Factors Influencing the Acceptance of Collaboration Technology within the Context of Virtual Teamwork Training

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ABSTRACT

The purpose of this dissertation was to identify the factors that influence electronic collaboration technology acceptance and predicted usage for virtual team collaboration projects in higher education courses. The research combined the unified theory of acceptance and usage of technology (UTAUT) with a virtual team training model.

The method of investigation was a cross-sectional study with 108 participants. Each participant completed a survey following their participation in virtual team training. Ten hypotheses were tested using a structural equation modeling technique, partial least squares. Five of the hypotheses were supported and five were not supported. The results indicated that three of the four UTAUT constructs were significant in predicting if the participants would use the collaboration technology in the future. Additionally, the findings revealed that the participants had a positive perception of the virtual teamwork training.

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Chapter I

INTRODUCTION

Due to advancements in technology and corporate globalization, virtual teams are redesigning the way organizations conduct business (Zofi, 2011). While there are a variety of other driving forces for the shift in the way business is done, technology advances such as instant messaging, voice over Internet protocol (VoIP), cloud computing, and video conferencing are having a significant impact on how we communicate with one another (Friedman, 2005). Virtual team projects using electronic collaboration systems are becoming increasingly more common in today's global market workforce (Lepsinger & DeRosa, 2010). Therefore, students pursuing a degree in business need to be prepared to work effectively in virtual collaborative environments (Chen, Sager, Corbitt, & Gardiner, 2008; Terris, 2011).

Colleges need to prepare students to work in virtual collaborative environments so that they are prepared to participate in our global workforce (Bower, 2011). Bower asserted that faculty members are ultimately responsible for the success of the virtual team learning experience. Therefore, a clear understanding of the strategies used to incorporate virtual team activities into a course is essential. The research in this dissertation incorporates a model for developing virtual teamwork activities into the college curriculum (Chen et al., 2008) and then uses a second model, one that combined the technology acceptance model (TAM) (Davis, 1989) with seven other prominent

theories in user behavior to develop a unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003).

Technology acceptance theory (Davis, 1989) is one of the most widely used models for examination of user behavior toward the acceptance of new technologies. Technology acceptance theory has demonstrated that when new technologies are implemented, many factors influence the rate of acceptance of the technology (Davis, 1989). The theoretical foundation of this study was technology acceptance research chosen for the robustness and preeminence of the models and theories found within this research domain.

Problem Statement

In order to successfully incorporate virtual team projects into the curriculum, faculty members need to incorporate virtual team learning principles into the team activities and be aware of the factors that influence students' technology acceptance of electronic collaboration systems.

Purpose Statement

The primary purpose of this research was to combine ideas from virtual team learning theories (Chen et al., 2008) with technology acceptance research (Venkatesh et al., 2003) to identify strategies for preparing college students for work in the global marketplace. The study identified the factors that influence a user's acceptance of electronic collaboration technology and the predicted use of the technology for virtual team collaboration projects in college courses.

A theoretical model for incorporating virtual teamwork training (Chen et al., 2008) was used in developing the intervention activity. The unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003) was modified and used to identify factors that impact user acceptance of electronic collaboration technologies. An application of the combined theories was used to test the model.

Definitions

Collocated Teams. Collocated teams are teams that are located in the same geographic area.

Distributed Teams. Distributed teams are teams that are located in dispersed geographic areas.

Mediator Variable. A mediator variable explains the relationship between the dependent variable and the independent variable. Mediator variables specify how or why a particular effect or relationship occurs. Baron and Kenny (1986) suggested that mediators explain how external events take on internal psychological significance. In this study performance expectancy, effort expectancy, and social influence served as a mediator variables to the independent variable training and resources.

Moderator Variable. A moderator variable affects the direction and/or strength of the relation between dependent and independent variables. Moderation occurs when the relationship between two variables depends on a third variable. The effect of a moderating variable is characterized statistically as an interaction. In this study gender and experience will moderate the independent variables performance expectancy, effort expectancy, and social influence.

Technology Acceptance Model (TAM). TAM is a model developed by Fred Davis (1989) and is the most widely used model for measuring technology adoption and use.

Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT (Venkatesh et al., 2003) is a model that extended TAM and incorporated eight distinct models of technology use and adoption. UTAUT incorporated social influence and facilitating conditions.

Virtual Teams. This study defines virtual teams, as did Chen, Sager, Corbitt, and Gardiner (2008), as teams that conduct teamwork via computer-mediated communications regardless of team members' geographic locations.

WebEx. WebEx is a Cisco Systems video conferencing and groupware tool that supports electronic meetings.

Conceptual Framework

Two theoretical frameworks were incorporated into this dissertation. The first was a model for incorporating virtual teamwork training into Management Information Systems (MIS) curricula (Chen et al., 2008). The activities in which the participants of this dissertation were engaged were designed based upon the criteria defined in the model presented by Chen and colleagues. The virtual teamwork training model was derived from David Kolb's (1984) learning cycle. The virtual teamwork training model incorporated learning processes including abstract conceptualization, active and concrete experimentation, and observational reflection. An in-depth description of the model is provided in Chapter 2. Additionally, Chapter 3 provides a description of how the model was implemented in this research study.

The second theoretical framework, UTAUT (Venkatesh et al., 2003) was used to identify the factors that influence the use of electronic collaboration technologies. The model combined the technology acceptance model with seven other theories from user behavior literature. The UTAUT model was modified for use in this study. The dependent variable for the model was the users' intention to use the collaboration technology. The independent variables were performance expectancy, effort expectancy, and social influence. The independent variables were moderated by gender and experience and mediated by training and resources.

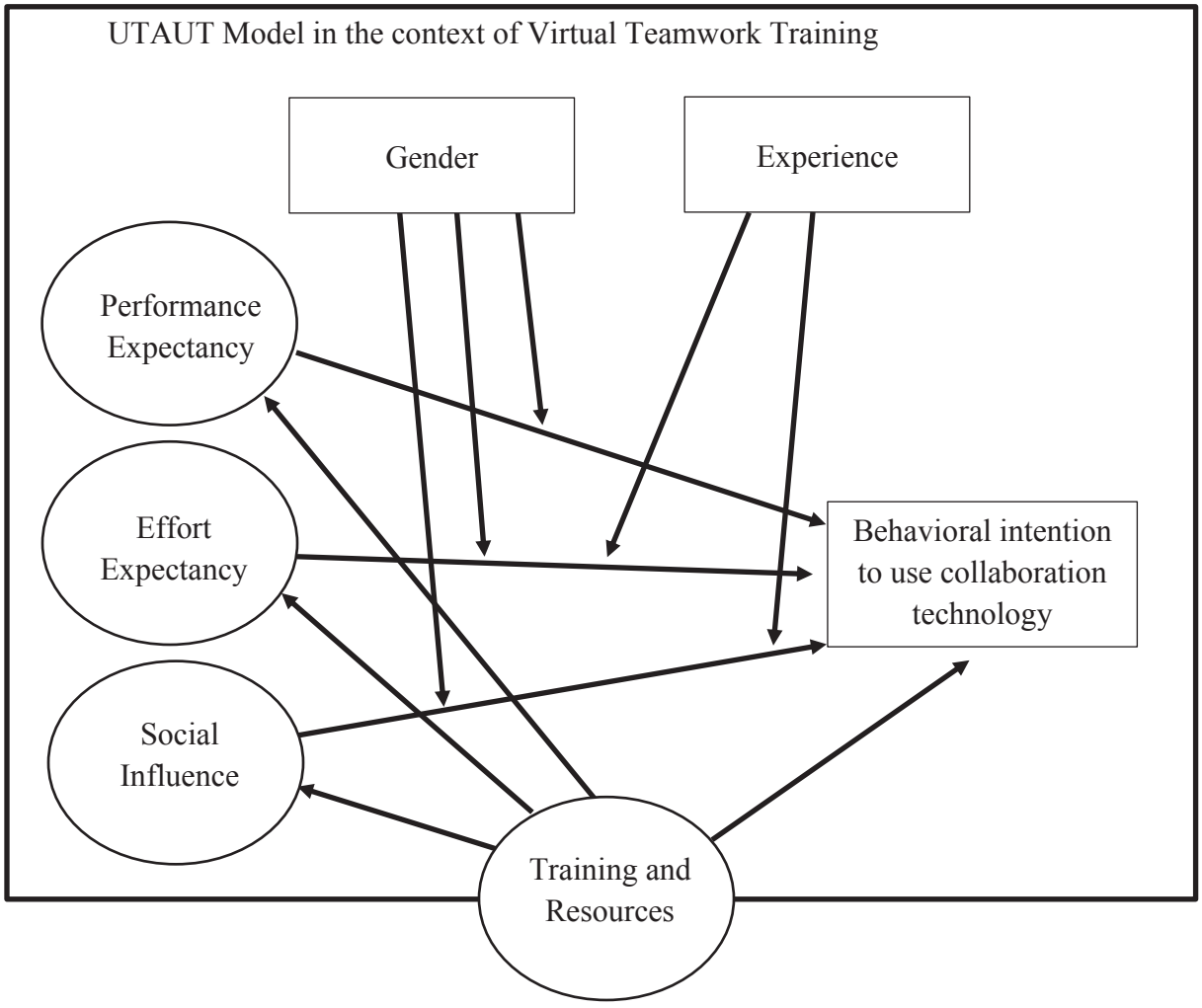

Figure 1. UTAUT Model within the Context of Virtual Teamwork Training

Chapter 2 provides a detailed explanation of UTAUT and the variables used in the study. Figure 1 shows graphically the derived model used in this study.

Data Collection

Undergraduate college of business students in principles of information systems courses participated in virtual team projects using a web-based video conferencing technology, WebEx. At the beginning of the semester, the instructor placed students in virtual teams of four students. Students in the principles of information systems courses participated in four team projects in which they met together face-to-face and four team projects that required virtual collaboration using electronic meeting technology. The projects that required face-to-face meetings included designing a network for a fictitious business, developing web pages for the business, creating a Visual Basic program for the same business, and developing example databases. The virtual meetings consisted of three discussion-based meetings and one problem-solving meeting. The discussion meetings were based on articles that were read prior to the meeting, and the problem solving meeting was one in which the participants developed a database proposal for their business.

The students were trained by the instructor to use WebEx. Using a modified version of Harvey Daniel's (1994) literature circles, individuals in teams were each given a unique pre-discussion activity and a during discussion activity. In the first virtual meeting, the students were instructed to discuss an article. During the virtual team meeting, each team participant executed his or her during-discussion activity. Following the virtual team meeting, each participant wrote on a discussion forum responses to discussion questions related to the article that the team members discussed during the

virtual meeting and a reflection on the virtual meeting experience. The team leader was asked to write and to post on the discussion board a summary of the meeting and to report information about the virtual meeting, such as the names of those who attended and the date and time of the virtual meeting, and the electronic record of the virtual meeting, to provide proof to the instructor that the meeting actually occurred and who was in attendance. The role of team leader was rotated among the team members and this meeting process was repeated for two additional articles, giving the students opportunities to meet virtually three times in a discussion-based environment. Figure 2 shows an example of the WebEx environment. Figure 3 shows the same meeting demonstrating how students can share documents and desktops.

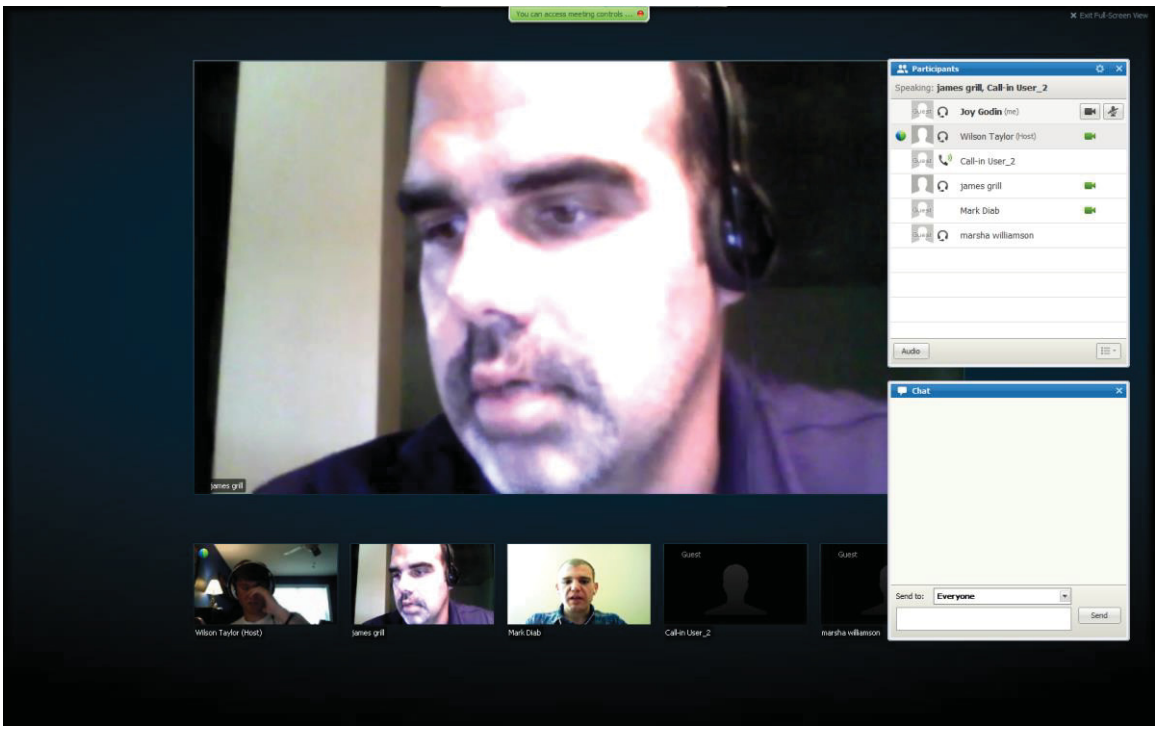

Figure 2 – Student Meeting in the WebEx Environment

After completing the face-to-face projects and three virtual article discussion meetings, the students participated in a virtual team meeting to plan a database project.

The students were asked to work together virtually in WebEx to design the tables for a database they would develop later and then to submit their database design to the instructor. Each student was asked to write a reflective account of the virtual team design process. The database design project was then graded based on a predetermined rubric.

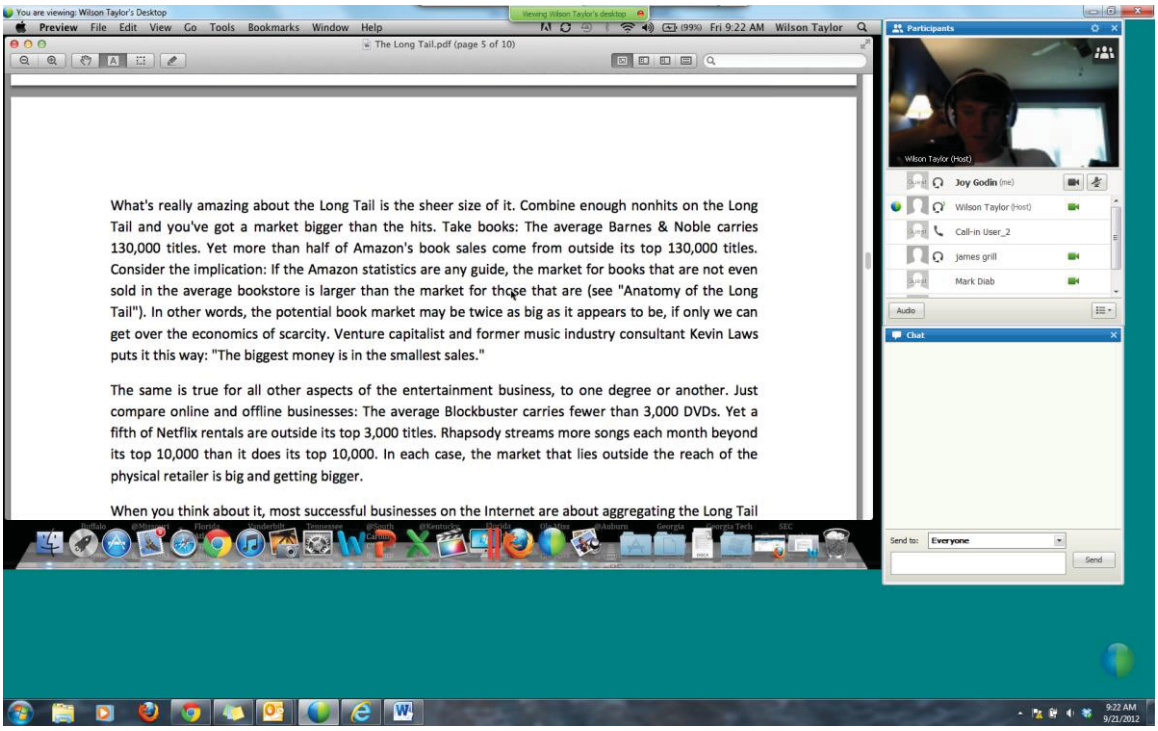

Figure 3 – Students in WebEx Meeting Sharing Documents through Desktop Sharing

After the students participated in four team meetings using WebEx – three discussion-based meetings and one problem solving meeting – they were given the technology acceptance survey. The survey was given in class and extra credit was awarded to students who completed the survey.

Research Questions

The research questions and hypotheses are as follows:

1. To what extent do training and resources, performance expectancy, effort expectancy, and social influence explain a student's intention to use a collaboration technology?

H1 - User training and available resources will have a significant effect on intention to use the collaboration technology.

H2 – Performance expectancy will have a significant effect on intention to use the collaboration technology.

H3 – Effort expectancy will have a significant effect on intention to use the collaboration technology.

H4 – Social influence will have a significant effect on intention to use the collaboration technology.

2. Do gender and experience moderate the effects of performance expectancy, effort expectancy, and social influence on a student's intention to use collaboration technology?

   H5 – The effect of performance expectancy on intention to use collaboration technology will be moderated by gender.

   H6 – The effect of effort expectancy on intention to use collaboration technology will be moderated by gender and experience.

   H7 - The effect of social influence on intention to use collaboration technology will be moderated by gender and experience.

3. Do performance expectancy, effort expectancy, and social influence mediate the effects of training and resources on a student's intention to use collaboration technology?

   H8 – Performance expectancy will mediate the effects of training and resources on intention to use the collaboration technology.

H9 – Effort expectancy will mediate the effects of training and resources on intention to use the collaboration technology.

H10 – Social influence will mediate the effects of training and resources on intention to use the collaboration technology.

4. How do students perceive virtual team training?

Significance of Study

This study contributes to a better theoretical understanding of the factors that influence the intention to use e-collaboration technology and the predicted use of the technology. The study also provides empirical support of the model for predicting collaboration technology use (Brown, Dennis, & Venkatesh, 2010). The researchers of this model called for future research to include other collaboration technology characteristics, such as synchronicity (Dennis, Fuller, & Valacich, 2008). This study employed synchronous technology for electronic collaboration in virtual teams as suggested by Brown et al. From a practical standpoint, college of business faculty members will have a greater understanding of what factors influence students' use of the electronic collaboration technology and may thereby make better informed decisions about class assignments that will encourage students to adopt and use the technology.

Data Analysis

The data in this dissertation were analyzed using descriptive statistics, correlational analysis, and structural equation modeling (SEM). A pilot study was conducted and all survey items were tested using Cronbach alpha (Field, 2009) to determine the reliability of the instrument. Descriptive statistics showed the demographics of the respondents, including statistics regarding gender and computer

experience. A correlational matrix (Fraenkel & Wallen, 2009) was used to test the different hypotheses in the research model. The matrix shows the influence each construct has on the dependent variable and how the variables correlated. A structural equation modeling tool, partial least squares (PLS), was used to determine these relationships. Using PLS allows the researcher to use regression analysis on only a portion of a model at one time (Chin, 1998). Additionally, PLS provides a means for researchers to perform structural equation modeling when sample sizes are small (Chin & Newsted, 1999). Descriptive statistics were also used to report the study participants' perspectives of the virtual team training.

Ethical Considerations

Before conducting this research, the Institutional Review Board (IRB) for the protection of human research participants at Valdosta State University granted research protocol exemption for this dissertation study (see Appendix A). Exemption was granted under exemption category 1 that describes the research as research conducted in established or commonly accepted educational settings, involving normal educational practices. This research was conducted in a college classroom as a regular instructional strategy and therefore granted IRB exemption.

Limitations

This study was conducted in a college of business principles of information systems course. Consequently, most of the participants were business majors and were of traditional college age (18-21). A broader age group representation would improve the generalizability of the findings in the study. Additionally, the participants in the study were of enrolled in the same class and met twice a week face-to-face. It might have been

interesting to have virtual teams who were in geographically dispersed locations, which might have forced them to meet virtually.

Overview of the Dissertation Chapters

This dissertation is divided into the following chapters: (a) Chapter 1 – Introduction, (b) Chapter 2 – Literature Review, (c) Chapter 3 – Methodology, (d) Chapter 4 – Data Analysis and Results, and (e) Chapter 5 – Discussions. A brief description of each chapter is provided below.

Chapter 1 includes a brief introduction to the study including the problem statement, purpose statement, and definitions to uncommon terms. The conceptual framework, description of the data collection process, and research questions are also provided in this chapter. The chapter concludes with the significance of the study, a brief description of how the data was analyzed, ethical considerations, limitations, an overview of each of the chapters, and a summary.

Chapter 2 provides a literature review of (a) virtual team learning theories, (b) collaboration technology theories, (c) technology acceptance theories, and (d) predicting collaboration technology use model. The chapter concludes with a summary of the literature review.

Chapter 3 outlines the methodology used to conduct this research. In this chapter the research model is presented along with the research questions and hypotheses. The virtual teamwork training model is identified and the research methods and procedures are described in detail. The chapter concludes with a description of the data analysis and a summary of the methodology.

Chapter 4 presents the data analysis and results of the study. The demographics of the respondents are first presented. Next, the evaluation of the PLS path model results are presented. The chapter concludes with testing of the research model and the hypotheses and a final summary of the data analysis and results.

Chapter 5 provides an overview of the entire study. A detailed discussion of the findings is presented in this chapter. Limitations of the study and suggestions for future research are also included. The chapter concludes with a summary of discussions.

Summary

This chapter provided an introduction to the dissertation titled "Factors Influencing the Acceptance of Collaboration Technology within the Context of Virtual Teamwork Training." The problem and purpose statements were first presented along with definitions to uncommon terms. An overview of the conceptual framework and data collection methods were described. The research questions along with the hypotheses were also presented. The significance of the study and techniques for data analysis were given. The chapter concluded with ethical considerations, limitations, and an overview of each of the dissertation chapters.

Chapter II

LITERATURE REVIEW

The primary purpose of this study was to combine virtual team learning theories with technology acceptance research to aid in identifying strategies for preparing college students for work in the global marketplace. This chapter provides a review of the literature that is germane to the study's purpose. The theoretical frameworks examined in the literature review include: virtual team learning theories, collaboration technology theories, and technology acceptance theories. The literature review concludes with a review of a model for predicting collaboration technology adoption and use. The collaboration technology adoption and use model served as the basis for this dissertation.

Virtual Team Learning Theories

A number of researchers identified theories that impact virtual team learning (Andres & Shipp, 2010; Kock, Lynn, Dow, & Akgun, 2006) as well as models for developing and implementing effective electronic collaboration learning environments (Bower, 2011; Chen et al., 2008; Kirschner, Stijbos, Kreihns, & Beers, 2004). Discussion of the literature on team learning theories was intended to provide a background for the experimental design described in Chapter 3. The virtual team learning theories section concludes with a description of a model for incorporating virtual teamwork training in college courses. The virtual teamwork training model presented in Table 1 at the end of this section was the model used to develop the experimental activities employed in this dissertation.

Team Learning Theory

Amy Edmonson (1999) presented a model of team learning that was tested in a multi-method field study of 51 work teams in a manufacturing company. Edmonson found that psychological safety defined as "a shared belief that the team is safe for interpersonal risk taking" (p. 5) was associated with team learning. Following educational philosopher John Dewey's (1922) belief that learning is an iterative process of designing, carrying out, reflecting upon, and modifying actions, Edmonson characterized learning in groups as a continuous process of reflection and action. Team members should feel open to test theories, ask questions, experiment, reflect, and seek feedback. Edmonson found that team structures, including effective leaders and training, and shared beliefs, influence team results.

Virtual Team Learning Model

Andres and Shipps (2010) developed a model for measuring team learning in technology-mediated distributed teams. The researchers combined the theory of affordances (Gibson, 1977; Kirschner et al., 2004) and social impact theory (Latane, 1981) to develop a framework that can be used to explain the impact of the collaboration mode (collocated versus distributed) on team learning and the social factors that impact team learning and problem solving.

Affordances Theory

Kirschner et al. (2004) characterized affordances as the aspects of an environment that impact successful completion of a learning task. The researchers categorized these affordances as technical, educational, and social. Technical affordances are the tools provided to complete a task. Educational (learning) affordances

denote the task environment's capacity to simulate typical team learning processes including information exchanges and other collaborative interactions. Social affordance refers to the ability of the task environment to encourage social dynamics such as trust and cooperation as well as productive shared exchanges needed for group project development and problem solving.

Thackara (2001) explained that interaction design impacts the quality of the user experience with a system and the value the system provides to a user. Kirchner et al. (2004) claimed that the technical, educational, and social affordances determine the usefulness of a system and should be the goals of interaction design. Figure 4 below demonstrates the role each of the affordances play on a system's usefulness.

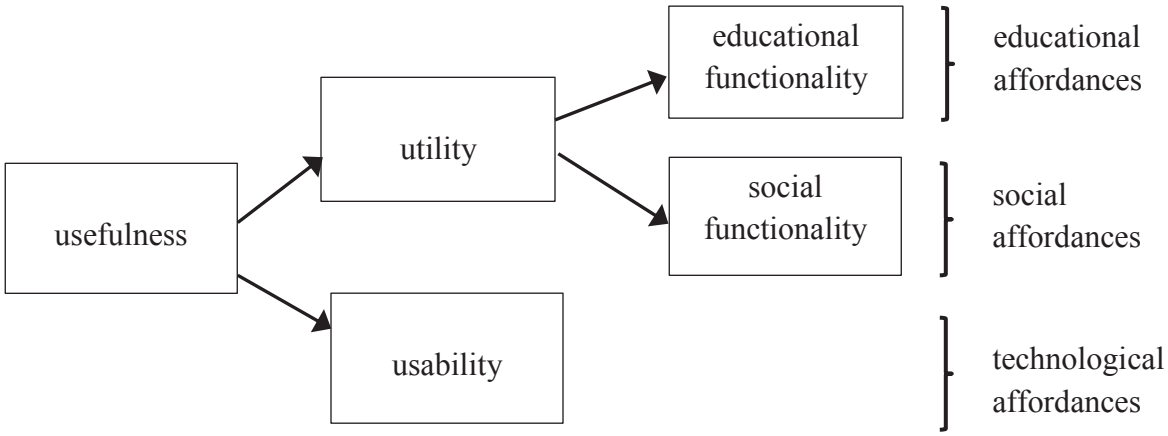

Figure 4. Userfulness and Various Types of Affordances

Social Impact Theory

Latane (1981) described Social Impact Theory (SIT) as the impact of other individuals' presence (whether it be implied, real, or imagined) on a person's feelings, motivations, and behaviors. Interpersonal interactions are defined in three dimensions: strength, immediacy, and number. Strength refers to the influence members of a group

have on other members. Immediacy refers to the amount of time it takes to exchange information or the physical proximity of the team members. Number dimension takes into consideration the number of people supporting an idea; the number increases the more others are influenced to embrace the idea as well.

Team Learning Model

Incorporating the theory of affordances and social impact theory into a model, Andres and Shipps (2010) used an empirical interpretive research approach to rate project-based team learning in collocated and distributed environments. Management Information Systems students were put in 12 four-person teams and asked to enhance the functionality of hypothetical information systems in a 2.5-hour team meeting. Six of the teams met face-to-face and the other six met using video conferencing.

The research hypotheses were as follows:

H1 – Groups working in a face-to-face collaboration setting should exhibit more effective team learning behaviors than in technology mediated settings.

H2 – Team learning behaviors will be positively associated with team productivity.

H3 – Team learning behaviors will be positively associated with team interaction quality.

Each team's performance was measured on team learning, team productivity, team interaction quality while programming ability was used as a control variable. Trained observers rated each of the virtual teams based on rating scales developed from team learning literature. Document analysis and a redefined rubric were used to measure productivity. A questionnaire followed the team project to determine the members' perceptions of the quality of the team interaction. The researchers found that collaboration mode does impact team learning which in turn also impacts productivity

and interaction quality. The results suggested that collocated teams have fewer communication problems and misunderstandings, and are able to move forward on a task better than distributed teams.

These findings of Andres and Shipps (2010) suggested that in addition to technology issues encountered in virtual teams, managers and educators should be aware of the technical, educational, and social affordances that impact team learning and the social dimensions present in virtual team learning. Heath et al. (2002) described the need to improve awareness of the principles and behaviors of individuals working in a collaborative environment.

Andres and Shipp (2010) suggested that virtual team members should be trained on how to work toward common goals in a virtual environment and understand the dynamics of virtual collaboration, such as coordination, negotiated decision making, and interpersonal interactions. Figure 5 depicts the team learning model developed by Andres and Shipps (2010). Andres and Shipps combined the theory of affordances and the social impact theoretical model to "explain the effects of collaboration mode on team learning behaviors and their subsequent impact on team performance and interaction quality" (p. 214). H1, H2, and H3 represent the hypotheses in the study.

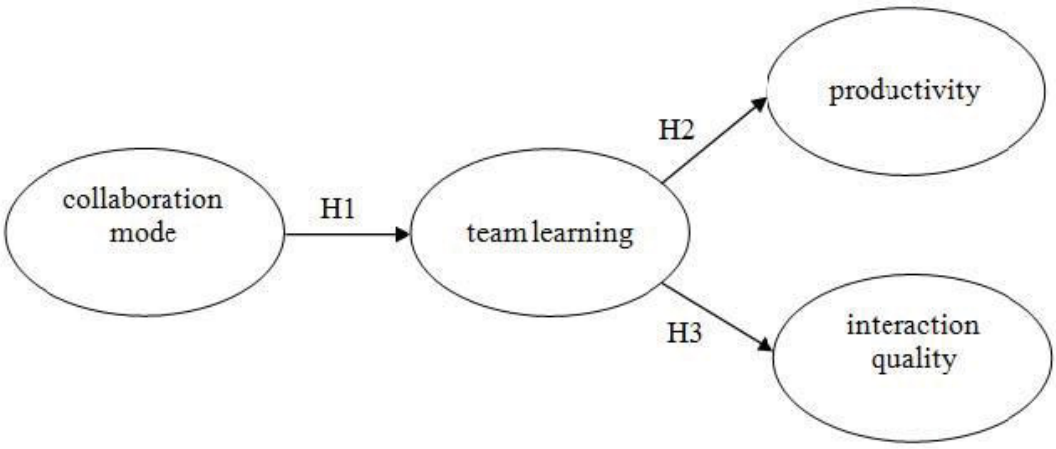

Figure 5. Team Learning Model

Strategies for Developing E-collaboration Skills

Lee, Bonk, Magjuka, Su, and Liu (2006) conducted an empirical study of 27 online MBA courses. The researchers collected data by content analysis, interview, and survey. Incorporating Carabajal, LaPointe, and Gunawardena's (2003) three dimensions for designing and implementing virtual teams, Lee et al. categorized the data based on task, social, and technical dimensions. The researchers found that instructors in the MBA program understood the importance of virtual teams but were not quite sure how to implement them. At the conclusion of the study, Lee and colleagues presented some recommendations for designing virtual team activities.

The first recommendation made by Lee et al. (2006), which related to the tasks involved in virtual team activities, was for instructors to monitor the teamwork process throughout the course not just in the conventional way of assessing the end result or the final project submissions. Carabajel et al. (2003), borrowing ideas from the social-constructivist perspective, suggested that more emphasis should be placed on the students' interactions during the team process than on the final outcome of the team. By

providing guidelines and assessing the teamwork process, instructors will give students tools to help them understand how to make teamwork more effective.

The second recommendation by Lee et al. (2006) related to the social aspects of teamwork. Instructors should be aware of the role social presence plays in teaming. By encouraging students to introduce themselves and by providing areas for students to get to know one another such as posting pictures or providing chat rooms, instructors encourage a sense of community. Virtual collaboration has several limitations of which instructors should make students aware, such as delayed feedback and invisibility. Lee and colleagues suggested that instructors guide students by making them aware of the limitations of virtual teams and providing them with suggestions for dealing with social dynamics in the virtual environment.

The third recommendation related to the technologies used in virtual team activities. Lee et al. (2006) suggested that instructors and students need training on the use of the tools available to learn to match the tool to the task. The researchers stressed the importance of selecting the proper technology for the task as this will determine the success of the virtual team and help to maintain the team.

Bower (2011) conducted a design-based research study investigating teaching and learning behaviors in a web-conferencing classroom environment. The researcher used a three-semester approach and found four levels of online collaborative competencies: operational, interactional, managerial, and design. Operation competencies were defined as the instructor's and students' abilities to use the tools provided in the collaborative environment. Interactional competencies referred to the users' capacity to interact and complete tasks or solve problems. Managerial competencies were the abilities to train

and manage the groups or class. Design competencies referred to the users' abilities to provide the tools in the system needed to have the best results for collaboration. Bower (2011) described the competencies as being hierarchical, meaning that the success of each competency depended on the mastery of the previous competencies. Bower found that the type of pedagogy employed influenced the collaboration competencies. In teacher-centered learning environments lower level competencies, operational and interactional, played a greater role. While in more student-centered environments, the managerial and design competencies became more important.

Bower (2011) contended that "it is the responsibility of the educational institutions to prepare students with the collaborative skills that they will require to participate in society and our increasingly competitive global environment" (p. 10). He also claimed that teachers are primarily accountable for the management and design collaboration competencies, as well as implementing pedagogical strategies to encourage the operational, interactional, managerial, and design competency development in the students using the web-based collaboration systems.

Employing the affordance theory (technical, social, educational) described in the previous section, Kirschner et al. (2004) developed a six-stage model that can be used to develop collaborative learning environments. Following Kirschner et al.'s model, the designer of the collaborative learning environment must complete the following steps:

1. *Determine what learners actually do*. This should be done prior to development by observing collaborative groups interacting.
2. *Determine what can be done to support those learners*. After observing, the designer should determine what needs to be supported.

3. *Determine the constraints of the learner, learning situation, and learning environment and the conventions that already exist.* The designer should examine technical, social, and educational constraints or affordances.
4. *Determine how learners perceive and experience the support provided.* Try new products with intended users before implementation so that improvements can be made.
5. *Determine how the learner actually uses the support provided.* Find out if the new system does what the learner hoped or expected it would do.
6. *Determine what has been learned.* Learning is the ultimate goal. The learner and the teacher will decide if the designed system is successful.

Virtual Teamwork Training Model

Chen, Sager, Corbitt, and Gardiner (2008) proposed a model for virtual teamwork training. The researchers used a mixed-methods approach examining survey data, student comments, and final project submissions. The researchers found that employing the virtual teamwork training model resulted in "increasing students' awareness of and competence in performing virtual teamwork" (p. 38).

The teamwork training model developed by Chen and colleagues (2008) was derived from David Kolb's (1984) learning cycle. Figure 6 depicts Kolb's learning cycle. Knowles, Holton, and Swanson (2005) described how Kolb defined learning as the process of creating knowledge through experience. Knowles et al. identified Kolb's four-step cycle of experiential learning. The first step is for the learner to be involved in concrete new experience. Second, the learner should reflect and make observations on the experience from many perspectives. Third, generalizations and theories are created based

on the reflections and observations. Lastly, the theories and concepts are tested in new situations. The educator's role is to serve as the facilitator of reflection and to encourage learners to discuss and reflect on concrete experiences in a trusting, open environment.

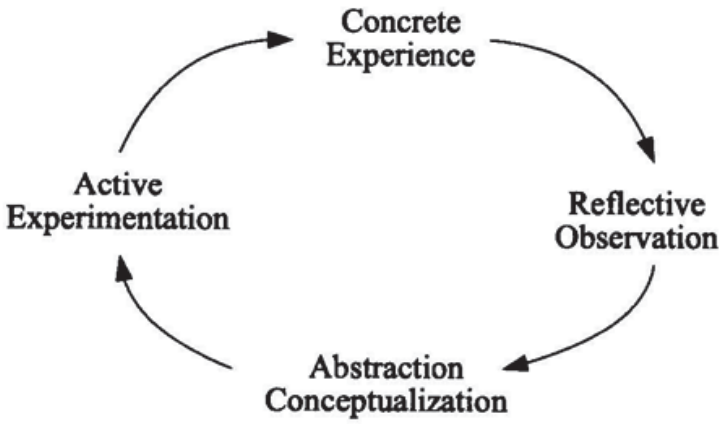

Figure 6. David Kolb's (1984) Learning Cycle

Chen et al. (2008) applied the ideas from Kolb's learning cycle into their model for virtual teamwork. Table 1 summarizes the training model proposed by Chen and his colleagues. Unlike Kolb's learning cycle, the model proposed by Chen et al. does not require that learners start the learning process with concrete examples. Instead they learn through abstract conceptualization – reading or hearing about virtual teamwork practices from others. The researchers suggested that instructors can provide relevant reading materials and informative lectures, and encourage group discussions about the virtual teamwork. Once students have been introduced to virtual teamwork practices, they will then participate in a virtual teamwork project. The teacher should design a virtual teamwork project that will have enough complexity that it will force the students to actively engage in virtual collaboration to complete the project. Additionally, Chen et al. (2008) explained that students should be required to reflect on activities as they occur and identify the lessons that were learned through each activity.

Table 1

Model of Virtual Teamwork Training

Learning Process	Learning Techniques	Teaching approach
Abstraction Conceptualization – (Conceptual Learning at the Beginning of the Class)	Students learn by reading, listening, and discussing the following knowledge areas • Face-to-face teamwork • Virtual teamwork • Computer mediated communication (CMC)	The instructor supplies relevant reading material, gives well-organized and informative lectures, and encourages teams to discuss relevant materials.
Active Experimentation and Concrete Experience – (Learning by doing the project)	Students learn by doing the following activities: • Engaging virtual teamwork by following the known effective practice • Engaging virtual teamwork by trial and error	The instructor designs the virtual teamwork with appropriate level of project complexity and task interdependence so that team members have to engage in serious virtual collaboration to complete the project.
Observational Reflection – (Learning by reflecting on project execution)	Students learn by reflecting and discussing effective/ineffective virtual team practices	The instructor encourages individual and group reflection via team discussion, team report writing, and online forum discussion.

Summary of Virtual Team Learning

A number of theories have been identified that impact team learning. Ideas from Kirschner et al.'s (2004) six-stage model of interaction design and Chen et al.'s (2008) model of virtual teamwork training will be incorporated into the research design of this dissertation. In line with the ideas of Kirschner and collegues, learners predicted and actual use will be measured using an evaluation instrument developed by Brown, Dennis, and Venkatesh (2011). The evaluation model will be described later in this chapter. The model developed by Chen et al. will be used to train the study participants and develop projects for them. The next section will examine the collaboration technology theories

that were integral in the development of the Brown et al. (2010) model for predicting collaboration technology that will be used in the model developed for this dissertation.

Collaboration Technology Theories

Brown et al. (2010) claimed that three collaboration technology theories were used to develop their model for predicting collaboration technology use. The three theories were social presence theory, channel expansion theory, and task closure theory. A description of each of the collaboration theories follows. The section will conclude with an examination of a model depicting the factors that influence process and outcome in electronic meetings (Dennis, George, Jessup, Nunamaker, & Vogel, 1988). The model developed by Dennis et al. served as the framework for the Brown et al. (2010) model that related collaboration constructs to key constructs in technology acceptance theories. The Brown et al. study was the primary model used in this dissertation and is presented at the end of this chapter.

Social Presence Theory

Social presence theory (Short, Williams, & Cristy, 1976) is the degree of awareness individuals have with one another while in a communication environment. Short et al. explained that communication technologies that are purely text based provide the lowest form of social presence; while at the other end of the communications spectrum, they placed face-to-face communication and considered it to be the highest form of social presence. In between the two ends, they placed communications technologies that incorporate video and audio synchronous communications. A number of researchers have studied social presence and found that it has an impact on learner participation (Koh, Kim, Butler, & Bock, 2007; Shen, Khalifi, & Yu, 2006) and social

interaction (Cobb, 2009). Collaborative learning and knowledge development have been linked to social interaction for some time now (Hiltz, 1994; Kearsley, 1995; Slavin, 1995). Lui, Gomez, and Yen (2009) found that social interaction served as a significant predictor of success in a virtual learning environment. In contrast to these findings, a study was conducted that found social presence did not have a significant impact on the learning experience in an e-training session (Hayashi, Chen, Ryan, & Wu, 2004). The researchers suggested that factors other than social presence may play more important roles in virtual learning environments. The following is a discussion of one of those potential factors, channel expansion theory.

Channel Expansion Theory

Channel expansion theory, an extension of media richness theory (Daft & Lengel, 1986), identified four experiences that influence users' perceptions of the richness of the communication channel (Carlson & Zmud, 1999). The richness of the communication channel refers to the ability of those using the communication channel to convey what they intend to convey using the channel. For example, a live interactive phone call may be considered a richer communication than email since email can be misinterpreted and through an interactive phone conversation the participants can clarify misunderstanding. Channel expansion theory suggests that experience using the channel, experience with the topic communicated, experience with the organizational context, and experience with other participants in the communication all impact user perceptions of the richness of the communication channel.

Prior experience using a technology impacts a person's ability to use the technology; therefore, prior experience with the technology can impact whether a person

will select and use a technology (Calson & Zmud, 1999; Daft & Lengel, 1986; Reinsch & Beswich, 1990). Additionally, participants' familiarity with one another will positively impact their experience working with collaboration technology (Carlson & Zmud, 1999; Dennis & Garfield, 2003). Likewise, a person's computer self-efficacy, referring to their belief in their own technical abilities to accomplish a task, will impact their perceptions of how well they will perform and their effort expectancies (Venkatesh, 2000). Task closure theory will be examined in the next section.

Task Closure Theory

The task closure model (Straub & Karahanna, 1998) suggested that collaborators are driven to bring closure to a task and that the motivation of closure impacts their choice of media for task completion. Face-to-face collaboration brings higher task closure than email, where the sender must wait for a response. Immediacy of communication is the ability of users to communicate quickly using collaboration technology (Dennis et al., 2008; Rice, 1987; Straub & Karahanna, 1998). Straub and Karahanna (1998) elucidated that team participants are motivated to complete tasks and that this drive for completion impacts team member's choice of collaboration tool to complete the task.

Task-Fit Theory

A number of researchers have studied the impact of task, reporting task fit as being an influencing factor for performance (Dennis, Wixom, & Vandenberg, 2001; Straub & Karahanna, 1998; Zigur & Buckland, 1998). Goodhue and Thompson (1995) described task-technology fit theories as contingency theories that maintain "when a technology provides features and support that 'fit' the requirements of the task" (p. 214)

then performance is positively impacted and sometimes utilization is positively impacted as well.

Idea generation and decision making have been identified as the two types of tasks commonly executed with collaboration technology (Dennis et al., 2001; Bajwa, Lewis, Pervan, & Lai, 2005). Idea generation tasks are additive tasks where concepts are generated by each individual participant and then combined to form a collection of ideas; a shared consensus is not necessary in idea generation (Brown et al., 2010). In contrast, Brown et al. described decision making tasks as those where group members work together to reach a consensus. Decision-making tasks require a greater amount of participant interaction and information processing than idea generation (Dennis et al., 2008). Brown et al. hypothesized that the task would moderate the effect social presence had on performance expectancy and be more important in decision making tasks. The next section will examine situational characteristics that impact users' intention to use a collaboration technology.

Situational Characteristics

The contexts in which a collaboration technology is implemented are known as the collaboration technology's situational characteristics (Dennis et al., 1988). A number of researchers identified a wide range of situational characteristics (Bajwa et al., 2005; Dennis et al., 1988; Pervan et al., 2005). Brown et al. (2010) focused on peer and superior influence as well as the organizational environmental factors, resource-facilitating conditions, and technology-facilitating conditions. "When peers and co-workers believe an individual should use the system, he or she will be more likely to do so," explained Brown et al. (2010, p. 24).

In addition to the influence others had over a participant's intention to use a system, Brown et al. (2010) posited that environmental factors play a role in a person's predicted use of a collaboration technology. The environmental factor of resource-facilitating conditions refers to the amount of funding available to encourage and support the use of collaboration technology. Technology-facilitating conditions refer to the compatibility of the current technology with the collaboration system (Brown et al.). When resources and technology are present, users will be more inclined to use the technology (Taylor & Todd, 1995). Brown et al. (2005) hypothesized that intention to use a collaboration technology would be positively influenced by peer and superior influence on resource- and technology-facilitating conditions.

Summary of Collaboration Technology Theories

Social presence theory, channel expansion theory, and task closure theory were collectively used to develop hypotheses for examining the factors that determine collaboration technology use (Brown et al., 2010). Social presence is the degree to which the other participants seem 'real' to each other (Kreijns, Kirschner, Jochems, & van Buuren, 2010). Channel expansion theory suggests that users' prior experience with a technology, their computer self-efficacy, and their prior experience with other team members will impact predicted use of collaboration technology in the future (Carlson & Zmud, 1999). The researchers of the task closure model (Straub & Karahanna, 1998) suggested that collaborators are driven to bring closure to a task and that the motivation of closure impacts their choice of media for task completion. Factors from each of these three collaboration technology theories were used as moderators, impacting factors that impact predicted use of the technology in the Brown et al. (2010) model.

In addition to these collaboration technology theories, Brown et al. (2010) identified task and situational characteristics that moderate factors contributing to virtual collaboration technology use. The following section will provide an overview of the technology acceptance theory literature.

Technology Acceptance Theories

In this section, technology acceptance research is examined. The theory of reasoned action, the technology acceptance model, and the theory of planned behavior are first discussed in detail. After the background theories are presented, an overview is provided of the UTAUT and the remaining models that were used to create it. This section will conclude with a thorough look at the Brown et al. (2010) model for predicting collaboration technology use, which combined the UTAUT model with theories from collaboration technology literature. A detailed examination is provided of the studies that were used to test the predicting collaboration technology use model.

Theory of Reasoned Action

The theory of reasoned action (TRA) was developed by Fishbein and Ajzen in 1975 and described in their book *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. TRA is a model for predicting behavior based on attitudes and beliefs (Fishbein & Ajzen, 1975; Sheppard, Hartwich, & Warshaw, 1988). On March 18, 2012, Google Scholar reported that Fishbein and Ajzen's book introducing TRA had been cited in 17,214 publications. TRA is used to predict a person's behavior, taking into account their attitude and their perceptions or the beliefs of those who are important to them. In information systems literature, the theory explains how these

factors influence an end-user's behavior. Figure 7 shows a graphic representation of TRA.

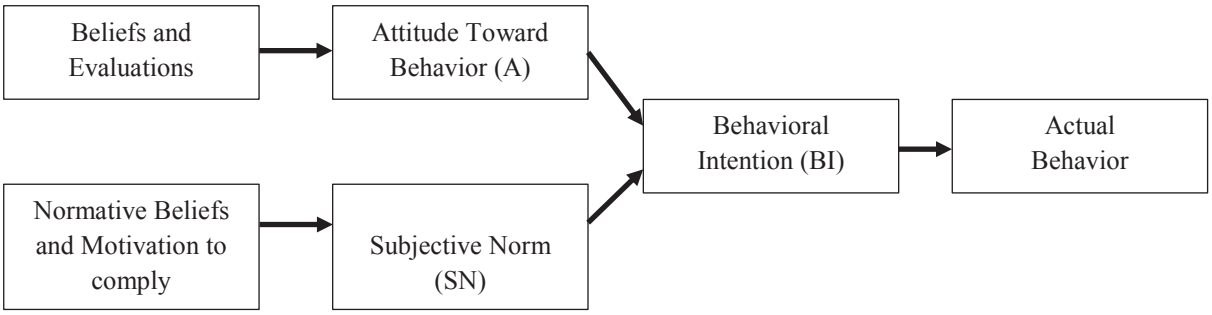

Figure 7. Theory of Reasoned Action

Sheppard et al. (1988) published a meta-analysis report of studies testing the theory of reasoned action. After examining 30 different studies with 11,566 subjects, they found strong evidence to support the predictive power of TRA. They also found that the model worked well outside of the domain Fishbein and Ajzen had originally intended. In fact, a number of researchers found that the TRA model can be used to predict behavior and use in information systems research (Davis, Bagozzi, & Warshaw, 1989; Karahanna, Straub, & Chervany, 1999; Taylor & Todd, 1995b). TRA was applied and used in the development of the next theory, the technology acceptance model.

Technology Acceptance Model

Fred Davis (1989) applied the theory of reasoned action to information systems research by developing the technology acceptance model (TAM). TAM is the most widely implemented theoretical model for evaluating technology adoption (Ma & Liu, 2004; Venkatesh, Morris, Davis, & Davis, 2003). Since 1989, when Davis first defined the TAM in *MIS Quarterly*, 16,393 research publications have cited the article, according to Google Scholar on June 29, 2013.

TAM applied two variables, perceived usefulness and perceived ease of use, which were used to determine behavioral intention to use and actual system use (Davis, 1989). Davis (1989) defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320); while perceived ease of use was defined as "the degree to which a person believes that using a particular system would be free of effort" (p. 320).

The primary principle of the TAM model is that a person's perceived usefulness of a technology and his/her perceived use of the technology will ultimately impact the amount of actual use of the technology. Figure 8 shows a graphical representation of the TAM.

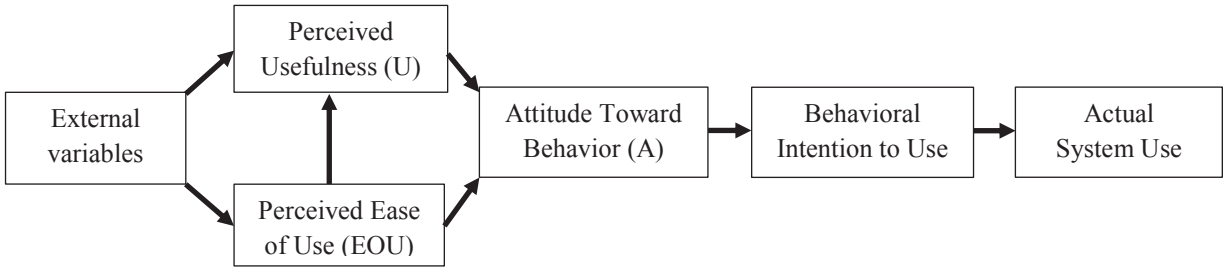

Figure 8. Technology Acceptance Model

Seeing that TAM is so widely researched and cited, several meta-analysis studies have been published investigating the TAM (Dennis, Wixom, & Vandenberg, 2001; King & He, 2006; Ma & Liu, 2004). King and He (2006) examined 88 published studies that incorporate the TAM model, finding the model to be robust and effective for predicting a system's use. King and He concluded that the model had a broad applicability and also confirmed the value of using students as alternates for business professional in TAM studies.

The robustness and applicability across many different research areas has made TAM the most widely implemented model for technology acceptance. In the next section, the theory of planned behavior will be discussed.

Theory of Planned Behavior (TPB)

Extended from the theory of reasoned action discussed above, the theory of planned behavior (TPB) (Ajzen, 1991) added the construct of perceived behavioral control. Perceived behavioral control is the perception of internal and external constraints on behavior (Taylor & Todd, 1995b). TPB is made up of three core constructs: attitude toward behavior, subjective norm, and perceived behavioral control (Ajzen, 1991). Figure 9 shows a pictorial representation of TPB. Attitude toward behavior and subjective norm are the constructs from the TRA model (Fishbein & Ajzen , 1975).

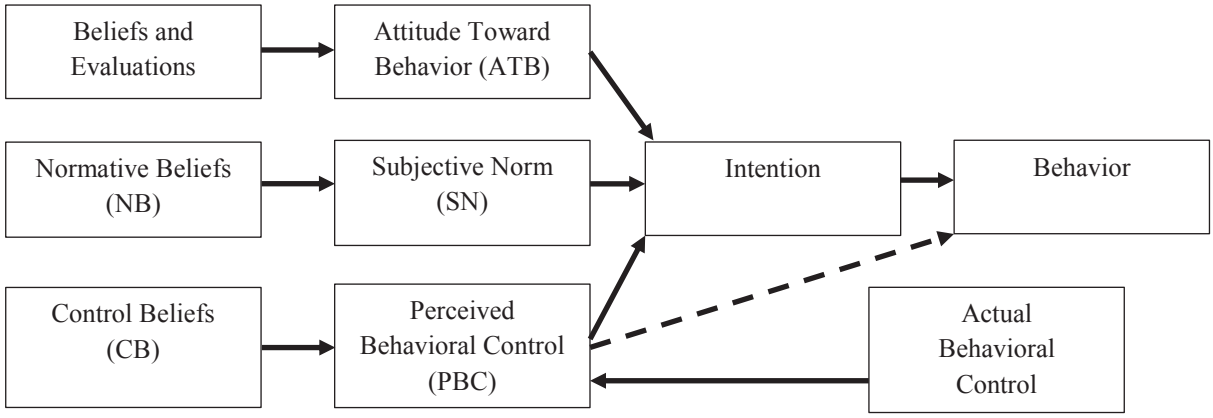

Figure 9. Theory of Planned Behavior

TPB has been applied to understanding user acceptance and usage of a variety of different technologies (Harrison, Mykytyn, & Riemenschneider, 1997; Mathieson, 1991; Taylor & Todd, 1995b). Taylor and Todd (1995b) compared the TAM and TPB models. They found TAM to be the more commonly implemented model in research; however, the researchers contended that TAM could be missing the social and control factors found

in other information technology usage models. A more recent study showed that TPB in some instances accounted for up to 50% of the variance of intention to use (Morris, Venkatesh, & Ackerman, 2005).

TPB extended TRA. The next section introduces a theory that unified eight user behavior models including TPB, TAM, and TRA. The combined model is known as the unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003).

Unified Theory of Acceptance and Use of Technology

Venkatesh et al. (2003) proposed a model known as the unified theory of acceptance and use of technology (UTAUT). The researchers designed UTAUT by incorporating eight prominent theories in user behavior. The models that were synthesized in the development of the UTAUT model are: (a) theory of reasoned action (TRA), (b) technology acceptance model (TAM), (c) motivational model (MM), (d) theory of planned behavior (TPB), (e) combined TAM and TPB (C-TAM-TPB), (f) model of PC utilization (MPCU), (g) innovation diffusion theory (IDT), and (h) social cognitive theory (SCT).

TRA, TAM, and TPB have already been discussed in the previous sections. The following will provide an overview of each of the remaining theories used in the synthesized UTAUT model.

Motivational Model

The motivational model (MM) theory resulted from a substantial body of research in the psychological domain explaining behavior (Venkatesh et al., 2003). Much research has been done applying the constructs of the MM theory in the information

systems field, looking at how motivation impacts technology use (Davis et. al, 1992; Venkatesh et al., 2003).

Two primary core constructs were presented as the central beliefs of the MM (Vallerand, Fortier, & Guay, 1997): intrinsic motivation and extrinsic motivation. Davis et al. (1992) described intrinsic motivation as the idea that a person will perform an activity without consideration of external events. In contrast, the researchers described extrinsic motivation as the idea that when a person performs an activity it is because he or she believes the activity will result in a valued outcome (Davis et al., 1992). Figure 10 demonstrates graphically the MM. The primary idea is that a person's motivation impacts his/her acceptance of a technology.

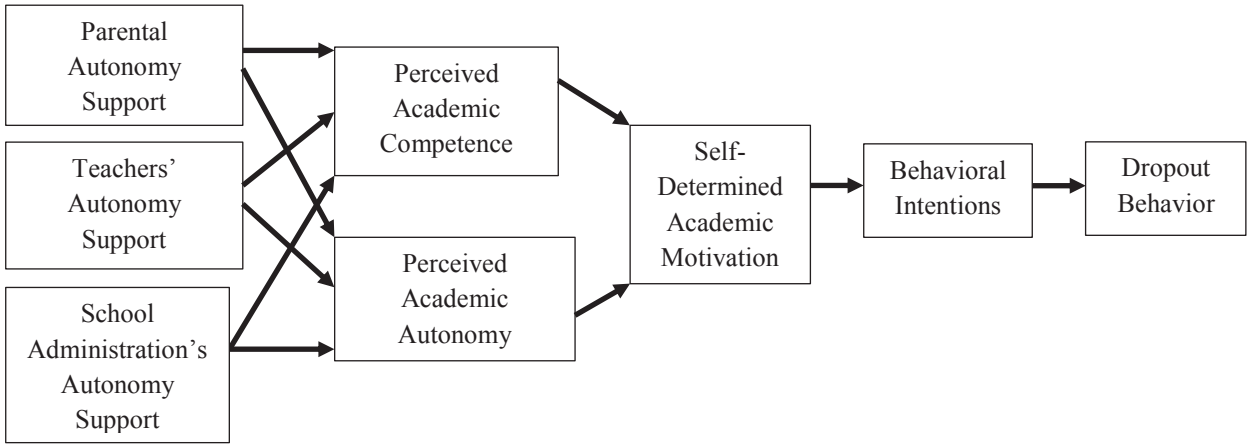

Figure 10. Motivational Model (Vallerand et al., 1997).

Combined TAM and TPB

Taylor and Todd (1995a) proposed a model that combined constructs of the technology acceptance model (TAM) with those of the theory of planned behavior (TPB). The combined model (C-TAM-TPB) added usefulness and ease of use to the TPB. Figure 11 presents the combined research model.

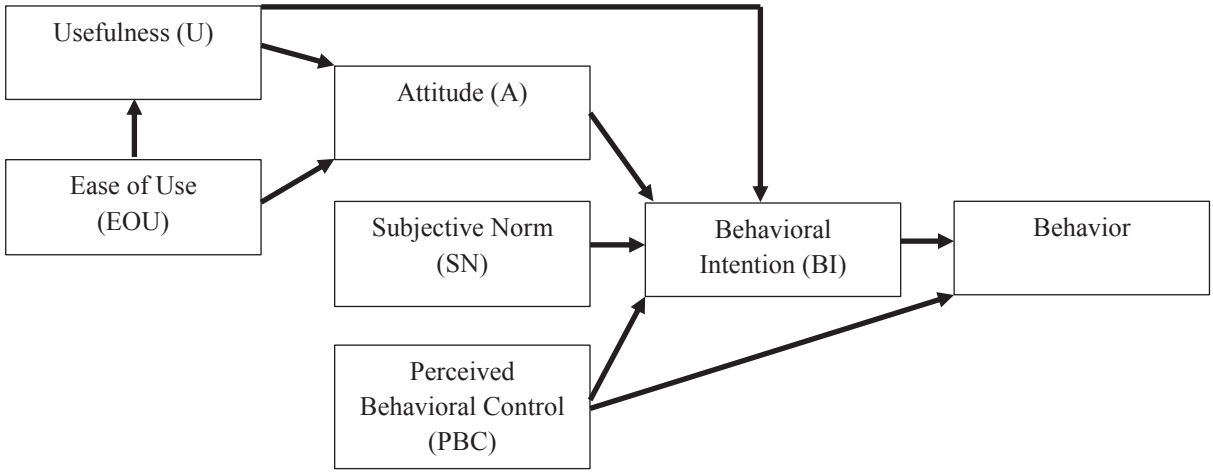

Figure 11. Combined TAM and TPB

To test the combined TAM and TPB model, Taylor and Todd (1995a) conducted a longitudinal study of 786 students, of which 430 were experienced computer users and 356 were inexperienced computer users. The researchers were trying to determine if the combined model could be used to predict behavioral intention for both groups (experience and inexperienced users) and if the actual system usage was the same for both groups. The study found all the direct determinants of intention to be significant with the exception of attitude. Taylor and Todd concluded that the model could be used to predict usage prior to users having any experience with a technology. However, they also concluded that experienced users had a stronger behavioral intention and behavior to use the technology than the inexperienced users.

The theory developed by Taylor and Todd (1995a) combined elements of TAM with social constructs of TPB. The study found that the factors that influence experienced users also impact inexperienced users. The next model that was used in the UTAUT synthesized theory was the model of PC utilization.

Model of PC Utilization

Thompson, Higgins, and Howell (1991) proposed the model of PC utilization (MPCU). Extending the theory of human behavior model developed by Triadis in 1977 (Venkatesh et al., 2003), the model differs from TPB and TRA in that it measures actual usage instead of intention to use (Thompson et al., 1991). The nature of the model makes it useful for predicting user acceptance of PCs as well as other technologies (Venkatesh et al., 2003). As shown in Figure 12, the model of PC utilization is composed of one dependent variable with six core constructs: (a) facilitating conditions for PC use, (b) social factors influencing PC use, (c) affect toward PC use, (d) complexity of PC use, (e) job fit with PC use, and (f) long-term consequences of PC use.

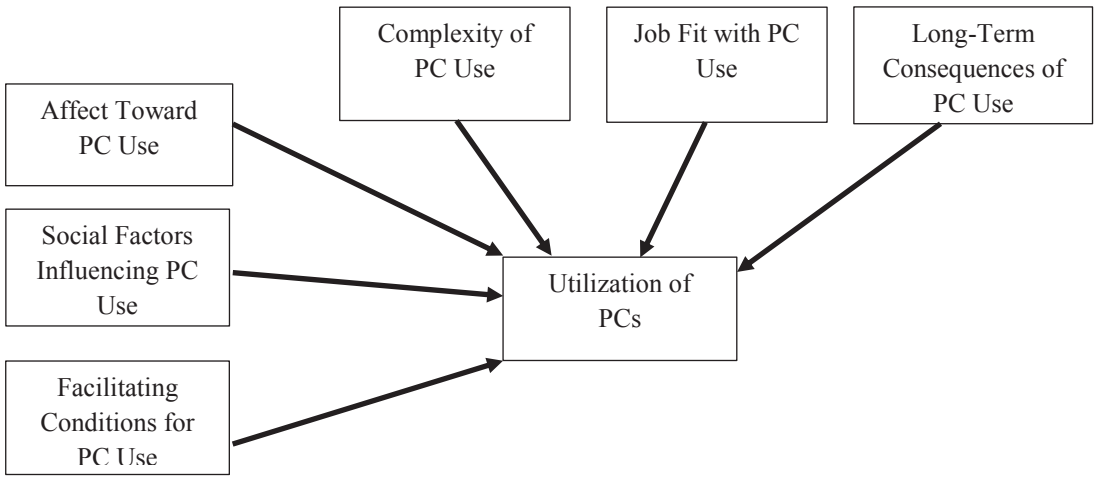

Figure 12. Model of PC Utilization

The next theory examined in the UTAUT study was the innovation diffusion theory.

Innovation Diffusion Theory

Everett Rogers developed the innovation diffusion theory in the 1960s, and it has since become a broadly applied model for measuring rate of adoption in behavioral science fields (Rogers, 1995). Moore and Benbasat (1991) modified the theory to examine the factors that lead to technology acceptance. The researchers identified six independent variables impacting technology acceptance: (a) relative advantage, (b) ease of use, (c) image, (d) visibility, (e) compatibility, (f) results demonstrability, and (g) voluntariness of use (Moore & Benbasat, 1991). The last of the eight models used in the synthesized UTAUT model is the social cognitive theory.

Social Cognitive Theory

Social cognitive theory, derived from social learning theory, is one of the most prominent models in the human behavior field (Venkatesh et al., 2003). Social cognitive theory suggests that behavior change is affected by environmental influences, personal factors, and attributes of the behavior itself (Compeau & Higgins, 1995). In 1995, Compeau and Higgins extended the social cognitive theory to apply to computer utilization. The researchers found that computer self-efficacy, one believing that he or she can perform a behavior, and a predicted positive outcome from performing the behavior will impact usage of a technology. Figure 13 is a pictorial representation of the social cognitive theory.

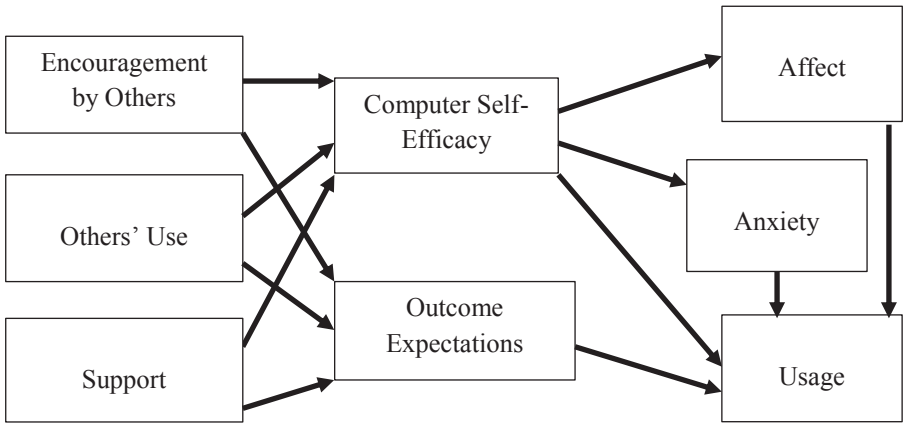

Figure 13. Social Cognitive Theory

This concludes the examination of the eight theories that were synthesized to develop the unified theory of acceptance and use of technology (UTAUT) developed by Venkatesh et al. (2003). An overview of the UTAUT study is provided in the next section.

Overview of UTAUT Study

A brief examination of the eight models used to formulate the UTAUT model was provided in the previous section. The UTAUT study began with four major objectives: (a) to review user acceptance literature, (b) to compare the eight models, (c) to develop the UTAUT model, and (4) to empirically test the UTAUT model (Venkatesh et al., 2003).

After reviewing the eight models of user behavior, Venkatesh et al. (2003) identified 32 constructs. The UTAUT study design was a longitudinal field study across four organizations and among employees being introduced to a new technology. In an effort to increase the robustness of the new model, the researchers included different

technologies, industries, organizations, and business functions, as well as varying levels of voluntariness (Venkatesh et al., 2003).

A questionnaire was developed by Venkatesh and colleagues from previously validated research items, changing only verb tenses where appropriate. A focus group evaluated the instrument. System logs were used to collect the use date (Venkatesh et al., 2003).

To empirically validate UTAUT, the survey was administered three times in two separate studies (n = 119) (Venkatesh et al., 2003). The survey was administered three different times: (a) post-training, (b) one month after implementation, and (c) three months after implementation. Partial least squares was used to examine the reliability and validity of the instrument. Loading patterns were found to be acceptable, with most loadings being .70 or higher; likewise, internal consistency reliabilities were greater than .70 as well (Venkatesh et al., 2003).

The survey results indicated that each of the eight models had one or more significant constructs (Venkatesh et al., 2003). The researchers found seven of the constructs appeared to be consistent determinants of intention to use or actual usage. Venkatesh et al. eliminated the following three constructs: (a) attitude toward technology, (b) self-efficacy, and (d) anxiety. The researchers theorized that the three constructs were not direct determinants of intention. The remaining four constructs were used in the UTAUT model. The constructs measured in the UTAUT model are: (a) performance expectancy, (b) effort expectancy, (c) social influence, and (d) facilitating conditions.

Performance expectancy is defined as the degree to which an individual believes that using the system will help in job performance. Effort expectancy is the "degree of

ease associated with the use of the system" (Venkatesh, 2003, p. 450). Social influence is the degree to which the individual believes that others find the use of the technology important. Facilitating conditions is the degree to which the user believes that a technical infrastructure exists to support the use of the technology. Four moderating factors will influence these independent variables in different ways, according to Venkatesh et al. (2003). The factors are: (a) gender, (b) age, (c) experience, and (d) voluntariness of use. A more in-depth discussion of the constructs and the moderators will be provided later in this section. Figure 14 reveals the UTAUT model graphically.

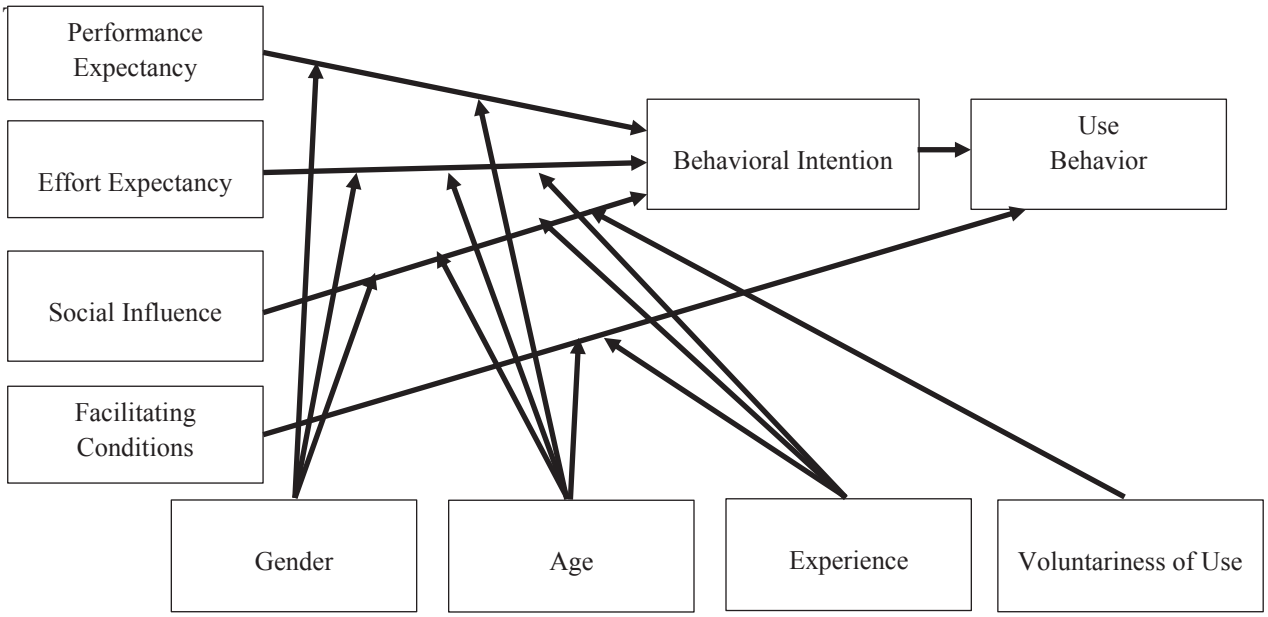

Figure 14. UTAUT Model

To cross-validate the model, Venkatesh et al. (2003) collected data from two new organizations using only the four highest loading factors (n = 133). Data was collected and analyzed in the same way as the previous study. The results were consistent with the first study's findings (Venkatesh et al., 2003). The survey items used in estimating UTAUT are found in Table 2. Each question was based on a 7-point Likert scale, 1 being

most negative and 7 being most positive. Venkatesh et al. (2003) used a focus group of five people to evaluate the questions.

Table 2

Items Used in Estimating UTAUT Model

Performance Expectancy 1. I would find the system useful in my job. 2. Using the system enables me to accomplish tasks more quickly. 3. Using the system increases my productivity. 4. If I use the system, I will increase my chances of getting a raise.
Effort Expectancy 5. My interaction with the system would be clear and understandable. 6. It would be easy for me to become skillful at using the system. 7. I would find the system easy to use. 8. Learning to operate the system is easy for me.
Attitude Toward Technology 9.Using the system is a bad/good idea. 10. The system makes work more interesting. 11. Working with the system is fun. 12. I like working with the system.
Social Influence 13. People who influence my behavior think that I should use the system. 14. People who are important to me think I should use the system. 15. The senior management of this business has been helpful in the use of the system. 16. In general, the organization has supported the use of the system.
Facilitating Conditions 17. I have the resources necessary to use the system. 18. I have the knowledge necessary to use the system. 19. The system is not compatible with other systems I use. 20. A specific person (or group) is available for assistance with system difficulties.
Self-efficacy I could complete the job or task using the system… 21. If there was no on around to tell me what to do as I go. 22. If I could call someone for help if I got stuck. 23. If I had a lot of time to complete the job for which the software was provided. 24. If I had just the built-in help facility for assistance.
Anxiety 25. I feel apprehensive about using the system. 26. It scares me to think that I could lose a lot of information using the system by hitting the wrong key. 27. I hesitate to use the system for fear of making mistakes I cannot correct. 28. The system is somewhat intimidating to me.

The following provides a detailed examination of the UTAUT model's four independent variables: (a) performance expectancy, (b) effort expectancy, (c) social influence, and (d) facilitating conditions. Venkatesh et al. (2003) contended that four moderating factors influenced the independent variables. The moderating factors include (a) gender, (b) age, (c) experience, and (d) voluntariness to use. The next section will provide a review of the independent variables and moderating factors and an explanation of how the moderators impact the independent variables. The section will conclude with a look at the two dependent variables: behavioral intention and actual use.

Independent Variables

Performance Expectancy. Performance expectancy was defined by Venkatesh et al. (2003) as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (p. 447). Performance expectancy was derived from four of the eight original theories (TAM, MPCU, IDT, and SCT). The UTAUT study researchers hypothesized that performance expectancy is moderated by gender and age, such that the effect is stronger for men, particularly young men. The study results supported this hypothesis and found that performance expectancy was moderated by gender and age and that the effect was strongest for young men.

Effort Expectancy. Effort expectancy was defined by Venkatesh et al. (2003) as "the degree of ease associated with the use of the system" (p. 450). Effort expectancy was derived from TAM, MPCU, and IDT theories. The UTAUT study researchers hypothesized and the study suggested that effort expectancy would be moderated by gender, age, and experience, finding the effect strongest for young women with minimal experience.

Social Influence. Social influence is "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003, p. 451). Gender, age, experience, and voluntariness were hypothesized and proven to moderate social influence, with older women under mandatory conditions with little experience having the strongest effect (Venkatesh et al., 2003).

Facilitating Conditions. Facilitating conditions are "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2003, p. 452). The latent variable facilitating conditions was developed based on constructs in TPB/DTPB, C-TAM-TPB, MPCU, and IDT theories. The UTAUT study researchers hypothesized that facilitating conditions would not have an influence on behavioral intention but that it would influence usage (Venkatesh et al., 2003). Both hypotheses were proven, finding that age and experience moderated facilitating conditions with a greater effect with older more experienced workers.

Moderating Factors

Gender. Gender served as a moderator in the UTAUT study because past research on gender differences found men tend to be highly task-oriented (Minton & Schneider, 1980). Venkatesh et al. (2003) contended that since men tend to be more task-oriented, performance expectancy will be more salient to men. They also referenced other research (Bem & Allen, 1974; Bozionelos, 1996) and indicated that effort expectancy would be more significant among women. In 1976, Miller suggested that women tend to be more sensitive to others' opinions; therefore, Venkatesh et al. (2003) contended that social

influence would be more significant among women when deciding to use a new technology.

Age. Age also served as a moderator to the independent variables. In the UTAUT study, age was defined as the approximate age of the participant at the time the survey was administered (Venkatesh et al., 2003). Previous research showed that age plays a role in technology adoption (Morris & Venkatesh, 2000; Venkatesh & Morris, 2000). Additional research (Plude & Hoyer, 1985) demonstrated that older individuals can have difficulty in processing complex commands and paying close attention to those processes on the job. Venkatesh et al. hypothesized that as age is increased, an individual's effort expectancy of a given task will also increase, meaning that the older a person is, the harder a job or task will be to accomplish. Conducting a meta-analysis, Rhodes (1983) found that social influences are more salient to workers as their age increases (Morris & Venkatesh, 2000).

Experience. Experience refers to the amount of experience an individual has in a specific domain. A number of researchers have shown that as experience increases, effort expectancy or difficulty of use will decrease (Agarwal & Prasad, 1997; Davis, Bagozzi, & Warshaw, 1989; Thompson et al., 1991; Thompson, Higgins, & Howell, 1994).

Voluntariness of Use. Voluntariness of use refers to whether or not an individual is mandated to use a particular technology. Venkatesh et al. (2003) explained that the majority of past technology acceptance research has focused on technology where participants primarily volunteer to use it. Nonetheless, some studies have shown that

technology use has been influenced by voluntariness to use (Hartwick & Barki, 1994; Rogers, 1995).

Dependent Variables

Behavior intension and actual use were the two dependent variables of the UTAUT model (Venkatesh et al., 2003). Both dependent variables are discussed in the next section.

Behavioral Intention. Behavioral intention, adapted from the TAM model (Davis, 1989) is defined as the plan to perform a task. Sheppard, Hartwick, and Warshaw (1988) showed how behavioral intention had a positive relationship with actual use. The majority of past technology acceptance research focused on behavioral intention instead of actual use (Trice & Treacy, 1988).

Actual Use. Actual use, also known as use behavior, is defined as the objective measure of use of a specific technology. Trice and Treacy (1988) reported that use is more difficult to report; therefore, most researchers choose to focus on behavioral intention instead. In the UTAUT study, actual use was reported by logging system use in the computer (Venkatesh et al., 2003).

Statistical Analysis used with the UTAUT Model

The structural equation modeling (SEM) technique partial least squares (PLS) is the most commonly implemented method for analyzing studies that employ the UTAUT model (Anderson & Schwager, 2004; Brown et al., 2002; Knutsen, 2005; Lin, Chan, & Jin, 2004; Venkatesh et al., 2003). PLS is a second generation multivariate data analysis technique that can be used to test if information systems research meets the standards of high quality statistical analysis (Gefen, Straub, & Boudreau, 2000). Researchers often

choose to use the PLS data analysis method due to its minimal requirements for sample size and normal distribution. According to Genfen et al. (2000), PLS does not require large sample sizes or normal distributions.

Research Employing UTAUT Model

According to Google Scholar, at the time this paper was written, the Venkatesh et al. (2003) UTAUT study was cited in over 4,980 published articles. A number of recent studies in a wide variety of research domains have applied the UTAUT model, including mobile banking implementations (Sangle & Awasthi, 2011; Zhou, 2012), wireless communications (Anderson & Schwager, 2004), organizational learning systems (Wong & Huang, 2011), and training in health care systems (Marshall, Mills, & Olson, 2008).

Summary of Technology Acceptance Research

This section provides a background of the technology acceptance research domain. In summary, the research domain was synthesized in 2003 with the UTAUT model that combined constructs from eight of the most prevalent theories in technology acceptance. The UTAUT theory suggests that four main predictors affect technology adoption: performance expectancy, effort expectancy, social influence, and facilitating conditions.

Venkatesh et al. (2003) called for future research to blend the UTAUT model with other established fields of research. The next and final model discussed in this literature review does just that. Brown, Dennis, and Venkatesh (2010) combined the constructs from the UTAUT model with those of collaboration technology research and developed a model for predicting collaboration technology use. The components of the Brown et al. (2010) model were combined with the previously reviewed Chen et al. (2010) model for

virtual teamwork training to conduct the primary study of this dissertation. Further discussion of the combined models was reported in the methodology chapter.

Predicting Collaboration Technology Use Model

In response to Venkatesh et al.'s (2003) recommendation for future research, Brown, Dennis, and Venkatesh (2010) extended the UTAUT model by incorporating theories from collaboration research to identify a model for predicting collaboration technology use. The Brown et al. (2010) study primarily combined UTAUT constructs with constructs from three theories in collaboration technology research – (a) social presence, (b) channel expansion theory, and (c) task closure model as well as other collaboration technology constructs.

Brown et al. (2010) combined the framework of Dennis et al. (1988), discussed earlier in this paper, and the UTAUT model to develop a model for predicting collaboration technology. The model was tested in two different studies. The survey instrument was provided and was modified for use in this dissertation.

The following three sections will provide an in-depth examination of the research model (Venkatesh et al., 2010). First, the primary research question of the study will be identified. Next, a description and diagram of the model will be provided, including the independent and dependent variables, the study hypotheses, and the survey instrument. Last, each of the two studies used to test the model will be explained.

Research Question

The overall research question in the Brown et al. (2010) study was: "Why do people choose to use collaboration technology?" (p. 13). Venkatesh et al. (2003) found that people accept a technology that they believe will help them to improve effectiveness

and efficiency while performing a task. The UTAUT model's constructs of performance expectancy and effort expectancy made it ideal for measuring effectiveness and efficiency in the Brown et al. (2010) study.

Model Description

The Brown et al. (2010) model combined the constructs of the UTAUT model (Venkatesh et al., 2003), eliminating voluntariness of use, with those of collaboration technology theory (Dennis et al., 1988). Researchers have identified a number of factors that influence performance and satisfaction of people who use collaboration technology (Dennis et al., 1988; Dennis et al., 2001; Fjermestad & Hiltz, 2001). The four categories of collaboration technology factors are: technology, individual and group, task, and situational (Dennis et al., 1988; Dennis et al., 2001; Fjermestad & Hiltz, 1999; Fjermestad & Hiltz, 2001; Zigur & Buckland, 1998).

The UTAUT and collaboration technology theory, dependent and independent variables, as well as the hypotheses, will be discussed in the next section. Figure 15 presents the research model for predicting collaboration technology use (Brown et al., 2010).

Brown et al. (2010) Study Independent Variables

As previously described in detail in the UTAUT study section, the UTAUT study independent variables were performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). In the Brown et al. (2010) model the four independent variables were moderated by gender, age, and collaboration technology experience. The hypotheses are provided for each independent variable and the moderators.

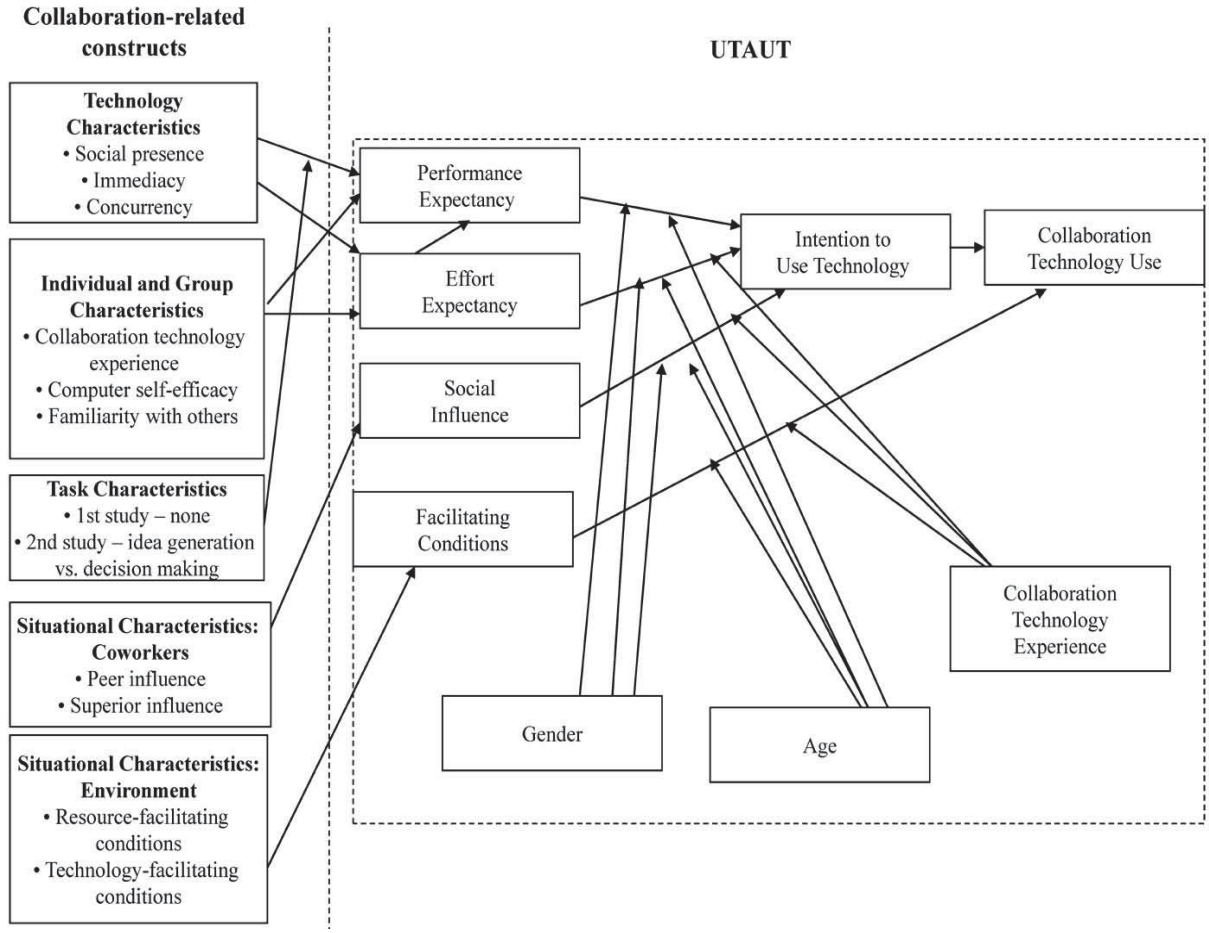

Figure 15. Model for Adoption and Use of Collaboration Technologies

Performance Expectancy. Performance expectancy is defined as "the extent to which use is expected to improve work performance" (Brown et al., 2010, p. 15).

Hypothesis 1a: The effect of performance expectancy on intention to use collaboration technology will be moderated by gender and age, such that it is strongest for younger men.

Effort Expectancy. Effort expectancy is defined as "the extent to which use is expected to be free of effort" (Brown et al., 2010, p. 15).

Hypothesis 1b: The effect of effort expectancy on intention to use collaboration technology will be moderated by gender, age, and experience, such that the effect will be strongest for older women with little experience.

Social Influence. Social influence is defined as "the extent to which the individual perceives that important others believe he or she should use the system" (Brown et al., 2010, p. 16).

Hypothesis 1c: The effect of social influence on behavioral intention to use collaboration technology will be moderated by gender, age, and experience, such that the effect will be strongest for older women with little experience.

Facilitating Conditions. Facilitating conditions is defined as "the extent to which the individual believes the organization and technical infrastructure support use of the system" (Brown et al., 2010, p. 17).

Hypothesis 1d: The effect of facilitating conditions on collaboration technology use will be moderated by age and experience, such that the effect is stronger for older users, particularly those with little experience.

The following variables are predictor variables: social presence, immediacy of communication, concurrency, collaboration technology experience, computer self-efficacy, familiarity with communication partner, influence of peers, influence of superior, resource-facilitating conditions, and technology-facilitating conditions. These predictor variables fall into the categories of technology characteristics, individual and group characteristics, task characteristics, and situation characteristics.

Technology Characteristics

Brown et al. (2010) created a category of technology characteristics including three factors: social presence, immediacy of communication, and concurrency. The three factors are defined below.

Social Presence. Social presence is defined as a technology's "ability to convey the psychological impression of the physical presence of their users*"* (Brown et al., 2010, p. 19).

Hypothesis 2a: Social presence will positively influence performance expectancy.

Hypothesis 2b: Social presence will positively influence effort expectancy.

Immediacy of Communication. Immediacy of communication "refers to the extent to which a collaboration technology enables the user to quickly communicate with others" (Brown et al., 2010, p. 20).

Hypothesis 2c: Immediacy of communication will positively influence performance expectancy.

Hypothesis 2d: Immediacy of communication will positively influence effort expectancy.

Concurrency. Concurrency is defined as "the ability of a collaboration technology to enable an individual to perform other tasks at the same time as using the technology" (Brown et al., 2010, p. 21).

Hypothesis 2e: Concurrency will positively influence performance expectancy.

Hypothesis 2f: Concurrency will positively influence effort expectancy.

Individual and Group Characteristics

Brown et al. (2010) created a category of individual and group characteristics. The individual characteristics are collaboration technology experience and computer self-efficacy. The group characteristic is familiarity with the communication partner. Each of the characteristics is defined below.

Collaboration Technology Experience. Collaboration technology experience is defined as "the ability to use a specific type of technology" (Brown et al., 2010, p. 21).

Hypothesis 3a: Collaboration technology experience will positively influence performance expectancy.

Hypothesis 3b: Collaboration technology experience will positively influence effort expectancy.

Computer Self-efficacy. Computer self-efficacy is defined as "an individual's belief in his or her ability to use technology to accomplish a task" (Brown et al., 2010, p. 22).

Hypothesis 3c: Computer self-efficacy will positively influence performance expectancy.

Hypothesis 3d: Computer self-efficacy will positively influence effort expectancy.

Familiarity with Communication Partner. Familiarity with the communication partner is the concept that "as individuals work together, they gradually develop an understanding of each other and jointly develop a set of norms and expectations around the use of collaboration technology" (Brown, et al., 2010, p. 22).

Hypothesis 3e: Familiarity with communication partners will positively influence performance expectancy.

Hypothesis 3f: Familiarity with communication partners will positively influence effort expectancy.

Task Characteristics

Brown et al. (2010) identified two types of tasks commonly performed with virtual communication technologies – idea generation/conferencing and decision making.

Hypothesis 4a: The effect of social presence on performance expectancy will be moderated by tasks such that social presence will be more important for decision-making tasks.

Hypothesis 4b: The effect of immediacy of communication on performance expectancy will be moderated by tasks such that immediacy of communication will be more important for decision-making tasks.

Hypothesis 4c: The effect of concurrency on performance expectancy will be moderated by tasks such that concurrency will be less important for decision-making tasks.

Situational Characteristics

Brown et al. (2010) created a category of situational characteristics which are coworker factors and environment factors.

Coworkers. Coworker factors are "the influence of peers and superiors" (Brown et al., 2010, p. 24)

Hypothesis 5a: The influence of peers will positively influence the perception of social influence.

Hypothesis 5b: The influence of superiors will positively influence the perception of social influence.

Environment. The environmental factors are resource-facilitating conditions and technology-facilitation conditions. Resource facilitating conditions are "the availability of money and infrastructure" to be able to use the system, "whereas technology-facilitating conditions relate to technical compatibility issues" (Brown et al., 2010, p. 25).

Hypothesis 5c: Resource-facilitating conditions will positively influence the perception of facilitating conditions.

Hypothesis 5d: Technology-facilitating conditions will positively influence the perception of facilitating conditions.

Brown et al. (2010) Study Dependent Variables

Intention to Use Technology. Intention to use technology is a measure of whether an individual plans to use a technology in the future. Researchers contend that technology acceptance can be measured by an individual's intention to use the technology (Brown et al., 2010; Davis, Bagozzi, & Warshaw, 1989; Venkatesh et al., 2003). Intention to use a technology is explained in terms of an individual's performance expectancy, effort expectancy, and social influences.

Collaboration Technology Use. The UTAUT study postulated that there is a positive direct effect of behavioral intention on use.

Hypothesis 6: Behavioral intention will positively influence use.

Table 3 provides a listing of the constructs and measures used to predict collaboration technology use (Brown et al. 2010).

Table 3

Survey Items for Predicting Collaboration Technology Use (Brown et al. 2010)

<COLLABORATION TOOL> is replaced with the actual system name in the company. Study 2 items are shown; Study 1 items are similar. Seven-point Likert agreement scale was used on most items unless otherwise described.
Use
1. I rate my intensity of use of <collaboration tool> to be: Very light…Very heavy (seven-point scale)
2. How frequently do you use <collaboration tool>: Never…Very frequently (seven-point scale)
3. On an average week, how much time (in hours) do you use <collaboration tool>?
4. Of the opportunities you have to use collaboration tools, including a telephone, what

percentage of time do you choose <collaboration tool>?
Intention to Use 5. I intend to use the <collaboration tool> in the next 6 months. 6. I predict I would use the system in the next 6 months. 7. I plan to use the system in the next 6 month.
Performance Expectancy 8. I believe <collaboration tool> will be useful for communication**.** 9. Using <collaboration tool> will enable me to accomplish work tasks more quickly. 10. Using the collaboration tool will increase my productivity.
Effort Expectancy 11. Using <collaboration tool> will not require a lot of mental effort. 12. I believe <collaboration tool> will be easy to use. 13. Using <collaboration tool> will be easy for me.
Social Influence 14. People who influence my behavior think that I should use <collaboration tool>. 15. People who are important to me think that I should use <collaboration tool>. 16. The senior management of this business thinks I should use <collaboration tool>.
Facilitating Conditions 17. I have the resources necessary to use <collaboration tool>. 18. I have the knowledge necessary to use <collaboration tool>. 19. A specific person (or group) is available for assistance with difficulties with <collaboration tool>.
Social Presence 20. Using <collaboration tool**>** to interact with others creates a warm environment for communication. 21. Using <collaboration tool> to interact with others creates a sociable environment for communication. 22. Using <collaboration tool> to interact with others creates a personal environment for communication.
Immediacy 23. <Collaboration tool> enables me to quickly reach communication partners. 24. When I communicate with someone using <collaboration tool>, they usually respond quickly. 25. When someone communicates with me using <collaboration tool>, I try to respond immediately.
Concurrency 26. I can easily use <collaboration tool> while participating in other activities. 27. I can easily communicate using <collaboration tool> while I am doing other things. 28. I can use <collaboration tool> while performing another task.
Technology Experience (seven-point scale) 29. My experience with audioconferencing is: None at all…Very extensive 30. My experience with videoconferencing is: None at all…Very extensive 31. My experience with messaging tools (e.g., MSN messenger) is: None at all…Very extensive 32. My experience with technologies similar to <collaboration tool> is: None at all…Very extensive

Computer Self-efficacy 33. I could complete a task using a computer if there was no one around to tell me what to do. 34. I could complete a task using a computer even if there was not a lot of time to complete it. 35. I could complete a task using a computer if I had just the built-in help facility for assistance.
Familiarity with Communication Partners 36. I feel comfortable discussing personal or private issues with co-workers with whom I collaborate. 37. I feel comfortable using informal communication (such as slang or abbreviations) with co-workers with whom I collaborate. 38. Overall, I feel that I know my collaborators well.
Peer Influence 39. My friends think I should use <collaboration tool**>.** 40. My peers think I should use <collaboration tool>. 41. My co-workers believe I should use <collaboration tool>.
Superior Influence 42. I believe the top management would like for me to use <collaboration tool>. 43. My supervisor suggests that I use <collaboration tool>. 44. There is pressure from the organization to use <collaboration tool>.
Resource-Facilitating Conditions 45. There isn't sufficient access to use <collaboration tool>. 46. Using <collaboration tool> is very resource intensive for me. 47. I am not able to use <collaboration tool> when I need it.
Technology-Facilitating Conditions 48. <Collaboration tool> is not compatible with other tools and technologies that I use. 49. <Collaboration tool> is not compatible with other software that I use. 50. I have trouble using <collaboration tool> seamlessly with other applications.

Overview of the Two Studies of Predicting Collaboration Technology Use

This section will provide an overview of the two studies that were used to test the model for predicting collaboration technology use (Brown et al., 2010). The first study was used to test the model in the context of a general collaboration tool used in day-to-day communications – short message service (SMS). The data in the first study were cross-sectional and did not include a specific task. The second study was intended to compliment the first study by testing the model in the context of a collaboration

technology implementation that examined task differences. Use data was collected six months after each study.

Measures

The survey instrument used in the Brown et al. (2010) study is shown in Table 3 above. The survey was developed using measures from previously validated models (Calson & Zmud, 1999; Compeau & Higgins, 1995; Davis et al., 1989; Venkatesh et al., 2003; Short et al., 1976; Taylor and Todd, 1995) and adapted for use in the Brown et al. study. Each of the validated studies was discussed in the previous sections on collaboration technologies and technology acceptance theories. Brown et al. did not identify previously validated scales to measure experience, immediacy, and concurrency, and therefore, created survey items using standard procedures of scale development (DeVellis, 2003). Several candidate scale items were created and peer feedback and card sorts were used to select the final survey items, giving items face and content validity.

Pretests and Pilot Study

In an effort to pretest the survey instrument, Brown et al. (2010) conducted two pretests. The researchers first asked ten people affiliated with the university to complete the survey and provide comments on the questions asked. Feedback was gathered from the ten participants and the survey was modified and given to a different group. The second group provided minimal suggestions for improvement and the survey remained the same.

The Brown et al. (2010) revised survey was then given to 111 undergraduate students in Finland. The students were asked about their use of SMS collaboration technology in the survey. The primary purpose of the pilot study was to validate the new

measures immediacy and concurrency developed by the researchers. The questions measuring immediacy and concurrency were found reliable with Cronbach's alpha greater than .80. The researchers found that all of the other scales also showed Cronbach's alpha greater than .80 as well.

Additionally, principal components analysis with varimax rotation was applied to the collaboration technology factors social presence, immediacy, concurrency, and familiarity with others. Brown et al. (2010) found positive results from this analysis as well, with loadings greater than .70 and cross-loadings less than .35. These results showed internal consistency and discriminant validity among the collaboration technology constructs. The UTAUT constructs were measured in the same fashion with the same positive results.

The sample size of 111 for the pilot study was not sufficient to measure internal consistency and discriminant validity; however, Brown et al. (2010) knew that the model and the survey items would be validated in the actual studies using confirmatory factor analysis in partial least squares (PLS).

Study One

As mentioned previously, the first study by Brown et al. (2010) examined users of SMS technology. SMS allows users to communicate using short text messages using a mobile device or computer (Doyle, 2001). The study data were collected from 349 voluntary users of SMS in Finland (Brown et al., 2010). Brown et al. (2010) described the study participants as primarily alumni and associates of a major university in Finland. The participants were given a paper survey and were asked to anonymously return the survey within one week. Out of the 500 participants who received surveys, 363 returned

the surveys and 349 surveys were usable, indicating a return rate of 73%. The average age of the participants was 34.3 and 36% were women.

Study Two

The second study examined participants in a Fortune 500 company in Finland who were using an in-house designed collaboration technology (Brown et al., 2010). The participants were employees who worked with technology design, programming, testing, and other similar fields. The employees used the collaboration technology to work with other employees in Finland, other European countries, and the United States. The collaboration system used by the employees in the study was one that was being beta tested. The use of the system was voluntary. The features that were available in the system included: (a) chat, (b) audioconferencing, (c) videoconferencing, (d) shared whiteboard, (e) saved meeting notes, and (f) functionality from other systems used in the organization. The participants were trained to use the new collaboration system. Following the training, 830 employees out of the 883 employees were given the survey instrument. Six months later a follow-up survey was issued to determine the employees' use of the system (Brown et al., 2010). The researchers' final response rate of the initial survey was 54% with 447 participants providing responses. The average age of the follow-up survey participants was 34.6 with 28% being women (Brown et al., 2010).

Predicting Collaboration Technology Study Implications and Conclusions

The result of the Brown et al. (2010) study was that UTAUT predictors – performance expectancy, effort expectancy, social influence, and facilitating conditions – serve as a channel through which the collaboration technology research factors – technology, individual/group, task, and situational characteristics – impact behavioral

intention and use of a particular collaboration technology. Brown et al. combined the UTAUT model (Venkatesh et al., 2003) with theories from collaboration technology research (Carlson et al., 1999; Daft & Lengel, 1986; Dennis et al., 1988; Short et al., 1976; Straub & Karahanna, 1998) and created a model for predicting collaboration technology use. The model was tested in two studies and found to be a viable model.

In addition to their contribution of integrating two prominent information technology fields of research in a combined model, Brown et al. (2003) concluded that social presence, immediacy, and concurrency are important factors in predicting collaboration technology use. The researchers also found that task plays an important role as well.

In the first study, "higher social presence, increased immediacy, and greater concurrency led to increased performance expectancy and effort expectancy" (Brown et al., 2010, p. 41). While in the second study in which task interactions were examined, the researchers found "(1) higher social presence only increased performance expectancy for decision-making tasks; (2) increased immediacy had beneficial performance expectancy effects for both task types, but stronger effects for decision-making tasks" (Brown et al, 2010, p. 41). Additionally, counter to their hypotheses, Brown et al. found greater concurrency led to greater performance expectancy only for decision-making tasks. The findings of the study identified that task and technology characteristics play an important role in technology acceptance research.

Brown et al. (2010) called for future research to include other constructs, including rehearsability and synchronicity, clearly articulating the focal task, organizational culture, innovation culture, and voluntariness. The researchers also

suggested that future studies evaluate interventions altering technology characteristics of social presence, immediacy, and concurrency or develop methods to improve group member familiarity. Brown et al. suggested that future studies examine perceptions when multiple collaboration tools are used. Group-level constructs (Burton-Jones & Gallivan, 2007) could also play a role in collaboration technology use (Brown et al., 2010). Therefore, future research could examine characteristics of groups that develop from collaboration technology use.

Summary of Predicting Collaboration Technology Use Model

The outcome of the Brown et al. (2010) study was a developed and validated model of the use of collaboration technologies. The model integrated UTAUT constructs with collaboration technology theories. The model was tested and validated by two different settings applying two different collaboration technologies.

Summary of Literature Review

The literature review included an overview of virtual team learning theories, collaboration technology theories, technology acceptance theories, and a model for predicting the use of collaboration technologies. The literature review indicated that while theories exist for virtual team learning and technology acceptance models are widely used, no studies were found that link both virtual team learning and collaboration technology acceptance research. The next chapter will provide a methodology for incorporating virtual team learning theories and identifying the factors that influence collaboration technology acceptance among college students.

Chapter III

METHODOLOGY

The purpose of this research was to combine ideas from virtual team learning theories with technology acceptance research to identify factors that contribute to the acceptance and use of electronic collaboration technologies. In Chapter 2, a summary of the literature related to virtual teams, collaboration technology, and technology acceptance was presented. In this chapter, an overview is provided of the model for incorporating virtual teamwork training and identifying factors that contribute to the use of an electronic collaboration system. Next, the theoretical constructs of the research model, including the research questions and hypotheses for the study, will be described. Finally, the research methods and procedures used to test the hypotheses are described in detail.

Research Model

The research model tested in this study was developed by combining constructs from the UTAUT theory (Venkatesh et al., 2003) with the model of virtual team training (Chen et al., 2010). The new model is presented in Figure 16. The model is intended to identify the factors from technology acceptance research, collaboration technology research, and virtual team training research that impact users' behavioral intention (BI) to use collaboration technologies. The research questions and hypotheses are presented in the next section.

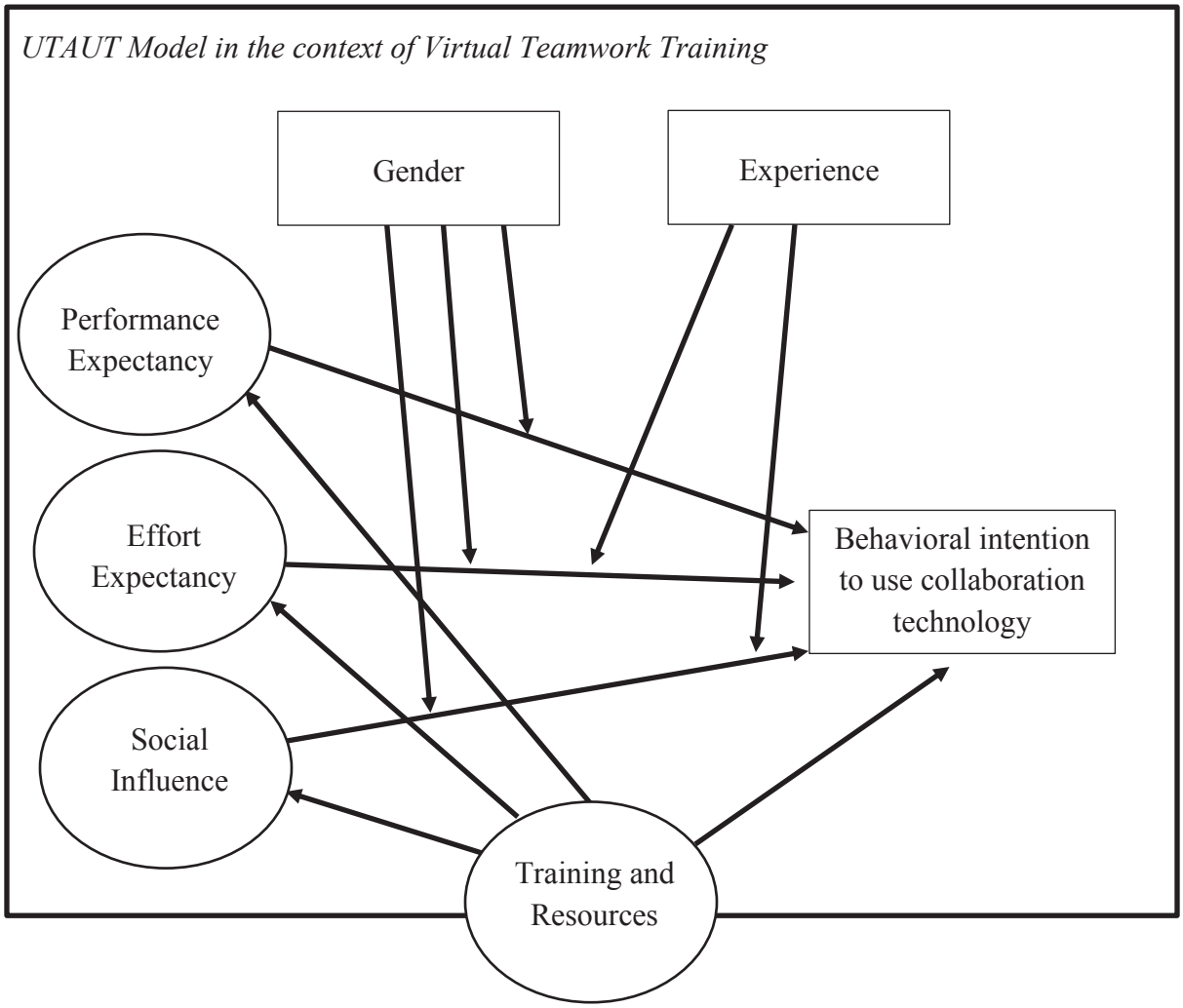

Figure 16. UTAUT Model within the Context of Virtual Teamwork Training

Research Questions and Hypotheses

As shown in Figure 16, the UTAUT model within the context of virtual teamwork training indicates that independent variables – training and resources, performance expectancy, effort expectancy, and social influence – are each hypothesized to influence the dependent variable – intention to use a collaboration technology. Gender and experience serve as moderating variables in the model. Four research questions were addressed in this study. The first four hypotheses answered the first question, "To what extent do training and resources, performance expectancy, effort expectancy, and social

influence explain a student's intention to use collaboration technology?" The second research question, "Do gender and experience moderate the effects of performance expectancy, effort expectancy, and social influence on a student's intention to use technology?" was answered by hypotheses 5, 6, and 7. The third research question was "Do performance expectancy, social influence, and effort expectancy mediate the effects of training and resources on a student's intention to use collaboration technology?" and was addressed by hypotheses 8, 9, and 10. The fourth research question was "How do students perceive virtual team training?" The following is a description of the factors and hypotheses for the first three research questions.

Training and Resources

The training and resources construct was derived from the UTAUT theory Venkatesh et al., 2003) and the model for incorporating virtual teamwork training (Chen, et al., 2008). Venkatesh and colleagues refer to facilitating conditions as the "degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system" (p. 453). The Chen et al. (2008) study found that student awareness of and competence in virtual teamwork was increased when their virtual teamwork training model was implemented.

In this dissertation study the training and resources construct refers to the degree to which individuals have been trained to participate in virtual teamwork activities and have adequate resources to accomplish tasks virtually. Therefore, the following is hypothesized:

H1 - User training and available resources will have a significant effect on intention to use the collaboration technology.

Training and resources were measured by the following three survey items:

- I have the resources necessary to use WebEx.
- I have the knowledge necessary to use WebEx.
- I received adequate training on how to use WebEx.

Performance Expectancy

Venkatesh et al. (2003) defined performance expectancy as the "degree to which an individual believes that using the system will help him or her to attain gains in job performance" (p. 447). In the proposed model of this dissertation, performance expectancy is defined as the degree to which an individual believes that using virtual team collaboration tools will result in successful project development. Therefore it is hypothesized:

H2 – Performance expectancy will have a significant effect on intention to use the collaboration technology.

Performance expectancy was measured by the following three survey items:

- I believe WebEx, or a similar collaboration technology, will be useful for communication.
- Using WebEx, or a similar collaboration technology, will enable me to accomplish future work tasks more quickly.
- Using WebEx, or a similar collaboration technology, will increase my productivity.

Effort Expectancy

Effort expectancy is defined in the UTAUT study as "the degree of ease associated with the use of the system" (Venkatesh et al., 2003, p. 450). In this

dissertation, effort expectancy is defined as the degree of ease associated with the use of the electronic collaboration system. Therefore, it is hypothesized:

H3 – Effort expectancy will have a significant effect on intention to use the collaboration technology.

Effort expectancy was measured by the following three survey items:

- Using WebEx, or a similar collaboration technology, requires little mental effort.
- I believe WebEx, or a similar collaboration technology, will be easy to use.
- Using WebEx, or a similar collaboration technology, will be easy for me.

Social Influence

Social influence is defined in the UTAUT model as the "degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003, p. 451). In this dissertation, social influence is defined as the degree to which an individual perceives that important others believe he or she should use virtual collaboration tools to perform tasks. Therefore, it is hypothesized:

H4 – Social influence will have a significant effect on intention to use the collaboration technology.

Social influence was measured by the following three survey items:

- Future employers, people who will influence my behavior, will think I should use WebEx, or a similar collaboration technology.
- People who are important to me think I should use WebEx.
- My instructor thinks I should use WebEx.

Moderating Variables

This section will provide a description of the moderating variables used in this study. The moderators include gender and experience. The moderators will affect the amount of variance each of the independent variables will show in relation to the dependent variable.

Gender. Researchers have found gender to be an important moderating factor of performance expectancy, effort expectancy, and social influence (Venkatesh et al., 2003). Gender was also a moderator in the TPB and TAM2 models (Morris et al., 2005; Venkatesh & Morris, 2000).

Experience. Experience in this study is defined as the amount of experience one has with computers. The UTAUT study showed that experience moderates the effects of effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003).

An individual's performance expectancy can be moderated by gender. Morris et al. (2003) found that female users experience lower performance expectancy than other individuals. Additional research concluded that age and gender moderate performance expectancy (Venkatesh & Morris, 2000). Therefore, based on the above findings, it is hypothesized:

H5 – The effect of performance expectancy on intention to use collaboration technology will be moderated by gender.

H6 - The effect of effort expectancy on intention to use collaboration technology will be moderated by gender and experience.

H7 - The effect of social influence on intention to use collaboration technology will be moderated by gender and experience.

Hypothesized Mediating Relationships

The previous section explained how training and resources, performance expectancy, effort expectancy, and social influence are hypothesized to influence intention to use the collaboration technology. Venkatesh (2000) found evidence for mediation of the effect of facilitating conditions, which is referred to as training and resources in this dissertation, on dependent variable actual technology use by the variable effort expectancy. In the research for this dissertation mediation was also tested for training and resources. All three of the other independent variables were tested to identify if they mediated the effects of training and resources on intention to use the collaboration technology. Therefore, the effects of training and resources on intention to use the collaboration technology is hypothesized to be mediated by performance expectancy, effort expectancy (Marshall, Mills, & Olsen, 2008; Venkatesh, 2000), and social influence. Based on the findings above, it is hypothesized:

H8 – Performance expectancy will mediate the effects of training and resources on intention to use the collaboration technology.

H9 – Effort expectancy will mediate the effects of training on intention to use the collaboration technology.

H10 – Social influence will mediate the effects of training and resources on intention to use the collaboration technology.

Virtual Teamwork Training Model

The UTAUT constructs were measured while in the context of the virtual teamwork training model (Chen et al., 2008). An in-depth description of the Chen et al. study can be found in the literature review, Chapter 2. A detailed description of how the

model was implemented in this study is discussed later in this chapter. The survey questions to evaluate the students' perceptions of the virtual team training were adapted from the Chen et al. (2008) model. The student perceptions survey items were the following:

- My understanding of virtual teamwork has increased as a result of this class.
- My ability to work in a virtual environment has been enhanced as a result of taking this class.
- This class was useful in terms of preparing me to work in virtual teams at some future time.
- Virtual teamwork training is an important component of business school curriculum.
- I have a good basic understanding of virtual teamwork.

Research Methods and Procedures

This section will describe the research methods and procedures that were employed in this dissertation study to test the hypotheses listed above. The primary purpose of this study was to look at the factors that affect the virtual collaboration technology acceptance and determine the role of virtual teamwork training in the technology acceptance. A correlational research design (Pedhazur & Schmlkin, 1991) was used to test the hypotheses. Fraenkel and Wallen (2009) described the primary purpose of correlational research as "to clarify our understanding of important phenomena by identifying relationships among variables" (p. 329). Additionally, correlational research allows for predictability of research models (Gall, Gall, & Borg, 2003).

Participants

Subjects for this study included 108 undergraduate business students enrolled in Principles of Information Systems. The participants were chosen based on my accessibility with the population and the participants' lack of initial familiarity with the collaboration technology. Most of the students had not previously participated in virtual team activities using electronic collaboration technologies such as WebEx.

Timeline and Procedures

Data can be collected at the same point in time (cross-sectional) or at different points in time (longitudinal) in correlational research (Frankel & Wallen, 2009). I used a cross-sectional approach in this dissertation study. I administered surveys to students at the end of the course in two different semesters. The cross-sectional approach was used because I wanted to examine the factors that affect acceptance of collaboration technology, and this would be best measured after participants had been trained and participated in virtual team activities.

Data Collection Method

The participants in the study participated in four virtual team meetings in the course of a semester. Following their participation in the virtual teamwork training and the four virtual team meetings, the participants were administered a survey at the conclusion of the course.

Procedures

IRB approval was received from both Valdosta State University and the university where the students were enrolled. The study began early in the following semester. Virtual team groups were assigned by me, the instructor, at the beginning of

each semester. Complying with the abstraction conceptualization learning process of the virtual teamwork training model (Chen et al., 2008), I provided lectures, articles, videos, and classroom discussions about participating in virtual teams. The participants were trained on the various types of tasks that can be accomplished using collaboration tools (i.e., discussion and presentation vs. brainstorming and production tasks).

The next phase of the training had the students actually participate in a virtual meeting. The researchers of the model of virtual teamwork training (Chen et al., 2008) described active experimentation and concrete experience as the second component of the model. Essentially, participants learn by doing using trial and error. Active experimentation and concrete experiences are integral parts of the learning life cycle presented by Kolb (1984). Cisco WebEx was the system used for the virtual meetings. WebEx is a Cisco Systems company that provides high quality on-demand collaboration, online meeting, web conferencing, and video conferencing applications. WebEx is one of the industry leaders for electronic collaboration technologies used in businesses today. WebEx offers a free trial version with all of the robust features of the version available for sale. Some of the features included in WebEx are video conferencing with integrated audio, desktop and document sharing, white board, and chat. WebEx provides users with the ability to record meetings.

I demonstrated in class how to set up a WebEx meeting and allowed some students to demonstrate the activity in the class. Additionally, the WebEx website provides online video training showing how to set up meetings, invite participants, and share video and audio among participants, as well as how to control presentation

capabilities. The students were shown the videos in class and were encouraged to ask questions and experiment with the technology.

After the students were provided instruction in class about how to use the technology, they were given an assignment to complete using the virtual collaboration tool, WebEx. The students were told to use the free trial version of WebEx. For each of the virtual meetings, one participant per team was instructed to serve as the coordinator of the meeting. The coordinator would set up the WebEx account and send email invitations to the other team members to join the meeting. The participants were encouraged to conduct these meetings from remote locations such as their apartments or homes to truly simulate a virtual meeting environment.

The first virtual meeting was an article discussion activity, specifically a literature circle activity (Appendix B). Using a modified version of Harvey Daniel's (1994) literature circles, each student was given a pre-meeting activity and a during-meeting activity. They were told to read the article and prepare their pre-meeting activity. The article was one that related to the topic of globalization and virtual teams. During the virtual meeting the participants were to discuss the article using their during-meeting activity. WebEx provides a means to record the virtual meeting. The meeting coordinator was instructed to record the meeting and submit the recording to the instructor to provide proof that the meeting was conducted and the team members were all present during the virtual meeting.

Following the meeting, each team participant answered online discussion questions about the article. Additionally, the team members were asked to reflect on the virtual team meeting. The students were instructed to reflect on the

effectiveness/ineffectiveness of the virtual team meeting on an online discussion forum. Observational reflection is the final phase of the model of virtual teamwork training (Chen et al., 2008).

The teams repeated this process with two additional articles relating to the course objectives. After completing three discussion-based virtual meetings using video conferencing technology, the team members participated in a final virtual team meeting. The last virtual team meeting allowed the team members to brainstorm and develop a database proposal. The students were trained in class to design databases and created two databases in a lab environment using activities provided by the instructor. Previously in the semester, the participants had developed a network project, a web design project, and a Visual Basic programming project for a fictitious business that they created.

During the final virtual team meeting, the students were instructed to brainstorm and create a database proposal for their fictitious business. The fourth virtual team meeting provided the students with an opportunity to participate in decision-making tasks. Decision-making tasks require a greater amount of participant interaction and information processing than idea generation (Dennis et al., 2008). The team members posted their proposals and team meeting video to a discussion board.

At the conclusion of the semester, during the last class meeting, students were given the survey to identify the factors that impact intention to use electronic collaboration technologies. The next section describes the survey administered to the participants.

Instruments and Measures

The survey questions were created using the preexisting scales from the UTAUT (Venkatesh et al., 2003), the predicting collaboration technology use model (Brown et al., 2010), and the model of virtual teamwork training (Chen et al., 2008). The scales were reworded to apply to this study's research domain, virtual collaboration, as is common practice in technology acceptance research (Davis, 1989; Marshall et al., 2008; Morris & Dillon, 1997). A pilot study was conducted to test the survey's reliability.

Pilot Study

The survey was administered to 63 participants following their participation in two virtual team meetings. The primary purpose of the pilot study was to determine the reliability of the survey items. Reliability of the survey items was measured using Cronbach's alpha (Field, 2009). Field described the acceptable range of alpha to be .7 to .8, with values substantially lower than .7 indicating an unreliable scale. Table 4 shows the Cronbach alpha for each construct. The results indicate that all of the instrument's items had high reliability with the exception of one construct, effort expectancy (α = .663). To address the lower Cronbach alpha value for effort expectancy one of the survey items for the effort expectancy was reworded to provide clarity. The pilot question read "Using WebEx will not require a lot of mental effort." The question was modified to read "Using WebEx, or a similar collaboration technology, requires little mental effort."

As a result of the pilot study, the survey questions were reworded to include "WebEx, or a similar collaboration technology" instead of just "WebEx." In the questions measuring social influence, references were changed to the future employees

and colleagues instead of current people who influence behavior. This change was made since the subjects are college students and not working in a business environment.

Survey Items

The following section contains a listing of the factors and the revised questions that were used to measure each latent variable. The first five constructs measured — intention to use, performance expectancy, effort expectancy, social influence, and training and resources — were from the UTAUT study (Vanketesh, et al., 2003) and the predicting collaboration technology use model (Brown, et al., 2010).

Table 4

Cronbach's Alpha Reliability Test Results for the Pilot Study

Construct	Number of items	Cronbach's Alpha
Intention to Use	3	.92
Performance Expectancy	3	.82
Effort Expectancy	3	.66
Social Influence	3	.79
Training and Resources	3	.79
Virtual Team Training	5	.85

The sixth factor, virtual teamwork training perceptions, was adapted from virtual teamwork training model (Chen et al., 2008).

Intention to Use. Intention to use was measured by the following three items:

- I intend to use WebEx, or a similar collaboration technology, in the future.
- I predict I would use WebEx, or a similar collaboration technology, in the future.
- I plan to use WebEx, or a similar collaboration technology, in the future.

Performance Expectancy. Performance expectancy was measured by the following three items:

- I believe WebEx, or a similar collaboration technology, will be useful for communication.
- Using WebEx, or a similar collaboration technology, will enable me to accomplish future work tasks more quickly.
- Using WebEx, or a similar collaboration technology, will increase my productivity.

Effort Expectancy. Effort expectancy was measured by the following three items:

- Using WebEx, or a similar collaboration technology, requires little mental effort.
- I believe WebEx, or a similar collaboration technology, will be easy to use.
- Using WebEx, or a similar collaboration technology, will be easy for me.

Social Influence. Social influence was measured by the following three items:

- Future employers, people who will influence my behavior, will think I should use WebEx, or a similar collaboration technology.
- People who are important to me think I should use WebEx.
- My instructor thinks I should use WebEx.

Training and Resources. Training and resources were measured by the following three items:

- I have the resources necessary to use WebEx.
- I have the knowledge necessary to use WebEx.
- I received adequate training on how to use WebEx.

Virtual Teamwork Training. The following items were taken directly from the virtual teamwork training model (Chen et al., 2008):

- My understanding of virtual teamwork has increased as a result of this class.

- My ability to work in a virtual environment has been enhanced as a result of taking this class.
- This class was useful in terms of preparing me to work in virtual teams at some future time.
- Virtual teamwork training is an important component of business school curriculum.
- I have a good basic understanding of virtual teamwork.

Moderating Variables. The moderating variables experience and gender were collected by the following survey questions:

- Computer experience – "How would you rate your computer experience?" (1-5, 1 = no experience…5 = expert)
- Gender – "Gender: _____"

Response Scales

The original scales in the UTAUT model, the predicting collaboration technology model, and the virtual teamwork training model used a 7-point Likert Scale for each response. The UTAUT and predicting collaboration technology model showed 1 being the negative end (strongly disagree) and 7 being the positive end (strongly agree). However, the virtual teamwork training model showed 1 being the positive end (strongly agree) and 7 being the negative end (strongly disagree). In this study, the survey followed the agreement scales used in the UTAUT and predicting collaboration technologies models, with 1 representing strongly disagree and 7 representing strongly agree.

Data Analysis

The data were analyzed using descriptive statistics, correlational analysis, and structural equation modeling (SEM). A pilot study was conducted and all survey items were tested using Cronbach alpha (Field, 2009) to determine the reliability of the instrument. Descriptive statistics showed the demographics of the respondents, including statistics regarding gender and computer experience. A correlational matrix (Fraenkel & Wallen, 2009) was used to test the different hypotheses in the research model. The matrix shows the influence each construct has on the dependent variable and how the variables correlate. A structural equation modeling tool, partial least squares (PLS), was used to determine these relationships. Using PLS allows the researcher to use regression analysis on only a portion of a model at one time (Chin, 1998). Additionally, PLS provides a means for researchers to perform structural equation modeling when sample sizes are small (Chin & Newsted, 1999). The study participants were asked to write reflections of their experiences while participating in virtual team meetings. The reflections were analyzed and compared to the results of the survey items related to the participants' perceptions of the virtual team training. The results of this study will be provided in the next chapter.

Summary of Methodology

A review of the model for incorporating virtual teamwork training and identifying factors that contribute to behavioral use of an electronic collaboration system was provided at the beginning of this chapter. The research model theoretical constructs, including the model diagram, research questions, and hypotheses for the study, were described. The virtual teamwork training procedures were also described in detail. The

students were trained to participate in virtual teams; additionally, each student participated in four virtual team meetings. The survey was administered over two semesters and the results were analyzed using descriptive statistics, correlational analysis, and SEM. The next chapter describes the results for the data collected.

Chapter IV

DATA ANALYSIS AND RESULTS

The data analysis and results of the study are provided in this chapter. The discussion includes demographics of the respondents, the reliability and validity of the measures, the correlation matrix, the testing of the hypotheses, and the summary of the findings.

Demographics of the Respondents

Out of 127 participants in the training, 108 (85%) surveys were completed. The demographics of those that responded are provided in Table 5. As shown in Table 5, 64 (59%) of the respondents were male and 44 (41%) were female. The mean age of those surveyed was 21.65 with a standard deviation of 1.5. The oldest participant was 26 and the youngest was 19.

The majority, 96 (89%) of the respondents reported that they had moderate to very strong computer experience. The mean reported for computer experiences was 5.65 out of 7 with a standard deviation of 1.04.

Table 5 also reports the participants' majors. The majority of the participants that reported were Management 37 (34.26%), Marketing 33 (30.55%), and Accounting 25 (23.14%) majors. Of those who participated only 7 (6.4%) were majoring in computer related fields of Computer Science and Management Information Systems.

Table 5

Demographics of the Respondents

Characteristics	Frequency	Percent (%)
Gender		
Male	64	59%
Female	44	41%
Age		
19	19	17.59%
20	42	38.89%
21	25	23.14%
22	12	11.11%
23	5	4.6%
26	5	4.6%
Computer Experience		
Very strong	24	22.22%
Strong	40	37.03%
Good	32	29.62%
Fair	7	6.48%
Weak	5	6.62%
Very Weak	0	0%
Major		
Accounting	25	23.14%
Advertising	1	.93%
Computer Science	2	1.85%
General Business	3	2.77%
Management	37	34.26%
Management Information Systems	5	4.62%
Marketing	33	30.55%
Did not report	2	1.85%

Evalution of the PLS Path Model

When using PLS path modeling, a global goodness-of-fit criterion is not provided (Henseler, Ringle, & Sinkovics, 2009). Chin (1998) defined a series of criteria to access partial model structures. The approach suggested by Chin is a two-step process: (1) assessment of the outer model, which is also known as the measurement model, and (2) assessment of the inner model, which is also known as the structural model.

The first step focuses on the reliability and validity of the survey instrument (the outer model). The survey instrument used in this study can be found in Appendix C. Once reliability and validity are established then the structural model can be assessed for the effects the independent variables have on the dependent variables.

Reliability and Validity of the Measures

Hensler et al. (2009) stated that "reflective measurement models should be assessed with regard to their reliability and validity" (p. 298). Reliability is the consistency of the indicators for a given construct. Validity determines whether a survey instrument measures what it is set out to measure (Field, 2009). Two types of validity were examined in this study: convergent validity and discriminant validity.

Reliability

Internal consistency reliability is usually the first criterion checked. Cronbach's α (Cronbach, 1951) is traditionally used to estimate the reliability based on indicator intercorrelations. All of the survey items in the study were tested to determine the Cronbach's alpha (α). The results are presented in Table 6. All coefficients were above the 0.7, which is the generally acceptable value for Cronbach's alpha (Field, 2009). The adjustments in the items from the pilot study increased the alpha values for effort expectancy (.66 to .91) and training and resources (.79 to .90).

Henseler et al. (2009) explained the Cronbach's α can underestimate the internal consistency reliability of latent variables in PLS path models; therefore, it is also important to report composite reliability ρ_c (Werts, Linn, & Jöreskog, 1974). Composite reliability takes into account that indicators have different loadings and is interpreted the

same way as the Cronbach's α. Cronbach α and composite reliability values above 0.7 in early stages of research and values above 0.8 or 0.9 in more advanced stages of research are considered satisfactory (Nunnally & Bernstein, 1994). Values below 0.6 reflect a lack of reliability. Table 7 shows the composite reliability values for this study. All of the constructs in the study passed the reliability tests with Cronbach's alpha greater than 0.7 and composite reliability values greater than 0.8.

Table 6

Cronbach's Alpha Reliability Test Results for the Study

Construct	Number of items	Cronbach's Alpha
Intention to Use	3	.93
Performance Expectancy	3	.81
Effort Expectancy	3	.92
Social Influence	3	.79
Training and Resources	3	.90
Virtual Team Training	5	.90

Validity

In PLS analysis two validity subtypes are assessed: convergent validity and discriminant validity. Convergent validity indicates that a group of indicators represent the same construct (Henseler et al., 2009). Average variance extracted (AVE) is the suggested criterion for measuring convergent validity (Fornell & Larcker, 1981).

Table 7

Composite Reliability Results for the Study

Construct	Number of items	Composite Reliability (ρ_c)
Intention to Use	3	.96
Performance Expectancy	3	.89
Effort Expectancy	3	.95
Social Influence	3	.88
Training and Resources	3	.94
Virtual Team Training	5	.93

An AVE of 0.5 indicates that a latent variable will on average be able to explain over half of the variance of its indicators (Henseler et al., 2009). The AVE values for each of the constructs in the study are reported in Table 8. All constructs have AVE values greater than 0.7, which is above the required 0.5 for sufficient convergent validity.

Table 8

Average Variance Extracted (AVE)

Construct	Number of items	AVE
Intention to Use	3	.88
Performance Expectancy	3	.72
Effort Expectancy	3	.86
Social Influence	3	.71
Training and Resources	3	.84
Virtual Team Training	5	.73

Discriminant validity determines if the items are more related to an indicated construct than to other constructs. Two measures of discriminant validity are suggested (Hensler et al., 2009): a comparison of cross-loadings and the Fornell-Larcker criterion. The loading of each indicator is expected to be greater than all of its cross-loadings (Chin, 1998). In this study, there were no items with cross-loading greater than the indicators. The Fornell-Larcker criterion (Fornell & Larker, 1981) is also used to measure discriminant validity (Henseler et al., 2009). Henseler et al. (2009) stated that "the Fornell-Larcker criterion suggests that a latent variable shares more variance with its assigned indicators than with any other latent variable" (p. 299). The discriminant validity is determined by comparing the square root of the AVE of each latent variable to the constructs correlations. For discriminant validity to exist the square root of AVE should be more than the absolute value of each of the constructs' correlations.

Table 9

Discriminant Validity: Average Variance Extracted and Construct Correlations

Construct	1	2	3	4	5	6
1. Intention to Use	.94					
2. Performance Expectancy	.72	.85				
3. Effort Expectancy	.39	.60	.93			
4. Social Influence	.65	.63	.58	.84		
5. Training and Resources	.48	.58	.60	.50	.92	
6. Virtual Team Training	.50	.61	.57	.66	.63	.85

Note: Square-root of AVE on the diagonal shaded in gray.

Table 9 shows the square root of the AVE values (shaded in gray) for each construct and the correlations with each construct. The square root of AVE for each construct is greater than the correlations of the constructs, indicating strong discriminant validity on each of the constructs. Using the above described tests for reliability and validity, all instrument items were found to conform to the rules of reliability and validity.

Test of the Research Model

After having found reliable and valid outer model estimations, inner model estimates were permitted (Henseler et al., 2009). The following will provide a description of the three research questions and the study hypotheses. Next, a correlational matrix will present the latent variable correlations. Third, the coefficient of determination (R^2) is reported. The results of the tested hypotheses are reported last.

Four research questions were defined in Chapter 1 of this study. The four research questions are as follows:

(1) To what extent do training and resources, performance expectancy, effort expectancy, and social influence explain a student's intention to use a collaboration technology?

(2) Do gender and experience moderate the effects of performance expectancy, effort expectancy, and social influence on a student's intention to use collaboration technology?

(3) Do performance expectancy, social influence, and effort expectancy mediate the effects of training and resources on a student's intention to use collaboration technology?

(4) How do students perceive virtual team training?

The first three questions are answered using the hypotheses listed in Table 10. A correlational matrix was used to test the correlations between the independent variables and the dependent variable. The structural model was tested by using partial least square (PLS) based structural equation modeling (SEM). SmartPLS was used to estimate the model (Ringle, Wende, & Wills, 2005). Research Question 4 was answered using mean responses to the survey items regarding student perceptions.

Table 10

Study Hypotheses

	Descriptions
H1	User training and available resources will have a significant effect on intention to use the collaboration technology.
H2	Performance expectancy will have a significant effect on intention to use the collaboration technology.
H3	Effort expectancy will have a significant effect on intention to use the collaboration technology.
H4	Social influence will have a significant effect on intention to use the collaboration technology.
H5	The effect of performance expectancy on intention to use collaboration technology will be moderated by gender.
H6	The effect of effort expectancy on intention to use collaboration technology will be moderated by gender and experience.
H7	The effect of social influence on intention to use collaboration technology will be moderated by gender and experience.
H8	Performance expectancy will mediate the effects of training and resources on intention to use the collaboration technology.
H9	Effort expectancy will mediate the effects of training and resources on intention to use the collaboration technology.
H10	Social influence will mediate the effects of training and resources on intention to use the collaboration technology.

Correlation Matrix

A correlation matrix presents the variables and how they correlate to one another. The latent variable correlation matrix is provided in Table 11, indicating the significance

levels for each. A two-tailed test level was used to evaluate the significance level of each correlation.

Table 11

Latent Variable Correlation Matrix

Variables	1	2	3	4	5	6
1. Intention to Use	1.0					
2. Performance Expectancy	.72**	1.00				
3. Effort Expectancy	.40	.56	1.00			
4. Social Influence	.65*	.63	.58	1.00		
5. Training and Resources	.48	.60	.60	.50	1.00	
6. Virtual Team Training	.50	.61	.57	.66	.63	1.00

** $p < 0.01$ * $p < 0.05$ N = 108

Next, the hypotheses tested are reported using partial least squares.

Coefficient of Determination

The essential criterion for assessing the structural model is the coefficient of determination (R^2) (Chin, 1998). Chin designates R^2 values of .67, .33, and .19 in PLS modeling as substantial, moderate, and weak, respectively. PLS analysis revealed the dependent variable, intention to use the collaboration technology, exhibited an R^2 value of .64. The results show a moderate to substantial coefficient of determination value. An R^2 value indicated that 64% of the variance in the dependent variable, intention to use the collaboration technology, is explained by the independent variables performance expectancy, effort expectancy, and social influence. The R^2 values for the independent

variables were as follows: performance expectancy ($R^2 = .34$), effort expectancy ($R^2 = .36$), and social influence ($R^2 = .25$).

Testing of the Hypotheses

The structural model was tested using partial least squares, a structural equation modeling technique appropriate for smaller sample sizes (Birkinshaw, Morris, & Hulland, 1995). The first research question was answered using hypotheses H1, H2, H3, and H4. The second research question was answered using hypotheses H5, H6, and H7. The third research question was answered using H8, H9, and H10. The research questions, the hypotheses, and the results of the PLS analysis are listed below. The total effects of the structural model were reported in using SmartPLS (Ringle et al., 2005).

Using PLS analysis and bootstrapping, findings of total effect with *t* values greater than 1.96 are considered significant. *T* values of 1.96 are significant at a .05 level ($p < .05$), *t* values of 2.6 are significant at a .01 level ($p < .01$), and t values of 3.34 are significant at a .001 level ($p < .001$) (Fraenkel & Wallen, 2009). Bootstrapping procedures are used in PLS path modeling to provide confidence intervals for parameter estimates, building the basis for statistical inference (Davison & Hinkley, 2004; Efron & Tibshirani, 1993).

Gender was hypothesized to moderate the effect of independent variables performance expectancy, effort expectancy, and social influence on the dependent variable intention to use the collaboration technology. Likewise, computer experience was hypothesized to moderate independent variables effort expectancy and social influence on the dependent variable intention to use the collaboration technology.

Variables that moderate change the strength of an effect or relationship between two variables. Performance expectancy, effort expectancy, and social influence were hypothesized to mediate the effects of training and resources on intention to use the collaboration technology. Mediator variables explain how or why an effect occurs between an independent and dependent variable (Baron & Kenny, 1986). The following will identify the research questions, hypotheses, and results of the study.

Research Question 1: To what extent do training and resources, performance expectancy, effort expectancy, and social influence explain a student's intention to use a collaboration technology?

Research Question 1 is answered by the following hypotheses:

H1 - User training and available resources will have a significant effect on intention to use the collaboration technology.

H2 – Performance expectancy will have a significant effect on intention to use the collaboration technology.

H3 – Effort expectancy will have a significant effect on intention to use the collaboration technology.

H4 – Social influence will have a significant effect on intention to use the collaboration technology.

The first four hypotheses were tested and the total effects are reported in the Table 12. The results show that training and resources had a significant effect on the intention to use the collaboration technology (BI). Hypothesis 1 is supported (H1: $\beta = 0.44$, $t = 5.07$, $p < .001$). Performance expectancy had a significant effect on the intention to use the collaboration technology. Hypothesis 2 is supported (H2: $\beta = .45$, $t = 4.48$, $p < .001$).

However, effort expectancy did not have a significant effect on intention to use the collaboration technology. Hypothesis 3 is not supported with significance levels greater than .05. Social influence had a significant effect on the intention to use the collaboration technology. Hypothesis 4 is supported (H4: $\beta = .34$, $t = 2.89$, $p < .01$).

Table 12

Results of Testing Hypotheses 1, 2, 3, and 4

	Original sample (O)	Sample Mean (M)	Standard deviation (STDEV)	Standard error (STERR)	t-stat (|O/STERR|)
TR → BI	.44	.44	.09	.09	5.08
PE → BI	.45	.47	.10	.10	4.48
EE → BI	-0.14	-0.16	0.14	0.14	1.02
SI → BI	0.34	0.29	0.12	0.12	2.85

Research Question 2: Do gender and experience moderate the effects of performance expectancy, effort expectancy, and social influence on a student's intention to use a collaboration technology?

Research Question 2 is answered by the following hypotheses:

H5 – The effect of performance expectancy on intention to use collaboration technology will be moderated by gender.

H6 – The effect of effort expectancy on intention to use collaboration technology will be moderated by gender and experience.

H7 – The effect of social influence on intention to use collaboration technology will be moderated by gender and experience.

Table 13

Results of Testing Hypotheses 5, 6, and 7

	Original sample (O)	Sample Mean (M)	Standard deviation (STDEV)	Standard error (STERR)	t-stat (|O/STERR|)
PE * Gender → BI	-.09	-.04	.12	.12	0.75
EE * Gender → BI	-0.05	-0.04	0.10	0.10	0.52
EE * Experience → BI	0.13	0.14	0.11	0.11	1.17
SI * Gender → BI	0.16	0.13	0.12	0.12	1.34
SI * Experience → BI	-0.14	-0.11	0.12	0.12	1.19

The results of the hypotheses 5, 6, and 7 testing are shown in Table 13. The findings revealed that gender did not moderate the effects of performance expectancy on intention to use the collaboration technology. Therefore, Hypothesis 5 was not supported with significance levels greater than .05. Neither gender nor computer experience moderated the effect of performance expectancy on the intention to use the collaboration technology. Hypothesis 6 was not supported with significance levels of greater than .05.

Neither gender nor computer experience moderated the effect of social influence on intention to use the collaboration technology. Likewise, Hypothesis 7 was not supported with significance levels greater than .05.

Research Question 3: Do performance expectancy, social influence, and effort expectancy mediate the effects of training and resources on a student's intention to use collaboration technology?

Research Question 3 was answered using hypotheses H8, H9, and H10. The hypotheses predicted that performance expectancy, effort expectancy, and social

influence would mediate the effects of training and resources on the dependent variable, intention to use the collaboration technology. A mediating variable transmits the effect of an independent variable on a dependent variable. Mediator variables specify how or why a particular effect or relationship occurs.

When testing for mediation, only the variables in the hypothesis are tested. The Sobel (1982) test was implemented in this study to test for mediation. Mediation occurs when the following is true: (1) the IV significantly affects the mediator, (2) the IV significantly affects the DV in the absence of the mediator, (3) the mediator has a significant unique effect on the DV, and (4) the effect of the IV on the DV shrinks upon the addition of the mediator to the model (Preacher & Hayes, 2004). MacKinnon and Dwyer (1993) and MacKinnon, Warsi, and Dwyer (1995) have published statistically based methods which formally assess mediation. The path coefficients are used to calculate and determine if mediation is present. To assess for mediation, Daniel Soper's free Sobel test calculator was used in this study. The Sobel test (Sobel, 1982) can be accessed online from http://www.danielsoper.com/statcalc3/calc.aspx?id=31.

Figure 17 represents the standardized regression coefficients for the relationship between training and resources and intention to use the collaboration technology. The standardized regression coefficient between training and resources and intention to use the collaboration technology while controlling for performance expectancy is found in parentheses.

Hypothesis 8

H8 – Performance expectancy will mediate the effects of training and resources on intention to use the collaboration technology.

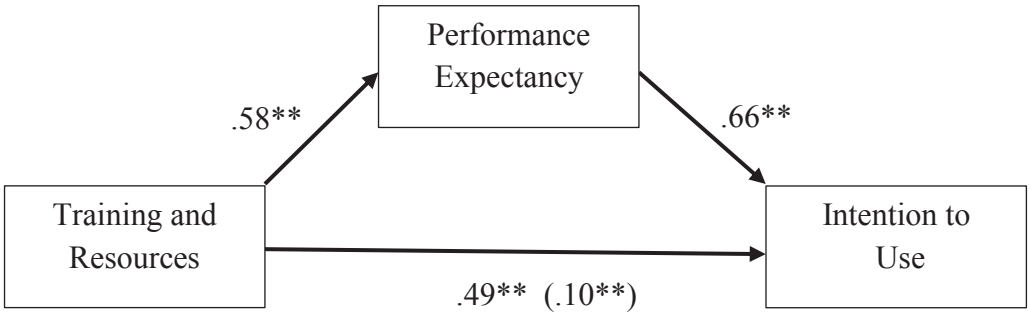

Figure 17. Hypothesis 8 (Performance Expectancy will mediate Training and Resources)
** p < .001

The results of the Sobel test suggest that the association between training and resources and the intention to use the collaboration technology is significantly mediated by performance expectancy ($z^1 = 5.51$, $p < .001$). Therefore, hypothesis 8 is supported.

Hypothesis 9

H9 – Effort expectancy will mediate the effects of training and resources on intention to use the collaboration technology.

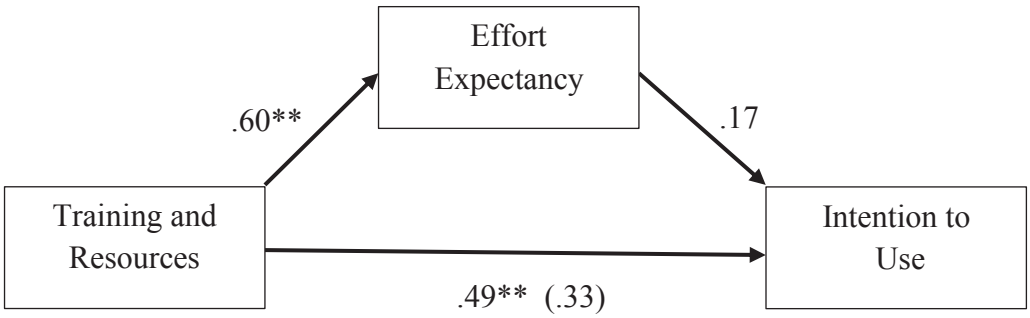

Figure 18. Hypothesis 9 (Effort Expectancy will mediate Training and Resources)
** p<.001

Figure 18 represents the standardized regression coefficients for the relationship between training and resources and intention to use the collaboration technology. The standardized regression coefficient between training and resources and intention to use the collaboration technology while controlling for effort expectancy is found in

parentheses. The results of the Sobel test suggest that the association between training and resources and the intention to use the collaboration technology is not significantly mediated by effort expectancy ($z^1 = 1.3$). Hypothesis 9 is not supported.

Hypothesis 10

H10– Social influence will mediate the effects of training and resources on intention to use the collaboration technology.

Figure 19 represents the standardized regression coefficients for the relationship between training and resources and intention to use the collaboration technology. The standardized regression coefficient between training and resources and intention to use the collaboration technology while controlling for social influence is found in parentheses.

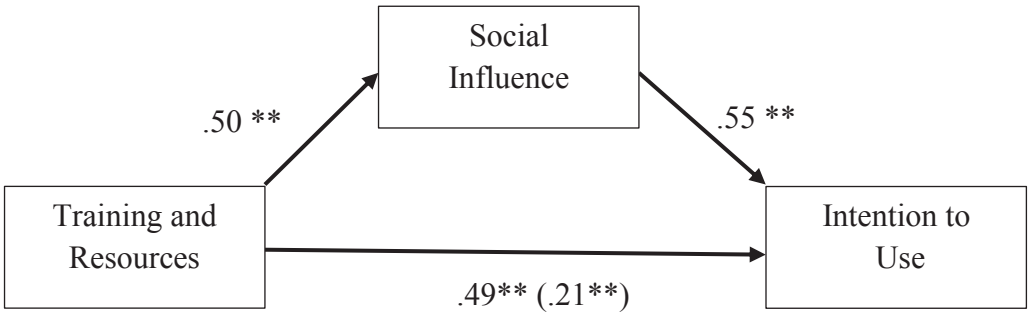

Figure 19. Hypothesis 10 (Social Influence will mediate Training and Resources)
** p<.001

The result of the Sobel test suggest that the association between training and resources and the intention to use the collaboration technology is significantly mediated by social influence ($z^1 = 4.757$, $p < .001$). Therefore, hypothesis 10 is supported.

Virtual Teamwork Training Question Results

Research Question 4: How do students perceive virtual team training?

Descriptive statistics were used to analyze the students' perceptions of the virtual team training. Five items were included on the survey that revealed the students' perceptions of the training. Table 14 reveals the results for the five items. The virtual teamwork training model survey items used a 7-point Likert scale with 1 representing strongly disagree and 7 representing strongly agree. Each of the virtual teamwork training items had response means of 5.59 or higher, indicating that they agree to strongly agree, and standard deviations of .988 to 1.14. Discussion of the results for each item will be provided in the next chapter.

Table 14

Virtual Teamwork Training Model Items Descriptive Statistics (N = 108)

	Survey Items	*M*	*SD*
Q16	My understanding of virtual teamwork has increased a result of this class.	6.06	1.04
Q17	My ability to work in a virtual environment has been enhanced as a result of taking this class.	6.06	1.00
Q18	This class was useful in terms of preparing me to work in virtual teams at some future time.	5.92	1.08
Q19	Virtual teamwork training is an important component of business school curriculum.	5.59	1.14
Q20	I have a good basic understanding of virtual teamwork.	5.87	1.03

In addition to the survey items, students were asked to reflect on their experiences during the virtual team meetings following each meeting. Each participant was asked to post a reflection on the course management system discussion board. A sample of the

responses were selected and presented in Appendix D. Sample reflections were taken from the first three virtual team meetings.

Summary of Data Analysis and Results

Using PLS analysis procedures (Henseler et al., 2009), the measurement instrument was proven to be both valid and reliable. The Cronbach α values for each construct were presented in Table 6 and composite reliability for each construct was shown in Table 7. The average variance extracted (AVE) was provided in Table 8.

Table 15

Summary of Hypotheses Results

	Descriptions	
H1	User training and available resources will have a significant effect on intention to use the collaboration technology.	Supported
H2	Performance expectancy will have a significant effect on intention to use the collaboration technology.	Supported
H3	Effort expectancy will have a significant effect on intention to use the collaboration technology.	Not Supported
H4	Social influence will have a significant effect on intention to use the collaboration technology.	Supported
H5	The effect of performance expectancy on intention to use collaboration technology will be moderated by gender.	Not Supported
H6	The effect of effort expectancy on intention to use collaboration technology will be moderated by gender and experience.	Not Supported
H7	The effect of social influence on intention to use collaboration technology will be moderated by gender and experience.	Not Supported
H8	Performance expectancy will mediate the effects of training and resources on intention to use the collaboration technology.	Supported

H9	Effort expectancy will mediate the effects of training and resources on intention to use the collaboration technology.	Not Supported
H10	Social influence will mediate the effects of training and resources on intention to use the collaboration technology.	Supported

The AVE was then used in Table 9, which demonstrated the discriminant validity of the measures. Once both reliability and validity of the instrument were established, PLS analysis and bootstrapping were used to test the study hypotheses for research questions one and two. A summary of the support or lack of support for each hypothesis is listed in Table 15.

A summary of the mediating effects of the independent variables (performance expectancy, effort expectancy, and social influence) on the effect training and resources had on the dependent variable intention to use the collaboration technology is found in Table 16.

Table 16

Summary of the Mediating Effects

	Construct	Direct Effect on Intention to Use	Indirect Effect on Intention to Use
H8	Training and Resources	.49 **	.10 **
	Performance Expectancy	.66 **	
H9	Training and Resources	.49 **	.33
	Effort Expectancy	.17	
H10	Training and Resources	.49 **	.21 **
	Social Influence	.55 **	

** $p < .001$

Figure 20 graphically depicts the positive effects found in the analysis. The data presented in this chapter supports the model presented in Figure 20. The next chapter provides conclusions that can be drawn from the findings.

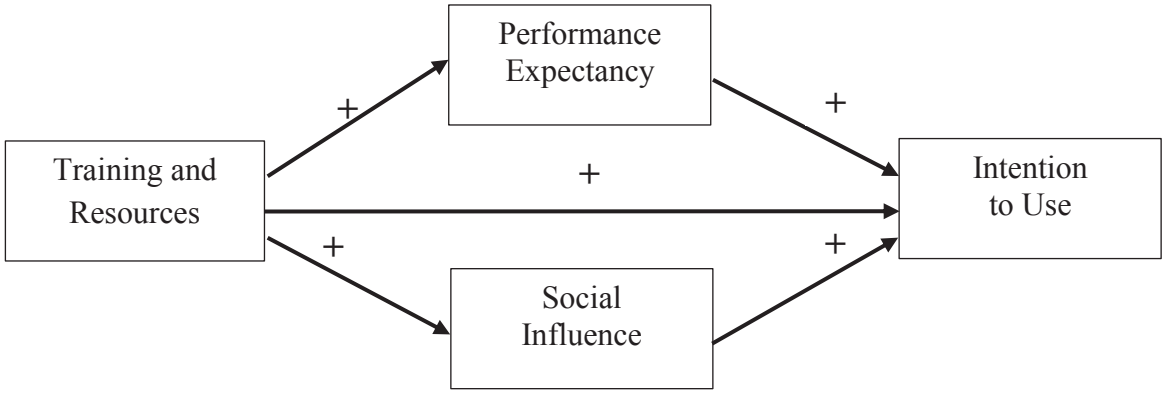

Figure 20. Actual Path Model.

Chapter V

DISCUSSION

A summary of the study, discussion of the findings, limitations of the study, and suggestions for future research are presented in this chapter. The first section summarizes the study, including a review of the study purpose, a condensed review of the literature, and an overview of the methods and procedures used to analyze the data. The second section provides a detailed discussion of the findings described by answering each of the three research questions. The third section identifies the limitations of the study, while the fourth section offers suggestions for future research.

Summary of the Study

In order to successfully incorporate virtual team projects into the curriculum, faculty members need to incorporate virtual team learning principles into the team activities and address the factors that influence students' technology acceptance of electronic collaboration systems. The primary purpose of this study was to combine the constructs from virtual team learning theories with technology acceptance research. The study's main goal was to identify strategies to help faculty better prepare today's college students for work in the global marketplace. The study identified the factors that influence a user's acceptance of electronic collaboration technology. The students' intentions to use the collaboration technology in the future and their perceptions of the virtual teamwork training were also examined.

UTAUT (Venkatesh et al., 2003) was examined in the framework of a virtual teamwork training model. The objective of the study was achieved by incorporating virtual teamwork training into Principles of Information Systems courses and then developing and testing an adapted UTAUT through surveying the students after they completed the training.

Through an extensive literature review, I found that virtual teamwork training is a relatively new field spanning only the past decade in contrast to technology acceptance literature, which is very well researched and has been studied since the 1980s. A number of researchers have identified theories that impact virtual team learning as well as models for developing and implementing effective electronic collaboration learning environments. A virtual teamwork training model published by Chen et al. in 2008 was incorporated into classroom activities and provided the framework for the testing of the UTAUT technology acceptance model (Venkatesh et al., 2003).

The first phase of the virtual teamwork training was known as abstraction. During this phase, students learned conceptually about virtual teamwork activities that helped them prepare for the virtual team meetings. The second phase was active experimentation. Students participated in four virtual team meetings. The first three meetings were discussion-based activities and the third meeting was a goal-based activity that required a completed product as a result of the meeting. The students met using Cisco's WebEx video conferencing collaboration tool. All meetings were recorded and submitted online. The final phase was observational, where students were asked to reflect on the learning process through verbal and written discussions.

A number of models and theories exist in technology acceptance research. Among them the most published are the technology acceptance model (TAM) (Davis, 1989) and UTAUT (Venkatesh et al., 2003). The UTAUT model was selected for use in this study as it is a more current model and incorporates eight of the more prominent behavioral models in technology acceptance research. The UTAUT model constructs include independent variables – training and resources, performance expectancy, effort expectancy, and social influence – which are hypothesized to influence the dependent variable – intention to use a collaboration technology. Gender and computer experience served as moderating variables in the adapted model. Upon completion of the virtual teamwork training activities, students were administered the modified UTAUT survey items.

Four research questions were addressed in this study. The four research questions were as follows:

- To what extent do training and resources, performance expectancy, effort expectancy, and social influence explain a student's intention to use a collaboration technology?
- Do gender and experience moderate the effects of performance expectancy, effort expectancy, and social influence on a student's intention to use collaboration technology?
- Does training and resources mediate the effects of performance expectancy, effort expectancy, and social influence on a student's intention to use collaboration technology?
- How do students perceive virtual team training?

The first research question was answered by addressing four hypotheses (H1, H2, H3, and H4). The second research question was answered by three hypotheses (H5, H6, and H7). The third research question was answered by three hypotheses (H8, H9, and H10). The fourth research question was answered using descriptive statistics. The results of the tests were presented in the Chapter 4. Table 20 of Chapter 4 provides a summary of the hypothesis and the results, indicating if the hypotheses were supported or not supported. Five of the hypotheses were supported and five were not supported. The instrument passed both reliability and validity testing. The data were analyzed using descriptive statistics, a correlational matrix, and structural equation modeling – partial least squares. The next section will provide discussion of the results by research question and hypotheses.

Discussion of the Findings

The results of this study support three of the four UTAUT (Venkatesh et al., 2003) constructs tested. Training and resources, performance expectancy, and social influence were all found to significantly affect the intention to use the virtual collaboration technology. However, the fourth UTAUT construct, effort expectancy, did not have a significant effect on intention to us the collaboration technology. Additionally, the study found positive student perceptions of the virtual teamwork training model implemented in the study. The following provides a summary of the findings and discussions of the results for each hypothesis. The discussions are presented by research question.

Research Question 1

Research Question 1: To what extent do training and resources, performance expectancy, effort expectancy, and social influence explain a student's intention to use a collaboration technology?

Training and available resources refers to the participants' perceptions of whether they were adequately trained and had the necessary resources to use the collaboration technology used in this study, WebEx. The results of the study supported Hypothesis 1, indicating that training and available resources do have a significant effect on intention to use the collaboration technology. Providing students with adequate experiential training will increase their knowledge of the technology and ultimately increase their intent to use it. The findings of this study supported the UTAUT (Venkatesh et al., 2003) study's findings and the study by Brown et al. (2010) that found facilitating conditions had a significant effect on intention to use the technologies.

The result of this hypothesis demonstrates to faculty members the importance of providing virtual teamwork training in the college curriculum. Additionally, providing students with tools (resources) such as WebEx or similar collaboration technology will impact their intention to use the collaboration technology. Further discussion of the students' perceptions of training will be provided in the discussion section for research Question 4.

Performance expectancy is defined as the degree to which an individual believes that using the system will help him or her to attain gains in job performance. The results of the study supported Hypothesis 2. Performance expectancy does have a significant and positive effect on intention to use the collaboration technology. The effect was

positive indicating that students who believed they would perform well using the collaboration technology also intended to use the collaboration technology. This finding supports the UTAUT study's findings that performance expectancy will have a significant effect on a person's intention to use a technology.

This finding should be of interest to faculty, indicating that if students believe they will perform well with the technology then they will more likely use it. Knowing that performance expectancy is significant may indicate to faculty that they may want to demonstrate the collaboration systems in their courses and assure students that they are not difficult systems to use. Providing students with positive and engaging experiences using collaboration technologies may encourage them to use them for future team collaboration projects. WebEx is much like many of the systems with which students could already be familiar, such as Google Hangout and Skype. Demonstrating the similarities could improve the students' performance expectancy and ultimately their intention to use the collaboration technology.

Effort expectancy was defined as the degree of ease associated with the use of the system. Effort expectancy did not have a significant effect on intention to use the collaboration technology. These findings were in contrast to the findings of Brown et al. (2010) and the original findings in the UTAUT model. Effort may be irrelevant with today's student since they are so immersed in technology. Technology is a part of everything they do. Effort may not play as significant a role in determining whether they intend to use a technology as it has for past generations.

Additionally, the findings could indicate that students who believed the collaboration technology was easy to use did not necessarily intend to use it. Students

today are fairly technologically inclined. However, just because they know how to use the technology does not mean they would prefer meeting virtually over meeting face-to-face. Since the students in this study were students in a traditional classroom-based environment, not online, these students may have preferred to meet face-to-face. More on this is discussed in the limitations of the study and suggestions for future research sections.

In this study, social influence refers to an individual's belief that people who are important to them or who will be important to them in the future believe that he or she should use the collaboration technology system. Social influence did have a positive significant effect on the student's intentions to use the collaboration technology. These findings support both the findings in the Brown et al. (2010) study and the UTAUT model (Venkatesh et al., 2003).

This finding indicates that students who believe that future employers think that they should be able to use virtual collaboration technologies are more inclined themselves to use the collaboration technology in the future. This finding demonstrates to faculty who are planning to incorporate virtual team learning activities the importance of relaying to students the need for learning the skills before they enter the workforce. Faculty could have guest speakers from industry talk to their students about how virtual collaboration is used in industry. Additionally, there are videos available that demonstrate how virtual teams work in industries using various technologies such as Second Life, WebEx, and other group systems.

Research Question 2

Research Question 2: Do gender and experience moderate the effects of performance expectancy, effort expectancy, and social influence on a student's intention to use collaboration technology?

Gender was not a significant moderator of performance expectancy in this study. While this finding was in contrast to previous studies (Brown et al., 2010), I found this finding particularly interesting. The subjects in this study were traditional-aged college students primarily ranging in ages 18-21 years of age.

Today's generation of students, both males and females, are increasingly becoming more computer savvy. In 2001, Marc Prensky coined the term "digital natives" to describe today's generation of youth. This phenomenon is the result of the rapid changes in technology in the last decade of the 20th century. Women and men in this age group may be equally proficient with using technologies such as video conferencing systems and group collaboration systems more so than past generations. The new age of technologies including smart phones, tablet computers, and social networking applications have all contributed to this new gender-neutral phenomenon of computer application expertise.

As noted in the findings of Hypothesis 3, effort expectancy was not a significant factor in this study. Additionally, gender and computer experience were not considered moderators for effort expectancy. Gender did not serve as a moderator for any of the three UTAUT (Venkatesh et al., 2003) constructs as hypothesized. This may have been due to the age of the subjects. Likewise, computer experience was not found to be a significant moderator of effort expectancy. As noted in Hypotheses 5 results, traditional-

aged students are all fairly computer savvy, and, therefore gender may not play a role in their acceptance of technology as it has in the past. The same is true for computer experience. The subjects reported high ratings when asked about their computer experience ($M = 5.67$). Traditional-aged students consider themselves to be knowledgeable with computers.

As mentioned in Hypotheses 5 and 6, gender and computer experience were not found to be significant moderators for any of the three UTAUT constructs – performance expectancy, effort expectancy, and social influence. This may have been due to the age of the subjects. More on this is discussed in the limitations of the study and suggestions for future research.

Research Question 3

Research Question 3: Do performance expectancy, social influence, and effort expectancy mediate the effects of training and resources on a student's intention to use collaboration technology?

Performance expectancy was found to significantly mediate the effects of training and resources on intention to use the collaboration technology. This significant mediation indicates that performance expectancy will increase the effects of training and resources and ultimately positively impact their intention to use the collaboration technology. While teaching virtual teamwork skills to students, it is important to reiterate to students how learning such a skill will help them in the future. Providing examples of how such systems are used in industry and discussing various cases in which groups may be required to work virtually will help students interpret how learning the skill will help them perform better on the job in the future.

Since effort expectancy was not a significant factor in the study, it will also not be a significant mediator. As mentioned above, effort may be irrelevant with today's students since they are so immersed with technology. It is a part of everything they do. More discussion related to effort expectancy can be found above in the discussion of research Question 1.

Social influence was found to significantly mediate the effects of training and resources on intention to use the collaboration technology. This significant mediation indicates that students' perceptions that future employers may expect them to use the technology will increase the effects of training and resources, which will in turn ultimately positively impact their intention to use the collaboration technology.

Students may not be aware of how prevalent virtual meetings and virtual teams have become in today's work force. Virtual teamwork training should include not only the technical training of how to use the technology, but also training on how to communicate well and work well with team members who may be in another state or country. Students must realize that employers will expect them to be able to collaborate with team members from a variety of locations and not only share ideas but also produce outcomes such as marketing plans, budgets, or development of software applications.

Research Question 4

Research Question 4: How do students perceive virtual team training?

Five survey questions related to student perceptions of the virtual team training. In the previous chapter the results of each of the questions were listed in Table 19. The questions were as follows:

- My understanding of virtual teamwork has increased as a result of this class.

- My ability to work in a virtual environment has been enhanced as a result of taking this class.
- This class was useful in terms of preparing me to work in virtual teams at some future time.
- Virtual teamwork training is an important component of business school curriculum.
- I have a good basic understanding of virtual teamwork.

Each of the virtual teamwork training questions had means of 5.59 or higher indicating agree to strongly agree findings and standard deviations ranged from 1.0 to 1.14. The questions were adapted from the original study by Chen et al. (2008). The responses to this study were at or above those received by Chen and colleagues. The responses indicate that the virtual teamwork training model was successful from the students' perceptions. The students also provided positive comments in their reflections of their meetings (see Appendix D). It was evident from their discussions in class and the reflections that substantial improvement from the last meeting was noticed each time they participated in a new meeting. The technical glitches were worked out and the meetings seemed to flow better each time. It might be tempting for a professor to just assign one virtual meeting activity in the course of a semester, but having multiple meetings provided value to the participants. The three additional virtual meetings gave the participants additional experiences and offered opportunities for them to improve each meeting. These activities were also more representative of how actual virtual teams work in industry. The more students used the technology, the more comfortable they became with it. This was evident through class discussions following each meeting.

While the Chen et al. (2008) virtual teamwork training model served as the framework for this dissertation, the Harvey Daniel's (1994) literature circle activity was revised and used in conjunction with the virtual teamwork training. One important finding of this study is that the revised literature circle activity was a successful tool for facilitating initial virtual meetings. Many of the comments from students related to how smoothly the meeting went because the participants were prepared. This was a result of incorporating the pre-discussion and during-discussion activities of the literature circle activity sheet.

From an educational leadership perspective, the findings of this study may indicate to college administrators and professors the importance of providing training to help students to learn to collaborate in virtual environments. The virtual teamwork training model could be adapted to any class from a wide spectrum of subject areas, not just in business or information systems courses. Additionally, college administrators may want to insure that faculty and students have the proper resources to support virtual collaboration.

I plan to continue to include the virtual teamwork training in future Principles of Information Systems courses as a result of the findings in this study. Having identified that social influence, the belief that those important to me think I should use the technology, plays a role in acceptance of collaboration technology, I will incorporate more industry cases providing examples of how businesses collaborate virtually and invite guest speakers to my classes who will support the need for learning how to collaborate in a virtual environment. Also, having identified that performance expectancy, the idea that learning this technology will improve one's future performance,

is a significant influence on intended use of collaboration technology; I plan to stress the importance of how learning to collaborate virtually will help them perform well on the job upon graduation.

Limitations of the Study

The UTAUT model is most often applied in industry settings. While it was interesting to apply the UTAUT model to a college environment with traditional-aged college students, the findings may have been different with a larger spectrum of ages. Likewise, the digital natives (Prensky, 2001) have a much different perspective about technology than those of past generations. Most of the college students were between the ages of 18-22 and provided a very narrow age representation. Additionally, the majority of the students were business majors, which may have influenced their perceptions as well. If students majoring in other programs such as social sciences, education, and nursing would have participated in the study, this could have increased the generalizability of the study.

The subjects of the study were college students majoring in business who were enrolled in a Principles of Information Systems campus-based course. Students met face-to-face three times a week throughout the training. In industry, virtual team members may occasionally meet or work in a collocated environment as well. So, while this could be considered a limitation, it represents what one may encounter in the workforce as well. However, if the study participants were never able to meet face-to-face, as they might encounter in an online course and were forced to only collaborate using technology their perceptions may have been different. The next section provides suggestions for future research.

Suggestions for Future Research

A number of suggestions can be provided for future research as a result of this study. First, the participants of this study were traditional college-aged student primarily ranging in ages from 18 to 22. It would be interesting to conduct the study including graduate students and participants from industry with a larger range of ages represented. Gender and computer experience could play a greater role with individuals who are not digital natives.

Virtual teamwork training is not only a skill that could be taught in business schools; it could be taught in other disciplines as well. Faculty researchers could implement the virtual teamwork training in a variety of courses from various colleges and examine the findings of the research to see if there were differences among students from other disciplines. It would be interesting to identify if the same factors that affect the user acceptance of collaboration technologies in college of business students affect students from other colleges, such as arts and sciences or education. Likewise, the students' perceptions of the training may also be different.

This study identified the students' perceptions of the virtual teamwork training but did not assess the quality of the training itself. The virtual team meetings in the study were observed but not assessed for quality of the collaboration methods and the products produced as a result of the collaboration. Through observation methods, future studies could assess the quality of the virtual meetings and the quality of the products created by the team members.

Summary of Discussion

The goal of this study was to help faculty identify methods to incorporate virtual teamwork collaboration skills into their classes and understand the factors that affect students' intentions to use the collaboration technologies in the future. This study incorporated an existing virtual teamwork training model while empirically testing several factors from existing technology acceptance research. The study found that students had positive perceptions of the virtual teamwork training and three out of the four technology acceptance factors were significant to their intention to use the collaboration technology in the future.

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Appendix A:

Institutional Review Board Protocol Exemption Report

Institutional Review Board (IRB)
for the Protection of Human Research Participants

PROTOCOL EXEMPTION REPORT

PROTOCOL NUMBER: IRB-02834-2012 **INVESTIGATOR:** Joy Godin

PROJECT TITLE: Factors Influencing the Acceptance of Collaboration Technology within the Context of Virtual Teamwork Training

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DETERMINATION:

This research protocol is exempt from Institutional Review Board oversight under Exemption Category 1. You may begin your study immediately. If the nature of the research project changes such that exemption criteria may no longer apply, please consult with the IRB Administrator (irb@valdosta.edu) before continuing your research.

ADDITIONAL COMMENTS/SUGGESTIONS:

Although not a requirement for exemption, the following suggestions are offered by the IRB Administrator to enhance the protection of participants and/or strengthen the research proposal:

None

If you make any of these suggested changes to your protocol, please submit revisions so that IRB has a complete protocol on file.

Barbara Gray 7/26/12

Barbara H. Gray, IRB Administrator Date

Thank you for submitting an IRB application.
Please direct questions to irb@valdosta.edu or 229-259-5045.

Form Revised: 05.04.2012

Appendix B:

Collaboration Technology Survey Used in Study

Collaboration Technology Survey

Statement of consent: By answering I agree, I acknowledge that I am participating in a research study about the factors influencing technology acceptance of video conferencing technologies. I understand this participation is entirely voluntary; I can withdraw my consent at any time and have the results of the participation returned to me, removed from the experimental records, or destroyed. Circle one: **Agree** **Disagree**

Legend			
Very Strongly Disagree	1	Agree	5
Strongly Disagree	2	Strongly Agree	6
Disagree	3	Very Strongly Agree	7

1.	I intend to use WebEx, or a similar collaboration technology, in the future.	1	2	3	4	5	6	7
2.	I predict I would use WebEx, or a similar collaboration technology, in the future.	1	2	3	4	5	6	7
3.	I plan to use WebEx, or a similar collaboration technology, in the future.	1	2	3	4	5	6	7
4.	I believe WebEx, or a similar collaboration technology, will be useful for communication.	1	2	3	4	5	6	7
5.	Using WebEx, or a similar collaboration technology, will enable me to accomplish future work tasks more quickly.	1	2	3	4	5	6	7
6.	Using WebEx, or a similar collaboration technology, will increase my productivity.	1	2	3	4	5	6	7
7.	Using WebEx, or a similar collaboration technology, requires little mental effort.	1	2	3	4	5	6	7
8.	I believe WebEx, or a similar collaboration technology, will be easy to use.	1	2	3	4	5	6	7
9.	Using WebEx, or a similar collaboration technology, will be easy for me.	1	2	3	4	5	6	7

10. Future employers, people who will influence my behavior, will think I should use WebEx, or a similar collaboration technology.	1	2	3	4	5	6	7
11. Future colleagues, people who will be important to me, will think that I should use WebEx, or a similar collaboration technology.	1	2	3	4	5	6	7
12. My instructor thinks I should use WebEx, or a similar collaboration technology.	1	2	3	4	5	6	7
13. I have the resources necessary to use WebEx.	1	2	3	4	5	6	7
14. I have the knowledge necessary to use WebEx.	1	2	3	4	5	6	7
15. I received adequate training on how to use WebEx.	1	2	3	4	5	6	7
16. My understanding of virtual teamwork has increased as a result of this class.	1	2	3	4	5	6	7
17. My ability to work in a virtual environment has been enhanced as a result of taking this class.	1	2	3	4	5	6	7
18. This class was useful in terms of preparing me to work in virtual teams at some future time.	1	2	3	4	5	6	7
19. Virtual teamwork training is an important component of business school curriculum.	1	2	3	4	5	6	7
20. I have a good basic understanding of virtual teamwork.	1	2	3	4	5	6	7
21. How would you rate your computer experience? (1 weak…7 strong)	1	2	3	4	5	6	7

22. Age: _____

23. Gender: _____

24. Major: _____

Appendix C:

Literature Circle Activity Used in Virtual Team Meetings

Literature Circle Activity

Group members should select one of the activities below. Each will have a pre-discussion activity to write and also a specific role to play in the discussion. Be sure to rotate activities for each virtual meeting.

Team Leader (Team Member A):

Pre-discussion – Write a short summary of the reading; set up virtual meeting and invite attendees, prepare to provide an orientation to WebEx for participants, record meeting

During discussion – Orient participants to WebEx. Record meeting. Summarize the discussion as it proceeds (in writing). It is also your job to keep the group on-track.

Post-discussion – Post the summary of the meeting to the discussion board and the meeting recording.

Team Member B:

Pre-discussion – Develop three open-ended questions for the group to discuss. Think about using words such as how? Why? If?

During discussion – Use your questions to spark conversation. It is also your job to direct the discussion so use your questions but also make sure that person C and D bring up their ideas to promote discussion.

Team Member C:

Pre-discussion – Choose three sections that you think are particularly interesting, unusual, or difficult to understand. Give page numbers plus the words that begin and end the section. Explain why you chose each.

During discussion – Show your group members your choices to spark discussion.

Team Member D:

Pre-discussion – Write about some connections you see between your experiences and this reading or connections you see between previous material you've studied and this reading.

During discussion – During the discussion, bring up the connections you found and ask others to share connections they see.

Team Member E (for groups of 5):

Pre-discussion – Choose five words that you find difficult to define and find definitions for those words.

During discussion – Bring up those words and let others know what they mean and how they are important to the reading.

Reference

Adapted from Daniels, H. (1994). *Literature Circles,* Portland, Maine: Stenhouse Publishers.

Appendix D:

Sample Excerpts - Student Reflections of Virtual Meetings

Excerpt 1 (1st virtual meeting): "I feel like we had a very good meeting and we discussed very important topics."

Excerpt 2 (1st virtual meeting): "Overall, I thought our first meeting went well. There was no static (which I was expecting) and I could understand everyone when they spoke. I also felt more productive because each member already had a task and each one of us brought our findings to the meeting."

Excerpt 3 (1st virtual meeting): "As a group I think we did a really good job of discussing the article and I also believe that everybody equally did their part to spark the discussion even further. The article at first was kind of hard to understand but once we started to discussion it helped me understand it a lot better. Overall, I was skeptical at first with the virtual meeting, but afterwards I found it pretty interesting and a cool way to meet."

Excerpt 4 (2nd virtual meeting): "Overall I thought it [second virtual meeting] was a much better meeting that the first and we will only continue to get better."

Excerpt 5 (3rd virtual meeting): "This team meeting was actually fun. The meeting went very well and we had a good flow going with discussions."

Excerpt 6 (2nd virtual meeting): "Overall, the meeting went very smoothly and was much better than the last meeting. The conversation flowed easily."

Excerpt 7 (3rd virtual meeting): "Using Webex our group could easily and conveniently converse and discuss this article. I believe that in the future this will be a good program to know how to operate."

Excerpt 8 (2nd virtual meeting): “As a whole our virtual meeting went well because everybody in our group participated and contributed to the discussion. I think all of the team members performed their task well individually and as a whole for our group.”

Excerpt 9 (3rd virtual meeting): “I feel that the meeting went extremely well and enjoyed listening to what people had to hear and say about the article.”