THE EFFECT OF TECHNOLOGY ACCEPTANCE ON UNDERGRADUATE STUDENTS' USAGE OF WEBCT AS A COLLABORATIVE TOOL

by

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ABSTRACT

The purpose of this research study was to use the Technology Acceptance Model (Pan, 2003) for re-examination of the relationships between students' attitude toward the use of WebCT and the relevance of the actual usage in light of social presence and sociability. By using Technology Acceptance Model (TAM) developed by F. Davis (1989), this study focused on variables such as perceived usefulness, perceived ease of use, computer self-efficacy, subjective norms, attitude and actual use of WebCT to account for the effect towards the achievement in the exam which is an outcome variable. The data were collected over three different time periods during the spring semester of 2007 to find how these results changed over time. The participants were the students who enrolled in the business marketing course (Principle of marketing) at the University of Central Florida in spring, 2007. The course was divided to three sections: on-campus, video-streaming and online classes. Although there were three different delivery methods, there was only one instructor and they used same material for all sections so the results were used to compare the differences from three classes. The study was conducted by using instruments to measure perceived usefulness, perceived ease of use, computer self-efficacy, subjective norms, actual use, attitude, sociability, social presence and an additional demographic instrument.

Path analysis in SAS and repeated measures ANOVA in SPSS v15.0 for Windows were used to analyze the data. The results suggest that the hypothesized extended model was a good fit. The model did indicate that students' attitude toward WebCT were determinants of the exam grades. The findings of path analysis indicated that the research did support TAM. Perceived ease of use, perceived usefulness, subjective norms and computer self-efficacy all affected to students' attitude

toward WebCT and actual usage. Sociability and social presence, which were added to the model, were both factors to influence students' attitude, too.

To my parents, Jen-Hsiao Yang & Hsiu-Ying Hua, this intellectual journey would not have completed without your constant support and love. To my loving sister, Huei-Yi, who is always proud of me with or without this accomplishment. Nothing can be more gratifying than sharing this moment with you.

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CHAPTER 1: INTRODUCTION

Background and Introduction

Technology has challenged the boundaries of educational structures that have traditionally facilitated and supported learning (Garmer & Firestone, 1996). The teaching and learning process has been dramatically altered by the convergence of a variety of technological, instructional and pedagogical developments in recent times (Bonk & King, 1998; Marina, 2001; Smith, 2002). New and innovative teaching strategies have been developed especially in the area of computer technology. Hoffman (2002) stated that the educational opportunities are now accessible and not restrained by geography, time, family and money. Instructional technology has changed the way learners make choices about when to learn, how to learn and where to learn (Ling, Arger, Smallwood, Toomey, Kirkpatrick & Banard, 2001). Technology has become an integral part of higher education, enabling students to access information rapidly and visually (Smith, 2002).

Jonassen and Reeves (1996) wrote about computer based cognitive tools and learning environments that were developed to function as intellectual partners to enable and facilitate critical thinking and higher order learning. Such technologies could have become common places for accessing information or tools for analyzing the world, interpreting and organizing personal knowledge and representing knowledge to others. In 2007, Driscoll also declared that technology has played a key role in various types of communication within the classroom. The changing means of communication could have taken place and had a real impact on learning.

Ellis, Gibbs and Rein (1991) stated that it is appropriate to think of the groupware spectrum with different systems at different points on the multidimensional spectrum. These kinds of systems also can use asynchronous and synchronous distributed interaction to enhance communication and collaboration within a real-time or non-real-time interaction.

The Technology Acceptance Model (TAM) has been widely used by researchers and practitioners to predict and explain user acceptance of information technologies (King & He, 2006; Legris, Ingham & Collerette, 2003; Ma & Liu, 2004; Schepers & Wetzels, 2007). The TAM debates system usage intentions, attitude and behavior as a function of perceived usefulness (PU) and perceived ease of use (PEU). Pan (2003) used the TAM to examine the WebCT usage from a student perspective. He received a positive attitude response that WebCT was easy to use, useful, and the model fits actual use and student's end-of-course grade. The online environment has been shown to be different from the traditional face-to-face course (Yang & Liu, 2007).

Gunawardena and Zittle (1997) found that social presence influences online learners' satisfaction. Interpersonal or social interaction occurs especially when learners have social feedback from the instructor or their peers through personal encouragement and motivational assistance. Studies have shown that social presence has a significant impact on improved learning, collaboration and satisfaction (Garrison & Anderson, 2003; Grnawardena & Zittle, 1997; Hackman & Walker, 1990; Richardson & Swan, 2003; Uziel, 2007). Smith (2006) validated that the effects of social presence and sociability on the overall TAM model were strong and suggested that these variables do influence users' perceptions of perceived ease of use significantly. Social presence theory is an important factor of distance education.

Purpose and Objectives of the Study

The purpose of this research study was to use the TAM (Pan, 2003) for re-examination of the relationships between students' attitude (AT) toward the use of WebCT and the relevance of the actual usage (AU) in light of social presence (SP) and sociability (S). This study anticipated finding evidence of students' attitude toward how WebCT influenced their use of the system to improve their learning environment. Previous research indicated that the validity and reliability of how the TAM measures PEU and PU with computer self-efficacy (CSE) (Lee, 2002; McAauley & Courneys, 1993) and subjective norms (SN) (Fisher, 1990; Wolski & Jackson, 1999); these were latent factors that would be measured to determine the differences between different types of classes using WebCT. Social presence has also been found to influence student persistent satisfaction in online learning (Arbaugh, 2001; Richardson & Swan; 2003, Smith, 2006)

Research Questions

1. How well does the initial Technology Acceptance Model (Time 1) explain the students' grades, actual use of WebCT and attitude toward WebCT?
2. How well does the initial Technology Acceptance Model (Time 2) explain the students' grades, actual use of WebCT and attitude toward WebCT?
3. How well does the initial Technology Acceptance Model (Time 3) explain the students' grades, actual use of WebCT and attitude toward WebCT?
4. How do the results obtained from the Technology Acceptance Model (TAM) change over time?

5. How do perceived usefulness (PU), perceived ease of use (PEU), attitude toward WebCT (AT), computer self-efficacy (CSE), subjective norm (SN), sociability (S) and social presence (SP) change over time by three sections of the course?

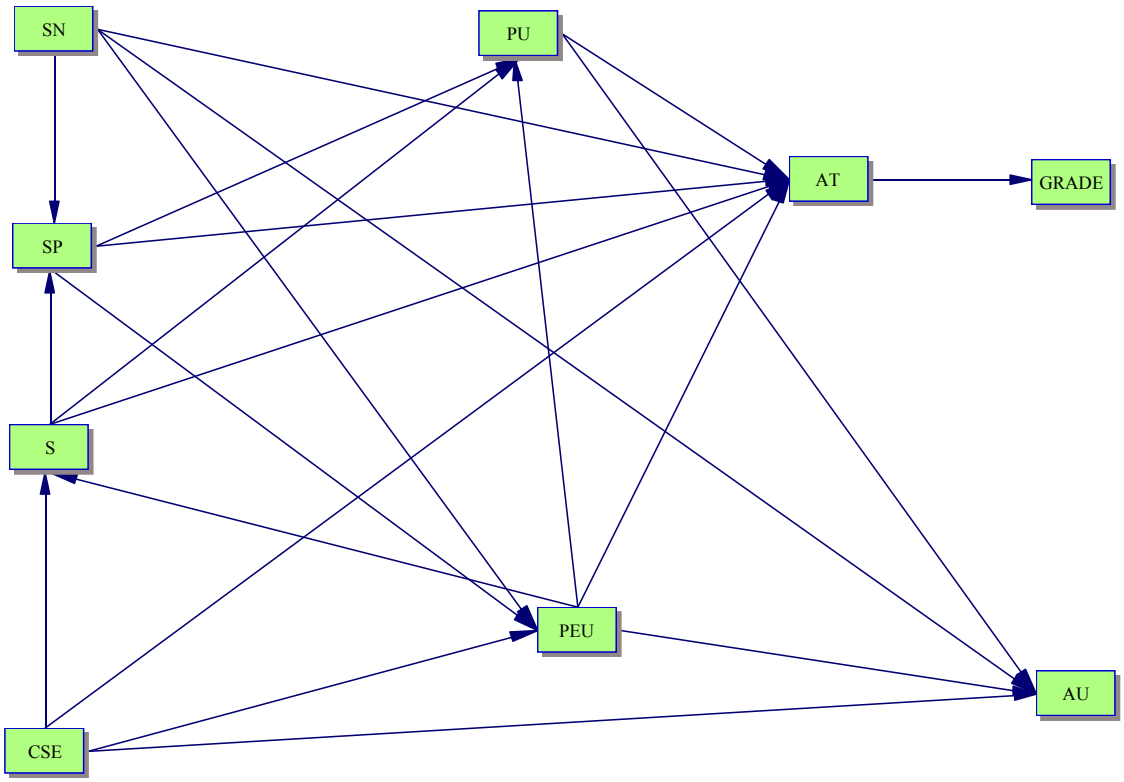


Figure 1. The Hypothesized Technology Model.

Relevance of the Study

The intent of this study was to use the hypothesized TAM (Figure 1) to test the students' attitude toward using WebCT as a collaborative tool and its impact on their actual use of the WebCT system and exam grades. The hypothesized TAM used the combined components of previous WebCT-related studies, such as Dziuban and Moskal (2001). Three sections of undergraduate business marketing course were divided into face-to-face, video streaming and

online class which represented different WebCT environments. Previously, little research has been conducted into how different environments and delivery methods affect the used technology, especially in an undergraduate business course. Although there were three sections of the class, all three delivery methods used the same instructor, which allowed for constant of the variable. The analysis of the results will help future instructors evaluate course design while considering the effect of social presence and sociability on student' attitude and actual WebCT usage. There was only one instructor for all three sections. The constant variable of the professor made this research study more effective. The study appears to be unusual because it studied TAM in lighting of sociability and social presence with only one instructor between different delivery methods.

Limitations of the Study

The limitations of the study were:

1. A self-reported study might not portray the full picture of the students' acceptance of WebCT due to the imperfections of quantitative research (Cheung, Chang & Lai, 2000).
2. Validity of the study depended on students' honesty of answering the questionnaire.
3. There were many versions of WebCT and different collaborative tools. This study tested one version (version 4.1) of WebCT but there may be differences when using different versions of WebCT or different collaborative tools.
4. Internal and external validity were limited to the reliability of the instruments utilized.
5. This was quantitative study and the qualitative inquiry was not included so the results may not be represented in multiple facets.

Assumptions of the Study

The assumptions of the study were:

1. The participants of the study responded honestly to the questionnaire items.
2. The participants answered the questionnaire on their own, without other influence or interface from others.
3. The participants could access the Web-based questionnaire.
4. Validity and reliability of the questionnaire items were secured to allow for accurate results.
5. Relationships between the variables were liner and additive, not curvilinear or interactive.
6. Variables were free of multicollinearity (not having a strong correlation with another variable).

Definition of Terms

The terms used were as follows:

Actual Use (AU): A self-reported behavioral response, measured by the individual's action in self-reported response (Davis, 1989).

Attitude (AT): Davis (1989) stated attitude is an individual's feeling or emotion about using the technology and Davis (1993) the attitude toward use of the target system, the degree to which an individual evaluates and associates the target system with his or her job.

Collaborative Tool (a.k.a. groupware): Computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment.

Collinearity (a.k.a. multicollinearity): According to Bollen (1989), "Multicollinearity is the extent to which a linear dependence exists between an explanatory variable and the other explanatory variables in an equation." Collinearity occurs when many variables in the analysis highly correlate one another.

Computer Self-efficacy (CSE): The concept of computer self-efficacy is suitable when dealing with a task that demands computer use. Computer self-efficacy refers to person's judgment of his or her capability to use a computer in prospective situations (Compeau & Higgins, 1995).

Cronbach Alpha coefficient: Commonly used measure of reliability for a set if two or more construct indicators. A customary cut-off point is 0.70. (Fraenkel &Wallen, 1996)

Distance Education (a.k.a. distance learning): Shelly, Cashman, Gunter, and Gunter (2002) defined distance education as "Delivery of education form one location to another; the learning takes place at this other location."

Path analysis: A model that "…concerns only observed variables and structural models: multiple exogenous and endogenous variables; endogenous variables can affect one another" (Kline, 1998). A path diagram is always used to depict the causation in path analysis.

Perceived Ease of Use (PEU): Davis (1989; 1993) defined "the degree to which a person believes that using a particular system would enhance his or her job performance"

Perceived Usefulness (PU): According to Davis (1989), PU refers to "the degree to which a person believes that using a particular system would be free of effort."

Sociability (S): "to be the extent the computer supported collaborative learning (CSCL) environment is able to give rise to… a social space" (Kreijns et al., 2002)

Social Presence (SP): Short, Williams & Christie (1976) define social presence as the "degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships."

Subjective Norms (SN): According to Robinson (2001), subjective norms include users' perception of the external forces/pressures and their motivation to comply with the forces/pressures.

Video Streaming: Videos into web pages for delivery via the Internet. Video is immediately played by your computer as it is downloaded from the Internet to your computer (McCronhon, Lo, Dang & Johnston, 2001).

CHAPTER 2: LITERATURE REVIEW

Introduction

This review of literature was composed of three areas: (1) collaborative tools used in online courses; (2) the Technology Acceptance Model with computer self-efficacy and subjective norms; (3) sociability and social presence. This chapter begins with a review of collaborative tools used in online courses.

Technology Acceptance Model (TAM) was adapted as a fundamental base for this study. The TAM has been and continues to be widely used by researchers and practitioners to predict and explain user acceptance of information technologies. The role of online learning systems has been considered to be an enhancement or supplemental material for learning (Cauble & Thurston, 2000). Although technology in learning appears to be an effective tool for learning, the learning environment facilitated with technology has become sufficient and necessary to impact traditional teaching and learning experiences (Rickeetts, Wolfe, Norvelle & Carpenter, 2000).

While many factors were responsible for the disparity between technologies and online learners, various studies indicated that the technology could help to raise student achievement and narrow the gap between instructor and student. Web-based collaborative tools allow students to generate different functions in a cooperative, distributed setting was widely used in online environments. Collaborative tools could be used for any goals and concepts in nearly every aspect of teaching and learning (Peirce, 2003).

The online environment has been different from traditional face-to-face courses (Yang &

Liu, 2007). Due to this particular circumstance, communications and interactions with others have been more complicated. Online distance education research has suggested that social presence had a significant influence on post-secondary student's satisfaction and performance in online courses (Arbaugh, 2001; Gelderman, 1998; Picciano, 2002; Richardson & Swan, 2003). Lasane, Sweigard, Czopp and Howard (1999) have claimed that students regard the cultivation of social relationships and recognition of balance between work and play as a significant part of college social development.

Collaborative Tool

In this context, collaboration has been defined as working together to fulfill a shared, collective, bonded goal. In the 1990s, collaborative learning had received a lot of attention in higher education, with numerous articles and books touting its virtues. Bruffe also (1993) stated that collaborative learning assumes that knowledge is a consensus among the members of a community of knowledgeable peers by talking together and reaching agreement. Software that allows teams or groups to interact is called collaborative software.

Collaborative software defined groupware as "computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment (Ellis, Gibbs & Rein, 1991)" (P.40). Collaborative tools involve communication, sharing of resources and sharing ideas. Groupware has been often used to mean collaborative software, but collaboration tools were being used before computers existed, as the basis for computer supported cooperative work. Everything that helped to solve a predefined task together in a group more easily was an effective collaborative tool (Doll & Deng, 2002).

Collaborative tools have also been described as automated tools that provide a means for collaboration. Expanding these concepts of collaboration and the successful use of collaborative tools has been based on a series of assumptions, including:

1. For complex problems requiring many skills and operations, groups outperform their best member because problem-solving skills and knowledge were beyond those of any one member.
2. Working in task oriented teams and sharing knowledge were critical elements of success.
3. Work group technology created new opportunities for teams or organizations that span boundaries.
4. Effective communication was prerequisite for coordination and collaboration.
5. Work group computing plays a pivotal role in leveraging knowledge and expertise in a rapidly changing environment.

There have been many software programs and services available for web-based communication and collaboration. They introduced educational activities that they most support: communication, collaboration, or coordination. The process of collaboration can be synchronous or asynchronous. In a synchronous system, users use the system at the same time, and in real time, to work together on a common task, whereas, in an asynchronous system, users work on the same common task but at different points in time. The collaborative tools have been broken down in to a variety of tools, including knowledge management, knowledge creation and information-sharing tools. Another way to look at collaborative tools is according to levels of collaboration:

- Electronic communication tools: email, voice, instant messaging.
- Electronic conferencing tools: data conferencing (white board capacity), audio and video conferencing, message boards (asynchronous discussions) and real-time chat sessions (synchronous).
- Collaborative management tools: time management software such as electronic calendars, project management tools, knowledge management tools and workflow systems.

All of the collaborative tools (asynchronous and synchronous) discussed here have been proven or have shown the potential to increase interaction and enhance learning in the online environment (Mason, Chesemore & Noord, 2006; Cavus & Ibrahim, 2007). Peirce (2003) summed up the rewards and challenges as beyond the basic rudiments of teaching and learning and promoting intellectual growth and encouraging students to question favored approaches or methodologies that dominate our disciplines.

Collaborative tools have been used for any goals and concepts for nearly every aspect of teaching and learning. Important facets have included the capture and management of documents, email, records, and a host of other information assets. The learning process, information storage, security, and retrieval have been shown to be important aspects that demand thorough attention as well. Collaboration tools have helped individuals work together more effectively through the use of online conferences, email, digital whiteboards, and instant messaging. These tools have become popular features offered by any collaboration software programs and services. Software has enabled a team of users to convene in one virtual boardroom to develop documents and other

projects. As a result, students have been shown to learn better even when they have been accessing instruction remotely.

Collaborative tools have been shown importance because they allow teams to work more effectively without losing time to travel to a location to work jointly. They also have provided an environment for managing complex projects using dispersed, cross-functional teams. The key benefits have been to allow team members to share information, set timelines and objectives, and streamline business processes across an entire organization. Students have been able to stay connected with each other and the instructor has facilitated more complex collaboration required for critical projects, processes and content. Taneva et al. (2004) have suggested that all interaction between students is mediated through the computer, and hence, by "logging on it" maintains a complete record of this interactions. The collaborative tools have also allowed for a detailed, machine-readable record of the students' interaction with their reference materials.

The biggest challenge facing in collaborative tool usage has been convincing people to use it. If people don't feel comfortable with the software, they won't show a consistent record of usage as measured by number of uploads. Another important challenge has been to overcome the establishment of clear policies and procedures for use of collaborative tools in teaching. When policies and procedures were not addressed early in the implementation process, there have been long-term difficulties, such as isolation and misunderstanding. Instructors should be sure to establish the necessary rules to ensure that the technologies will be used to benefit the instruction (Mason, Chesemore & Noord, 2006).

The Technology Acceptance Model

This study has focused on the students' intentions to adopt and use technology in an online course. The success of online technology for students' performance was dependent upon their acceptance of the use of web-based technology to obtain course information and interact with others as an alternative to a traditional face-to-face course. The study of technology adoption research has been shown to be important to improve instructional design and create an efficient learning environment which could be acceptable for students (Davis, 1989; Ong, Lai, & Wang, 2004; Zhao & Cziko, 2001)

Based on Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA), Davis (1989) expanded TAM into a compressed and powerful theoretical model which identified two distinct constructs: perceived usefulness (PU) and perceived ease of use (PEOU) which directly affected the attitude toward targeted system use and indirectly affected actual system use (Davis, 1993). The model determined an individual's acceptance and behavioral intent to use a technologically-based system.

The definitions of each factor were as follows:

- Perceive usefulness (PU) has been defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p.320; Davis, 1993, p.477).
- Perceived ease of use (PEU) has referred to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989) (p. 320).
- Attitude toward use of target system has been defined "the degree to which an individual evaluates and associates the target system with his or her job" (Davis, 1993) (p. 476).

- Actual system use has been defined “a behavioral response, measured by the individual’s action in reality (Davis, 1989).

The TAM posits that behavior intention to use technology was a function of perceived usefulness and perceived ease of use. A wide variety of researches have shown the intention to use a technology has been the strongest predictor of actual usage behavior (Davis & Venkatesh, 2004; Venkatesh & Davis, 2000). It has been postulated that the intention to use a technology is more directly influenced by the individual’s perception of its usefulness even if they did not have a positive attitude toward using the technology (Venkatesh & Davis, 1996; Venkatesh & Davis, 2000). Therefore, as the model has been further developed, attitude toward using the technology has been removed based on empirical evidence that the attitude construct was not shown to fully mediate the effects of perceived usefulness or intention (Davis, 1989; Davis & Venkatesh, 2004).

Self-efficacy has been shown to be concerned with individual’s perceived ability to perform certain behaviors (Bandura, 1977; Bandura, 1982). Bandura (1977, 1982) has defined perceived self-efficacy as personal judgments of one’s capabilities to organize and execute certain courses of action. Self-efficacy has been shown to involved judgments of capabilities to perform activities rather than personal qualities (Zimmerman, 1995, 2000). The concept of computer self-efficacy has been shown to be suitable when dealing with a task that demands computer use. Computer self-efficacy has referred to a person’s judgment of his or her capability to use a computer in prospective situations (Compeau & Higgins, 1995). Researches have shown self-efficacy has been a good predictor to student achievement in online courses, in other words, the more capabilities they used, the more effective the students (Jourdan, 2003; Mylona, 1999; Pan, et al., 2005a; Pan, et al., 2005b).

Triandis (1994) has defined norms as ideas about what is correct behavior for members of a particular group. Subjective norms have been represented as perceived external pressures to use (or not to use) the system (Liker & Sindi, 1997). Subjective norms have included vertical pressure, which referred to the social pressure from people who were either superordinate or subordinate to the individual, and horizontal pressure, which referred to the social pressure from people closely related to the individual (Anadarajan, Igbaria & Anakwe, 2000). Subjective norms have been shown to have a significant effect on behavioral intent and adoption of a new system (Anadarajan, Igbaria & Anakwe, 2000; Liker & Sindi, 1997; Schepers &Wetzels, 2007).

Fishbein and Ajzen (1975) have provided the theoretical basis in developing the Theory of Reasoned Action (TRA) that emphasized the importance of the determinant's consciously intended behaviors. TRA has suggested that a person's behavior was determined by his/her intention to perform the behavior and that this intention has, in turn, been a function of his/her attitude toward the behavior and his/her subjective norms. The best predictor of behavior has been shown to be intention. Based on the TAM, Venkatesh and Davis (2000) stated that subjective norms have a significant direct effect on usage intention over and above perceived usefulness and perceived ease of use for target system.

Sociability and Social Presence

The root of the construct social presence has been traced back to Mehrabian's (1969) concept of immediacy, which he defined as "those communication behaviors that enhance closeness to and nonverbal interaction with another" (p. 203). His research has suggested that nonverbal cues such as facial expressions, body movements, and eye contact increase the sensory stimulation of

interlocutors. This in turn has led to more intense, more affective, more immediate interactions. Short, Williams, and Christie (1976) have postulated that the inability of these media to transmit nonverbal cues would, as Mehrabian had shown, have a negative effect on interpersonal communication. It was Short et al. (1976) who introduced and defined the term social presence as degree of salience of the other in an interaction and the consequent salience of their interpersonal interactions.

Sproull and Keisler (1986) regarded the implications of Mehrabian's (1969) work from a different perspective. They argued that the critical difference between face-to-face communication and mediated communication was the absence of social context cues. Their research indicated that the lack of cues to define the nature of a social situation had led to uninhibited communication such as hostile and intense language (i.e., flaming), greater self-absorption, and a resistance to defer speaking turns to higher-status participants.

This dimension has pertained to the social and/or affective remarks that appear in the discourse. Garrison, Anderson & Archer (2001) argued that the cognitive presence dimension has been enhanced and sustained by establishing socio-emotional interaction within the groups. Social presence refers to the development of a supportive environment in which participants feel comfortable enough to publicly share and express their ideas within a collaborative context.

The effectiveness of group learning in an asynchronous distributed learning group has been shown to depend largely on the social interaction that takes place during the collaborative activities in a computer-supported collaborative learning (CSCL) environment (Wagner, 1994; Swan, 2002). Rourke et al. (1999) also evaluated social presence and confirmed that the sociability and educational effectiveness of the two computer-conferencing classes. Swan and

Shih (2005) have found that high social presence group online students have different perceptions of learning from low social presence group standards interacting with their classmates.

Gunawardena (1995) have conducted significant research demonstrating that social presence has had a positive affect on student satisfaction and performance. Swan (2002) also conducted an intensive study which found that students who perceived that they had greater interaction reward with the instructor showed improved learning and better experiences in online courses. Heinich (2002) had advocated that interaction with the information and learning environment provided for newly constructed knowledge, skills and attitudes. Interaction has been especially important to create a sense of social presence for an online learner (Murphy & Cifuentes, 2001). Kearsly (2000) stated that the most important role of the instructor in online classes was to ensure a high degree of interactivity and participation. The instructor has played an important role to facilitate the learner's interactions within the context of an online environment.

Kreijns, Kirschner, Jochems and Van Buuren (2004a, 2004b) have clarified that social presence and sociability were two separate constructs. They have defined sociability as "to be the extent the CSCL environment is able to give rise to … a social space. Or more precisely, the extent to which a CSCL environment is able to facilitate the emergence of a social space" (p.157). Sociability refers to those social policies and technical structures that support the community's shared purpose and social interactions among group members (Preece, 2000). One challenge has been to technical structures to support human-computer interactions and another has been to

develop technical structures that support human-human interactions as mediated through technology.

Summary

The fourth type of interaction have shown to be unique to distance education, learner-interface, has been added to Moore's (1989) three types of interaction, learner-instructor; learner-content; and learner-learner by Hillman, Willis, and Gunawardena (1994). The learner-interface interaction has been the interaction that takes place between the learner and technology. Students must use the technology to interact with the content, the instructor, and the other students. Wiley (2006) discussed sociability in online learning environments. He pointed out that the achievement of higher order learning outcomes requires social interaction to be an integral part of the learning experience. The key to the efficacy of collaborative learning has been to be social interaction and lack of it has been a factor causing the negative effectiveness of collaborative learning (Kreijns et al, 2003). Kreijns et al. (2003) have believed that designing a sociable CSCL environment has been the solution for collaborative learning efficacy.

Moore (1989) has observed that distance educators have often limited themselves to one medium which has, for example, limited the incorporation of all three types of interaction. It has been shown that educators should incorporate all three types of interaction in all types of mediums. Collaborative tools have been computer-based systems which included different functions that support people engaged in a common task or goal and that provide an interface to shared environment.

Davis' (1985) Technology Acceptance Model (TAM) has drawn on a

belief-affection-behavior relationship and has received great attention and has been documented for decades. Probing of the learning process in a marketing course using WebCT from the perspective of system design characteristics has been rarely done. The purpose of this study is to use the Technology Acceptance Model to examine the usage of collaborative tools for six variables, such as perceived ease of use, perceived usefulness, student attitude toward WebCT, subjective norm, computer self-efficacy and student actual use of the WebCT. The study has been also expanded the TAM by factoring in two variables, social presence and sociability while the instructor variable was held constant.

CHAPTER 3: RESEARCH METHODOLOGY

Introduction

Derived from Davis' (1985) Technology Acceptance Model (TAM), a hypothetical model has been designed to replicate the TAM on students' attitude toward the use of WebCT, the relevance of the actual usage and exam grades. This study has been extended beyond many previous studies with two more constructs: sociability and social presence (Smith, 2006). Participants' demographic information has also been examined. Using the expanded version of the TAM, the study examined the causal relationships between sociability, social presence, perceived usefulness and perceived ease of use.

Design of the Study

This is a research study of students' use of WebCT in a marketing undergraduate course at the University of Central Florida (UCF) in Orlando, Florida. The purpose is to determine if the Technology Acceptance Model (TAM) could explain the relationship between different types of classes. Sociability and social presence were added to the TAM which examined the relationship between sociability, social presence, perceived usefulness, perceived ease of use and attitude. Students' personal subjective norms and self-efficacy to WebCT also were explored and measured. After the semester, the exam grades were compared to all items in the TAM and analyzed the relationships between them.

Study Population and Sample Selection

The target population of this study was the students who enrolled in the MAR3023(g)(h)(i) - Principles of Marketing which was an undergraduate course for junior students in the College of Business at the University of Central Florida (UCF) located in Orlando, Florida. This course with 1,015 students was divided into three sections: on-campus, video streaming and branch campus section. In spring, 2007, there were 432 students enrolled in the on-campus section, 483 students enrolled in the video streaming section and 100 students enrolled in the branch campus section.

The on-campus section had regular face-to-face meetings in the classroom and used WebCT as a support tool for the course material. The students of video-streaming section used WebCT to view or download the instructor's videos from the face-to-face class and also used WebCT as a support tool for the course material. WebCT was the main delivery system for the branch campus section because it was a totally online section and students did not have any face-to-face meetings or lab time. All three sections used WebCT as a collaborative tool to access lecture material and course syllabus, post messages on the discussion board, exchange email with the instructor and classmates, link to the quizzes and receive grades.

Participation of students in this study was voluntary. Participants were required to provide the PID (Personal Identification) for identification. The students were awarded extra points for completing the questionnaires as approved by the UCF IRB (University of Central Florida Institutional Review Board). The informed consent letter was signed prior to participation. The consent form included the theme, procedures of the study and human subjects' rights pertaining to the study. Whether the students participated in the study or not, there were no detrimental effect on their relationship with the instructor, the researcher, or UCF. Their responses and

students' identification were securely stored for confidentiality.

Data Collection Instrument

Based on Davis' (Davis, 1985; 1989) Technology Acceptance Model, the instruments were modified from a valid instrument (Pan, 2003). The questionnaire comprised five scales and demographic questions to measure nine constructs: perceived ease of use, perceived usefulness, attitude toward WebCT, actual usage, subjective norms, computer self-efficacy, sociability, social presence and individual descriptive information. Therefore, (1) a Usability Instrument; (2) an Attitude Instrument; (3) a Computer Self-efficacy Instrument; (4) a Subjective Norms Instrument; (5) a WebCT Use Instrument; (6) Sociability and Social Presence Instrument; (7) a Student Demographic Instrument. The following section will describe each of the instruments.

Usability Instrument

Davis (1989) contended that perceived ease of use exerted a causal influence on perceived usefulness and both in turn affected users' attitude toward new technology use. The Usability instrument measures two constructs: students' perceived ease of use and perceived usefulness of WebCT. The items in the instrument measured on a five-point scale with 1 as "Strongly Disagree," 2 as "Disagree," 3 as "Neither Agree or Disagree," 4 as "Agree," and 5 as "Strongly Agree."

Attitude Instrument

The Attitude Instrument was adapted from Ajzen and Fishbein' (1980), Stoel and Lee's (2003) Attitude scales and Venkatesh and Davis's (2000) Intention to use scale. According to

their perceptions of using WebCT, respondents were required to scale with their perceptions of using WebCT and the intention to use WebCT. The items measured on a five-point scale with 1 as "Strongly Disagree," 2 as "Disagree," 3 as "Neither Agree or Disagree," 4 as "Agree," and 5 as "Strongly Agree."

Computer Self-efficacy Instrument

The CSE instrument was based on Lee (2002) who measured student's beliefs about their computer skills. The questions included course content self-efficacy, general Internet self-efficacy, email skills self-efficacy and form use self-efficacy. Students were encouraged to answer the questions based on the perception about their skills in course content and WebCT. A total 19 items were examined by a five-point Likert scale with 1 as "Strongly Disagree," 2 as "Disagree," 3 as "Neither Agree or Disagree," 4 as "Agree," and 5 as "Strongly Agree."

Subjective Norms Instrument

Wolski and Jackson (1999) suggested that there were two types of external pressures form vertical, which was the relationship between faculty and students, and horizontal, which was relationship between students and students. Therefore, there were 2 items of 2 types of external pressures in the questionnaire and coded as Subjective Norms (SN). The items measured on a five-point scale with 1 as "Strongly Disagree," 2 as "Disagree," 3 as "Neither Agree or Disagree," 4 as "Agree," and 5 as "Strongly Agree."

System Actual Use Instrument

The system actual use included the frequency and duration of students' use of the WebCT (Davis, 1993). The frequency self-report scale was measured on a scale with 1 as "Less than

once a week," 2 as "Once a week," 3 as "Twice a week," 4 as "Three times a week," and 5 as "More than three times a week." The duration self report scale was also measured on a scale with 1 as "Less than 30 minutes," 2 as "Between 30-60 minutes," 3 as "Between 60-90 minutes," 4 as "Between 90-120 minutes," and 5 as "More than 120 minutes."

Sociability and Social Presence Instrument

The sociability and social presence instrument validated by Kreijins et al. (2004) measured social presence and sociability as predictors of student satisfaction with computer-mediated conferencing context. A total of ten items measured sociability and social presence using a five-point Likert scale with 1 as "Not Applicable At All," 2 as "Rarely Applicable," 3as "Moderately Applicable," 4 as "Largely Applicable," and 5 as "Totally Applicable" were used.

Student Demographic Instrument

General demographic information was requested in the questionnaire such as age, gender, online experience and the prior experience with WebCT. There were total 16 items in the demographic instrument.

Data Collection Procedures

After the approval of UCF IRB, the research was expected and conducted in Spring Term 2007. Students were required to review the informed consent form, which made it clear to the participants that whether or not students participated in the study, there were no detrimental effects on their relationship with the instructor, the research or the school. During, the first exam

time, the on-campus and video streaming section students were asked to go the behavior lab to fill out the first survey. At the same time, the branch campus students took the same survey online. Around three weeks later, all the students took the same survey again. Then, they took the last same survey at the final exam time. The students received an announcement from the instructor encouraging them to participate in the survey and they got the extra points for completing the survey.

Data Analysis

A path analysis design was used for this research study to test the relationships between the observed variables in the hypothesized theoretical model. All the questions were measured using five-point Likert scale. The independent variables included PU, PEU, CSE, SN, S and SP. The dependent variables were students' attitude toward using WebCT, actual usage and the exam grades. Repeated measures ANOVA also used to analyze the differences over three times.

Summary

This chapter describes the method that was used in this research study. The undergraduate students in University of Central Florida were the participants. They were enrolled the marketing class in spring, 2007. During the three exam periods, data was collected. The path analysis and repeated measures analysis of variance were used to analyze the survey results. In Chapter 4, the results are presented.

CHAPTER 4: RESULTS

Introduction

The purpose of this study was to investigate the effect of technology acceptance on undergraduate students' attitude toward their use of collaborative tool and their actual WebCT usage by replicating the Technology Acceptance Model (TAM) study. In addition to re-examination of the TAM, this study was extended by adding sociability and social presence to the hypothetical model. Though the instruments were adapted from the literature, the author attempted to reaffirm that the instrument carried the validity and reliability to satisfactory degree. Thus exploratory factor analysis and internal consistency reliability analysis were done using SPSS for windows. To test the theoretical model a path analysis was performed using SAS statistical software. The repeated measures ANOVA were also tested using SPSS to look the changes of each variable over three times.

A total of 693 students participated in the survey designed for the study who were enrolled in the Principle of Marketing course in the spring semester, 2007. The survey was administered three times during the semester to see the incremental change in different variables towards the contribution to exam grade of students. Of those, 410 students participated in the initial Technology Acceptance Model (Time 1), 416 students participated in TAM 2 and 272 students participated in TAM 3. The survey questionnaire was administered in the behavior lab or online on a voluntary basis. All consent forms were completed prior to data collection. Student information was retained in a confidential manner as required by the UCFIRB.

Student demographics indicated that 49.6% of the participants were male and 50.4% were

female students in the marketing class. Overall, 77.2% of students were juniors, 19.2% were seniors, 3.3% were sophomores and only 0.3% were freshmen. In addition, more than 45% of students had completed more than 5 WebCT courses.

Reliability

There were five scales used to measure perceived usefulness, perceived ease of use, attitude, computer self-efficacy, subjective norms, sociability and social presence. The perceived usefulness scale, perceived ease of use and social presence had three items; computer self-efficacy, 18 items; attitude and subjective norms had four items; and sociability has seven items for a total of 42 items. An internal consistency reliability testing for those seven scales was examined, using SPSS version 15.0 for windows. The reliability of those five scales was studied and is presented by the following table with three times.

Table 1. Internal Consistency Reliability Coefficients.

	PU	PEU	AT	CSE	SN	S	SP
Time 1	0.872	0.760	0.842	0.845	0.672	0.826	0.840
Time 2	0.890	0.758	0.837	0.861	0.615	0.812	0.825
Time 3	0.866	0.805	0.828	0.895	0.651	0.811	0.769

From the Cronbach Alpha Coefficients of reliability analysis of the data varied on three time occasions varied from 0.615 to 0.895. The PU, PEU, AT, CSE, S and SP are all deemed satisfactory except SN.

Research Question 1

How well does the initial Technology Acceptance Model (Time 1) explain the students' grades, actual use of WebCT and attitude toward WebCT?

Path analysis is a way of analyzing the direct and indirect effect of variables hypothesized as causal. SAS was used to find the coefficients of the pathways through multiple regressions. The Goodness of Fit (GFI) and McDonald's Centrality were both 0.98. The Bentler's Comparative Fit was also 0.99. Conventionally, researchers recommend a measurement result greater than 0.90 (Sivo, Pan & Hahs-Vaughn, in press); Therefore, fit index suggested that the model fit extremely well and did a good job of explaining the covariation in the data. The Root Mean Square Error of Approximation (RMSEA) is used to estimate the lack of fit in a model compared to a perfect model. Values of 0.08 or less are desired (Fan & Sivo, 2005; Sivo, Fan, Witta & Willse, 2006) and results of this model indicate an excellent model fit with a RMSEA of 0.049.

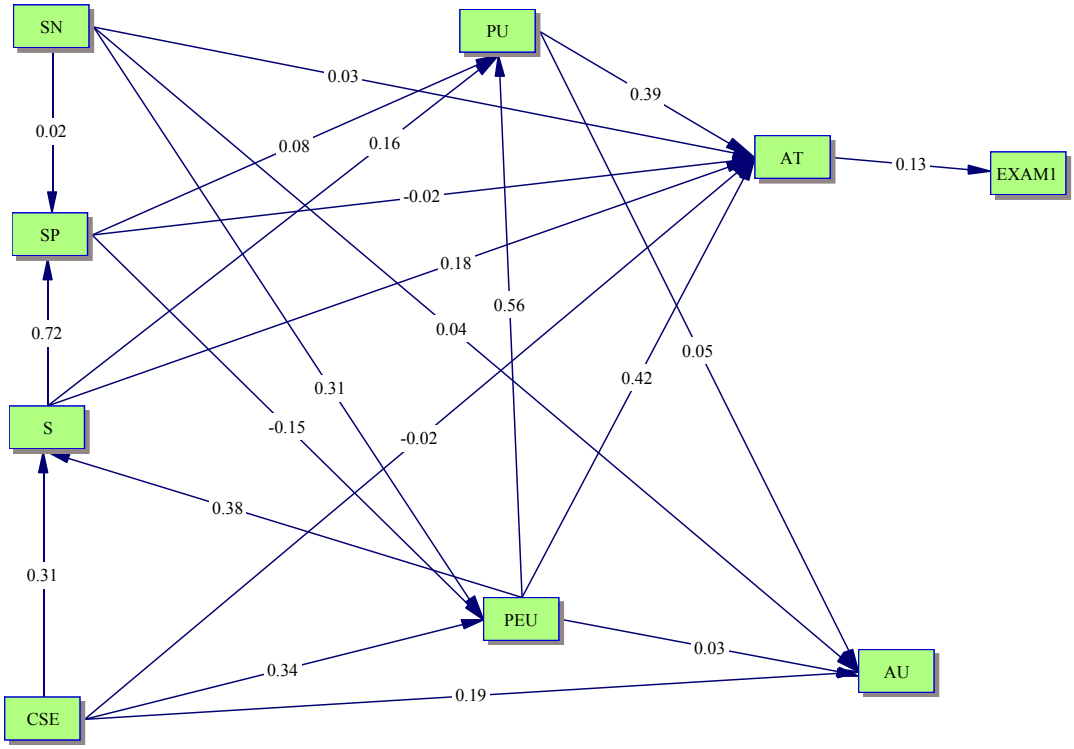
At time 1, 410 students completed the survey. Students' attitude toward using WebCT explained approximately 2% of the variance in their exam grades. The perceived usefulness and perceived ease of use explained about 50% and 19% of the variance in students' exam score respectively. In the initial Technology Acceptance Model (Time1), the perceived ease of use contributed highest ($\beta = 0.56$) to perceived usefulness. The computer self-efficacy apparently contributed the most ($\beta = 0.34$) and the subjective norm contributed second ($\beta = 0.31$) to perceived ease of use. The social presence is the lowest ($\beta = 0.15$) contributor to path coefficients of perceived ease of use.

The attitude variable was most supported by the perceived ease of use (β = 0.42), perceived usefulness (β = 0.39), sociability (β = 0.18), social presence (β = 0.02), computer self-efficacy (β = 0.02) and subjective norm (β = 0.03), the least. Both the perceived ease of use (β = 0.38) and computer self-efficacy (β = 0.31) contributed to the sociability. Sociability is apparently contributed the most (β = 0.72) to social presence. For the actual use, the computer self-efficacy supported the most (β = 0.19) and the perceived ease of use was the least. The attitude variable supported the exam grade. In accordance with the results the relationships among variables in the initial TAM (Time1) are illustrated as follows, using path analysis.

Table 2. Path Equations for Time 1

1.	PU	=	0.5627 PEU	+ 0.1593 S	+ 0.0826 SP	+ 0.7310
2.	PEU	=	0.3439 CSE	- 0.1512 SP	+ 0.3083 SN	+ 0.9010
3.	AT	=	0.3909 PU	+ 0.4171 PEU	+ 0.1849 S	- 0.0246 SP
			- 0.0203 CSE	+ 0.0338 SN	+ 0.5525	
4.	S	=	0.3785 PEU	+ 0.3104 CSE	+ 0.8517	
5.	SP	=	0.7231 S	+ 0.0150 SN	+ 0.7157	
6.	AU	=	0.0541 PU	+ 0.0263 PEU	+ 0.1946 CSE	+ 0.0374 SN
			+ 0.9684			
7.	Exam 2	=	0.1285 AT	+ 0.9917		

PU: perceived usefulness; PEU: perceived ease of use; AT: attitude toward WebCT; CSE: computer self-efficacy; SN: subjective norm; AU: actual use; S: sociability; SP: social presence



PU: perceived usefulness; PEU: perceived ease of use; AT: attitude toward WebCT; CSE: computer self-efficacy; SN: subjective norm; AU: actual use; S: sociability; SP: social presence

Figure 2. TAM 1

Inspection of the squared multiple correlations suggested that in Time1, the combined contribution of PU, PEU, S, SP, CSE and SN to the variance of AT was explained about 70%. The PU and PEU were being the two highest contributors of this explanation. The attitude toward WebCT was explained by only about 2% of the students' exam grade.

Table 3. Squared Multiple Correlation Time 1

	Variable	Error Variance	Total Variance	R-Square
1	Perceived usefulness time 1	0.53519	1.00149	0.4656
2	Perceived ease of use time 1	0.81998	1.01012	0.1882
3	Attitude toward WebCT time 1	0.30706	1.00604	0.6948
4	Sociability time 1	0.72808	1.00382	0.2747
5	Social presence time 1	0.51274	1.00101	0.4878
6	Exam 1	0.98358	1.00010	0.0165
7	Actual use time 1	0.93595	0.99813	0.0623

Research Question 2

How well does the initial Technology Acceptance Model (Time 2) explain the students' grades, actual use of WebCT and attitude toward WebCT?

At time 2, the Goodness of Fit (GFI) was 0.97; the Bentler's Comparative Fit was 0.97; McDonald's Centrality was 0.95. Conventionally, researchers recommend a measurement result greater than 0.90 (Fan & Sivo, 2005; Sivo, Fan, Witta & Willse, 2006; Sivo, Pan & Hahs-Vaughn, in press); Therefore these fit index suggested that the model fit extremely well and did a good job of explaining the covariation in the data. The RMSEA is used to estimate the lack of fit in a model compared to a perfect model. The results of this model indicate an acceptable fitting model with a RMSEA of 0.087.

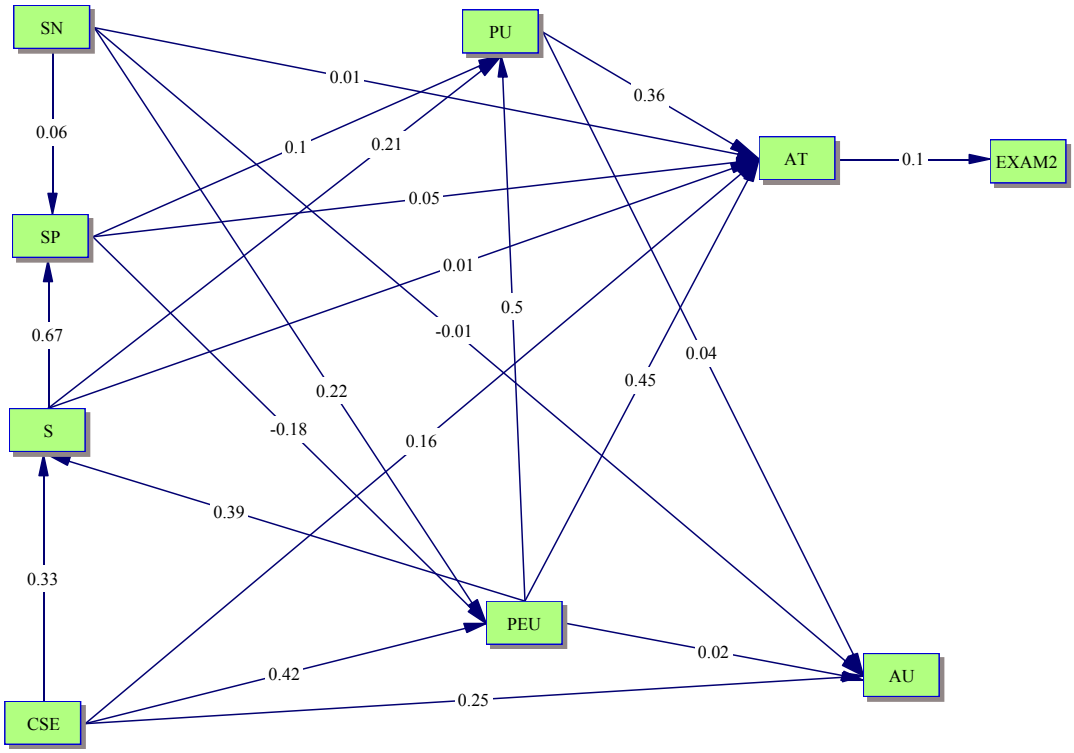
At Time 2, there were 416 students completed the survey. The perceived usefulness was highly supported by perceived ease of use ($\beta = 0.5$) and by sociability ($\beta = 0.21$). Like the results for the initial TAM, the results at Time 2 suggested that students' computer self-efficacy ($\beta = 0.42$) did a better job of explaining students' perception of how easy WebCT was to use. The computer self-efficacy apparently contributed the most ($\beta = 0.42$) to perceived ease of use. The attitude variable was still most supported by the perceived ease of use ($\beta = 0.45$) and perceived usefulness ($\beta = 0.36$), but social presence ($\beta = 0.04$) and computer self-efficacy ($\beta = 0.15$) became positive in Time 2. At the same time, the perceived ease of use ($\beta = 0.39$) and computer self-efficacy ($\beta = 0.33$) were also contributed to the sociability. Unlike Time 1, the subjective norms changed to negative value to the social presence and the actual use. Although the perceived usefulness ($\beta = 0.04$) and the perceived ease of use ($\beta = 0.02$) had a lower contribution

to the actual use, the computer self-efficacy (β = 0.25) had a higher value than the first time. Some of the associated t-values are not significant. The relationships among those variables on the Time 2 are illustrated as follows.

Table 4. Path Equations for Time 2

1.	PU	=	0.4964 PEU	+ 0.2076 S	+ 0.1024 SP	+ 0.7490
2.	PEU	=	0.4180 CSE	- 0.1803 SP	+ 0.2175 SN	+ 0.8991
3.	AT	=	0.3619 PU	+ 0.4532 PEU	+ 0.0118 S	+ 0.0470 SP
			+ 0.1554 CSE	+ 0.0120 SN	+ 0.5406	
4.	S	=	0.3905 PEU	+ 0.3327 CSE	+ 0.8271	
5.	SP	=	0.6729 S	- 0.0596 SN	+ 0.7878	
6.	AU	=	0.0370 PU	- 0.0235 PEU	+ 0.2526 CSE	- 0.00958 SN
			+ 0.9673			
7.	Exam 2	=	0.1024 AT	+ 0.9947		

PU: perceived usefulness; PEU: perceived ease of use; AT: attitude toward WebCT; CSE: computer self-efficacy; SN: subjective norm; AU: actual use; S: sociability; SP: social presence



PU: perceived usefulness; PEU: perceived ease of use; AT: attitude toward WebCT; CSE: computer self-efficacy; SN: subjective norm; AU: actual use; S: sociability; SP: social presence

Figure 3. TAM 2

Inspection of the squared multiple correlations suggested that a substantial portion of each variable explained about 32% of the variation in sociability and 71% of variation in attitude toward using WebCT the second time. Only 44% of the variation in perceived usefulness was jointly explained by perceived ease of use, sociability and social presence in Time 2. The social presence, computer self-efficacy and the subjective norms also jointly explained 19% of the variation of perceived ease of use. The sociability and the subjective norms together explained about 40% of the variation in social presence. The following table (see Table 5.) showed the explained variance in the variables considered.

Table 5. Squared Multiple Correlation Time 2

	Variable	Error Variance	Total Variance	R-Square
1	Perceived usefulness time 2	0.56203	1.00189	0.4390
2	Perceived ease of use time 2	0.82023	1.01475	0.1917
3	Attitude toward WebCT time 2	0.28988	0.99193	0.7078
4	Sociability time 2	0.68702	1.00433	0.3159
5	Social presence time 2	0.62894	1.01331	0.3793
6	Exam 2	0.98943	0.99991	0.0105
7	Actual use time 2	0.93414	0.99841	0.0644

Research Question 3

How well does the initial Technology Acceptance Model (Time 3) explain the students' grades, actual use of WebCT and attitude toward WebCT?

At time 3, there were 272 students completed survey. The Goodness of Fit (GFI) and McDonald's Centrality were both 0.97. The Bentler's Comparative Fit was also 0.98. Conventionally, researchers recommend a measurement result greater than 0.90 (Sivo, Pan & Hahs-Vaughn, in press); Therefore, the fit indices suggested that the model fits extremely well and did a good job of explaining the covariation in the data. The RMSEA is used to estimate the lack of fit in a model compared to a perfect model and values of 0.08 or less are desired (Fan & Sivo, 2005; Sivo, Fan, Witta & Willse, 2006). The results of this model indicate an acceptable fitting model with a RMSEA of 0.069.

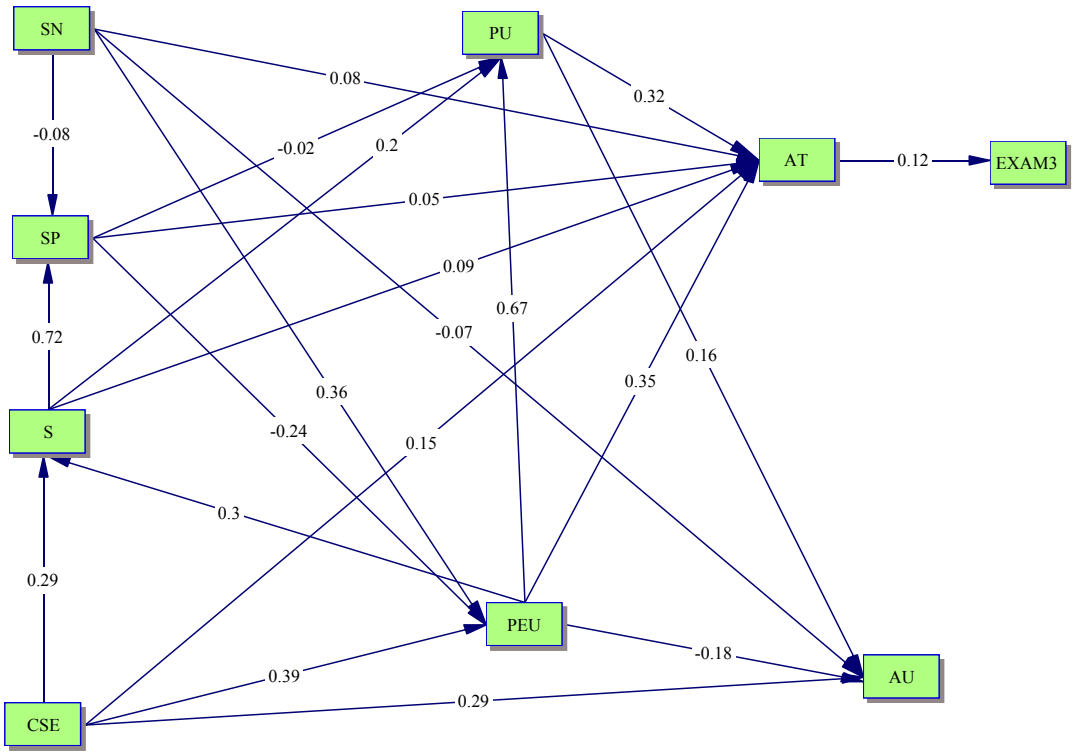
Like the Time1 and Time 2, computer self-efficacy supported perceived usefulness the most ($\beta = 0.67$) followed by the contribution from subjective norms ($\beta = 0.2$) and the social presence ($\beta = -0.02$) which indicated that students' perception about the software use was good towards improving their system usage. The perceived ease of use and sociability are the most supported to perceived usefulness of the third time. At the third time, the perceived ease of use ($\beta = 0.3$) and the computer self-efficacy ($\beta = 0.29$) contributed almost the same amount to the sociability. It showed that students' perceptions of sociability were based on the ease of WebCT use and their computer ability. The attitude variable was most supported by the perceived ease of use ($\beta = 0.35$), followed by perceived usefulness ($\beta = 0.32$), sociability ($\beta = 0.18$), computer self-efficacy ($\beta = 0.15$), social presence ($\beta = 0.08$) and subjective norm ($\beta = 0.05$). Although

attitude toward using WebCT to exam grade was a lower value at time 2, the value (β = 0.12) went up, returning to the first time level. The results of contribution of variables at Time 3 were illustrated as follows.

Table 6. Path Equations for Time 3

1.	PU	=	0.6688 PEU	+ 0.2030 S	- 0.0216 SP	+ 0.6591
2.	PEU	=	0.3983 CSE	- 0.2443 SP	+ 0.3627 SN	+ 0.7951
3.	AT	=	0.3224 PU	+ 0.3509 PEU	+ 0.0879 S	+ 0.0509 SP
			+ 0.1546 CSE	+ 0.0846 SN	+ 0.5633	
4.	S	=	0.2952 PEU	+ 0.2851 CSE	+ 0.9075	
5.	SP	=	0.7249 S	- 0.0790 SN	+ 0.7489	
6.	AU	=	0.1604 PU	- 0.1778 PEU	+ 0.2860 CSE	- 0.0678 SN
			+ 0.964			
7.	Exam 2	=	0.1233 AT	+ 0.9924		

PU: perceived usefulness; PEU: perceived ease of use; AT: attitude toward WebCT; CSE: computer self-efficacy; SN: subjective norm; AU: actual use; S: sociability; SP: social presence



PU: perceived usefulness; PEU: perceived ease of use; AT: attitude toward WebCT; CSE: computer self-efficacy; SN: subjective norm; AU: actual use; S: sociability; SP: social presence

Figure 4. TAM 3

Inspection of the squared multiple correlations suggested that the combination of perceived ease of use, sociability and social presence together explained about 57% of the variation in perceived usefulness at Time 3. About 68% of the variation in students' attitude was jointly explained by perceived usefulness, perceived ease of use, sociability, social presence, computer self-efficacy and subjective norms at the third time. The sociability and the subjective norms also jointly explained 44% of the variation of perceived usefulness. The social presence, computer self-efficacy and the subjective norms together explained about 37% of the variation in perceived ease of use. The attitude only explained 2% of the variance in exam grade. The perceived usefulness, perceived ease of use, computer self-efficacy and subjective norms also jointly explained 7% of variance in the actual use. Some of the associated t-values are not significant. The following table showed the explained variance in the variables considered.

Table 7. Squared Multiple Correlation Time 3

	Variable	Error Variance	Total Variance	R-Square
1	Perceived usefulness time 3	0.43507	1.00167	0.5657
2	Perceived ease of use time 3	0.63408	1.00310	0.3679
3	Attitude toward WebCT time 3	0.31308	0.98653	0.6827
4	Sociability time 3	0.82347	0.99996	0.1765
5	Social presence time 3	0.56299	1.00385	0.4392
6	Exam 3	0.98459	0.99979	0.0152
7	Actual use time 3	0.92376	0.99372	0.0704

Research Question 4

How do the results obtained from the Technology Acceptance Model (TAM) change over time?

The results obtained for the hypothesized TAM model found to be changed over time in the semester as the measures were administered at three different time periods. Table 8 displays how the beta coefficients change for different variables over time.

Table 8. The Change of Beta Over Time: Time1-Time2-Time3

Beta	From VAR	To VAR	Time 1	Time 2	Time 3
1	PEU	PU	0.5627	0.4964	0.6688
2	S	PU	0.1593	0.2076	0.2030
3	SP	PU	0.0826	0.1024	-0.0216
4	SP	PEU	-0.1512	-0.1803	-0.2443
5	CSE	PEU	0.3439	0.4180	0.3983
6	SN	PEU	0.3083	0.2175	0.3627
7	PU	AT	0.3909	0.3619	0.3224
8	PEU	AT	0.4171	0.4532	0.3509
9	S	AT	0.1849	0.0118	0.0879
10	SP	AT	-0.0246	0.0470	0.0509
11	CSE	AT	-0.0203	0.1554	0.1546
12	SN	AT	0.0338	0.0120	0.0846
13	PEU	S	0.3785	0.3905	0.2952
14	CSE	S	0.3104	0.3327	0.2851
15	S	SP	0.7231	0.6729	0.7249
16	SN	SP	0.0150	-0.0596	-0.0790
17	AT	EXAM	0.1285	0.1024	0.1233
18	PU	AU	0.0541	0.0370	0.1604
19	PEU	AU	0.0263	-0.0235	-0.1778
20	CSE	AU	0.1946	0.2526	0.2860
21	SN	AU	0.0374	-0.00958	-0.0678

PU: perceived usefulness; PEU: perceived ease of use; AT: attitude toward WebCT; CSE: computer self-efficacy; SN: subjective norm; AU: actual use; S: sociability; SP: social presence

From the above table of beta coefficients it was discovered that some independent variables changed steadily in their contribution towards dependent variables that are discussed as follows:

The computer self-efficacy had a steady increase in the beta coefficients to contribute to actual use starting from 0.1946 (Time 1) to 0.2860 (Time 3) over time suggesting that the computer self-efficacy best predicted students' actual usage of WebCT. The social presence to attitude toward using WebCT had the similar increasing results from 0.0246 (Time 1) to 0.0509 (Time 3) which also predicted that good social presence with positive attitude. The social presence had a steady increased in the beta to contribute to perceived ease of use starting from 0.1512 (Time 1) to 0.2443 (Time 3) with T-value bigger than 2 so the social presence was a good predictor of perceived ease of use. On the other hand, the perceived usefulness to attitude consistently dropped from 0.3909 (time 1) to 0.3224 (time 3). As time passed, the students somehow realized that use of the computer would not make their work useful for them.

The coefficient of computer self-efficacy to perceived ease of use and sociability increased in Time 2 and then dropped in Time 3 indicating that students might be confused about their ability to determine whether or not the system is easy to use and the system connections (sociability) with others in the class. The coefficient of perceived ease of use to attitude and sociability also increased in Time 2 and then dropped in Time 3 indicating that students already realized that their judgment of how the software is going to ease their work is not true or somehow mixed up. Several beta coefficients dropped from Time 1 to Time 2 and then increased in Time 3, like perceived ease of use to perceived usefulness, subjective norms to perceived ease of use, sociability to attitude, subjective norms to attitude, sociability to social presence, perceived usefulness to actual use and attitude to exam grade. The social presence to perceived

usefulness improved from 0.0826 (time 1) to 0.1024 (time 2) which meant the more they experienced the social presence the more they perceived that WebCT was useful.

The squared multiple correlations, when compared in three time periods showed consistent improvement in the variables considered (PEU and AU). The squared multiple correlations had increased from Time 1 to Time 2 and then dropped in Time 3 for the variables AT, S and SP. The squared multiple correlations had decreased from Time 1 to Time 2 and then increased in Time 3 for the variables PU, SP and exam scores.

Research Question 5

How do perceived usefulness (PU), perceived ease of use (PEU), attitude toward WebCT (AT), computer self-efficacy (CSE), subjective norm (SN), Actual use (AU), sociability (S) and social presence (SP) change over time by three sections of the course?

Perceived Usefulness

There were a total of 79 people who completed all three surveys. More precisely, there were 21 people from on-campus section, 30 people from video-streaming section and 28 people from branch campus section. Review of the means affirms that the change in ratings over time was the predicted direction. The means at time three being roughly equal in value and the means at time one of branch campus section was much higher than on-campus section (see Table 9.).

Table 9. Descriptive Statistics: Perceived Usefulness

	Class	Mean	Std. Deviation	N
COMPUTE PU_T1	On-campus	9.90	2.931	21
	Video-streaming	10.43	2.515	30
	ITV	11.86	2.223	28
	Total	10.80	2.633	79
COMPUTE PU_T2	On-campus	9.62	3.074	21
	Video-streaming	11.13	2.389	30
	ITV	11.11	2.544	28
	Total	10.72	2.689	79
COMPUTE PU_T3	On-campus	10.29	2.969	21
	Video-streaming	10.93	2.625	30
	ITV	10.82	2.374	28
	Total	10.72	2.616	79

To determine whether the three sections of the different delivery styles demonstrated perceived usefulness, the focus of this analysis is placed on the interaction between class sections and time. There was a statistically significant interaction effect ($F_{2,76}$=3.017, P=0.05) between three sections over times, which means three sections' perceived usefulness directly changed over times (see Table 10). The perceived usefulness of three different sections could be accounted for 7.4% of the change that occurred over time in the semester.

Table 10. Tests of Within-Subjects Contrasts: Perceived Usefulness

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time	Linear	.103	1	.103	.031	.861	.000	.031	.053
	Quadratic	.381	1	.381	.136	.714	.002	.136	.065
time *	Linear	20.064	2	10.032	3.017	.055	.074	6.034	.569
Class	Quadratic	8.155	2	4.077	1.452	.241	.037	2.904	.302
Error(time)	Linear	252.708	76	3.325					
	Quadratic	213.436	76	2.808					

The branch campus students responded with a higher score in PU at the beginning, but dropped over time and moved close to the other two groups. The plotted means demonstrated visually what was seen numerically above (see Figure 5).

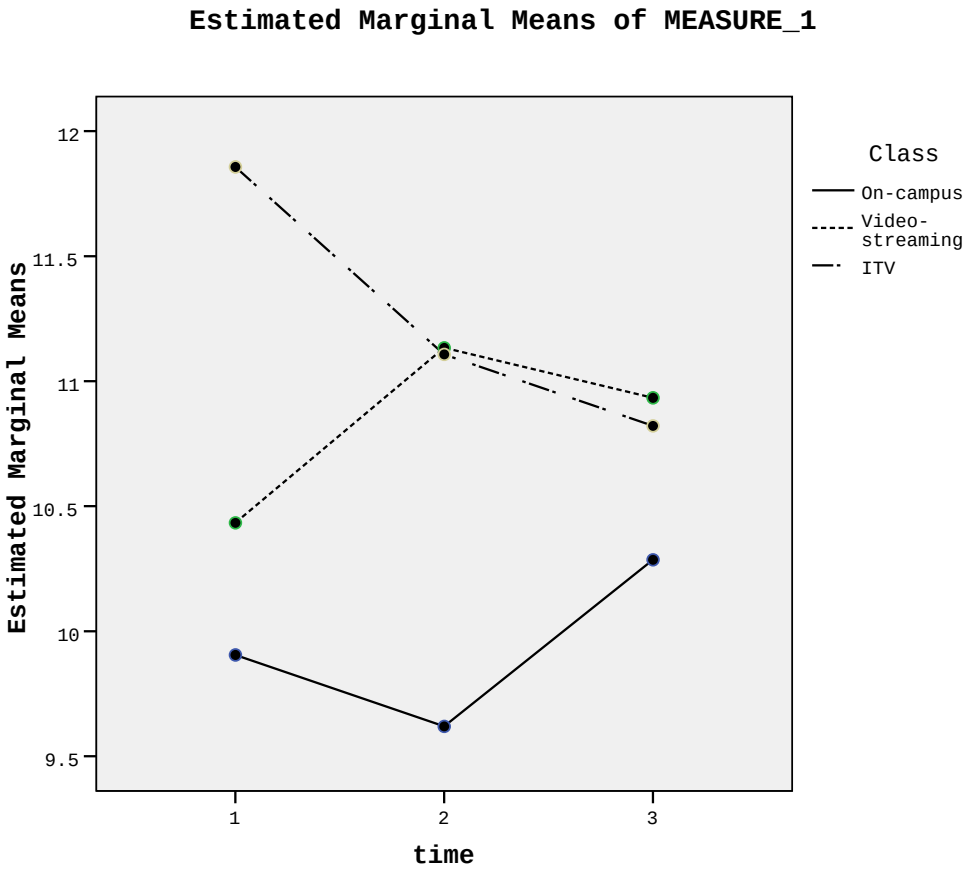


Figure 5. Perceived Usefulness Plots

Perceived Ease of Use

There was a statistically significant interaction effect ($F_{2,76}$=2.516, P=0.08) between three sections over times, which means three sections' perceived ease of use directly changed over times (see Table 11). The perceived ease of use of three different sections could be accounted for 6.2% of the change that occurred over time in the semester.

Table 11. Tests of Within-Subjects Contrasts: Perceived Ease of Use

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time	Linear	.832	1	.832	.272	.604	.004	.272	.081
	Quadratic	.156	1	.156	.072	.789	.001	.072	.058
time *	Linear	5.018	2	2.509	.820	.444	.021	1.640	.185
Class	Quadratic	10.928	2	5.464	2.516	.088	.062	5.031	.490
Error(time)	Linear	232.577	76	3.060					
	Quadratic	165.072	76	2.172					

The perceived ease of use was also a statistically significant between on-campus (M=10.81), video-streaming (M=12.022) and branch campus (M=11.905) scores ($F_{2,76}$=3.084, P=0.052). The 7.5% of variance in score could be explained by section differences (see Table 12).

Table 12. Tests of Between-Subjects Effects: Perceived Ease of Use

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Intercept	31027.500	1	31027.500	3066.804	.000	.976	3066.804	1.000
Class	62.409	2	31.204	3.084	.052	.075	6.169	.579
Error	768.908	76	10.117					

The on-campus and branch campus sections both had the highest scores of perceived ease of use in time 3 but the video-streaming section got the highest score in time 2 and the lowest score in time 3. The plotted means demonstrated visually what was seen numerically above (See Figure 6).

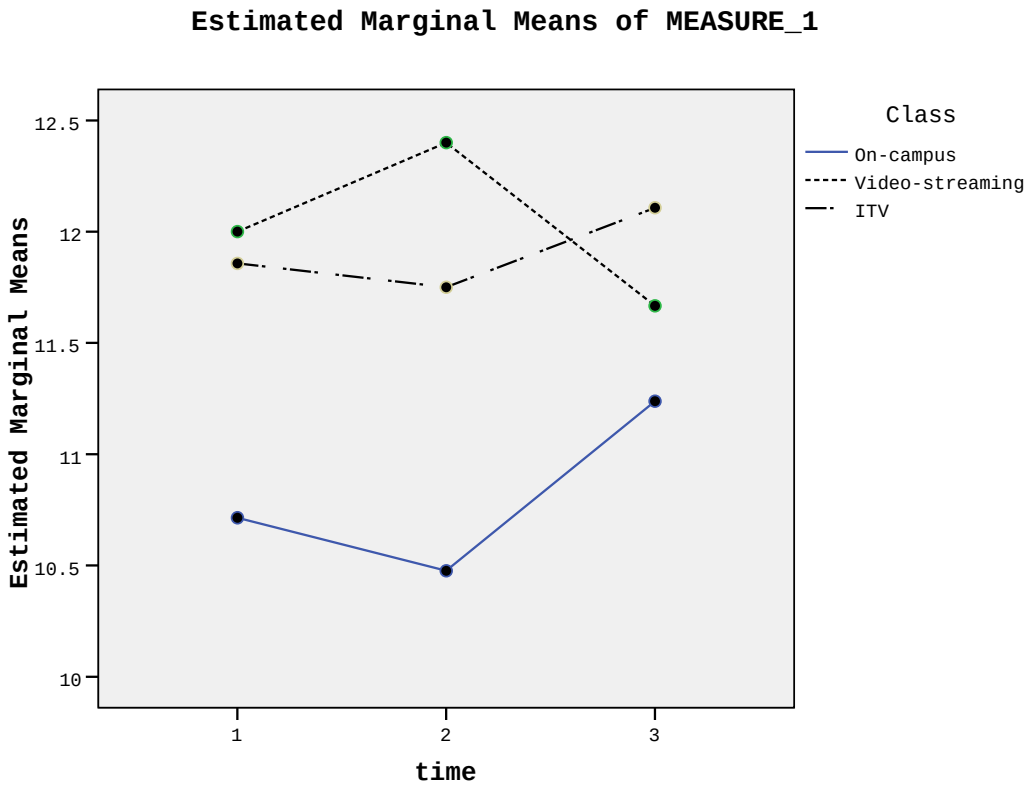


Figure 6. Perceived Ease of Use Plots

Attitude Toward WebCT

To determine whether three sections of different delivery styles demonstrated students' attitude toward using WebCT, the focus of this analysis is placed on the interaction between class sections and time. There was a statistically significant interaction effect ($F_{2,76}$=2.85, P=0.064) between three sections over times, which means the three sections' attitude directly changed the three time periods (see Table 13). The students' attitude in the three different sections could account for the 7% variance of the change that occurred over time in the research.

Table 13. Tests of Within-Subjects Contrasts: Attitude

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time	Linear	2.057	1	2.057	.564	.455	.007	.564	.115
	Quadratic	.753	1	.753	.327	.569	.004	.327	.087
time *	Linear	.154	2	.077	.021	.979	.001	.042	.053
Class	Quadratic	13.145	2	6.572	2.850	.064	.070	5.700	.543
Error(time)	Linear	277.061	76	3.646					
	Quadratic	175.252	76	2.306					

There was a statistically significant difference between attitudes of on-campus (M=13.41, s=0.532), video-streaming (M=15.16, s=0.445) and branch campus (M=15.75, s=0.46) score ($F_{2,76}$=5.784, P<0.01). Almost 13% of the variance in score could be accounted for repeated trials (See Table 14).

Table 14. Tests of Between-Subjects Effects: Attitude

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Intercept	50505.625	1	50505.625	2837.306	.000	.974	2837.306	1.000
Class	205.926	2	102.963	5.784	.005	.132	11.569	.857
Error	1352.842	76	17.801					

Multiple comparisons showed attitude had statistically significant differences between on-campus and video-streaming sections and on-campus and branch campus sections (See Table 15).

Table 15. Multiple Comparisons: Attitude

Multiple Comparisons

Measure: MEASURE_1

	(I) Class	(J) Class	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	On-campus	Video-streamin	-1.74*	.693	.037	-3.40	-.09
		ITV	-2.34*	.703	.004	-4.02	-.66
	Video-streamin	On-campus	1.74*	.693	.037	.09	3.40
		ITV	-.59	.640	.624	-2.12	.94
	ITV	On-campus	2.34*	.703	.004	.66	4.02
		Video-streamin	.59	.640	.624	-.94	2.12

Based on observed means.

*. The mean difference is significant at the .05 level.

Computer Self-efficacy

A review of Box's test for the equality of covariance revealed that the covariance matrices of the three sections were not different to a statistically significant degree. To determine whether computer self-efficacy improved over time, a review of this result revealed that there was not a statistically significant interaction effect ($F_{2,73}$=1.237, P>0.05) between three different delivery styles over time. In addition, only three percent of the variance in score could be explained by students' computer ability group differences over time (See Table 16).

Table 16. Tests of Within-Subjects Contrasts: Computer Self-efficacy

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time	Linear	53.280	1	53.280	1.390	.242	.019	1.390	.214
	Quadratic	5.502	1	5.502	.167	.684	.002	.167	.069
time *	Linear	94.813	2	47.406	1.237	.296	.033	2.474	.261
Class	Quadratic	75.491	2	37.746	1.147	.323	.030	2.293	.245
Error(time)	Linear	2797.891	73	38.327					
	Quadratic	2402.971	73	32.917					

However, there was a statistically significant difference in students' computer self-efficacy survey between on-campus (M=56.92, s=1.95), video-streaming (M=63.99, s=1.59) and branch campus (M=63.42, s=1.71) score ($F_{2,73}$=4.527, P<0.05). 11% of the variance in score could be accounted for repeated trials (See Table 17).

Table 17. Tests of Between-Subjects Effects: Computer Self-efficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Intercept	836908.260	1	836908.260	3672.428	.000	.981	3672.428	1.000
Class	2063.402	2	1031.701	4.527	.014	.110	9.054	.755
Error	16635.944	73	227.890					

Based on the scores of students' computer self-efficacy, multiple comparisons showed statistically significant differences between on-campus and video-streaming sections and on-campus and branch campus sections (See Table 18).

Table 18. Multiple Comparisons: Computer Self-efficacy

Multiple Comparisons

Measure: MEASURE_1

	(I) Class	(J) Class	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	On-campus	Video-streamin	-7.07*	2.516	.017	-13.09	-1.05
		ITV	-6.51*	2.592	.038	-12.71	-.30
	Video-streamin	On-campus	7.07*	2.516	.017	1.05	13.09
		ITV	.57	2.335	.968	-5.02	6.15
	ITV	On-campus	6.51*	2.592	.038	.30	12.71
		Video-streamin	-.57	2.335	.968	-6.15	5.02

Based on observed means.

*. The mean difference is significant at the .05 level.

Subjective Norms

To determine whether three sections of different delivery styles demonstrated students' perception of the external forces/pressures, the focus of this analysis was placed on the interaction between class sections and time. There was a statistically significant interaction effect ($F_{2,73}$=3.096, P=0.051) between three sections over times, which means the three sections' subjective norms scores directly changed over times (see Table 19). The students' perception of external pressures of three different sections could be accounted for 8% of the change that occurred over time. There was also a statistically significant difference of students' subjective norms scores between the time 1 (M=15.37, s=2.02), time 2 (M=15.05, s=2.44) and time 3 (M=14.53, s=2.36) score ($F_{1,7}$3=8.482, P=0.05). Almost 10% of the variance in score of subjective norms could be attributed to time.

Table 19. Tests of Within-Subjects Contrasts: Subjective Norms

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time	Linear	27.786	1	27.786	8.482	.005	.104	8.482	.820
	Quadratic	2.294	1	2.294	.721	.398	.010	.721	.134
time * Class	Linear	.921	2	.461	.141	.869	.004	.281	.071
	Quadratic	19.687	2	9.844	3.096	.051	.078	6.193	.580
Error(time)	Linear	239.131	73	3.276					
	Quadratic	232.084	73	3.179					

Furthermore, there was a statistically significant difference of students' perceptions of the external forces between the on-campus (M=14.25, s=0.38), video-streaming (M=15.67, s=0.31) and branch campus (M=14.77, s=0.31) score ($F_{2,73}$=4.573, P<0.05). Almost 11% of the variance in score could be accounted for repeated trials (See Table 20).

Table 20. Tests of Between-Subjects Effects: Subjective Norms

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Intercept	48771.531	1	48771.531	5921.397	.000	.988	5921.397	1.000
Class	75.333	2	37.666	4.573	.013	.111	9.146	.760
Error	601.264	73	8.236					

Multiple comparisons showed a statistically significant difference of subjective norms between on-campus and video-streaming sections (See Table 21).

Table 21. Multiple Comparisons: Subjective Norms

Multiple Comparisons

Measure: MEASURE_1

	(I) Class	(J) Class	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	On-campus	Video-streamin	-1.42*	.489	.013	-2.59	-.25
		ITV	-.53	.492	.534	-1.71	.65
	Video-streamin	On-campus	1.42*	.489	.013	.25	2.59
		ITV	.89	.439	.111	-.16	1.94
	ITV	On-campus	.53	.492	.534	-.65	1.71
		Video-streamin	-.89	.439	.111	-1.94	.16

Based on observed means.

*. The mean difference is significant at the .05 level.

In time 2, the subjective norms mean of on-campus section was higher than the branch campus section. The subjective norms means of video-streaming section steady dropped over the three times (See Figure 7).

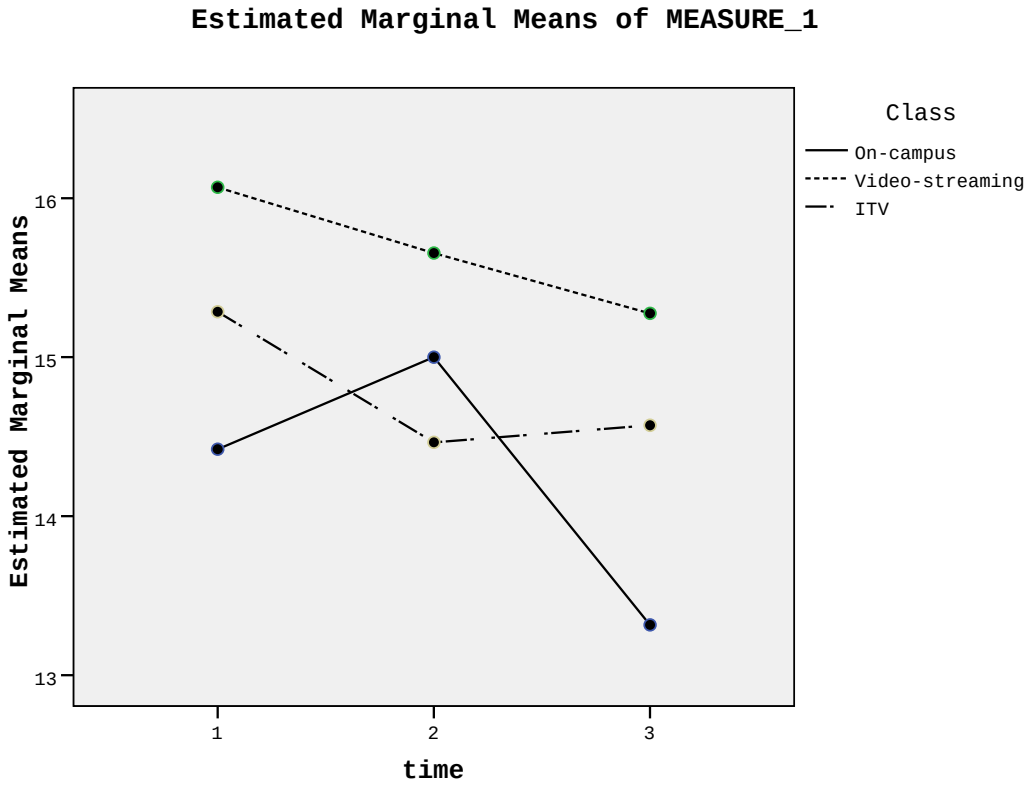


Figure 7. Subjective Norms Plots

Actual Use

There was also a statistically significant difference of students' usage of WebCT between the time 1 (M=147.72, s=98.59), time 2 (M=122.28, s=89.55) and time 3 (M=142.78, s=93.96) score ($F_{1,76}$=8.393, P=0.05) which meant students changed their ways to use WebCT over time. Almost 10% of the variance in actual usage score could be attributed to time (See Table 22).

Table 22. Tests of Within-Subjects Contrasts: Actual Use

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time	Linear	1166.786	1	1166.786	.255	.615	.003	.255	.079
	Quadratic	28257.733	1	28257.733	8.393	.005	.099	8.393	.816
time * Class	Linear	533.592	2	266.796	.058	.943	.002	.117	.059
	Quadratic	1163.669	2	581.834	.173	.842	.005	.346	.076
Error(time)	Linear	347253.750	76	4569.128					
	Quadratic	255886.964	76	3366.934					

In Table23, actual usage of WebCT also showed a statistically significant difference between the on-campus (M=91.43, s=15.88), video-streaming (M=174.67, s=13.29) and branch campus (M=132.5, s=13.75) score ($F_{2,76}$=8.189, P=0.01). Almost 18% of the variance in actual usage score could be accounted for repeated trials (See Table 23).

Table 23. Tests of Between-Subjects Effects: Actual Use

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Intercept	4085438.499	1	4085438.499	257.207	.000	.772	257.207	1.000
Class	260142.685	2	130071.343	8.189	.001	.177	16.378	.954
Error	1207173.929	76	15883.867					

Multiple comparisons showed a statistically significant difference between on-campus and video-streaming sections, which meant video-streaming students use WebCT for a longer duration of time over the course of the semester than on-campus students (See Table 24).

Table 24. Multiple Comparisons: Actual Use

Multiple Comparisons

Measure: MEASURE_1

	(I) Class	(J) Class	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	On-campus	Video-streamin	-83.24*	20.703	.000	-132.73	-33.75
		ITV	-41.07	21.005	.130	-91.28	9.14
	Video-streamin	On-campus	83.24*	20.703	.000	33.75	132.73
		ITV	42.17	19.120	.077	-3.54	87.87
	ITV	On-campus	41.07	21.005	.130	-9.14	91.28
		Video-streamin	-42.17	19.120	.077	-87.87	3.54

Based on observed means.

*. The mean difference is significant at the .05 level.

Additionally, in the actual usage of WebCT, three sections had the same responses from time 1 to time 3 and the lowest scores were in time 2. The plotted means demonstrated visually what was seen numerically above (See Figure 8).

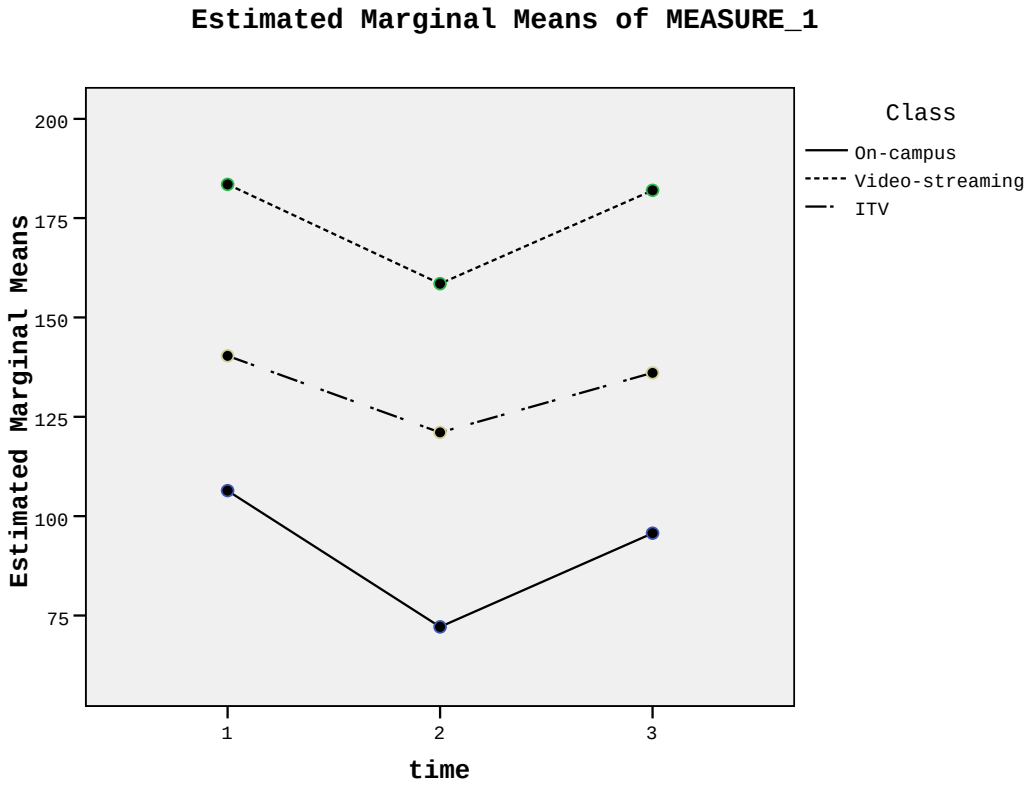


Figure 8. Actual use Plots

Sociability

In the WebCT environment, sociability was not a statistically significant interaction effect ($F_{2,76}$=0.884, P>0.05) between three different class sections over time. In addition, only two percent of the variance in score could be explained by group differences over time (See Table 25).

Table 25. Tests of Within-Subjects Contrasts: Sociability

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time	Linear	10.680	1	10.680	.810	.371	.011	.810	.144
	Quadratic	.000	1	.000	.000	.996	.000	.000	.050
time * Class	Linear	23.287	2	11.643	.884	.418	.023	1.767	.197
	Quadratic	20.880	2	10.440	1.510	.227	.038	3.020	.312
Error(time)	Linear	1001.511	76	13.178					
	Quadratic	525.478	76	6.914					

However, sociability showed a statistically significant difference between the on-campus (M=20.27, s=0.82), video-streaming (M=22.46, s=0.69) and branch campus (M=19.49, s=0.71) score ($F_{2,76}$=4.79, P<0.05). Different delivery sections can account for almost 11% of the change that occurred in the sociability scores (See Table 26).

Table 26. Tests of Between-Subjects Effects: Sociability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Intercept	99527.621	1	99527.621	2334.318	.000	.968	2334.318	1.000
Class	408.834	2	204.417	4.794	.011	.112	9.589	.781
Error	3240.390	76	42.637					

In sociability scores, multiple comparisons showed a statistically significant difference between video-streaming and branch campus sections, which meant students' sociability with other people in the class had differences between the video-steaming and branch campus class (See Table 27).

Table 27. Multiple Comparisons: Sociability

Multiple Comparisons

Measure: MEASURE_1

	(I) Class	(J) Class	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	On-campus	Video-streamin	-2.19	1.073	.110	-4.75	.38
		ITV	.78	1.088	.753	-1.82	3.38
	Video-streamin	On-campus	2.19	1.073	.110	-.38	4.75
		ITV	2.97*	.991	.010	.60	5.34
	ITV	On-campus	-.78	1.088	.753	-3.38	1.82
		Video-streamin	-2.97*	.991	.010	-5.34	-.60

Based on observed means.

*. The mean difference is significant at the .05 level.

For the sociability variable, the branch campus had the lowest mean in all three sections over time. The plotted means demonstrated visually what was seen numerically above (See Figure 9).

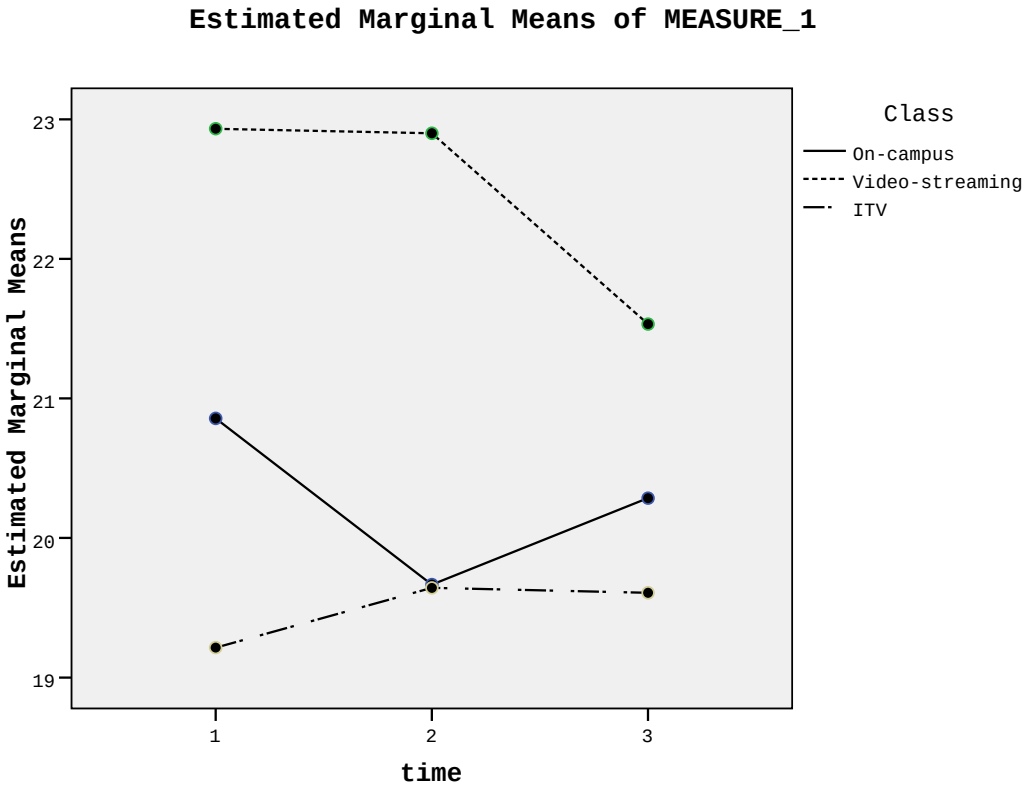


Figure 9. Sociability Plots

Social Presence

There was also a statistically significant salience of the other person in the interaction and the consequent salience of the interpersonal relationships between the time 1 (M=7.28, s=2.56), time 2 (M=7.37, s=2.96) and time 3 (M=7.94, s=2.64) social presence score ($F_{1,76}$=4.158, P<0.05). Almost 5% of the variance in social presence score could be attributed to time (See Table 28). To ensure that the change was in the predicted direction, it was important to inspect the means in Table 29.

Table 28. Tests of Within-Subjects Contrasts: Social Presence

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time	Linear	17.430	1	17.430	4.158	.045	.052	4.158	.521
	Quadratic	3.690	1	3.690	1.017	.317	.013	1.017	.169
time * Class	Linear	4.328	2	2.164	.516	.599	.013	1.032	.132
	Quadratic	4.428	2	2.214	.610	.546	.016	1.220	.148
Error(time)	Linear	318.558	76	4.192					
	Quadratic	275.859	76	3.630					

Table 29. Descriptive Statistics: Social Presence

		Class	Mean	Std. Deviation	N
COMPUTE	SP_T1	On-campus	6.76	2.773	21
		Video-streaming	7.90	2.746	30
		ITV	7.00	2.091	28
		Total	7.28	2.557	79
COMPUTE	SP_T2	On-campus	6.52	3.356	21
		Video-streaming	7.70	3.164	30
		ITV	7.64	2.329	28
		Total	7.37	2.958	79
COMPUTE	SP_T3	On-campus	7.48	2.600	21
		Video-streaming	8.17	2.960	30
		ITV	8.04	2.349	28
		Total	7.94	2.643	79

Review of the means affirms that the change in scores over time was the predicted direction with the on-campus group, which was lower than the other two groups. Over three times, the branch campus group increased the most. The plotted means demonstrated visually what was seen numerically above (See Figure 10).

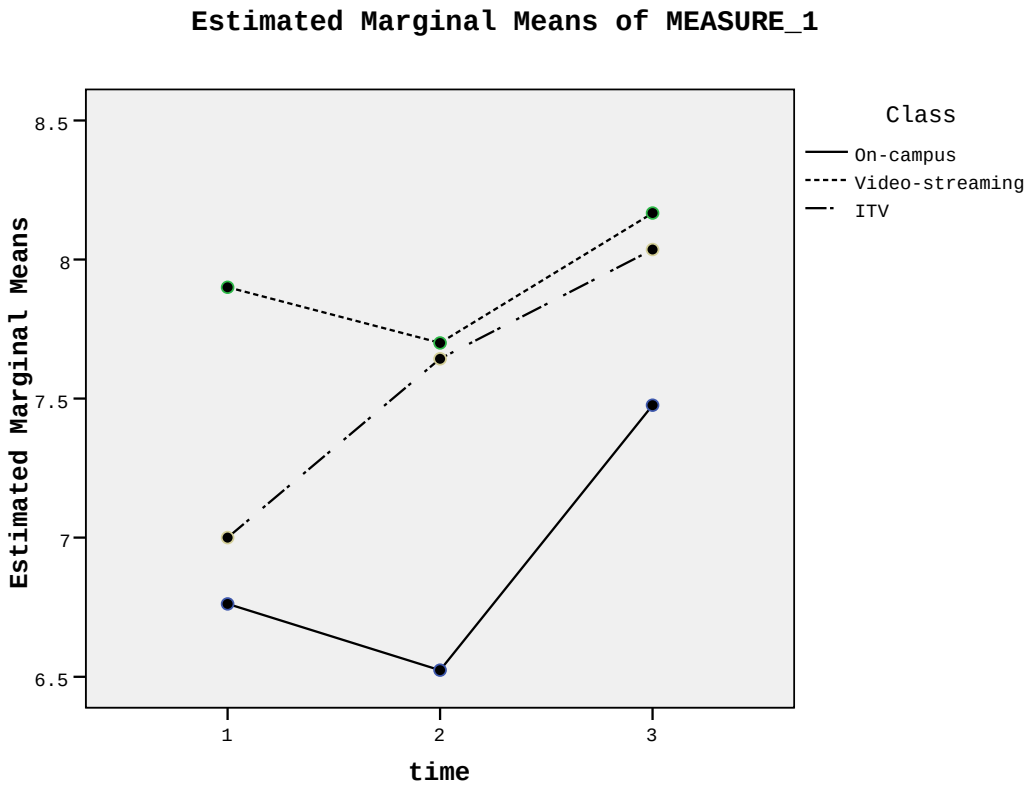


Figure 10. Social Presence Plots

Summary

The research study used path analysis to examine the hypothesized TAM each three times and repeated measures ANOVA to all variables in the TAM within the three different sections over time. This chapter provided the statistics of all the results from the surveys and descriptions

of the five research questions. The significant findings of the study, the limitations, a description of further research and recommendations will be discussed in the next chapter.

CHAPTER 5: DISCUSSION

Purpose of the Study

Technology has played a key role in various types of communication within the classroom, changing the way communication has taken place and is having a real impact on learning (Driscoll, 2007). By collaborating, instructors can ensure easy access to top-level e-learning on a range of topics (Mason, Chesmore & Noord, 2006). Asynchronous discussion has been perceived as being very necessary to be used in online courses and positive correlations have been found between the instructors' perceived importance and necessity of the technology beyond how they likely used it (Liu, 2005). Use of WebCT, as a collaborative tool, could be very helpful in the traditional classroom or as a medium for an online course.

Technology Acceptance Model (TAM) is an information system theory that models how users come to accept and use a technology (Davis et al, 1989; Davis, 1993). The usage of WebCT in an online environment has shown positive relationships between the technology and achievement in technology if used properly. The TAM was initially designed to predict an end user's acceptance or rejection of an information system project. The researcher tested and expanded the TAM to investigate different relationships between different variables in the TAM.

Jung et al. (2002) investigated the effects of three types of interaction (academic, collaborative and social) among online undergraduate students in Korea regarding their satisfaction, participation and attitude toward online education. Social interaction with instructors and collaborative interaction with peers were identified as important factors for enhancing learning and active participation in online discussions. To better explain students' attitude

towards the acceptance of technology, sociability and social presence were added to the hypothetical model, and the study was conducted to explain whether Davis' (1989) Technology Acceptance Model (TAM) could be used to measure technology acceptance in different types of class delivery methods.

A perceived strong advantage of this research study was that there was only one instructor for all three sections and all students had the same course content. The only difference was the delivery method: the on-campus section had traditional classroom meetings; the video-streaming section downloaded video from the internet; and the branch campus only had online materials. The constant variable of the professor made this research study more consistent and effective. This will allow the researcher to investigate differences in usage of WebCT.

Research Questions

This section presents the conclusion of the study and its significance through the above research questions.

Research Question 1

How well does the initial Technology Acceptance Model (Time 1) explain the students' grades, actual use of WebCT and attitude toward WebCT?

In time 1, the perceived ease of use ($b = 0.5603$, $t = 13.3680$, $\beta = 0.5627$) was the predictor to the perceived usefulness. The sociability ($b = 0.1591$, $t = 2.7886$, $\beta = 0.1593$) also had an influence on the perceived usefulness. Combining these results when the students felt more at

ease to using WebCT and built a social space in WebCT they found out WebCT was more useful. However, the social presence (b = 0.0826, t = 1.5502, β = 0.0826) is not very good at predicting the degree of perceived usefulness. The computer self-efficacy (b = 0.3456, t = 6.3459, β = 0.3439) and subjective norms (b = 0.3098, t = 6.1617, β = 0.3083) affected perceived ease of use equally and social presence also supported (b = -0.1519, t = -2.1104, β = -0.1512) the perceived ease of use. The perceived ease of use (b = 0.4162, t = 10.2259, β = 0.4171), perceived usefulness (b = 0.3918, t = 9.9640, β = 0.3909) and sociability (b = 0.1851, t = 4.1202, β = 0.1849) were the three most important factors to predict students' attitude toward using WebCT. Sociability (b = 0.7220, t = 17.1422, β = 0.7231) was the strongest predictor of the social presence.

However, CSE, SN and SP affected PEU so there was some influence towards attitude. Students' computer ability and their perceptions of external pressures influenced how they felt about the difficulty of using WebCT. Students' attitude toward WebCT explained approximately 2% of the variance in their exam grades. Perceived usefulness, perceived ease of use and sociability explained about 50%, 19% and 27% of the variance in students' attitude respectively.

Research Question 2

How well does the initial Technology Acceptance Model (Time 2) explain the students' grades, actual use of WebCT and attitude toward WebCT?

In time 2, the sociability (b = 0.6729, t = 14.9182, β = 0.6729) was the strongest predictor to the social presence. The perceived ease of use (b = 0.4933, t = 11.7759, β = 0.4964) was the

predictor to the perceived usefulness. The sociability (b = 0.2074, t = 3.9456, β = 0.2076) and social presence (b = 0.1019, t = 2.1541, β = 0.1024) also had an influence on the perceived usefulness, which meant the students felt more at ease to using WebCT and built a social space in WebCT they found out WebCT was more useful. Like time 1, the computer self-efficacy (b = 0.4211, t = 8.0243, β = 0.4180) and subjective norms (b = 0.2191, t = 4.5417, β = 0.2175) affected perceived ease of use equally and social presence also supported (b = -0.18004, t = -2.8044, β = -0.1803) the perceived ease of use. The perceived ease of use (b = 0.4481, t = 12.2879, β = 0.4532), perceived usefulness (b = 0.3601, t = 10.1284, β = 0.3619) and computer self-efficacy (b = 0.1548, t = 4.6845, β = 0.1554) were the three most important factors to predict students' attitude toward using WebCT.

Unlike time 1, the computer self-efficacy did not contribute to students' attitude at first and changed to support the positive attitude toward using WebCT. It showed that the higher the students' computer ability, the higher the attitude toward using WebCT. The social presence only contributed to perceived usefulness in time 2.

Research Question 3

How well does the initial Technology Acceptance Model (Time 3) explain the students' grades, actual use of WebCT and attitude toward WebCT?

In time 3, the sociability (b = 0.7263, t = 13.5287, β = 0.7249) was still the strongest predictor to the social presence. The perceived ease of use (b = 0.6683, t = 15.2852, β = 0.6688) was the predictor to the perceived usefulness. The sociability (b = 0.2032, t = 3.4862, β = 0.2030)

also had an influence on the perceived usefulness, which meant the students felt more at ease using WebCT and built a social space in WebCT they found out the WebCT was more useful.

The perceived usefulness (b = 0.1598, t = 1.8354, β = 0.1604) and perceived ease of use (b = -0.1770, t = -1.8468, β = -0.1778) both changed to support the actual use, so PU and PEU might need students to have more WebCT usage time to appear the influence the actual use from time 2. The perceived ease of use (b = 0.3480, t = 6.1273, β = 0.3509), perceived usefulness (b = 0.3199, t = 6.1163, β = 0.3224), computer self-efficacy (b = 0.1536, t = 3.3111, β = 0.1546), subjective norms (b = 0.0840, t = 1.8805, β = 0.0846) and sociability (b = 0.0873, t = 1.6877, β = 0.0879) all contributed to the attitude toward using WebCT in time 3. All these variables became a factor to students' attitude toward WebCT at the end of the semester and the variance accounting for attitude was approximately 68%.

Research Question 4

How do the results obtained from the Technology Acceptance Model (TAM) change over time?

According to Table 8, some betas were significant at all three times and they showed steady increasing or decreasing effects. Perceived ease of use and sociability both supported perceived usefulness but the values are on the contrary from time 1 to time 3. It means that with more interactions through WebCT to perceived usefulness, the more the students would have difficulties using the system. The more interpersonal relationships, the easier it is to use the system; in other words, sociability helped students' using WebCT and enhanced their job

performance. Although the students' attitude dropped a little bit after exam grades for time 2, the beta were all statistically significant and had no big differences, so attitude was a good predictor of exam scores. The computer self-efficacy had a steady increase in the beta to contribute to actual use over time, suggesting that the computer self-efficacy could predict students' actual use of WebCT well.

Some betas were not significant at all three times. For example, social presence and subjective norms did not support students' attitude toward WebCT, which meant social presence and subjective norms had limited contributed to students' attitude toward WebCT. Although social presence got higher score at time 2, the relationship still not strong enough to support students' perceptions of perceived usefulness. Subjective norms also showed low contribution to social presence and actual use. Lower reliability of subjective norms might be the reason or subjective norms did not have directly effect to social presence and actual usage.

Some betas showed only significant at one or two time. Sociability only affect students' attitude toward WebCT at the first time, which meant students felt the importance of scalability at the beginning of the class but the feeling dropped. The perceptions of perceived usefulness and perceived ease of use changed to support actual use at the end of semester, which meant students need more time to realize the usefulness of WebCT and how ease to actual use the system. On the other hand, computer self-efficacy started to affect students' attitude toward using WebCT at time 2 and kept to time 3.

Research Question 5

How do perceived usefulness (PU), perceived ease of use (PEU), attitude toward WebCT (AT), computer self-efficacy (CSE), subjective norms (SN), sociability (S) and social presence (SP) change over time by three sections of the course?

The purpose of this statistical analysis was to summarize the efficacy of all the TAM items, including PEU, PU, AT, CSE, SN, AU, S and SP, assessed three times and by different populations. Because of different delivery methods and passing a whole semester, there were some differences between groups and time.

There were statistically significant interaction effects between different sections over three time in perceived usefulness, perceived ease of use, attitude toward WebCT and subjective norms. There were statistically significant differences between on-campus, video-streaming and branch campus scores in perceived ease of use, attitude toward WebCT, computer self-efficacy, subjective norms, actual use and sociability. There were statistically significant differences between time 1, time 2 and time 3 in subjective norms, actual use and social presence.

In all variables, the means of the on-campus section was lower than the other group except the subjective norms and sociability. The results showed that the on-campus students had lower expectation of using WebCT in the course but they had a better attitude toward WebCT, seeing it as more useful, easier to use or had a strong social space.

1. The total online class had higher expectations of WebCT but they dropped their expectations over time. On the other hand, the on-campus students found out WebCT is useful for them, so the score of perceived usefulness rose at the end of semester.

2. The video-steaming section students had to download the video from the web, so it might be the reason they think WebCT is not very easy to use. Otherwise, the on-campus and total online section students only used some simple tools, like the discussion board, E-mail, quiz and course content, in WebCT, so they might think the system is not hard to use.
3. The on-campus class used WebCT as a support tool; the video-streaming class used WeCT as the main delivery system; and the totally online class saw WebCT as the only course delivery system. The different method of usage might cause different attitudes toward WebCT. Therefore, the branch campus students had a more positive attitude toward using WebCT and the on-campus students had a lower attitude, only using it as a support tool.
4. The on-campus class still had most classes in the traditional classroom so their demand of dealing with computer tasks was lower than the other two classes. At the end of the semester, the branch campus class had increased their judgment of their capability to use a computer in prospective situations.
5. Basically, although the on-campus section had a higher subjective norms score at time 2, all three groups dropped their perception of the external forces/pressures and their motivation to comply with the forces/pressures at time 3.
6. There were some differences between the three different sections and some changes between the three times, but generally the students kept their original behaviors of using WebCT.
7. The branch campus had the lowest mean of all three sections for sociability. It might be

because, although the collaborative tool replaced many functions in the real classroom, it is still not as good as the face-to-face relationship.

8. In all three sections, students found that interaction and the consequent salience of the interpersonal relationships rose by the end of the semester.

The Significant Findings of the Study

Conventionally, researchers recommend a measurement result greater than 0.645 (Shavelson, 1996). All variables in the hypothesized TAM had a reliability coefficient over 0.615. They were close to the conventional measurement suggestion so the researcher considered the reliability test and the reliability of survey to be fairly reliable for survey research. However, subjective norms showed lower effects than the other variables (See table. 2, 4, 6) which might because subjective norms had the lowest reliability.

1. The study did support the Technology Acceptance Model (TAM).
2. Perceived ease of use was the most significant predictor of perceived usefulness of students' using WebCT to enhance their exam performance.
3. Computer self-efficacy and subjective norms contributed to perceived ease of use to a statistically significant degree.
4. Perceived usefulness, perceived ease of use and sociability supported attitude toward WebCT to a statistically significant degree.
5. The students' attitude toward using WebCT was significant to exam grades.
6. Sociability is the most significant predictor of social presence.

7. Perceived ease of use and computer self-efficacy contributed to sociability to a statistically significant degree.

Overall, the data suggested that the hypothesized technology model was a successful model to use when trying to predict participants' attitude toward WebCT and exam grades in the future. This result is similar to Smith (2006) and validated the data which suggested that the hypothesized TAM was a successful model to use when trying to predict participants' intentions to continue using oTPD in the future. Pan (2003) and Sen (2005) both received similar results of using TAM to predict students' final grades. The majority of the relationships hypothesized between the variables were supported by the data and the paths were significant at $t > 1.645$.

Furthermore, Smith (2006) addressed the importance of sociability and social presence to continuance intention. The results from the study also agreed that sociability and social presence, the expanded external variables, had a significant impact on the TAM. Sociability had a strong positive direct relationship with social presence, having the highest standardized path coefficient measure within the structured model of (Time 1 = 0.72, Time 2 = 0.67, and Time 3 = 0.72). The results still proved that students' perceptions of social presence are founded upon sociability of the targeted system, in this case WebCT.

Previous research has suggested students' attitude toward WebCT is a strong predictor of final grades (Pan, Sivo & Brophy, 2003). The research study also indicated the same result as previous study (Pan, 2003; Pan, Sivo & Brophy, 2003). Attitude's coefficient reported a little weak, but still significantly predicted students' exam grades. Therefore, a positive attitude toward WebCT indicated a better performance in the exam grade. The results have shown that

collaborative tools have been proven the potential to enhance learning (Mason, Chesemore & Noord, 2006; Cavus & Ibrahim, 2007).

The research study addressed an important concept of different delivery methods over three times. Perceived ease of use, attitude toward WebCT, computer self-efficacy, subjective norm, actual use and sociability might have differences between different groups. Students changed their thoughts about subjective norms, actual use and social presence as time passed. The perceived usefulness, perceived ease of use, attitude toward WebCT and subjective norms variables were affected by both different groups and over time. Since there was only one instructor, the researcher can hypothesize that one reason why students changed their perceptions was the different usage of WebCT. Besides, some beta in the path analysis showed differences at time 2. The reason why cause this problem might be WebCT went down two days around the second exam time which was also the second survey time. Although some variables did not show the differences the technical difficulty might cause the changes at time 2.

Limitations

More anecdotal stories and case studies must be gathered to generate consistent results (Ricketts, Wolfe, Norvelle, &Carpenter, 2000) and to elicit Moskal and Dziuban's (2001) notion of "close and close approximations to desired objectives" (p.180). The research study only measured quantitative data so further research should gather qualitative information from the instructor and students. Therefore, the researcher can develop different facets of in-depth facts which can be helped to understand the relationships between different variables more clearly.

Class standing of the participants was 77.2% junior, 19.2% senior, 3.3% sophomore and only 0.3% freshman, which meant that more than 45% of students had already taken more than 5 WebCT courses prior to this course. Most of the participants were very familiar with using WebCT. The students were already expert WebCT users and knew how to operate functions in WebCT so that might be another reason to get the similar results in some of the variables, like computer self-efficacy.

Although there were many responses in each data collection (time 1, 2, and 3), there were only 79 students who completed all three time surveys. It is hypothesized that the serial measurement of only 79 students is the reason why there was no statistically significance between some variables, such as perceived usefulness, perceived ease of use, attitude toward WebCT, etc., over time. A larger sample size may have found different findings. In addition, the research study used self-reported survey so the results depended on students' responses. Especially, actual use measured students' duration and frequency of using WebCT. It might have differences between the report and reality.

Further Research Recommendations

The Technology Acceptance Model was successfully expanded and explored for the variables influencing computer use in the undergraduate students in different delivery methods. The data were gathered in spring, 2007 to see the students' attitude toward WebCT, actual usage and relationships with exam grades. Further research should examine the effects of other interactive functions in WebCT to improve the instruction and students' learning. There should also be a comparative study between different versions of WebCT or different collaborative tools

to see if the obtained result of this study would be similar or different in any respect of attitude towards the acceptance of technology.

APPENDIX A: QUESTIONNAIRE

Usability Instrument

Part I: Perception Scales

Instructions:

1. You will be asked to respond based on your perception about the use of WebCT.
2. Please use the following rating scale to respond.

   1 = Strongly Disagree,
   2 = Disagree,
   3 = Neither Agree or Disagree,
   4 = Agree,
   5 = Strongly Agree

Perception Scales

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
1. Using WebCT improves my job performance.					
2. Using WebCT in my class increases my productivity.					
3. Using WebCT enhances my effectiveness in my course work.					
4. Using WebCT makes it easier to do my course work.					
5. I find it easy to get WebCT to do what I want it to do.					
6. It is easy for me to become skillful at using WebCT.					

Attitude Instrument

Part II: Attitude scales

Instruction:

1. You will be asked to respond based on your perception about the use of WebCT.
2. Please use the following rating scale to respond.

   1 = Strongly Disagree,
   2 = Disagree,
   3 = Neither Agree or Disagree,
   4 = Agree,
   5 = Strongly Agree

Attitude Scales

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
7. I like to use WebCT.					
8. It is beneficial to use WebCT.					
9. WebCT is fun to use..					
10. I intend to use WebCT.					

Computer Self-efficacy Instrument

Instruction:

3. You will be asked to respond based on your perception about the use of WebCT.
4. Please use the following rating scale to respond.

   1 = Strongly Disagree,
   2 = Disagree,
   3 = Neither Agree or Disagree,
   4 = Agree,
   5 = Strongly Agree

Computer Self-efficacy Scales

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
11. Using WebCT helps me doing well in this course.					
12. I use WebCT to complete class assignments.					
13. When I am using WebCT, I click on a link to visit a specific web site.					
14. When I am using WebCT, I access a specific web site by typing the address (URL).					
15. When I am using WebCT, I print information/content from a web site.					
16. When I am using WebCT, I conduct an Internet search using search engines.					
17. When I am using WebCT, I download/Save an image from a web site to a disk.					
18. When I am using WebCT, I copy a block of text from a web site and pasting it to a document in a word processor.					
19. When I am using WebCT, I send an email message to a specific person (one-to-one interaction).					
20. When I am using WebCT, I send one e-mail to more than one person at a time.					

21. When I am using WebCT, I attach files to the email and send it out.					
22. When I am using WebCT, I reply/forward/delete an email message.					
23. When I am using WebCT, I save a file attached to an e-mail message to a local disk and then viewing the contents of that file.					
24. When I am using WebCT, I read a message posted on the discussion area.					
25. When I am using WebCT, I post a new message to the discussion area.					
26. When I am using WebCT, I reply to a message posted on the discussion area so that all members can view it.					
27. When I am using WebCT, I download/save a file from the discussion area when needed.					
28. When I am using WebCT, I upload/share a file from the discussion area when needed.					

Subjective Norm & System Use Instrument

Part IV: Subjective Norm Scales + Actual Use

Instruction:

1. You will be asked to respond based on your perception about the use of WebCT.
2. Please use the following rating scale to respond.

   1 = Strongly Disagree,
   2 = Disagree,
   3 = Neither Agree or Disagree,
   4 = Agree,
   5 = Strongly Agree

Subjective Norm Scales

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
29. The instructor thinks that I should use WebCT for my course work.					
30. My peers think that I should use WebCT for my course work.					
31. Generally, I would do what my instructor thinks I should do.					
32. Overall, I would do what my peers think I should do.					

Actual Use

33. In general, how often do you log on to the WebCT class?
    _ Less than once a week
    _ Once a week
    _ Twice a week
    _ Three times a week
    _ More than three times a week.
34. On average, how long do you stay in the WebCT class each time you login?
    _ Less than 30 minutes
    _ Between 30-60 minutes
    _ Between 60-90 minutes
    _ Between 90-120 minutes
    _ More than 120 minutes

Sociability & Social Presence Instrument

Part V: Sociability Scales + Social Presence Scale

Instruction:

1. You will be asked to respond based on your perception about the use of WebCT.
2. Please use the following rating scale to respond.

   1 = Not Applicable At All,
   2 = Rarely Applicable,
   3 = Moderately Applicable,
   4 = Largely Applicable,
   5 = Totally Applicable

Sociability Scales

	Not Applicable At All	Rarely Applicable	Moderately Applicable	Largely Applicable	Totally Applicable
35. The WebCT environment enables me to easily contact my classmates.					
36. I do not feel lonely in the WebCT environment.					
37. The WebCT environment enables me to get a good impression of my classmates.					
38. The WebCT environment enables me to identify myself in the class.					
39. I feel comfortable with the WebCT environment.					
40. The WebCT environment allows for non task-related conversations.					
41. The WebCT environment enables me to make close friendships with my classmates.					

Social Presence Scales

	Not Applicable At All	Rarely Applicable	Moderately Applicable	Largely Applicable	Totally Applicable
42. When I have real-time conversations in the WebCT environment, I feel that I deal with real people and not with abstract anonymous persons.					
43. When I have non real-time conversations in the WebCT environment, I also feel that I deal with very real persons and not with abstract anonymous persons.					
44. Real-time conversations in the WebCT environment can hardly be distinguished from face-to-face conversations.					

Student Demographic Instrument

Part VI: Demographics

Instruction:

1. Based on your individual information, please select a most proper answer to each question.
2. There are 16 questions.

Demographics Information

45. Gender
    _ Male
    _ Female
46. Academic Status
    _ Freshman
    _ Sophomore
    _ Junior
    _ Senior
    _ Graduate
    _ Other, please specify _____
47. Age
    _ 18
    _ 19
    _ 20
    _ 21
    _ Over 22
48. Racial/Ethnic groups
    _ Caucasians
    _ African Americans
    _ Hispanics
    _ Asian America
    _ Pacific Islanders
    _ American Indians (Native Americans)
    _ Alaskan Native
49. Which one of the following options is the major reason why you take this course using WebCT?
    _ The instructor
    _ Classmates
    _ The Web component
    _ Course Content
    _ Others, please specify_____

50. Occupation status?
    _ Full-time worker (over 20 hours a week)
    _ Part-time worker (no more than 20 hours a week)
    _ Full-time student
    _ None of the above
51. How many classes have you ever taken using WebCT prior to the current one?
    _ 0
    _ 1
    _ 2
    _ 3
    _ 4
    _ 5
    _ More
52. In general, how long have you used the computer?
    _ Less than 1 year
    _ 1 to 3 years
    _ 4 to 6 years
    _ Over 6 years
53. How do you rate your computer ability?
    _ Expert (Programming/Technical coding)
    _ Pretty Good (Familiar with using kinds of software)
    _ Basic (Only use Internet or less than 5 programs)
    _ Limited
54. What activities do you usually do with computer (marks many that apply)?
    _ Work
    _ Play games
    _ Surfing Internet
    _ Real-time conversation
    _ Shopping
    _ Banking/Financing
    _ Others
55. Which one of the following learning habits applies to you?
    _ Do it at the last minute
    _ Follow the schedule suggested by the instructor
    _ Do it in advance.
56. Do you have a computer with internet access in the place you study?
    _ Yes
    _ No

57. What type of class do you prefer?
    _ A traditional face-to-face class without using WebCT
    _ A face-to-face class with using WebCT
    _ A mixed mode class
    _ A video streaming class using WebCT
    _ A total online class
    _ Others, please specify
58. Do you have resources that can help you with technical glitches in WebCT?
    _ Yes, please specify _____
    _ No
    _ Don't know
59. What class are you in?
    _ On-campus (g)
    _ Video Streaming (h)
    _ ITV (i)
60. What is your major? _____
61. Would you want to be a class like this again?
    _ Yes
    _ No
62. What is your PID? _____

APPENDIX B: IRB APPROVAL LETTER

University of Central Florida

Office of Research & Commercialization

February 14, 2007

Huei-Hsuan Yang
715 Woodvalley Way
Orlando, FL 32825

Dear Ms. Yang:

With reference to your protocol #07-4177 entitled, "The Effect of Technology Acceptance on Marketing Students' Usage of WebCT as a Collaborative Tool," I am enclosing for your records the approved, expedited document of the UCFIRB Form you had submitted to our office. **This study was approved on 02/12/2007. The expiration date for this study will be 02/11/2008.** Should there be a need to extend this study, a Continuing Review form must be submitted to the IRB Office for review by the Chairman or full IRB at least one month prior to the expiration date. This is the responsibility of the investigator.

Please be advised that this approval is given for one year. Should there be any addendums or administrative changes to the already approved protocol, they must also be submitted to the Board through use of the Addendum/Modification Request form. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur.

Should you have any questions, please do not hesitate to call me at 407-823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

Joanne Muratori
(FWA00000351 Exp. 5/13/07, IRB00001138)

Copies: IRB File
Carolyn Massiah, Ph.D.
Stephen A. Sivo, Ph.D.

JM:jt

12201 Research Parkway • Suite 501 • Orlando, FL 32826-3246 • 407-823-3778 • Fax 407-823-3299

APPENDIX C: INFORMED CONSENT LETTER

Consent Form

February 27, 2007

Dear Student:

Our names are Professor Carolyn Massiah and Huei-Hsuan Yang

You are being asked to participate in an experiment designed to gather information on usage of WebCT. This research project was designed solely for research purposes and no one except the research team will have access to any of your responses. All responses will be kept anonymous. Your identity will be kept confidential using a numerical coding system. Consent forms will be collected separately from surveys and will be stored separately from the other materials in a locked file cabinet to ensure that no one other than study personnel could match them with the completed questionnaires.

You must be at least 18 years of age in order to participate in this study. Your participation in this project is voluntary. You do not have to answer any question(s) that you do not wish to answer. Please be advised that you may choose not to participate in this research, and you may withdraw from the experiment at any time without consequence. Non-participation will not affect your grade. You will receive 10 extra credit points in MAR 3023: Principles of Marketing for participating. Students who choose not to participate in the research will be given the alternative to earn the same amount of extra credit by writing a two-page, single-spaced summary of a chosen chapter in the textbook.

There are no other direct benefits or compensation for participation. This experiment will take approximately 15 minutes outside of your regularly scheduled class time. There are no anticipated risks associated with participation.

If you have any questions or comments about this research, please contact Professor Carolyn Massiah, Marketing Department, College of Business Administration, Orlando, FL; (407) 823-6764. Information regarding your rights as a research volunteer may be obtained from:
IRB Coordinator
Institutional Review Board (IRB)
University of Central Florida (UCF)
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246

Telephone: (407) 823-2901

Sincerely,

Huei-Hsuan Yang

_____I have read the procedure described above.

_____I voluntarily agree to participate in the procedure and I have received a copy of this description.

_____I would like to receive a copy of the procedure described above.

_____I would not like to receive a copy of the procedure described above.

Participant (PID)	Signature	Date

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