratio in a pie chart.

Table 4-1 Gender Information of Participants

	Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	58	55.2	55.8	55.8
	Male	46	43.8	44.2	100.0
	Total	104	99.0	100.0	
Missing	System	1	1.0		
Total		105	100.0		

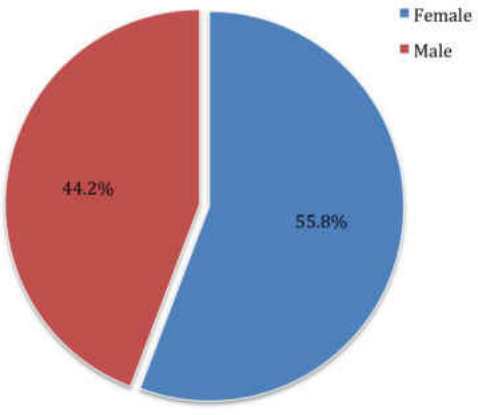


Figure 4-2 Pie Chart for Participants' Gender Information

Age

The majority of the valid participants of this study were under the age of 30, which made up over 80% of the participants. Table 4-2 shows the detailed percentage composition of the participants. Figure 4-3 visually demonstrates the age distribution in a bar chart.

Table 4-2 Age Information of Participants

	Age	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<30	85	81.0	81.7	81.7
	30-39	12	11.4	11.5	93.3
	40-49	7	6.7	6.7	100
	Total	104	99.0	100.0	
Missing	System	1	1.0		
Total		105	100.0		

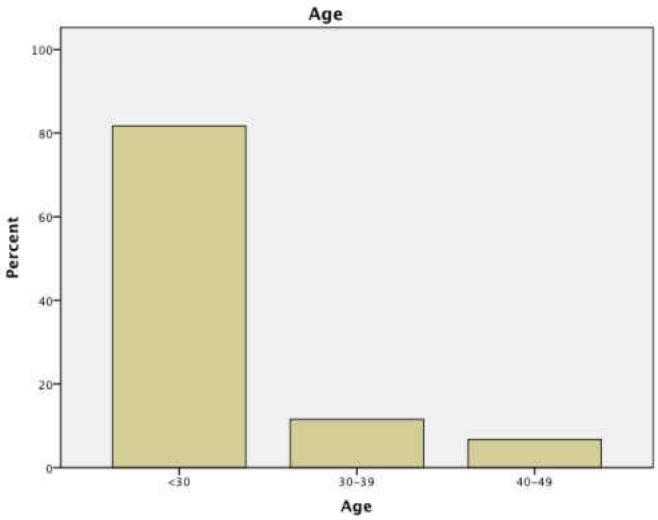


Figure 4-3 Bar Chart for Participants' Age Information

College

The majority of the participants came from the College of Arts and Social Science, which provided more than half of the overall participants. Table 4-3 shows the detailed ratio of participants' college information. Figure 4-4 visually demonstrates the composition of the group's collective college information in a pie chart.

Table 4-3 College Information of Participants

	College	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Arts & Social Science	56	53.3	53.8	53.8
	Foreign Languages	14	13.3	13.5	67.3
	Science	16	15.2	15.4	82.7
	Law	7	6.7	6.7	89.4
	Business	11	10.5	10.6	100.0
	Total	104	99.0	100.0	
Missing	System	1	1.0		
Total		105	100.0		

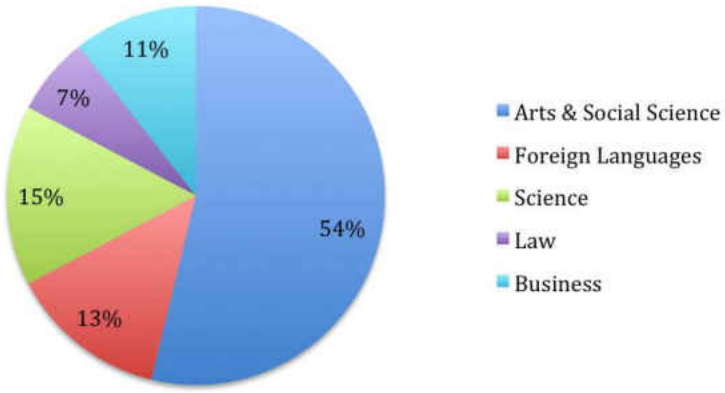


Figure 4-4 Pie Chart for Participants' College Information

Job Status

The majority of the participants in this research study were part-time faculty members of the Soochow University. Table 4-4 shows the details of participants' job status. Figure 4-5 visually demonstrates the ratio in a pie chart.

Table 4-4 Job Status of Participants

	Job Status	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Part-Time	82	78.1	78.8	78.8
	Full-Time	22	21.0	21.2	100.0
	Total	104	99.0	100.0	
Missing	System	1	1.0		
Total		105	100.0		

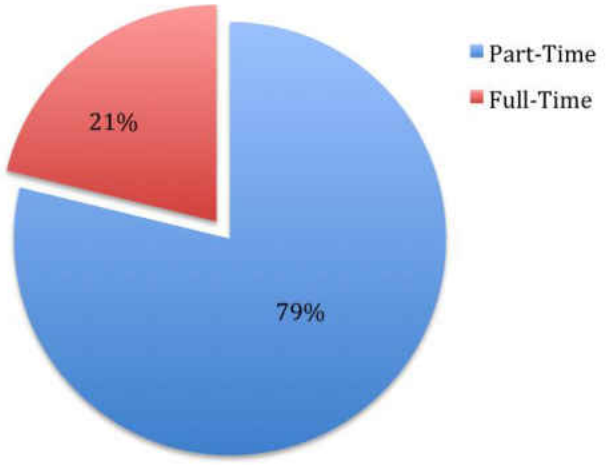


Figure 4-5 Pie Chart of the Participants' Job Status

Job Title

Teaching assistants made up the majority of the participants in this research study. This helped to explain why the majority of the participants were under age 30, as teaching assistants are mostly graduate students who are generally young. It is worth noting that many teaching assistants were hired to teach and they were the most active users of the LMS system. Although their official job titles were still teaching assistants, they were performing the duty of instructors most of the time. Table 4-5 describes the detailed information of participants' job titles. Figure 4-6 visually demonstrates the information in a bar chart.

Table 4-5 Job Title Information of Participants

	Job Title	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Associate Professor	5	4.8	4.8	4.8
	Assistant Professor	9	8.6	8.7	13.5
	Instructor	1	1.0	1.0	14.4
	Teaching Assistant	89	84.8	85.6	100.0
	Total	104	99.0	100.0	
Missing	System	1	1.0		
Total		105	100.0		

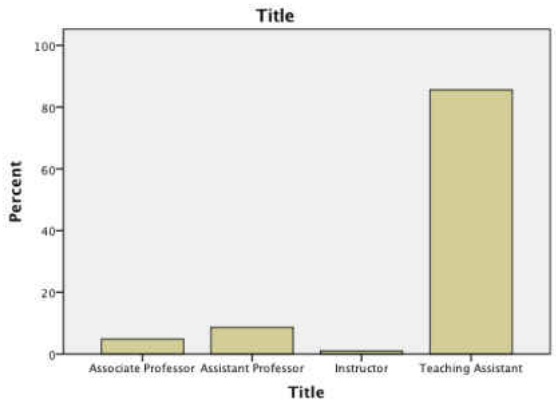


Figure 4-6 Bar Chart for Participants' Job Title Information

Computer Experience

The majority of the participants have used computers for 10 or more years. Table 4-6 shows the detailed information of participants' computer experience. Figure 4-7 visually depicts the information in a histogram.

Table 4-6 Computer Experience Information of Participants

	Years	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	1	1.0	1.0	1.0
	4	1	1.0	1.0	1.9
	5	6	5.7	5.8	7.8
	6	2	1.9	1.9	9.7
	7	1	1.0	1.0	10.7
	8	8	7.6	7.8	18.4
	9	2	1.9	1.9	20.4
	10	36	34.3	35.0	55.3
	11	3	2.9	2.9	58.3
	12	15	14.3	14.6	72.8
	13	4	3.8	3.9	76.7
	14	6	5.7	5.8	82.5
	15	12	11.4	11.7	94.2
	16	3	2.9	2.9	97.1
	18	2	1.9	1.9	99.0
	20	1	1.0	1.0	100.0
	Total	103	98.1	100.0	
Missing	System	2	1.9		
Total		105	100.0		

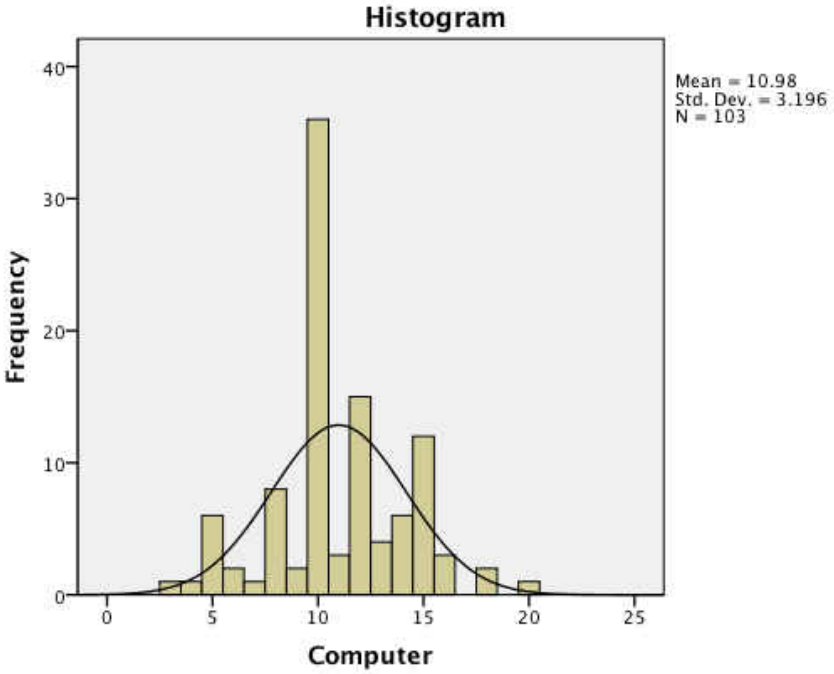


Figure 4-7 Histogram for Participants' Computer Experience

LMS Experience

The majority of the participants have had 1 to 5 years of experience with the LMS at Soochow University. Table 4-7 shows the composition of participants' LMS experience. Figure 4-8 visually illustrates the information in a histogram.

Table 4-7 LMS Experience Information of Participants

	Years	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	5	4.8	4.9	4.9
	1	27	25.7	26.2	31.1
	2	22	21.0	21.4	52.4
	3	18	17.1	17.5	69.9
	4	15	14.3	14.6	84.5
	5	11	10.5	10.7	95.1
	6	3	2.9	2.9	98.1
	7	2	1.9	1.9	100.0
	Total	103	98.1	100.0	
Missing	System	2	1.9		
Total		105	100.0		

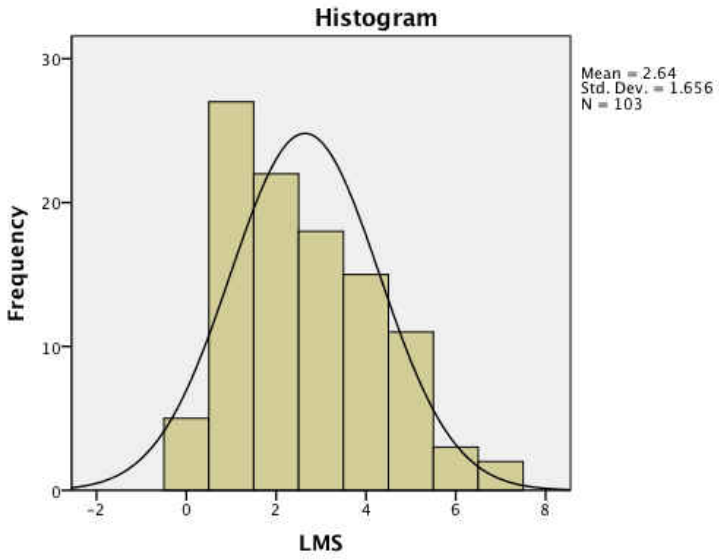


Figure 4-8 Histogram for Participants' LMS Experience

Years Taught in Colleges

Among all the valid participants, 97 of them indicated that they have had experience teaching in colleges as part-time faculty. The average teaching experience of participants as

part-time faculty was 2.05 (std. 0.982) years, which ranged from 1 to 6 years. Eleven participants indicated that they have had experience teaching in colleges as full-time faculty. The average teaching experience of participants as full-time faculty was 4.73 (std. 3.927) years, which ranged from 1 to 12 years. Table 4-8 shows the detailed information of participants' part-time teaching experience in colleges. Table 4-9 shows the detailed information of participants' full-time teaching experience in colleges.

Table 4-8 Participants' Part-Time Teaching Experience in Colleges

	Years	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	31	29.5	32.6	32.6
	2	36	34.3	37.9	70.5
	3	23	21.9	24.2	94.7
	4	3	2.9	3.2	97.9
	5	1	1.0	1.1	98.9
	6	1	1.0	1.1	100.0
	Total	95	90.5	100.0	
Missing	System	10	9.5		
Total		105	100.0		

Table 4-9 Participants' Full-Time Teaching Experience in Colleges

	Years	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	1.0	9.1	9.1
	2	3	2.9	27.3	36.4
	3	3	2.9	27.3	63.6
	4	1	1.0	9.1	72.7
	10	2	1.9	18.2	90.9
	12	1	1.0	9.1	100.0
	Total	11	10.5	100.0	
Missing	System	94	89.5		
Total		105	100.0		

Years Taught in Soochow University

Ninety-two participants indicated that they have had experience teaching in Soochow University as part-time faculty. The average teaching experience of participants as part-time faculty in Soochow University was 1.95 (std. 0.882) years, which ranged from 1 to 5 years. Nine participants indicated that they have had experience teaching in Soochow University as full-time faculty. The average teaching experience of participants as full-time faculty in Soochow University was 3.11 (std. 2.421) years, which ranged from 1 to 9 years. Table 4-10 shows the detailed information of participants' part-time teaching experience in Soochow University. Table 4-11 shows the detailed information of participants' full-time teaching experience in Soochow University.

Table 4-10 Participants' Part-Time Teaching Experience in Soochow University

	Years	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	32	30.5	34.8	34.8
	2	38	36.2	41.3	76.1
	3	18	17.1	19.6	95.7
	4	3	2.9	3.3	98.9
	5	1	1.0	1.1	100.0
	Total	92	87.6	100.0	
Missing	System	13	12.4		
Total		105	100.0		

Table 4-11 Participants' Full-Time Teaching Experience in Soochow University

	Years	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	1.9	22.2	22.2
	2	2	1.9	22.2	44.4
	3	3	2.9	33.3	77.8
	4	1	1.0	11.1	88.9
	9	1	1.9	11.1	100.0
	Total	9	8.6	100.0	
Missing	System	96	91.4		
Total		105	100.0		

Grade Level Currently Teaching

In terms of the grades the participants were currently teaching at the time of the survey, 21 of the participants were teaching first-year college students, 33 participants were teaching second-year students, 15 participants were teaching third year students, 3 participants were teaching fourth-year students, and 15 participants were teaching graduate-level students. The rest of the valid participants were teaching multiple grade levels in different combinations. Table 4-12 shows the detailed information on the grade levels the participants were teaching at the time of the survey.

Table 4-12 Grade Level Currently Teaching by the Participants

	Grade	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1st Year	21	20.0	20.2	20.2
	1-2	1	1.0	1.0	21.2
	1-3	1	1.0	1.0	22.1
	1-4	5	4.8	4.8	26.9
	1-Graduate	4	3.8	3.8	30.8
	2nd Year	33	31.4	31.7	62.5
	2-3	2	1.9	1.9	64.4
	2-4	4	3.8	3.8	68.3
	3rd Year	15	14.3	14.4	82.7
	4th Year	3	2.9	2.9	85.6
	Graduate	15	14.3	14.4	100.0
	Total	104	99.0	100.0	
Missing		1	1.0		
Total		105	100.0		

Reliability

Although previous research has shown high reliability on the measurement items, this research study examined the internal consistency on the 15 sets of measurement items (perceived usefulness, perceived ease of use, behavioral intention, computer self-efficacy, perceptions of external control, computer playfulness, computer anxiety, perceived enjoyment, subjective norm, image, job relevance, output quality, result demonstrability, management support, and voluntariness) using the collected data. Table 4-13 shows Cronbach's alpha (Cronbach, 1951) for the 15 manifest variables.

Table 4-13 Cronbach's Reliability Analysis

	Cronbach's Alpha (α)	N of Items
Perceived Usefulness (PU)	.956	4
Perceived Ease of Use (PEOU)	.918	4
Behavioral Intention (BI)	.975	2
Computer Self-Efficacy (CSE)	.868	4
Perceptions of External Control (PEC)	.761	4
Computer Playfulness (CPLAY)	.641	4
Computer Anxiety (CANX)	.929	4
Perceived Enjoyment (ENJ)	.923	3
Subjective Norm (SN)	.799	4
Image (IMG)	.963	3
Job Relevance (JOB)	.946	3
Output Quality (OUT)	.930	3
Result Demonstrability (RES)	.855	4
Management Support (MS)	.879	5
Voluntariness (VOL)	.498	3

As shown in Table 4-13, 11 out of the 15 manifest variables have Cronbach's alpha over 0.8, which indicates good internal consistency. Possible improvement of the results was explored by dropping measurement items from the measurement sets that have Cronbach's alpha lower than 0.8. After item number 4 was dropped from the measurement set for perceptions of external control (PEC), Cronbach's alpha was significantly increased from 0.761 to 0.901, which shows high internal consistency among the measurement items. The same technique was also applied to subjective norm (SN). After dropping measurement item number 3, Cronbach's alpha increased to 0.818, which is considered as

good (Carmines & Zeller, 1979). The initial Cronbach's alpha for computer playfulness (CPLAY) was 0.641, which was not acceptable. After dropping measurement item number 4, Cronbach's alpha increased to 0.792, which is considered respectable (DeVellis, 1991). Cronbach's alpha for voluntariness (VOL) was at an unacceptable level of 0.498; after dropping the first measurement item, Cronbach's alpha increased to 0.817, which is considered acceptable for internal consistency. Table 4-14 shows adjusted reliability for the constructs.

Table 4-14 Adjusted Cronbach's Reliability

	Cronbach's Alpha (α)	N of Items
Perceived Usefulness (PU)	.956	4
Perceived Ease of Use (PEOU)	.918	4
Behavioral Intention (BI)	.975	2
Computer Self-Efficacy (CSE)	.868	4
Perceptions of External Control (PEC)	.901*	3
Computer Playfulness (CPLAY)	.792*	3
Computer Anxiety (CANX)	.929	4
Perceived Enjoyment (ENJ)	.923	3
Subjective Norm (SN)	.818*	3
Image (IMG)	.963	3
Job Relevance (JOB)	.946	3
Output Quality (OUT)	.930	3
Result Demonstrability (RES)	.855	4
Management Support (MS)	.879	5
Voluntariness (VOL)	.817*	2

*Measurement item was dropped to improve the internal consistency.

Path Analysis

Path analysis was conducted on the data from the 105 valid responses using SAS® for Windows® 9.1.3 PROC CALIS procedure to examine the causal relationships among the manifest variables of the proposed research model: perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, management support, and voluntariness. These analyses used the maximum likelihood method of parameter estimation on the variance-covariance matrix.

Analysis of Initial Research Model

The significance of path coefficients for the hypothesized research model is presented in Table 4-15. The path coefficient *t* values for hypothesized paths result demonstrability (RES) to perceived usefulness (PU), perceptions of external control (PEC) to perceived ease of use (PEOU), computer anxiety to perceived ease of use (PEOU), and computer playfulness to perceived ease of use (PEOU) were below the recommended cut off point of 1.96 in absolute value (Hatcher, 1994, p. 215). This indicated that the hypothesized paths mentioned above failed to reach statistical significance.

Table 4-15 Manifest Variable Equations with Estimates of Hypothesized Research Model

Path to Variable	Path from Variable	Path Coefficient	Std. Error	*t*
PU	PEOU	0.2211	0.0595	3.7185*
	SN	0.2201	0.0581	3.7882*
	IMG	0.1695	0.0570	2.9765*
	JOB	0.8559	0.0586	14.5957*
	RES	-0.0477	0.0584	-0.8177
	JOB_OUT_INTX	-0.3863	0.0601	-6.4290*
PEOU	CSE	0.1664	0.0727	2.2908*
	PEC	0.0987	0.0608	1.6250
	CANX	0.0119	0.0680	0.1750
	CPLAY	-0.0969	0.0718	-1.3490
	ENJ	0.7023	0.0629	11.1637*
BI	PU	0.4145	0.0607	6.8242*
	PEOU	0.3734	0.0686	5.4414*
	SN	0.2157	0.0655	3.2914*
	SN_VOL_INTX	-0.1385	0.0631	-2.1945*
PEC	MS	0.4937	0.0861	5.7332*
SN	MS	0.4412	0.0889	4.9649*
IMG	MS	0.3579	0.0925	3.8715*
JOB	MS	0.4763	0.0871	5.4701*
RES	MS	0.4599	0.0879	5.2302*
JOB_OUT_INTX	MS	0.5664	0.0816	6.9409*

PU = Perceived Usefulness, PEOU = Perceived Ease of Use, BI = Behavioral Intention, SN = Subjective Norm, IMG = Image, JOB = Job Relevance, OUT = Output Quality, RES = Result Demonstrability, CSE = Computer Self-Efficacy, PEC = Perceptions of External Control, CANX = Computer Anxiety, CPLAY = Computer Playfulness, ENJ = Perceived Enjoyment, MS = Managerial Support, VOL = Voluntariness, JOB_OUT_INTX = Interactions between JOB and OUT, SN_VOL_INTX = Interactions between SN and VOL.

*When *t* value exceeds 1.96 in absolute value at the $p < .05$ level, it is considered significant (Hatcher, 1994, p. 215).

Table 4-16 presents the equations with standardized path coefficients for the hypothesized research model, along with the R^2 value for the endogenous variables. The R^2 value represents the percent of the variance in an endogenous variable that can be explained by its antecedent manifest variables (Hatcher, 1994; Ku, 2009). As such, perceived ease of use (PEOU), subjective norm (SN), image (IMG), job relevance (JOB), result demonstrability (RES), and the interaction between job relevance and output quality (JOB_OUT_INTX) together accounted for 75% of variance of perceived usefulness. Computer self-efficacy (CSE), perceptions of external control (PEC), computer anxiety (CANX), computer playfulness (CPLAY), and perceived enjoyment (ENJ) together accounted for 62% of the variance of perceived ease of use. Perceived usefulness (PU), perceived ease of use (PEOU), subjective norm (SN), and the interaction between subjective norm and voluntariness (SN_VOL_INTX) accounted for 59% of the variance of behavioral intention (BI). Management support (MS) accounted for 24% of the variance of perceptions of external control, 19% of the variance of subjective norm, 13% of the variance of image, 23% of the variance of job relevance, 21% of the variance of result demonstrability, and 32% of the variance of the interaction between job relevance and output quality. Figure 4-9 shows the standardized path diagram of the hypothesized research model.

Table 4-16 Manifest Variable Equations with Standardized Estimates of Hypothesized Research Model

Path to Variable	Path from Variable	Path Coefficient	Error Variance	R^2
PU	PEOU	0.1909	0.30582	0.7539
	SN	0.1974		
	IMG	0.1521		
	JOB	0.7678		
	RES	-0.0428		
	JOB_OUT_INTX	-0.3465		
PEOU	CSE	0.1729	0.35529	0.6167
	PEC	0.1026		
	CANX	0.0124		
	CPLAY	-0.1007		
	ENJ	0.7294		
BI	PU	0.4732	0.39019	0.5908
	PEOU	0.3682		
	SN	0.2209		
	SN_VOL_INTX	-0.1419		
PEC	MS	0.4937	0.75628	0.2437
SN	MS	0.4412	0.80537	0.1946
IMG	MS	0.3579	0.87188	0.1281
JOB	MS	0.4763	0.77318	0.2268
RES	MS	0.4599	0.78853	0.2115
JOB_OUT_INTX	MS	0.5664	0.67920	0.3208

PU = Perceived Usefulness, PEOU = Perceived Ease of Use, BI = Behavioral Intention, SN = Subjective Norm, IMG = Image, JOB = Job Relevance, OUT = Output Quality, RES = Result Demonstrability, CSE = Computer Self-Efficacy, PEC = Perceptions of External Control, CANX = Computer Anxiety, CPLAY = Computer Playfulness, ENJ = Perceived Enjoyment, MS = Managerial Support, VOL = Voluntariness, JOB_OUT_INTX = Interactions between JOB and OUT, SN_VOL_INTX = Interactions between SN and VOL.

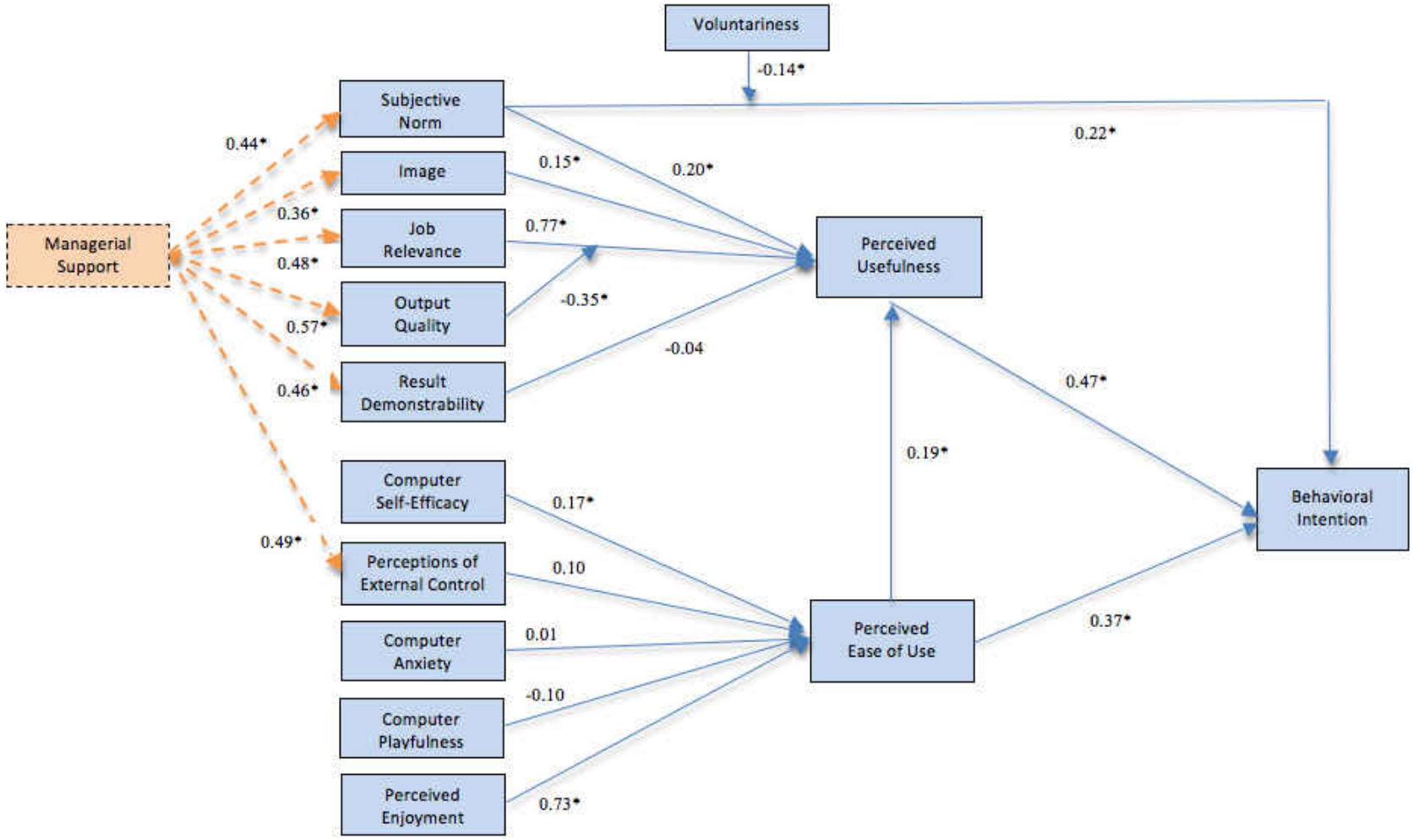


Figure 4-9 Path Diagram with Standardized Estimates for the Hypothesized Research Model

A series of goodness of fit indices – chi-square, goodness of fit index (GFI), standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA), Bentler's (1989) comparative fit index (CFI), and Bentler & Bonett's (1980) normed-fit index (NFI) – were adopted in this research to analyze the fitness of the proposed research model. All of these indices except chi-square value range from 0 to 1. For NFI index, 0 indicates that all manifest variables are uncorrelated and 1 represents a perfect goodness of fit for the model (Hatcher, 1994). CFI is a variation of NFI and has shown to be less biased in small samples (Bentler, 1989). While GFI, CFI and NFI are suggested to have a value of ≥ .90 for a good model fit (Bentler, 1989, 2004; Bentler & Bonett, 1980; Hu & Bentler, 1999; McDonald & Marsh, 1990; Sivo, Pan, & Hahs-Vaughn, 2007), the RMSEA is suggested to have a value of ≤ .08 for a good model fit, and SRMR is recommended to have a value of ≤ .06 for a good model fit (Fan & Sivo, 2005; Sivo, Fan, Witta, & Willse, 2006).

As presented in table 4-17 below, the estimation for the hypothesized research model (initial model) has a significant model chi-square value, χ^2 (69, N = 105) = 660.36, p < .0001. The result indicated that the data did not fit the hypothesized research model. In addition, the goodness of fit index (GFI) for the initial model of this research was equal to .52, Bentler's (1989) comparative fit index (CFI) valued at .48, and the Bentler & Bonett's (1980) normed-fit index (NFI) scored at .47. The values of all these indices were well below the suggested cutoff point of .9, which indicated a poor model fit between the hypothesized research model and the data. The standardized root mean square residual (SRMR) was .25, which was greater than the cutoff point of ≤ .06. The root mean square error of approximation (RMSEA) also returned an unfavorable value at .29, which was above the

desired value of ≤ .08. Based on the results of all these goodness of fit indices, the initial research model was rejected and subsequent modifications were explored as an attempt to improve the model's fit.

Table 4-17 Goodness of Fit Indices for Hypothesized Research Model

	Fit Index
Chi-Square	660.36
Chi-Square Degree of Freedom (df)	69
Chi-Square Probability value (*p*)	< .0001
Goodness of Fit Index (GFI)	.52
Standardized Root Mean Square Residual (SRMR)	.25
Root Mean Square Error of Approximation (RMSEA) Estimate	.29
Bentler's (1989) Comparative Fit Index (CFI)	.48
Bentler & Bonett's (1980) Normed-Fit Index (NFI)	.47

Note: N = 105.

Analysis of Revised Research Model

The PROC CALIS procedure used in this research study provides a set of modification indices as part of the output. Researchers often reference to these modification indices when making reasonable adjustments to their research models. The current research study followed the same pattern, and a series of adjustments were made to the initial research model to improve the model fit based on the recommendations from the modification indices.

Firstly, the path coefficients were reviewed to see if there were any statistically insignificant paths that could be removed from the initial research model. Billings and Wroten (1978) mentioned that the standardized path coefficients should exceed 0.32 in absolute value to be meaningful in size. This was used as a reference in addition to the path coefficient *t* values to determine the removal of the insignificant paths. However, the experimentation indicated that the model fit was not improved by removing any of those paths. Consequently, a set of new paths were added to the research model as an attempt to improve the model fit based on the suggestions indicated in the modification indices. As the result, the overall goodness of fit indices for the revised research model indicated an improved and acceptable model fit. Table 4-18 below presents the goodness of fit indices for the revised research model. As shown in the table, the goodness of fit index (GFI), Bentler's (1989) comparative fit index (CFI), and Bentler & Bonett's (1980) normed-fit index (NFI) all reached the recommended cutoff point of ≥ .90 (Bentler, 1989, 2004; Bentler & Bonett, 1980; Hu & Bentler, 1999; McDonald & Marsh, 1990; Sivo et al., 2007). The standardized root mean square residual (SRMR) also achieved the cutoff level of ≤ .06. The root mean square error of approximation (RMSEA) estimate yielded a less ideal value of .11, which is higher than the cutoff level of ≤ .08. Although chi-square was still at a significant level of $p < .0001$, the value χ^2 dropped significantly from the previous 660.36 (df = 69, N = 105) to 102.62 (df = 45, N = 105). Despite the imperfection of the RMSEA value (.11), all other fit indices (GFI, NFI, CFI, and SRMR) indicated an improved and acceptable model fit.

Table 4-18 Goodness of Fit Indices for Revised Research Model

	Fit Index
Chi-Square	102.62
Chi-Square Degree of Freedom (df)	45
Chi-Square Probability value (*p*)	< .0001
Goodness of Fit Index (GFI)	. 90
Standardized Root Mean Square Residual (SRMR)	.06
Root Mean Square Error of Approximation (RMSEA) Estimate	.11
Bentler's (1989) Comparative Fit Index (CFI)	.95
Bentler & Bonett's (1980) Normed-Fit Index (NFI)	.92

Note: N = 105.

The significance of the path coefficients for the revised research model is presented in Table 4-19 below. As shown in the table, the majority of the paths in the revised research model reached statistical significance with the path coefficient *t* values larger than absolute value 1.96 (Hatcher, 1994). However, the path coefficient *t* values for paths perceived ease of use (PEOU) to perceived usefulness (PU) (*t* = 1.3320), result demonstrability (RES) to perceived usefulness (*t* = -0.8487), perceived enjoyment (ENJ) to perceived usefulness (*t* = 1.7468), computer self-efficacy (CSE) to perceived ease of use (*t* = 1.9087), perceptions of external control (PEC) to perceived ease of use (*t* = 1.0215), computer anxiety (CANX) to perceived ease of use (*t* = 0.8192), computer self-efficacy to perceptions of external control (*t* = 1.8259), management support (MS) to image (IMG) (*t* = 0.9053), job relevance (JOB) to result demonstrability (*t* = -0.2486), and perceived enjoyment to result demonstrability (*t*

= 0.5791) were still below the recommended cutoff point of 1.96 in absolute value (Hatcher, 1994, p. 215).

Table 4-19 Manifest Variable Equations with Estimates of Revised Research Model

Path to Variable	Path from Variable	Path Coefficient	Std. Error	*t*
PU	PEOU	0.1181	0.0893	1.3220
	SN	0.1934	0.0595	3.2488*
	IMG	0.1952	0.0882	2.2137*
	JOB	0.8915	0.1229	7.2525 *
	RES	-0.0887	0.1045	-0.8487
	JOB_OUT_INTX	-0.4005	0.1584	-2.5283 *
	ENJ	0.1739	0.0995	1.7468
	CPLAY	-0.1227	0.0564	-2.1753*
PEOU	CSE	0.1338	0.0701	1.9087
	PEC	0.0948	0.0928	1.0215
	CANX	0.0535	0.0653	0.8192
	CPLAY	-0.1450	0.0732	-1.9819*
	ENJ	0.5812	0.0931	6.2455*
	IMG	0.2272	0.0737	3.0832*
BI	PU	0.3868	0.0716	5.4045 *
	PEOU	0.3277	0.0692	4.7341*
	SN	0.2218	0.0679	3.2667*
	CPLAY	0.1468	0.0633	2.3201*
	SN_VOL_INTX	-0.1453	0.0544	-2.6735*

Path to Variable	Path from Variable	Path Coefficient	Std. Error	*t*
PEC	MS	0.1426	0.0592	2.4066 *
	SN	0.1396	0.0600	2.3267*
	ENJ	0.5151	0.0634	8.1249*
	CSE	0.0964	0.0528	1.8259
	CPLAY	0.2176	0.0625	3.4846*
SN	MS	0.3033	0.0956	3.1741*
	ENJ	0.2998	0.0956	3.1368*
IMG	MS	0.0776	0.0857	0.9053
	ENJ	0.5423	0.0860	6.3047*
	CPLAY	0.1265	0.0548	2.3071*
JOB	MS	0.2438	0.0810	3.0104 *
	IMG	0.2755	0.0883	3.1198*
	ENJ	0.2909	0.0948	3.0675*
RES	MS	-0.1222	0.0592	-2.0638*
	PEC	0.3883	0.0801	4.8449*
	IMG	-0.1585	0.0733	-2.1613*
	JOB	-0.0280	0.1127	-0.2486
	JOB_OUT_INTX	0.7943	0.1388	5.7225*
	ENJ	0.0455	0.0786	0.5791
	CSE	-0.0996	0.0488	-2.0396*
JOB_OUT_INTX	MS	0.3239	0.0756	4.2848 *
	ENJ	0.5271	0.0756	6.9734*

PU = Perceived Usefulness, PEOU = Perceived Ease of Use, BI = Behavioral Intention, SN = Subjective Norm, IMG = Image, JOB = Job Relevance, OUT = Output Quality, RES = Result Demonstrability, CSE = Computer Self-Efficacy, PEC = Perceptions of External Control, CANX = Computer Anxiety, CPLAY = Computer Playfulness, ENJ = Perceived Enjoyment, MS = Managerial Support, VOL = Voluntariness, JOB_OUT_INTX = Interactions between JOB and OUT, SN_VOL_INTX = Interactions between SN and VOL.

*When *t* value exceeds 1.96 in absolute value at the $p < .05$ level, it is considered significant (Hatcher, 1994, p. 215).

Table 4-20 presents the equations with standardized path coefficients for the revised research model along with the R^2 value for the endogenous variables. As shown in the table, perceived ease of use (PEOU), subjective norm (SN), image (IMG), job relevance (JOB), result demonstrability (RES), the interaction between job relevance and output quality (JOB_OUT_INTX), perceived enjoyment (ENJ), and computer playfulness (CPLAY) together accounted for 71% of the variance of perceived usefulness (PU). Computer self-efficacy (CSE), perceptions of external control (PEC), computer anxiety (CANX), computer playfulness (CPLAY), perceived enjoyment, and image (IMG) together accounted for 67% of the variance of perceived ease of use. Perceived usefulness, perceived ease of use, subjective norm (SN), the interaction between subjective norm and voluntariness (SN_VOL_INTX), and computer playfulness together accounted for 62% of the variance of behavioral intention (BI). Management support (MS), subjective norm, perceived enjoyment, computer self-efficacy, and computer playfulness together accounted for 66% of the variance of perceptions of external control, management support and perceived enjoyment accounted for 27% of the variance of subjective norm; management support, perceived enjoyment, and computer playfulness accounted for 40% of the variance of image; management support, image, and perceived enjoyment accounted for 45% of the variance of job relevance; management support, perceptions of external control, image, job relevance, the interaction between job relevance and output quality, perceived enjoyment, and computer self-efficacy together accounted for 78% of the variance of result demonstrability, and management support and perceived enjoyment accounted for 54% of the variance of the interaction between job relevance and output quality. Figure 4-10

shows the standardized path diagram of the revised research model with initial paths. The following Figure 4-11 shows the added path diagram of the revised research model in addition to the initial path diagram illustrated in Figure 4-10.

Table 4-20 Manifest Variable Equations with Standardized Estimates of Revised Research Model

Path to Variable	Path from Variable	Path Coefficient	Error Variance	R^2
PU	PEOU	0.1198	0.28521	0.7059
	SN	0.1964		
	IMG	0.1965		
	JOB	0.8832		
	RES	-0.0884		
	JOB_OUT_INTX	-0.4066		
	ENJ	0.1766		
	CPLAY	-0.1246		
PEOU	CSE	0.1340	0.32678	0.6725
	PEC	0.0937		
	CANX	0.0535		
	CPLAY	-0.1452		
	ENJ	0.5819		
	IMG	0.2254		
BI	PU	0.3831	0.37295	0.6227
	PEOU	0.3292		
	SN	0.2231		
	SN_VOL_INTX	-0.1462		
	CPLAY	0.1476		

Path to Variable	Path from Variable	Path Coefficient	Error Variance	R^2
PEC	MS	0.1445	0.33131	0.6599
	SN	0.1414		
	ENJ	0.5218		
	CSE	0.0976		
	CPLAY	0.2205		
SN	MS	0.3033	0.73452	0.2655
	ENJ	0.2998		
IMG	MS	0.0783	0.58569	0.4037
	ENJ	0.5472		
	CPLAY	0.1277		
JOB	MS	0.2499	0.52161	0.4518
	IMG	0.2798		
	ENJ	0.2982		
RES	MS	-0.1245	0.20893	0.7829
	PEC	0.3907		
	IMG	-0.1601		
	JOB	-0.0279		
	JOB_OUT_INTX	0.8094		
	ENJ	0.0464		
	CSE	-0.1015		
JOB_OUT_INTX	MS	0.3240	0.45957	0.5401
	ENJ	0.5273		

PU = Perceived Usefulness, PEOU = Perceived Ease of Use, BI = Behavioral Intention, SN = Subjective Norm, IMG = Image, JOB = Job Relevance, OUT = Output Quality, RES = Result Demonstrability, CSE = Computer Self-Efficacy, PEC = Perceptions of External Control, CANX = Computer Anxiety, CPLAY = Computer Playfulness, ENJ = Perceived Enjoyment, MS = Managerial Support, VOL = Voluntariness, JOB_OUT_INTX = Interactions between JOB and OUT, SN_VOL_INTX = Interactions between SN and VOL.

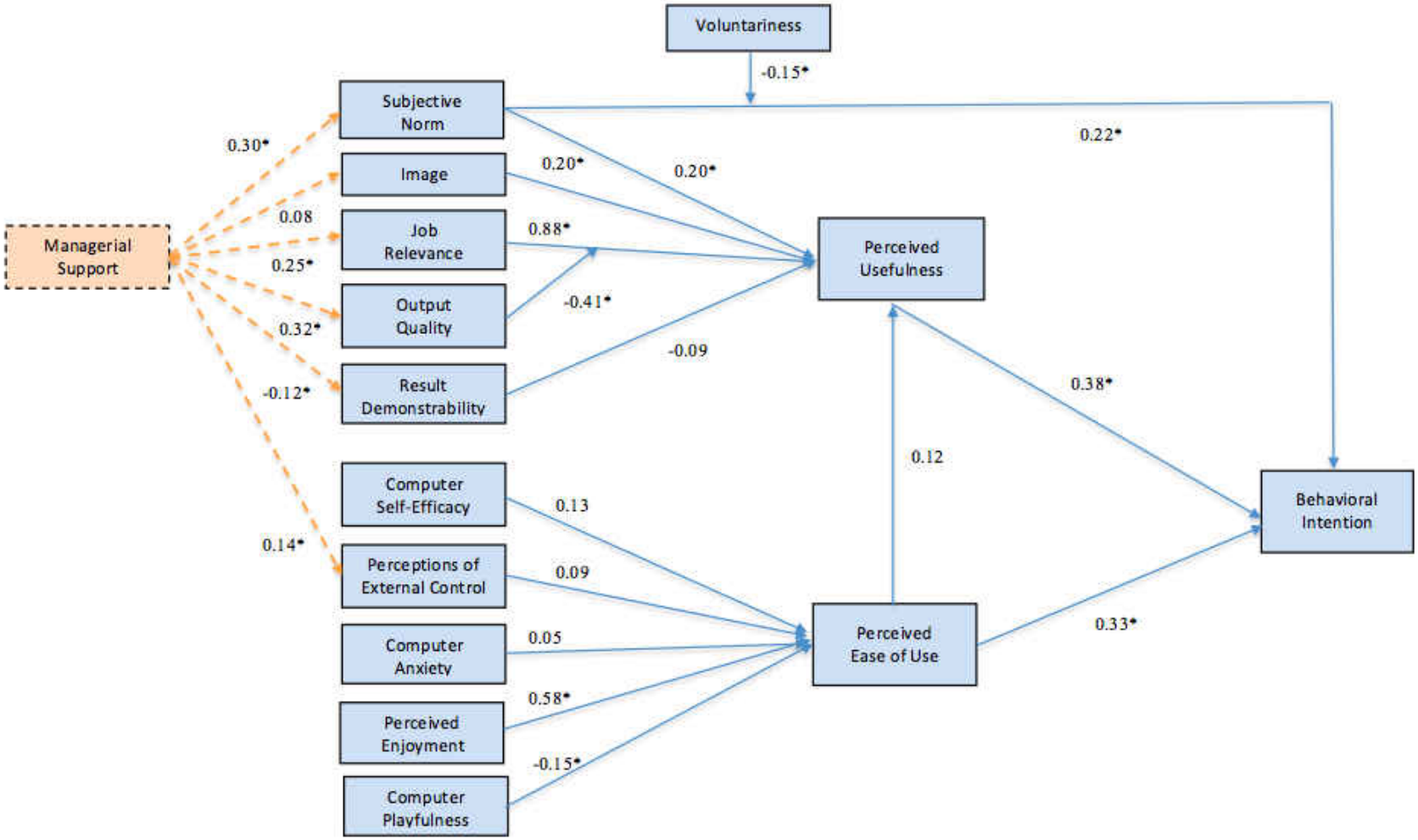


Figure 4-10 Standardized Path Diagram of Revised Model Showing Initial Paths Only

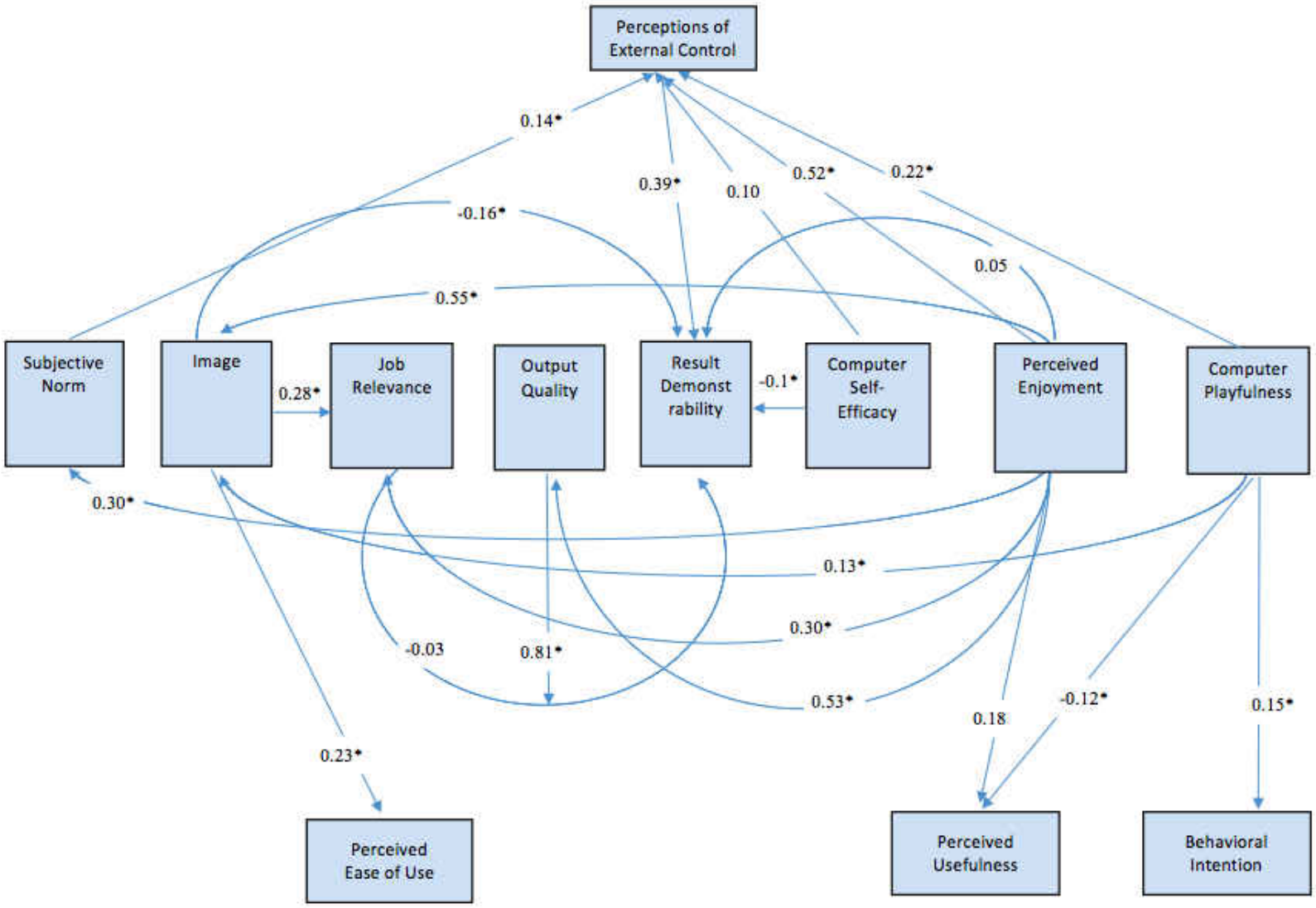


Figure 4-11 Standardized Path Diagram of Revised Model Showing Added Paths Only

Research Question 1

How well do Technology Acceptance Model 3 (TAM3) variables (perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and voluntariness) explain faculty members' behavioral intention of using a LMS?

Initial Research Model

Referring back to Table 4-15 and 4-16, in the initial hypothesized research model, perceived usefulness (PU), perceived ease of use (PEOU), subjective norm (SN), and the interaction of subjective norm and voluntariness (SN_VOL_INTX) accounted for 59% of all the variance for behavioral intention (BI). The path coefficient *t* values of above variables all exceeded 1.96 at $p < .05$, which indicated statistically significant correlations between perceived usefulness, perceived ease of use, subjective norm, and the interaction of subjective norm and voluntariness and behavioral intention.

The R^2 for perceived usefulness is .7539, which indicated that perceived ease of use, subjective norm, image (IMG), job relevance (JOB), result demonstrability (RES), and the interaction between job relevance and output quality (JOB_OUT_INTX) accounted for approximately 75% of all the variance of perceived usefulness. However, the path coefficient *t* value (-0.8177) of result demonstrability is below the cutoff level of 1.96 ($p < .05$), which indicated a weak linkage between result demonstrability and perceived usefulness.

The variables computer self-efficacy (CSE), perceptions of external control (PEC), computer anxiety (CANX), computer playfulness (CPLAY), and perceived enjoyment (ENJ) accounted for 62% (R^2 = 0.6167) of the variance of perceived ease of use. However, the path coefficient *t* values suggested that only perceived enjoyment and computer self-efficacy reached the statistical significance level with *t* values greater than 1.96 at $p < 0.5$.

Revised Research Model

In the revised research model (please refer to Table 4-19 and Table 4-20), an additional path – computer playfulness (CPLAY) to behavioral intention (BI) – was added based on the modification indices. Perceived usefulness (PU), perceived ease of use (PEOU), subjective norm (SN), computer playfulness, and the interaction between subjective norm and voluntariness (SN_VOL_INTX) together accounted for 62% of all the variance of behavioral intention (R^2 = .6627). The *t* values for all the path coefficients of above variables were greater than the cutoff point of 1.96 at $p < 0.5$ level.

For perceived usefulness, two additional paths were added to the revised model – perceived enjoyment (ENJ) to perceived usefulness and computer playfulness to perceived usefulness. The variables perceived ease of use, subjective norm, image (IMG), job relevance (JOB), result demonstrability (RES), the interaction between job relevance and output quality (JOB_OUT_INTX), perceived enjoyment, and computer playfulness together accounted for about 71% of the variance. Contradictory to the initial research model, the path coefficient *t* value for the variable perceived ease of use failed to reach the statistical significance with $t = 1.3220$ ($p < .05$). Result demonstrability remains insignificant with *t* value at -0.8487 ($p < .05$). The *t* value also indicated that the newly added variable

perceived enjoyment failed to reach statistical significance either, with *t* value below the cutoff point of 1.96 (t = 1.7468, p < 0.5). The other new variable – computer playfulness – had a statistically significant negative impact on perceived usefulness (t = -2.1753, p < .05).

For perceived ease of use, a new path from image to perceived ease of use was added in addition to the paths from initial research model. Computer self-efficacy (CSE) remained to be significant at t = 1.9087 (p < .05), computer playfulness became a significant factor with t value at -1.9819 (p < .05), perceived enjoyment and image also reached the statistical significance at p < .05 with t values at 6.2455 and 3.0832 respectively. Together, all six variables accounted for 67% of the variance of perceived ease of use.

Research Question 2

How well does management support affect the determinants of perceived usefulness (subjective norm, image, job relevance, output quality, and result demonstrability)?

Initial Research Model

In the initial research model, management support (MS) had statistically significant path coefficients with subjective norm (SN) (t = 4.9649), image (IMG) (t = 3.8715), job relevance (JOB) (t = 5.4701), result demonstrability (RES) (t = 5.2302) and the interaction between job relevance and output quality (JOB_OUT_INTX) (t = 6.9409) at p < .05 level. Management support accounted for 19% of the variance of subjective norm, 13% of the variance of job relevance, 21% of the variance of result demonstrability, and 32% of the variance for the interaction between job relevance and output quality (Table 4-15 and Table 4-16).

Revised Research Model

In the revised research model (Table 4-19 and 4-20), a new path – perceived enjoyment (ENJ) to subjective norm (SN) – was added in addition to management support (MS) as a factor that has influence on subjective norm. Paths from both management support and perceived enjoyment to subjective norm were statistically significant at $p < .05$ with path coefficient t values at 3.1741 and 3.1368 respectively. Management support along with perceived enjoyment accounted for approximately 27% of the variance of subjective norm.

For variable image (IMG), two new paths – perceived enjoyment to image and computer playfulness (CPLAY) to image – were added in addition to management support as factors that have influence on image. The path coefficients for both new paths were statistically significant at $p < .05$ with t value at 6.3047 and 2.3071 respectively. However, the path coefficient for management support failed to reach the cutoff point with t value at 0.9053, which is less than the recommended 1.96 or greater at $p < .05$. Together, all three variables accounted for 40% of the variance of image.

For variable job relevance (JOB), two new paths from image and perceived enjoyment were added in addition to management support. All three paths had path coefficients with t values over 3, which indicated significant correlations from image and perceived enjoyment to job relevance. Management support, image, and perceived enjoyment together accounted for 45% of the variance of job relevance.

Six new paths from perceptions of external control (PEC), image, job relevance, job relevance and output quality interaction (JOB_OUT_INTX), perceived enjoyment, and

computer self-efficacy (CSE) to result demonstrability (RES) were added in the revised model in addition to management support as factors that influence result demonstrability. All path coefficients but job relevance (t = -0.2486, p < .05) and perceived enjoyment (t = 0.5791, p < .05) failed to reach statistical significance. All variables together accounted for 78% of the variance of perceptions of external control.

For the interaction between job relevance and output quality, a path from perceived enjoyment was added in addition to management support. Both path coefficients were statistically significant, with t value for management support at 4.2848 and t value for perceived enjoyment at 6.9734. Both were greater than the recommended cutoff line of 1.96 at p < .05. Management support and perceived enjoyment together accounted for 54% of the variance of the interaction between job relevance and output quality.

Research Question 3

How well does management support affect the perceptions of external control?

Initial Research Model

In the initial research model (see Table 4-15 and Table 4-16), management support (MS) had significant path coefficient with perceptions of external control (PEC) (t = 0.2437, p < .05). Management support accounted for about 24% of the variance of perceptions of external control.

Revised Research Model

In the revised research model (Table 4-19 and Table 4-20), four new paths were added from subjective norm (SN), perceived enjoyment (ENJ), computer self-efficacy (CSE),

and computer playfulness (CPLAY) to perceptions of external control in addition to management support (MS). Unfortunately, the path coefficient for computer self-efficacy failed to reach statistical significance, with *t* value less than the recommended 1.96 or greater at $p < .05$. The path coefficients for all other variables were significant, with *t* values greater than 1.96 at $p < .05$ level.

Summary

This research focuses on the correlations among the manifest variables of the hypothesized research model (perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, management support, and voluntariness). A total of 54 measurement items were used to measure the manifest variables. The results in this chapter are presented in four sections.

In the first section of this chapter, demographic characteristics are explored using IBM® SPSS® Statistics. As revealed in the results, over 80% of the participants were 30 years old or younger and most of them were teaching assistants. Also, over half of the participants were from the College of Arts and Social Sciences and most of the participants (80%) have used computers for over ten years. As to the LMS, about half of the participants (47%) had one or two years of experience with it.

In the second section of this chapter, a reliability test was conducted to examine the internal consistency on the 15 sets of measurement items. Based on the results from the Cronbach's alpha, perceptions of external control, subjective norm, computer playfulness,

and voluntariness had to drop one measurement item each so that Cronbach's alpha values of all construct variables reached 0.8 or greater.

The third section of this chapter shows the results of the path analysis on the hypothesized research model. Goodness of fit indices indicated that the model fit was problematic, as all adopted fit indices failed to reach the cutoff point respectively. Subsequent modifications were made based on the recommendations from the modification indices. The revised research model added a set of paths in addition to the initial model design. The overall goodness of fit was improved with the goodness of fit index (GFI), Bentler's (1989) comparative fit index (CFI), and Bentler & Bonett's (1980) normed-fit index (NFI) all reached the recommended cutoff point of .90 or greater (Bentler, 1989, 2004; Bentler & Bonett, 1980; Hu & Bentler, 1999; McDonald & Marsh, 1990; Sivo et al., 2007). The standardized root mean square residual (SRMR) also achieved the cutoff level of .06 or lower. Despite the less-than-favorable root mean square error of approximation (RMSEA), all other fit indices indicated an acceptable model fit between the revised research model and the data.

The fourth section of this chapter attempted to answer the research questions using results generated from the path analysis. The majority of the path coefficients of the initial research model reached statistical significance. The revised research model revealed a much more complex relationship among the variables and the variance of each of the endogenous variables was increased in general.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

Introduction

The Technology Acceptance Model (TAM) has been widely adopted as a robust framework for predicting users' acceptance of technology (Davis, 1986, 1989, 1993; Davis et al., 1989; Davis et al., 1992; Davis & Venkatesh, 1996; Venkatesh, 2000; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000; Venkatesh et al., 2003). Although first introduced in business settings, the TAM has found many applications in academic settings to predict students and faculty's adoption of campus technology such as the learning management system (LMS) and the like (Birch & Irvine, 2009; Flosi, 2008; Ku, 2009; Y.-C. Lee, 2008; Pan, Gunter, et al., 2005; Pan, Sivo, et al., 2005; Siegel, 2008; Yang, 2007). The Technology Acceptance Model 3 (TAM3) is the latest attempt from Venkatesh and Bala (2008) in seeking a more comprehensive understanding of users' behavioral intention and adoption of technology.

Soochow University, located in Taipei City, Taiwan, has adopted a learning management system (LMS) since 2003. The growth of the adoption has been steady yet slow. This research was conducted in the hope that it would provide a better understanding of the faculty's perception and behavioral intention of the LMS, so that the administrators and instructional designers at Soochow University can develop more effective intervention to improve and ease faculty's adoption of the LMS.

This chapter begins by providing a brief overview of the purpose of the study as well as of participants and data collection. Conclusions and significance about the research

findings are then discussed in the following section. Lastly, limitations and a list of recommendations for future research are provided.

Purpose of Study

The purpose of this study was to identify the factors and causal relationships that influence faculty's behavioral intention of using LMS at Soochow University. The theoretical model of this research was based on Venkatesh and Bala's (2008) Technology Acceptance model 3 (TAM3). The TAM3 is the latest iteration of the widely adopted Technology Acceptance Model (TAM) that was first introduced by Davis (1986, 1989) for studying user acceptance of technology. This research study introduced management support in addition to the TAM3 variables (perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and voluntariness) as the hypothesized research model to investigate the faculty's adoption of LMS. This study sought to answer the following research questions:

1. How well do the Technology Acceptance Model 3 (TAM3) variables (perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and voluntariness) explain the faculty members' behavioral intention of using a LMS?
2. How well does management support affect the determinants of perceived usefulness (subjective norm, image, job relevance, output quality, and result demonstrability)?
3. How well does management support affect the perceptions of external control?

Conclusions

The results from path analysis indicated that all of the goodness of fit indices for the initial research model failed to reach their recommended cutoff points. The goodness of fit index (GFI) (.52), Bentler's (1989) comparative fit index (CFI) (.48), and the Bentler & Bonett's (1980) normed-fit index (NFI) (.47) were all below the recommended .90 cutoff. The standardized root mean square residual (SRMR) (.25) was greater than the recommended value of ≤ .06. Furthermore, the root mean square error of approximation (RMSEA) (.29) was greater than the recommended cutoff of ≤ .08. All these indices suggested that the initial research model did not fit the data. One of the potential explanations could be the distinct characteristics of the sample. The original TAM3 was introduced in a Western business setting to provide a comprehensive framework for predicting users' adoption of technology. This current research study, however, was administered in an academic environment in East Asia. The distinction between the samples of these two research studies may have caused the poor fit between the initial research model and data.

Based on the recommendations provided by the modification indices from the PROC CALIS procedure in SAS®, a list of new paths was added in addition to the paths in the initial research model. Consequently, the goodness of fit indices showed an overall improved model fit. The GFI, CFI, and NFI all reached the recommended cutoff point of ≥ .90. The SRMR achieved the cutoff point of ≤ .06 as well. However, the RMSEA estimate valued at .11, which was higher than the ideal level of ≤ .08. Despite the imperfection of the RMSEA estimate, all other fit indices indicated that the fit of the revised research model

was acceptable. MacCallum (1986) suggested that data-driven model modifications should have a sample size of at least 300. This current research study only accounted for 105 valid data entries, which may explain the less-than-ideal value of the RMSEA estimate in the revised model.

Research Question 1

How well do Technology Acceptance Model 3 (TAM3) variables (perceived usefulness, perceived ease of use, subjective norm, image, job relevance, output quality, result demonstrability, computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and voluntariness) explain faculty members' behavioral intention of using a LMS?

Explaining and Predicting Perceived Usefulness

In the initial research model, perceived ease of use (PEOU), subjective norm (SN), image (IMG), job relevance (JOB), result demonstrability (RES), and the interaction between job relevance and output quality (JOB_OUT_INTX) accounted for 75% of the variance of perceived usefulness (PU). Perceived ease of use, subjective norm, image, job relevance, and the interaction between job relevance and output quality were all significant predictors of perceived usefulness with path coefficient t values above 1.96 at $p < .05$, which is consistent with the findings in TAM2 (Venkatesh & Davis, 2000) and TAM3 (Venkatesh & Bala, 2008). However, contrary to TAM2 and TAM3, the interaction between job relevance and output quality had a negative impact, so that when output quality was stronger, the effect of job relevance on perceived usefulness was weaker. On the other hand,

when job relevance was more prominent, the effect of output quality on perceived usefulness was less significant.

After the model was revised, perceived enjoyment (ENJ) and computer playfulness (CPLAY) were added as additional predictors for perceived usefulness. Seventy-one percent of the variance of perceived usefulness can be explained by the eight variables. Subjective norm, image, job relevance, computer playfulness, and the interaction between job relevance and output quality appeared to be significant predictors of perceived usefulness. Subjective norm, image, job relevance, and the interaction between job relevance and output quality continued to have positive impact on perceived usefulness. The interaction between job relevance and output quality continued to have a negative effect on perceived usefulness, which was consistent with the results from initial research model. Computer playfulness also had a negative effect on perceived usefulness, such that when the system was perceived to be more playful to use, the system was considered to be less useful. Result demonstrability remained an insignificant predictor for perceived usefulness. Perceived enjoyment was added as a predictor based on the recommendation of the modification indices; however, the result indicated that it was not significant statistically. One exception was perceived ease of use; contradictory to the findings from previous research studies (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000) and the results from initial research model, perceived ease of use did not have a statistically significant effect on perceived usefulness in the revised research model. One possible explanation was that as new paths being added in, the significance of perceived ease of use on perceived usefulness was diluted.

Explaining and Predicting Perceived Ease of Use

Computer self-efficacy (CSE), perceptions of external control (PEC), computer anxiety (CANX), computer playfulness, and computer enjoyment accounted for 62% of the variance of perceived ease of use in the initial research model. Contrary to what Venkatesh and Bala (2008) found in TAM3, only computer self-efficacy and perceived enjoyment were found to be significant predictors of perceived ease of use, and had positive influence on perceived ease of use. All other path coefficients failed to reach statistical significance in the initial research model.

In the revised research model, image was added as a predicting factor for perceived ease of use in addition to the paths from initial research model. Computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and image together accounted for 67% of the variance of perceived ease of use. Computer self-efficacy remained to be a significant predictor for perceived ease of use with a positive influence in the revised research model. Perceptions of external control and computer anxiety remained insignificant statistically, as they were in the initial research model. Computer playfulness appeared as a significant predictor with a negative influence on perceived ease of use in the revised research model. In fact, when the system was considered more playful to use, it was considered less easy to use. Image was also shown to have a significant positive impact on perceived ease of use, such that when using the system was considered more likely to enhance a user's image or social status, the system was then more likely to be considered as easier to use.

Explaining and Predicting Behavioral Intention

In the initial research model, perceived usefulness, perceived ease of use, subjective norm, and the interaction between subjective norm and voluntariness together accounted for 59% of all the variance of behavioral intention. Consistent with findings from previous research studies (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000), perceived usefulness, perceived ease of use, subjective norm, and the interaction between subjective norm and voluntariness all had a significant effect on behavioral intention. Perceived usefulness and perceived ease of use were shown to have strong positive influence on behavioral intention, while the interaction between subjective norm and voluntariness was shown to have a negative impact on behavioral intention. This indicated that the effect of subjective norm on behavioral intention was stronger when system use was mandatory.

In the revised research model, a new path from computer playfulness to behavioral intention was added in addition to the paths from initial research model. All path coefficients were shown to be statistically significant. Perceived usefulness, perceived ease of use, subjective norm, and computer playfulness all had positive influence on behavioral intention. Consistent with the results from initial research model and previous research findings (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000), the interaction between subjective norm and voluntariness suggested that the effect of subjective norm on behavioral intention was stronger when system use was mandatory.

Research Question 2

How well does management support affect the determinants of perceived usefulness (subjective norm, image, job relevance, output quality, and result demonstrability)?

Explaining and Predicting Subjective Norm

Management support had significant effect and accounted for 19% of the variance of subjective norm in the initial research model. The effect was positive, so that when management support became stronger, subjective norm was consequently strengthened. Perceived enjoyment was added in the revised research model in addition to management support as factors that influence subjective norm. Both variables had significant positive effects on subjective norm and accounted for about 27% of the variance of subjective norm.

Explaining and Predicting Image

Management support was a significant predictor of image and accounted for 13% of the variance of image in the initial research model. Perceived enjoyment and computer playfulness were added as additional predictors of image in the revised model based on the recommendation modification indices. Contrary to the results from the initial research model, management support was no longer a significant predictor to image in the revised research model. Perceived enjoyment and computer playfulness, on the other hand, were shown to have strong effects in predicting image.

Explaining and Predicting Job Relevance

Management support had a significant positive effect on job relevance and accounted for about 23% of the variance of job relevance in the initial research model. Image and perceived enjoyment were later added during the model modification as predictors for job relevance in addition to management support. Image, perceived enjoyment, and management support together accounted for 45% of the variance of job relevance in the revised model. The path coefficients of all three variables were significant

statistically, which indicated that they were strong predictors of job relevance with positive influence.

Explaining and Predicting Result Demonstrability

Management support was a significant predictor of result demonstrability with a positive effect in the initial research model. It accounted for 21% of the variance of result demonstrability. During the path analysis, the modification indices indicated that there were other predictors for result demonstrability. Therefore, perceptions of external control, image, job relevance, perceived enjoyment, computer self-efficacy, and the interaction between job relevance and output quality were added as additional predicting factors to result demonstrability. The seven variables altogether accounted for 78% of the variance of result demonstrability, which was a significant improvement from the initial research model. In contradiction to the results from initial research model, management support appeared to have a statistically significant negative effect on result demonstrability, so that when management showed more support to the use of the system, the results from using the system were considered as less presentable. Aside from management support, image and computer self-efficacy also appeared to be significant predictors of result demonstrability with negative effects. Perceptions of external control and the interaction between job relevance and output quality were shown as strong predictors with positive influence. The path coefficients for perceived enjoyment and job relevance indicated that they were not significant predictors of result demonstrability.

Explaining and Predicting the Interaction between Job Relevance and Output Quality

Since output quality was a moderator for the interaction between job relevance and perceived usefulness, the effect of management support on job relevance was actually applied to the interaction between job relevance and output quality. Based on the result from the initial research model, management support had a significant effect on the interaction between job relevance and output quality and accounted for 32% of the variance of the interaction. After the modification, perceived enjoyment was added in addition to management support as a predictor for the interaction between job relevance and output quality. Both variables were shown to have positive effects on the interaction between job relevance and output quality, and the path coefficients from management support and perceived enjoyment to the interaction between job relevance and output quality were significant. When management support and perceived enjoyment became stronger, the moderating effect of output quality on the interaction between job relevance and perceived usefulness became stronger. The two variables together accounted for 54% percent of the variance of the interaction between job relevance and output quality.

Research Question 3

How well does management support affect the perceptions of external control?

Management support had a significant effect on perceptions of external control, with positive influence in the initial research model. Management support accounted for 24% of the variance of perceptions of external control. After the model was revised, additional paths were added from subjective norm, perceived enjoyment, computer self-efficacy, and computer playfulness to perceptions of external control. Management support, subjective

norm, perceived enjoyment, and computer playfulness all had significant effects on perceptions of external control with positive influence. Among them, perceived enjoyment stood out as the most significant predictor at $p < .001$ level. However, computer self-efficacy failed to reach statistical significance, and therefore, had the least effect on perceptions of external control.

Significance of the Findings

The purpose of this research study was to understand and identify factors that affect faculty's behavioral intention on a learning management system (LMS). Although many of research studies have been done to investigate students' adoption of the LMS; few research studies have investigated faculty acceptance and behavioral intention toward a LMS. Some researchers have noted that faculty members are the essential link for the adoption of campus technology. Without faculty adoption, many of the campus technologies would not be able to reach the students (Al-Busaidi & Al-Shihi, 2010; Flosi, 2008; Luke et al., 1998; Mumtaz, 2000; Zhao & Cziko, 2001).

Among many of the research models, the Technology Acceptance Model (TAM) (Davis, 1986, 1989) is one of the most adopted research frameworks for understanding users' acceptance of technology. The current research study adopted the TAM3 (Venkatesh & Bala, 2008) – the latest iteration of the Technology Acceptance Model – as the theoretical foundation in the hope that it would provide a comprehensive understanding of the factors that influence faculty's behavioral intention related to the LMS. The findings of this study may increase school administrators' and instructional designers' understanding and help them develop effective interventions to improve and ease the adoption of LMS. This

research study may also contribute to the existing body of literature by extending and validating TAM3.

This research study took TAM3 from a Western business setting and applied it to an academic environment in East Asia. Based on suggestions from previous researchers (Crant, 2000; Jasperson et al., 2005; Marler et al., 2009; Venkatesh & Bala, 2008), this research study extended the TAM3 by adding management support as a determinant for subjective norm, image, job relevance, result demonstrability, perceptions of external control, and the interaction between job relevance and output quality. The research findings of this study revealed a much more complex map of relationships among the construct variables than what was predicted in the original TAM3. The significant findings of the research are presented as following:

1. As was shown in numerous research studies (Davis, 1986, 1989, 1993; Davis et al., 1989; Davis et al., 1992; Davis & Venkatesh, 1996; Ku, 2009; Pan, Gunter, et al., 2005; Pan, Sivo, et al., 2005; Venkatesh, 2000; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000), perceived ease of use, perceived usefulness, subjective norm, and the interaction between subjective norm and voluntariness were significant determinants of behavioral intention. In addition, computer playfulness was also found to be a significant predictor of behavioral intention. When the faculty members felt more playful and spontaneous using the computers, they were more likely to use the LMS.
2. Consistent with what Venkatesh and Davis (2000) found in their TAM2 study, subjective norm, image, job relevance, and the interaction between job relevance

and output quality were significant determinants of perceived usefulness. In addition, computer playfulness was also found to be a significant determinant of perceived usefulness with a negative effect, which indicated that when faulty members felt more playful and spontaneous using the computers, they were less likely to consider the LMS to be useful. Another interesting finding was that job relevance emerged as the largest predictor for perceived usefulness, which implies that faculty members' judgments about the LMS' usefulness relied on their perceptions of whether or not the LMS was applicable to their jobs.

3. Computer playfulness, perceived enjoyment, and image were found to be the only three significant determinants of perceived ease of use. Contrary to perceived enjoyment and image, which had positive influence on perceived ease of use, computer playfulness had a negative impact on perceived ease of use. Although this may sound contradictory to our first impression, Venkatesh (2000) suggested that those people who are more playful with computers in general are more likely to indulge in using a new system, thus may tend to underestimate the difficulty of adapting the system.
4. In line with Venkatesh and Bala's (2008) suggestion, management support was found to be a significant determinant of perceptions of external control. In addition, subjective norm, perceived enjoyment, and computer playfulness were also found to be significant determinants of perceptions of external control. It is worth noting that perceived enjoyment had a greater impact on perceptions of external control than other variables, which provided support to Venkatesh's (2000) suggestion that as

users' experience with the system increases, perceived enjoyment is going to be the dominant determinant of perceived ease of use.

5. Consistent with Venkatesh and Bala's (2008) suggestion, management support was a significant determinant of subjective norm. In addition, perceived enjoyment was also found to be a significant determinant of subjective norm. This interesting finding implied that by manipulating the level of perceived enjoyment, the faculty's perceptions on the subjective norm could be enhanced consequently.
6. Both perceived enjoyment and computer playfulness were significant determinants of image. Perceived enjoyment was found to have a larger impact on image than computer playfulness. Computer playfulness is categorized as an intrinsic motivation. Although intrinsic motivation can change over-time, it is not something that can be easily manipulated. On the contrary, as evidenced in previous study (Venkatesh, 1999), perceived enjoyment could be enhanced through training. This implied that by enhancing faculty's perceived enjoyment of the LMS, their perceived social image would also change accordingly.
7. In support of Venkatesh and Bala's (2008) suggestion, this study found that management support was a significant determinant of job relevance. In addition, this study also found that image and perceived enjoyment were significant determinants of job relevance. The implication here was that if the faculty members believed using the LMS system could enhance their social images, they would consider the LMS be more relevant to their jobs. Perceived enjoyment indicated the more faculty members enjoyed using the LMS, the more they considered the LMS to be relevant to their jobs.

8. The interaction between job relevance and output quality was jointly determined by management support and perceived enjoyment. The finding revealed that perceived enjoyment had a greater impact on the interaction between job relevance and output quality. Given the fact that perceived enjoyment had a significant impact on job relevance as mentioned in the previous point, it is reasonable that perceived enjoyment also had a significant impact on the interaction between job relevance and output quality.
9. Result demonstrability was jointly determined by management support, perceptions of external control, image, computer self-efficacy, and the interaction between job relevance and output quality. It is interesting to note that management support, image, and computer self-efficacy had negative impact on result demonstrability. However, due to the complex interrelationship among the determinants, the negative values of the path coefficients may not reflect the true effects among the variables.

Implications for Practitioners

A few implications can be drawn based on the findings of this research study to help practitioners develop effective interventions on enhancing faculty's adoption of the LMS system. First, this research study provided strong support to the original TAM model that perceived usefulness and perceived ease of use are the most important predictors for behavioral intention. All effective interventions should center on increasing perceived usefulness and perceived ease of use. Second, management support had significant predicting effects on the determinants of perceived usefulness. By increasing management

support, such as by providing additional resources, leading, sponsoring, and championing the adoption of the LMS, the perceived usefulness could potentially be increased, and thus, increase the overall adoption of the LMS. Last, perceived enjoyment appeared to be a significant predictor for many of the determinants of perceived usefulness and perceived ease of use. Similar to management support, increasing faculty's perceived enjoyment could potentially increase perceived usefulness and perceived ease of use, and eventually may increase the overall adoption of the LMS. Previous research has indicated that enhancing user's social presence and socio-emotional content may help enhance the user's perceived enjoyment (Farnham, Zaner, & Cheng, 2001). Practitioners may consider incorporating some of the social network features into the system to boost the faculty's perceived enjoyment, which in turn may help the adoption of the LMS.

Limitations

The limitations of this current research are listed as following:

1. This research study was a single investigation of 105 faculty participants from Soochow University with a response rate of 21.34%. With a total faculty body of over 1200, the results from this research study might not represent the entire target population. Additional efforts will have to be made to generalize the findings to other populations.
2. The sample of this research may be biased given the low response rate from full-time faculty members and high response rate from teaching assistants. This may further imply that the results from this research are not suitable for generalization.

3. The low response rate of this research may indicate a non-response bias and thus render the survey results less accurate, as observed by early researchers (Backstrom & Hursh, 1963; Rea & Parker, 1997). However, arguments from other researchers suggested that a low response rate may yield more accurate survey results (Visser, Krosnick, Marquette, & Curtin, 1996). More recent studies suggested that the difference of accuracy between low response rate survey and high response rate survey is minimal (Curtin, Presser, & Singer, 2000; Holbrook, Krosnick, & Pfent, 2008).
4. There were 15 construct variables in the research model and the sample size for this study was only 105, which was less than desired. Kline (1991) recommended that the sample size should be at least 10 times the number of the variables in path analysis, or 20 times to be ideal. MacCallum (1986) also suggested that model modifications based on samples of 100 observations will lead to poor outcomes.
5. This research study relied on a self-reported method to collect data, which may be potentially biased in nature.
6. The validity of the study depends on the honesty of the participants' answers to the questions.

Recommendations for Further Research

Based on the findings of this current study and related research, the recommendations for future research are listed as following:

1. One of the first recommendations for further research is to obtain a larger sample size. Path analysis is very demanding in terms of sample size (Norman & Streiner,

2003). As discussed previously, the sample size for this current research was less than the recommended 10 to 20 times the number of the construct variables (Kline, 1991; MacCallum, 1986). An adequate sample size will improve the outcome of data-driven modification during analysis; it will also make the research results more representative to the target population.

2. It is also recommended for future research to boost the response rate of the survey. As it was shown in the results, about 80% of the respondents were in part-time positions. This result may cause the current research to be less representative of the target population than it was intended to be. Additional efforts and sampling methods may be needed to boost the response rate of full-time faculty members.
3. Future research may be conducted on students rather than on faculty members using the Technology Acceptance Model 3 (TAM3). Although many studies have been done on students in regards to the adoption of a learning management system (LMS) (Birch & Irvine, 2009; Ku, 2009; Pan, Gunter, et al., 2005; Pan, Sivo, et al., 2005; Yang, 2007), the majority of them used simple variations of TAM1 or TAM2. Few research studies have been done with TAM3 to study students' adoption of a learning management system. The TAM3 is a more comprehensive research model than TAM1 and TAM2, which may yield better insight in identifying the determinants of students' adoption of LMS.
4. The current research study acquired a large amount of demographic information from the participants, such as gender, age, job title, years of teaching, and experience with the LMS, etc. All these pieces of demographic information were only analyzed using descriptive statistics, and were not accounted for as factors that

could potentially influence the faculty's adoption of a LMS. Future research may bring in some of the demographic information into path analysis as factors that influence faculty's adoption of LMS. This may reveal more correlations than the current research model, and may add another layer of understanding in faculty's adoption of a LMS.

5. Future research may also be conducted in a Western business setting using the initial hypothesized research model. Same as the introduction of previous TAM models, the TAM3 (Venkatesh & Bala, 2008) was first introduced in a business setting to help understand the determinants of users' adoption of technology. The current research study was conducted in an academic environment in East Asia, and the hypothesized research model did not fit well with the data. However, in a Western business environment similar to the one that Venkatesh and Bala (2008) did their research, the hypothesized research model may fit better and yield better outcomes.

APPENDIX A: PRE-NOTICE LETTER

PRE-NOTICE LETTER

Dear Professor,

My name is Zhigang Li. I am a doctoral student at the College of Education at the University of Central Florida. A few days from now you will receive in the campus mail a request to fill out a brief questionnaire for an important research project being conducted by me and in conjunction with Dr. Cheng-Hsin Ku from the Instructional Technology Division of Center for Teaching and Learning and my research advisor, Dr. Stephen Sivo from the University of Central Florida. This research study is designed to capture faculty members' belief and intention of using the learning management system at Soochow University.

We would like to do everything we can do to make it easy and enjoyable for you to participate in the study. We are writing in advance because we have found that many people like to know ahead of time that they will be contacted.

Your participation in our study is highly appreciated. We thank you in advance for your time and consideration.

Sincerely yours,

Zhigang Li
Doctoral Student
College of Education
University of Central Florida

APPENDIX B: PRE-NOTICE LETTER (CHINESE TRANSLATION)

PRE-NOTICE LETTER

敬愛的教授，

您好，我的名字叫做李志剛。我是中佛羅里達大學教育學院的博士生。在接下來的幾天內，您將通過校園郵件收到一份關於網絡學園使用狀況的調查問卷。 該項調查研究是由我與東吳大學教學科技推廣組的古正欣組長以及我的指導教授 ——同樣來自中佛羅里達大學教育學院的 Stephen Sivo 博士共同合作進行的 。本項調查研究的目的在於尋找提升與改進網路學園系統的關鍵因素。

我們將盡最大的努力,讓您能夠輕鬆愉快地參與此次的研究調查活動。我們提前發出這封信,以方便您預先瞭解研究的主題及相關內容,再考慮是否參加。

我們由衷地期望您能夠參與本項調查研究，我們在此提前感謝您的時間和參與。

李志剛 敬上

APPENDIX C: INFORMED CONSENT LETTER

INFORMED CONSENT LETTER

Dear Professor,

My name is Zhigang Li. I am a doctoral student at the College of Education at the University of Central Florida. In conjunction with Dr. Cheng-Hsin Ku from the Instructional Technology Division of Center for Teaching and Learning and Dr. Stephen Sivo from the College of Education of the University of Central Florida, we are conducting a research study on faculty members' belief and intention of using the learning management system. The purpose of this study is to identify the variables affecting faculty members' acceptance of the web-based learning management system.

You are invited to participate in a survey, and it will take no more than 10 minutes. Your participation in this study is voluntary. You must be at least 18 years of age or older to participate. You do not have to answer any questions that you feel uncomfortable to answer, and you may choose not to participate in this study or withdraw from this survey at any time. There are no anticipated risks associated with participation.

The analysis of this study will be in aggregate form; therefore no individual answer will be published or presented. There are no direct benefits or compensation for participation. However, your participation in this study is

critical for the future improvement of the online learning management system at Soochow University, and your assistance will lead instructors and courseware designers to provide better web-based contents and learning environments. I would like to thank you in advance for participating. Thank you so much for your time.

If you have any questions or comments regarding to this survey study, please feel free to contact me (zhigang@mail.ucf.edu), my research partner Dr. Cheng-Hsin Ku (alanku@scu.edu.tw), or my research advisor, Dr. Stephen Sivo, (ssivo@mail.ucf.edu). This research study is conducted under the oversight of the UCF Institutional Review Board. Questions or concerns about research participants' rights may be directed to the UCF IRB office:

University of Central Florida, Office of Research & Commercialization,
12201 Research Parkway, Suite501
Orlando, Florida 32826-3246
Telephone: (407)823-2901

_____ I am at least 18 years of age and completing this survey constitutes my informed consent.

APPENDIX D: INFORMED CONSENT LETTER (CHINESE TRANSLATION)

INFORMED CONSENT LETTER

尊敬的教授，

您好，我的名字叫做李志剛，是一名中佛羅里達大學教育學院的博士生。目前我正在與東吳大學教學科技推廣組的古正欣組長以及我的指導教授 ——同樣來自中佛羅里達大學教育學院的 Stephen Sivo 博士共同合作進行一項關於老師們對網路學園的使用接受情況的調查研究 。 本項調查研究的目的在於尋找提升與改進網路學園系統的關鍵因素。

我們在此誠摯地邀請您參與本項調查研究。您僅需抽出 10 分鐘的時間填寫一份簡要的調查問卷。本項調查研究為自願參與。您必須年滿 18 歲以上才能夠參與本項研究。如果您有任何不想回答的問題，您可以選擇在任何時候退出本項調查。參與本項調查不會為您帶來任何預期的風險。

本項調查研究所收集的數據,將會被綜合進行統計處理。任何有關個人的資料都不會在未來的報告中出現。本項研究的結果,可以為學校的教學資源部門提供有用的資訊，來幫助他們就網路學園的使用,為老師們提供更好的服務，因此您的參與對本項研究至關重要。

如果您對本項調查研究有任何疑問，您可以通過電子郵件聯絡我 (Zhigang@mail.ucf.edu)、 我的合作夥伴古正欣組長（alanku@scu.edu.tw）、以及我的指導教授 Dr. Stephen Sivo (ssivo@mail.ucf.edu)。

本項調查研究經過中佛羅里達大學的內部評鑑委員會的評審。如果您作為本項調查研究的參與者，對自身的權益有任何問題，請直接聯絡中佛羅里達大學內部評審委員會辦公室：
University of Central Florida, Office of Research & Commercialization,
12201 Research Parkway, Suite501
Orlando, Florida 32826-3246
電話: (407)823-2901

APPENDIX E: RESEARCH QUESTIONNAIRE

Management Support And Faculty's Adoption Of Learning Management System:

Applying Technology Acceptance Model 3

Important: This survey is to understand your behavioral intention on adopting the LMS system. If you don't have experience with the system, please answer the questions as best as you can based on your knowledge and understanding of the system that you have learned from others.

For your convenience, an electronic copy of this survey can be found and filled out at: https://education.ucf.edu/PathToSurvey.html

Please circle the number that best describes your agreement or disagreement with each statement.

7 Strongly Agree	6 Agree	5 Somewhat Agree	4 Neither	3 Somewhat Disagree	2 Disagree	1 Strongly Disagree

Perceived Usefulness

Using the system would improve my performance in my job.	7	6	5	4	3	2	1
Using the system in my job would increase my productivity.	7	6	5	4	3	2	1
Using the system would enhance my effectiveness in my job.	7	6	5	4	3	2	1
I would find the system to be useful in my job.	7	6	5	4	3	2	1

Perceived Ease of Use (PEOU)

My interaction with the system is understandable.	7	6	5	4	3	2	1
Interacting with the system does not require a lot of my	7	6	5	4	3	2	1

mental effort.							
I find the system to be easy to use.	7	6	5	4	3	2	1
I find it easy to get the system to do what I want it to do.	7	6	5	4	3	2	1

Behavioral Intention (BI)

Assuming I had access to the system, I intend to use it.	7	6	5	4	3	2	1
Given that I had access to the system, I predict that I would use it.	7	6	5	4	3	2	1

Computer Self-Efficacy (CSE)

I could complete the job using a software package . . .							
...if there was no one around to tell me what to do as I go.	7	6	5	4	3	2	1
...if I had just the built-in help facility for assistance.	7	6	5	4	3	2	1
...if someone showed me how to do it first.	7	6	5	4	3	2	1
...if I had used similar packages before this one to do the same job.	7	6	5	4	3	2	1

Perceptions of External Control (PEC)

I have control over using the system.	7	6	5	4	3	2	1
I have the resources necessary to use the system.	7	6	5	4	3	2	1
Given the resources, opportunities and knowledge it takes to use the system, it would be easy for me to use the system.	7	6	5	4	3	2	1
The system is not compatible with other systems I use.	7	6	5	4	3	2	1

Computer Playfulness (CPLAY)

The following questions ask you how you would

characterize yourself when you use computers:							
. . . spontaneous	7	6	5	4	3	2	1
. . . creative	7	6	5	4	3	2	1
. . . playful	7	6	5	4	3	2	1
. . . unoriginal	7	6	5	4	3	2	1

Computer Anxiety (CANX)

Computers do not scare me at all.	7	6	5	4	3	2	1
Working with a computer makes me nervous.	7	6	5	4	3	2	1
Computers make me feel uncomfortable.	7	6	5	4	3	2	1
Computers make me feel uneasy.	7	6	5	4	3	2	1

Perceived Enjoyment (ENJ)

I find using the system to be enjoyable.	7	6	5	4	3	2	1
The actual process of using the system is pleasant.	7	6	5	4	3	2	1
I have fun using the system.	7	6	5	4	3	2	1

Subjective Norm (SN)

People who influence my behavior think that I should use the system.	7	6	5	4	3	2	1
People who are important to me think that I should use the system.	7	6	5	4	3	2	1
The senior management of this business has been helpful in the use of the system.	7	6	5	4	3	2	1
In general, the organization has supported the use of the system.	7	6	5	4	3	2	1

Image (IMG)

People in my organization who use the system have more prestige than those who do not.	7	6	5	4	3	2	1
People in my organization who use the system have a high profile.	7	6	5	4	3	2	1
Having the system is a status symbol in my organization.	7	6	5	4	3	2	1

Job Relevance

In my job, usage of the system is important.	7	6	5	4	3	2	1
In my job, usage of the system is relevant.	7	6	5	4	3	2	1
The use of the system is pertinent to my various job-related tasks.	7	6	5	4	3	2	1

Output Quality (OUT)

The quality of the output I get from the system is high.	7	6	5	4	3	2	1
I have no problem with the quality of the system's output.	7	6	5	4	3	2	1
I rate the results from the system to be excellent.	7	6	5	4	3	2	1

Result Demonstrability (RES)

I have no difficulty telling others about the results of using the system.	7	6	5	4	3	2	1
I believe I could communicate to others the consequences of using the system.	7	6	5	4	3	2	1
The results of using the system are apparent to me.	7	6	5	4	3	2	1
I would have difficulty explaining why using the system may or may not be beneficial.	7	6	5	4	3	2	1

Management Support (MS)

Management is aware of the benefits that can be achieved with the use of the system.	7	6	5	4	3	2	1
Management always supports and encourages the use of the system.	7	6	5	4	3	2	1
Management provides most of the necessary help and resources to enable people to use the system.	7	6	5	4	3	2	1
Management is really keen to see that people are happy with using the system.	7	6	5	4	3	2	1
Management provides good access to hardware resources for people to use the system.	7	6	5	4	3	2	1

Voluntariness (VOL)

My use of the system is voluntary.	7	6	5	4	3	2	1
My supervisor does not require me to use the system.	7	6	5	4	3	2	1
Although it might be helpful, using the system is certainly not compulsory in my job.	7	6	5	4	3	2	1

Demographic Questions

1. Gender:

   _____ Female

   _____ Male

2. Age:
   _____ Under 30
   _____ 30-39
   _____ 40-49
   _____ 50-59
   _____ Above 60

3. Major discipline taught:

   _____ Arts & social science

_____ Foreign languages & cultures

_____ Science

_____ Law

_____ Business

4. Please indicate your current status:

   _____ Part-time

   _____ Full-time

5. Please indicate your rank:

   _____ Full Professor

   _____ Associate Professor

   _____ Assistant Professor

   _____ Visiting Professor

   _____ Instructor

   _____ Teaching Assistant

   _____ Other (please specify)

6. How many years have you taught at the university level? (Please fill in whole numbers only)

   Part-time _____

   Full-time _____

7. How many years have you been at your current institution? (Please fill in while numbers only)

   Part-time _____

   Full-time _____

8. What levels do you teach at this university?

   _____ 1st year students

   _____ 2nd year students

_____ 3rd year students

_____ 4th year students

_____ Graduate students

9. How many years of experience do you have using computers (for example, email, typing documents, entering students grades, research)? Please fill in a whole number only. _____

10. Learning management software allows Instructors to perform several functions online such as posting assignments, notices, and grades. How many years of experience do you have using LMS? (Please fill in a whole number only)

    _____

11. Do you have any comments that you would like to share with us regarding the LMS?

Thank you for your participation and time.

Please return the completed survey to Division of Instructional Technology with campus mail.

APPENDIX F: RESEARCH QUESTIONNAIRE (CHINESE TRANSLATION)

管理層的支持與教師們對學習管理系統的使用：應用科技接受模式 3

注意：本問卷主要是瞭解您在運用網路學園系統的行為意圖。如果您沒有使用這類系統的經驗，請盡量依據您對這類系統的理解和知識作答。

為了方便您的填寫，這份調查問卷的網路版可在以下網址查詢及填寫。

https://education.ucf.edu/PathToSurvey.html

請圈選最接近您的觀點的選項。

7 非常同意	6 同意	5 部分同意	4 既不同意也不反對	3 部分不同意	2 不同意	1 非常不同意

使用網路學園能夠提高我在教學上的表現	7	6	5	4	3	2	1
使用網路學園能夠提高我的教學生產力	7	6	5	4	3	2	1
使用網路學園能夠增強我的教學效果	7	6	5	4	3	2	1
我認為網路學園對我的教學很有幫助	7	6	5	4	3	2	1
我與網路學園的互動是容易懂的	7	6	5	4	3	2	1
跟網路學園的互動不需要太多的思考	7	6	5	4	3	2	1
我覺得網路學園很容易使用	7	6	5	4	3	2	1
我覺得使用網路學園很容易做到我想要做的事	7	6	5	4	3	2	1
假設我有使用網路學園的條件，我會願意使用它	7	6	5	4	3	2	1
如果我有使用網路學園的機會，我預期我會使用它	7	6	5	4	3	2	1

在下列假設的情況下，我能夠運用套裝軟體來完成工作：							
……沒有人在身旁指導我如何使用	7	6	5	4	3	2	1
……僅有預設的輔助說明系統來幫助我	7	6	5	4	3	2	1
……有人預先為我示範如何使用	7	6	5	4	3	2	1
……我有使用類似軟體的相關工作經驗	7	6	5	4	3	2	1
我對使用網路學園有完全的掌控	7	6	5	4	3	2	1
我擁有使用網路學園必要的資源	7	6	5	4	3	2	1
給我必要的資源、機會和知識， 使用網路學園對我來說將會是很容易的	7	6	5	4	3	2	1
網路學園跟我使用過的其他系統不相容	7	6	5	4	3	2	1
請利用以下詞彙來描述您自己使用電腦的特性：							
自發的	7	6	5	4	3	2	1
有創造性的	7	6	5	4	3	2	1
有樂趣的	7	6	5	4	3	2	1
模仿別人的	7	6	5	4	3	2	1
我不會害怕使用電腦	7	6	5	4	3	2	1
使用電腦會使我緊張	7	6	5	4	3	2	1
電腦會使我感到不舒服	7	6	5	4	3	2	1
電腦會使我感到不自在	7	6	5	4	3	2	1
我認為使用網路學園是令人享受的	7	6	5	4	3	2	1
使用網路學園的過程是讓人愉快的	7	6	5	4	3	2	1

使用網路學園讓我覺得有趣	7	6	5	4	3	2	1
對我的行為有影響的人認為我應該使用網路學園	7	6	5	4	3	2	1
對我來說很重要的人認為我應該使用網路學園	7	6	5	4	3	2	1
學校的管理階層對使用網路學園提供了很大幫助	7	6	5	4	3	2	1
總體而言，我的學校支持網路學園的使用	7	6	5	4	3	2	1
在學校，使用網路學園的老師比較受到尊重	7	6	5	4	3	2	1
在學校使用網路學園的老師有比較好的形象	7	6	5	4	3	2	1
在學校使用網路學園是地位的象徵	7	6	5	4	3	2	1
使用網路學園對我的教學是很重要的	7	6	5	4	3	2	1
使用網路學園與我的教學是密切相關的	7	6	5	4	3	2	1
使用網路學園與我的各項教學工作是相關的	7	6	5	4	3	2	1
網路學園的課程品質很高	7	6	5	4	3	2	1
我從來沒有懷疑網路學園的產出品質	7	6	5	4	3	2	1
我認為使用網路學園的效果是卓越的	7	6	5	4	3	2	1
我能夠毫無困難地告知他人使用網路學園的效果	7	6	5	4	3	2	1
我可以將使用網路學園的成效傳遞給別人	7	6	5	4	3	2	1
我可以清楚地看到使用網路學園的效果	7	6	5	4	3	2	1
我很難解釋使用網路學園能否帶來好處	7	6	5	4	3	2	1
學校的管理階層有意識到使用網路學園的效益	7	6	5	4	3	2	1
學校的管理階層一直鼓勵大家使用網路學園	7	6	5	4	3	2	1

學校的管理階層提供大量的幫助和資源以促使大家使用網路學園	7	6	5	4	3	2	1
學校的管理階層很期盼看到大家樂意使用網路學園	7	6	5	4	3	2	1
學校的管理階層給使用網路學園的老師提供更好的硬體資源	7	6	5	4	3	2	1

我自願使用網路學園	7	6	5	4	3	2	1
我的主管沒有要求我必須使用網路學園	7	6	5	4	3	2	1
儘管網路學園可能對教學有所幫助，在我的工作中並沒有硬性要求使用	7	6	5	4	3	2	1

1. 性別

   _____ 女

   _____ 男

2. 年齡

   _____ 未滿 30 歲

   _____ 30-39 歲

   _____ 40-49 歲

   _____ 50-59 歲

   _____ 超過 60 歲

3. 所屬學院：

   _____ 人文與社會學院

   _____ 外語學院

_____ 理學院

_____ 法學院

_____ 商學院

4. 請標出您現在的職別：

_____ 兼職

_____ 全職

5. 請標出您的職稱：

_____ 教授

_____ 副教授

_____ 助理教授

_____ 客座教授

_____ 講師

_____ 教學助理

_____ 其他 （請敘述） _____

6. 您在大學任教的年資總共有多久？（請只填寫整數）

兼職 _____ 年

全職 _____ 年

7. 您在本校任教的年資有多久？（請只填寫整數）

兼職 _____ 年

全職 _____ 年

8. 您目前在這所大學的授課年級？（可復選）

_____ 大一

_____ 大二

_____ 大三

_____ 大四

_____ 研究生（含碩士生和博士生）

9. 您有多少年使用電腦（例如：email, 文書處理，成績上傳）的經驗？請輸入整數年份 _____

10. 網路學園系統允許教師使用各項線上功能，例如發佈作業、通知、還有上傳成績。您有多少年使用網路學園系統的經驗？（請填入整數年份）_____

11. 請問您對網路學園還有其它任何的建議？

感謝您參與本次研究問卷調查。

請將完成的問卷透過校園郵件回寄給教學科技推廣組。

APPENDIX G: FIRST REMINDER

FIRST REMINDER

Dear Professor,

Last week, a survey seeking your opinions on the learning management system was mailed to you through campus mail.

We would like to thank you for taking the time to participate in our study. If you have not yet had time to complete our questionnaire, please do so today. We know that you are busy, but your response is critical to our study and future improvement of the online learning management system at Soochow University.

If by any chance you misplaced our questionnaire, or you did not receive one, please email me at zhigang@mail.ucf.edu or contact Dr. Cheng-Hsin Ku at alanku@scu.edu.tw, we will be happy to get another one in the mail to you immediately.

For your convenience, an electronic version of the questionnaire can also be found and filled out at: https://education.ucf.edu/PathToSurvey.html.

Thank you again for your participation.

Sincerely,

Zhigang Li
Doctoral Student
College of Education
University of Central Florida

APPENDIX H: FIRST REMINDER (CHINESE TRANSLATION)

FIRST REMINDER

敬愛的教授，

上個星期我們向您寄送了一份關於網路學園使用情況的調查問卷。我們在此感謝您參與本項研究。如果你在閱讀這封信的時候尚未填寫該調查問卷，我們期望您今日能夠在百忙之中抽空填寫。我們理解您的日常工作繁忙，但是您的回答對於本項調查研究以及網路學園的未來改進具有至關重要的作用。

如果您尚未收到本項研究的調查問卷，請您通過電子郵件聯絡我（Zhigang@mail.ucf.edu) 或者教學科技推廣組古正欣組長（ alanku@scu.edu.tw），我們會立刻給您寄送一份到您的校園郵箱中。為方便您的參與，您也可以通過以下網址填寫調查問卷：
http://scu.edu.tw/PathToSurvey.html

再次感謝您的參與。
敬祝教安！
李志剛 敬上

APPENDIX I: SECOND REMINDER

SECOND REMINDER

Dear Professor,

About two weeks ago, we sent you a questionnaire that asked about your opinions on using the learning management system at Soochow University. We are writing to you again because we have not yet received your completed questionnaire.

Your participation is very important for both the research team and yourself as a faculty member, as the results from this study may yield valuable information to the technology department of the university so that they could provide services that better meet faculty's needs.

Enclosed you will find a replacement questionnaire. We sincerely hope you could take **10 minutes** to share your experiences with us by filling out our questionnaire. For your convenience, an electronic version of the questionnaire can be found and filled out at: https://education.ucf.edu/PathToSurvey.html.

Thank you again for your time and participation in this study!

Sincerely,

Zhigang Li

Doctoral Student

College of Education

University of Central Florida

APPENDIX J: SECOND REMINDER (CHINESE TRANSLATION)

SECOND REMINDER

敬愛的教授，

大約兩個多星期前，我們給您寄送了一份關於網路學園使用及接受程度的調查問卷。我們向您發出本封信函的原因是我們尚未收到您填寫的問卷。您的參與對與本項調查研究具有至關重要的意義。只有充分採集到您的意見和觀點， 本項研究才能協助學校的教學資源部門針對您的需求進行修正與改進。

信封內，我們隨附了一份替代問卷。我們誠摯地期望您能夠在百忙之中抽出大約十分鐘左右的時間,來分享您對網路學園的意見。為了您的方便，您也可以透過以下網址來填寫本調查問卷的網路版本：
http://scu.edu.tw/PathToSurvey.html

再次感謝您的時間及參與！

李志剛 敬上

APPENDIX K: UCF IRB PERMISSION LETTER

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Zhigang Li**

Date: **November 09, 2010**

Dear Researcher:

On 11/09/2010, the IRB approved the following activity as human participant research that is exempt from regulation:

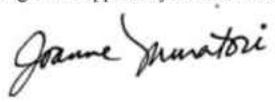
Type of Review:	Exempt Determination
Project Title:	MANAGEMENT SUPPORT AND FACULTY'S ADOPTION OF LEARNING MANAGEMENT SYSTEM: APPLYING TECHNOLOGY ACCEPTANCE MODEL 3
Investigator:	Zhigang Li
IRB Number:	SBE-10-07155
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 11/09/2010 03:59:24 PM EST



IRB Coordinator

REFERENCES

Adkins, S. S. (2010). The worldwide market for self-paced eLearning products and services: 2009-2014 forecast and analysis. Monroe, WA: Ambient Insight, LLC.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Al-Busaidi, K. A., & Al-Shihi, H. (2010). Instructors' acceptance of learning management systems: A theorectical framework. *Communications of the IBIMA*.

Arafeh, S. (2004). The implications of information and communications technologies for distance education: Looking toward the future. Arlington, VA: SRI Ineternational.

ASTD. (2006). E-learning evolves into mature training tool. *T+D, 60*(4), 20.

Backstrom, C. H., & Hursh, G. H.-C. (1963). *Survey research*. Evanston, IL: Northwestern University Press.

Bentler, P. M. (1989). *EQS structural equations program manual*. Los Angeles: BMDP Statistical Software.

Bentler, P. M. (2004). *EQS 6 structural equations program manual*. Encino, CA: Multivariate Software, Inc.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*(3), 588-606. doi: 10.1037/0033-2909.88.3.588

Billings, R. S., & Wroten, S. P. (1978). Use of path analysis in industrial/organizational psychology: Criticisms and suggestions. *Journal of Applied Psychology, 63*(6), 677-688.

Birch, A., & Irvine, V. (2009). Preservice teachers' acceptance of ICT integration in the classroom: Applying the UTAUT model. *Educational Media International, 46*(4), 295-315.

Bonk, C. J. (2002). Online training in an online world. *USDLA Journal, 16*(3).

Britt, P. (2004). Elearning on the rise. *EContent, 27*(11), 36-40.

Brown, S. C. (2009). *Technology acceptance and organizational change: An integration of theory.* Doctor of Philosophy, Auburn University, Auburn, AL.

Burgess, L. A. (2003). WebCT as an e-learning tool: A study of technology students' perceptions. *Journal of Technology Education, 15*(1), 6-15.

Burton-Jones, A., & Hubona, G. S. (2005). Individual differences and usage behavior: Revisiting a technology acceptance model assumption. *The DATA BASE for Advance in Information Systems, 36*(2), 58-77.

Carliner, S. (2005). Course management systems versus learning management systems. *Learning Circuits*. Retrieved from http://www.astd.org/LC/2005/1105_carliner.htm

Carmines, E. G., & Zeller, R. A. (1979). *Reliability and validity assessment* (Vol. 17). Thousand Oaks, CA: Sage Publications, Inc.

Cavus, N., & Momani, A. a. M. (2009). Computer aided evaluation of learning management systems. *Procedia Social and Behavioral Sciences, 1*, 426-430.

Chismar, W. G., & Wiley-Patton, S. (2002). *Does the extended technology acceptance model apply to physicians.* Paper presented at the 36th Hawaii International on System Sciences: IEEE, Hawaii.

CICC. (2006). *e-Learning in Asia*. Paper presented at the e-Learning Contents Conference 2006.

Crant, J. M. (2000). Proactive behavior in organizations. *Journal of Management, 26*(3), 435-462.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Pyschometrika, 16*(3), 297-334.

Curtin, R., Presser, S., & Singer, E. (2000). The effects of response rate changes on the index of consumer sentiment. *Public Opinion Quarterly, 64*(4), 413-428.

Daniels, P. (2009). Course management systems and implications for practice. *International Journal of Emerging Technologies & Society, 7*(2), 97-108.

Davis, F. D. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results.* Massachusetts Institute of Technology, Boston, MA.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, September*, 318-340.

Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies, 38*, 475-487.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparision of two theoretical models. *Management Science, 35*(8), 982-1003.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology, 22*, 1111-1132.

Davis, F. D., & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: Three experiments. *International Journal of Human-Computer Studies, 45*, 19-45.

DeVellis, R. F. (1991). *Scale development*. Newbury Park, NJ: Sage Publications.

Dillman, D. A. (2007). *Mail and Internet survey: The tailored design method* (2nd ed.). Hoboken, New Jersey: John Wiley & Sons, Inc.

Dobrzanski, L. A., Honysz, R., & Brytan, Z. (2006). Application of interactive course management system in distance learning of material science. *Journal of Achievements in Materials and Manufacturing Engineering, 17*(1-2), 429-432.

Dziuban, C., & Moskal, P. (2001). Evaluating distributed learning in metropolitan universities. *Metropolitan Universities, 12*(1), 41-49.

EduTools. (2010). WCET EduTools: Providing decisionmaking tools for the E-D-U community, from http://www.edutools.info/

Ellis, R. K. (2009). A field guide to learning management systems. *ASTD Learning Circuits*.

Fan, X., & Sivo, S. A. (2005). Sensitivity of fit indexes to misspecified structural or measurment model components: Rationale of two-index strategy revisited. *Structural Equation Modeling, 12*(3), 343-367.

Farnham, S., Zaner, M., & Cheng, L. (2001). Designing for sociability in shared browsers. In M. Hirose (Ed.), *Human-computer interaction:INTERACT '01* (pp. 115-123). Tokyo, Japan: IOS Press.

Feldstein, M. (2010). The evolving LMS market. *2011*(March 28). Retrieved from http://www.mfeldstein.com/the-evolving-lms-market-part-i/

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Flosi, A. B. (2008). *Course Management Software: Applying the technology acceptance model to study use by post-secondary faculty.* Nova Southeastern University, Fort Lauderdale-Davie, FL.

Gefen, D., Straub, D. W., & Boudreau, M.-C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the Assoication for Information Systems, 4*(7).

Green, K. C. (2010). *The 2010 national survey of information technology in U.S. higher education*. Paper presented at the 2010 EDUCAUSE Conference, Anaheim, CA.

Greene, K., Hale, J. L., & Rubin, D. L. (1997). A test of the theory of reasoned action in the context of condom use and AIDS. *Communication Reports, 10*(1), 21-33.

Hatcher, L. (1994). *A step-by-step approach to using SAS® for factor analysis and structural equation modeling*. Cary, NC: SAS Institute Inc.

Hayes, R. (2000). Exploring discount usability methods to assess the suitability of online course delivery products. *The Internet and Higher Education, 2*(2-3), 119-134.

Holbrook, A. L., Krosnick, J. A., & Pfent, A. (2008). The causes and consequences of response rates in surveys by the news media and government contractor survey research firms. In J. M. Lepkowski, C. Tucker, J. M. Brick, E. d. Leeuw, L. Japec, P. J. Lavrakas, M. W. Link & R. L. Sangster (Eds.), *Advances in telephone survey methodology*. New York: John Wiley & Sons, Inc.

Hu, L.-t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1-55.

Igbaria, M., & Iivari, J. (1995). The effects of self-efficacy on computer usage. *Omega, 23*(6), 587-605.

Igbaria, M., Zinatelli, N., Cragg, P., & Cavaye, A. L. M. (1997). Personal computing acceptance factors in small firms: A structural equation model. *MIS Quarterly, 21*(3), 279-305.

Ikegulu, P. R. (1998). Effects of screen designs in CBI environments. *Information & Technology*. doi: ED428757

Internet World Stats. (2010). Internet usage statistics. Retrieved March 28, 2010, from http://www.internetworldstats.com/stats.htm

Jarvenpaa, S. L., & Ives, B. (1991). Executive involvement and participation in the management of information technology. *MIS Quarterly, 15*(2), 205-227.

Jasperson, J. S., Carter, P. E., & Zmud, R. W. (2005). A comprehensive conceptualization of the post-adoptive behaviors associated with IT-enabled work systems. *MIS Quarterly, 29*, 525-557.

Kline, R. B. (1991). Latent variable path analysis in clinical research: A beginner's tour guide. *Journal of Clinical Psychology, 47*(4), 471-484.

Ku, C.-H. (2009). *Exending the technology acceptance model using perceived user resources in higher education web-based online learning courses.* University of Central Florida, Orlando, FL.

Lee, Y.-C. (2008). The role of perceived resources in online learning adoption. *Computers & Education, 50*, 1423-1438.

Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2003). The technology acceptance model: Past, present, and future. *Communications of the Assoication for Information Systems, 12*(50), 752-780.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management, 40*, 191-204.

Leonard-Barton, D., & Deschamps, I. (1988). Managerial influence in the implementation of new technology. *Management Science, 34*(10), 1252-1265.

Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. *MIS Quarterly, 31*(1), 59-87.

Luke, N., Moore, J. L., & Sawyer, S. B. (1998). Authentic approaches to encourage technology-using teachers. *Technology and Teacher Education Annual*, 1-6.

MacCallum, R. C. (1986). Specification searches in covariance structure modeling. *Psychological Bulletin, 100*(1), 107-120.

Mahdizadeh, H., Biemans, H., & Mulder, M. (2008). Determining factors of the use of e-learning environments by university teachers. *Computers & Education, 51*, 142-154.

Mallon, D., Bersin, J., Howard, C., & O'Leonard, K. (2009). Learning management systems 2009: Executive summary. Oakland, CA: Bersin & Associates, LLC.

Marler, J. H., Fisher, S. L., & Ke, W. (2009). Employee self-service technology acceptance: A comparison of pre-implementation and post-implementation relationships. *Personnel Psychology, 62*, 327-358.

Martins, C. B. M. J., Steil, A. V., & Todesco, J. L. (2004). Factors influencing the adoption of the Internet as a teaching tool at foreign language schools. *Computers & Education, 42*(4), 353-374. doi: 10.1016/j.compedu.2003.08.007

Mathieson, K., Peacock, E., & Chin, W. W. (2001). Extending the technology acceptance model: The influence of perceived user resources. *The DATA BASE for Advance in Information Systems, 32*(3), 86-112.

McDonald, R. P., & Marsh, H. W. (1990). Choosing a multivariate model: Noncentrality and goodness of fit. *Psychological Bulletin, 107*(2), 247-255. doi: 10.1037/0033-2909.107.2.247

McGill, T. J., & Hobbs, V. J. (2008). How students and instructors using a virtual learning environment perceive the fit between technology and task. *Journal of Computer Assisted Learning, 24*, 191-202.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*.

Meli, P. L. (2008). *Perspectives of health information management faculty use of an e-learning laboratory and technology acceptance.* University of Central Florida, Orlando, FL.

Ministry of Education, Taiwan. (2010). Colleges and universities overview. Retrieved April 7, 2010, from http://www.edu.tw/statistics/content.aspx?site_content_sn=%2021549

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research, 2*(3), 192-222.

Moran, M., Hawkes, M., & Gayar, O. E. (2010). Tablet personal computer integration in higher education: Applying the unified theory of acceptance and use technology model to understand supporting factors. *Journal of Educational Computing Research, 42*(1), 79-101.

Mumtaz, S. (2000). Factors affecting teachers use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education, 9*(3), 319-342.

Norman, G. R., & Streiner, D. L. (2003). *PDQ statistics*. Hamilton, Ontario: BC Decker, Inc.

Pan, C.-C., Gunter, G., Sivo, S., & Cornell, R. (2005). End-user acceptance of a learning management system in two hybrid large-sized introductory undergraduate courses. *Journal of Educational Technology Systems, 33*(4), 355-365.

Pan, C.-C., Sivo, S., Gunter, G., & Cornell, R. (2005). Students' perceived ease of use of a course management system: an exogenous or endogenous variable? *Journal of Educational Computing Research, 33*(3), 285-307.

Parker, R. E., Bianchi, A., & Cheah, T. Y. (2008). Perceptions of instructional technology: Factors of influence and anticipated consequences. *Journal of Educational Technology & Society, 11*(2), 274-293.

Phillips, L. A., Calantone, R., & Lee, M.-T. (1994). International technology adoption: Behavior structure, demand certainty and culture. *Journal of Business & Industrial Marketing, 9*(2), 16-28.

Piccoli, G., Ahmad, R., & Ives, B. (2001). Web-based virtual learning environments: A research framework and a preliminary assessment of effectiveness in basic IT skill training. *MIS Quarterly, 25*(4), 401-426.

Pishva, D., Nishantha, G. G. D., & Dang, H. A. (2010, 7-10 Feb. 2010). *A survey on how Blackboard is assisting educational institutions around the world and the future trends.* Paper presented at the The 12th International Conference on Advanced Communication Technology (ICACT).

Pituch, K. A., & Lee, Y.-K. (2006). The influence of system characteristics on e-learning use. *Computers & Education, 47*, 222-244.

PRWeb. (2011). Global eLearning market to reach $107.3 billion by 2015, according to new report by Global Industry Analysts, Inc. Retrieved November 6, 2011, from http://www.prweb.com/releases/elearning/corporate_elearning/prweb4531974.htm

Raajj, E. M. v., & Schepers, J. J. L. (2008). The acceptance and use of a virtual learning environment in China. *Computers & Education, 50*, 838-852.

Rea, L. M., & Parker, R. A. (1997). *Designing and conducting survey research: A comprehensive guide*. San Francisco, CA: Jossey-Bass.

Richardson, J. C., & Swan, K. (2003). Examining social presenece in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Network, 7*(1), 68-88.

Schepers, J., & Wetzels, M. (2007). A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects. *Information & Management, 44*, 90-103.

Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Siegel, D. M. (2008). *Accepting technology and overcoming resistance to change using the motivation and acceptance model.* University of Central Florida, Orlando, FL.

Sivo, S. A., Fan, X., Witta, E. L., & Willse, J. T. (2006). The search for "optimal" cutoff properties: Fit index criteria in structural equation modeling. *The Journal of Experimental Education, 74*(3), 267-288. doi: 10.3200/jexe.74.3.267-288

Sivo, S. A., Pan, C.-C., & Hahs-Vaughn, D. L. (2007). Combined longitudinal effects of attitude and subjective norms on student outcomes in a web-enhanced course: A structural equation modelling approach. *British Journal of Educational Technology, 38*(5), 861-875.

Sparks, P., Shepherd, R., & Frewer, L. J. (1995). Assessing and structuring attitudes toward the use of gene technology in food production: The role of perceived ethical obligation. *Basic and Applied Social Psychology, 16*(3), 267-285.

Straub, D. W. (1989). Validating instruments in MIS research. *MIS Quarterly, 13*(2), 147-169.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research, 6*(144-176).

Venkatesh, V. (1999). Creating favorable user perceptions: Exploring the role of intrinsic motivation. *MIS Quarterly, 23*(2), 239-260.

Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research, 11*(4), 342-365.

Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences, 39*(2), 273-315.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478.

Visser, P. S., Krosnick, J. A., Marquette, J., & Curtin, M. (1996). Mail surveys for election forecasting? An evaluation of the Columbus Dispatch Poll. *Public Opinion Quarterly, 60*(2), 181-227.

Webster, J., & Martocchio, J. J. (1992). Microcomputer Playfulness: Development of a Measure with Workplace Implications. *MIS Quarterly, 16*(2), 201-226.

White, J. T., & Myers, S. D. (2001). You can teach an old dog new tricks: The faculty's role in technology implementation. *Business Communication Quarterly, 64*(3), 95-101.

WorldWideLearn. (2010). E-learning glossary. Retrieved June 10, 2010, from http://www.worldwidelearn.com/elearning-essentials/elearning-glossary.htm

Yang, H.-H. (2007). *The effect of technology acceptance on undergraduate students' use of WebCT as a collaborative tool.* University of Central Florida, Orlando, FL.

Zhao, Y., & Cziko, G. A. (2001). Teacher adoption of technology: A perceptual control theory perspective. *Journal of Technology and Teacher Education, 9*(1), 5-30.