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## **A Pilot Study of Virtual Teamwork Training**

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### **ABSTRACT**

*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. An overview is provided of a model for incorporating virtual teamwork training and identifying factors that contribute to the use of an electronic collaboration system. Additionally, theoretical constructs of the research model, including the research questions and hypotheses for the study, are included. A pilot study was used to test the reliability of the instrument. The results of the pilot are described. Finally, the paper concludes with the proposed data analysis methods.*

### **INTRODUCTION**

Today's college graduates need to be able to work in a global marketplace. Some of the skills required for this involve being able to work in teams, being able to work in a virtual environment, and being able to use whatever technology is needed to work virtually. Most of today's young professionals are technologically savvy. Are they, however, prepared to collaborate virtually and produce high quality products using the technologies they use for everyday socializing? For years now college students have been prepared to work in teams, it is now equally as important to prepare young business professionals to work in virtual teams. The model presented in this study will combine a revised virtual teamwork-training model with technology acceptance constructs. A pilot study was conducted to test the instrument and details will be provided for how the data will be analyzed in future studies.

### **VIRTUAL TEAM LEARNING THEORIES**

A number of researchers have identified theories that impact virtual team learning (Andres & Shipp, 2010; Kock, Lynn, Dow, & Akgün, 2006) as well as models for developing and implementing effective electronic collaboration learning environments (Bower, 2011; Chen, Sager, Corbitt, & Gardiner, 2008; Kirschner, Stijbos, Kreijns, & Beers, 2004). Following educational philosopher John Dewey's (1922) belief that learning is an iterative process of designing, carrying out, reflecting upon and modifying actions, Edmonson (1999) 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 results.

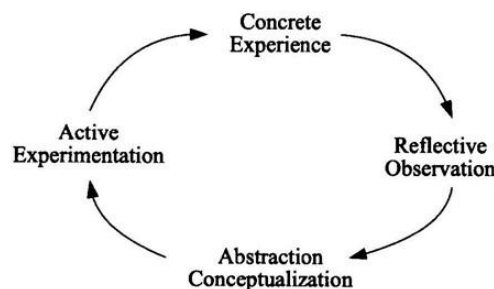
Andres and Shipps (2010) developed a model for measuring team learning in technology-mediated distributed teams. The researchers combined the theory of affordances (Gibson, 1977; Kirschner et al., 2004) and social impact theory (Latané, 1981) to develop a framework that can be used to explain the impact of the collaboration mode on team learning and the social factors that impact team learning and problem solving. 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, Svensson, Hindmarsh, Luff, and vom Lehn (2002) described the need to improve awareness of the principles and behaviors of individuals working in a collaborative environment. Andres and Shipp 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.

### VIRTUAL TEAMWORK TRAINING MODEL

Chen et al. (2008, p. 38) proposed a model for virtual teamwork training. They 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.”

The teamwork training model developed by Chen et al. (2008) was derived from Kolb (1984) learning cycle. Figure 1 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 for learners is to be involved in concrete new experience. Second, learners should reflect and make observations on their experiences from many perspectives. Third, generalizations and theories are created based on reflections and observations. Lastly, theories and concepts are tested in new situations. The educator’s role is to serve as facilitator of reflection and encourage learners to discuss and reflect on concrete experiences in a trusting, open environment.



**Figure 1: Kolb’s (1984) Learning Cycle (Chen et al., 2008).**

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 could 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.

Learning Process	Learning Techniques	Teaching approach
<b>Abstraction Conceptualization</b> —conceptual learning at the beginning of the class	Students learn by reading, listening, and discussing the following knowledge areas <ul style="list-style-type: none"> <li>• Face-to-face teamwork</li> <li>• Virtual teamwork</li> <li>• Computer mediated communication (CMC)</li> </ul>	The instructor supplies relevant reading material, gives well-organized and informative lectures, and encourages teams to discuss relevant materials.
<b>Active Experimentation and Concrete Experience</b> —learning by doing the project)	Students learn by doing the following activities: <ul style="list-style-type: none"> <li>• Engaging virtual teamwork by following the known effective practice</li> <li>• Engaging virtual teamwork by trial and error</li> </ul>	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.
<b>Observational Reflection</b> —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.

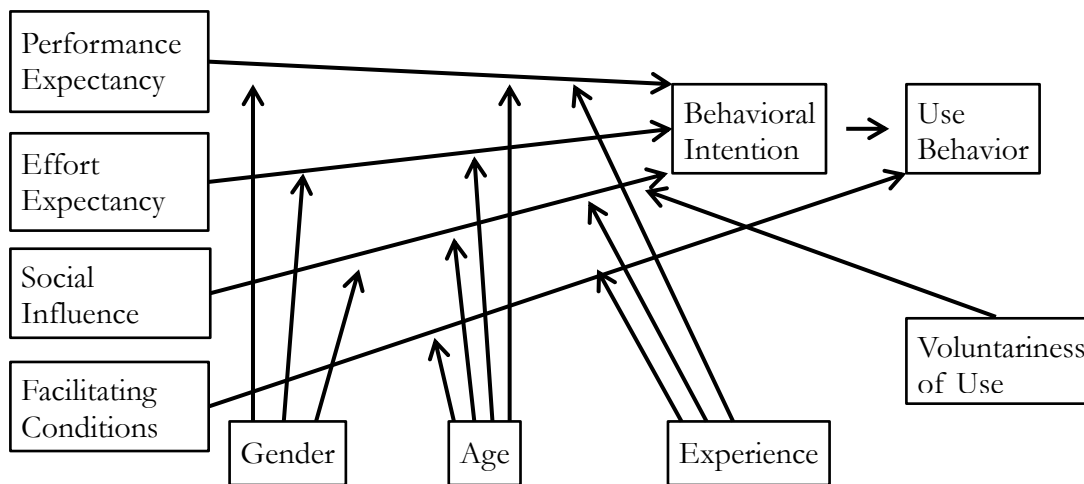
**Table 1: Model of Virtual Teamwork Training, (Chen et al., 2008).**

## UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

After reviewing eight models of user behavior, Venkatesh, Morris, Davis, and Davis (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).

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 et al., 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. Figure 2 reveals the UTAUT model graphically.



**Figure 2: UTAUT Model (Venkatesh et al., 2003).**

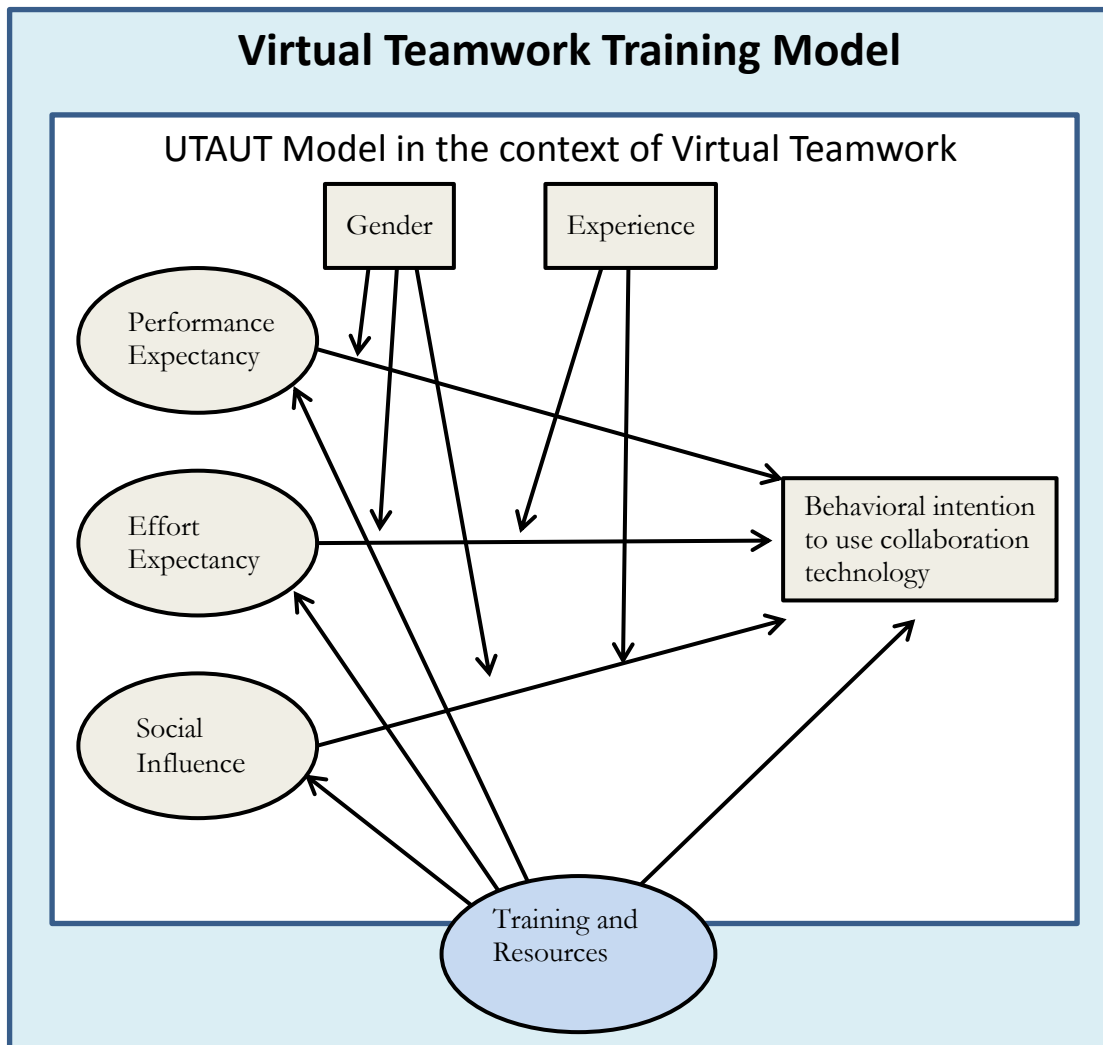
## RESEARCH MODEL

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 3. The model is intended to identify the factors from technology acceptance 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.

As shown in Figure 3, 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 “Does training and resources mediate the effects of performance expectancy, effort expectancy, and social influence 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.



**Figure 3. UTAUT Model within the Context of Virtual Teamwork Training.**

## **Research Questions and Hypotheses**

### Training and Resources

The training and resources constructs were derived from the UTAUT theory (Venkatesh et al., 2003) and the model for incorporating virtual teamwork training (Chen, et al., 2008). Venkatesh and colleagues referred 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). Chen et al. (2008) found that student awareness of and competence in virtual teamwork was increased when their virtual teamwork training model was implemented.

In this 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, based on the above findings, the following is hypothesized:

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

### Performance Expectancy

Venkatesh et al. (2003, p. 447) define 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.” 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.

### 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). The UTAUT researchers contended that gender and experience moderate the correlation between effort expectancy and intended use. Likewise, in this proposed model, effort expectancy is defined as the “degree of ease associated with the use of the electronic collaboration system.” Therefore, based on the above findings, it is hypothesized:

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

### 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). The UTAUT study found that gender, experience, and voluntariness moderated the social influence predictor's correlation with intended use. 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.

### Moderating Variables

The moderating variables included in the study were gender and experience. Moderators 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, Venkatesh, & Ackerman, 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. (2005) 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 the training and resources, performance expectancy, effort expectancy, and social influence are hypothesized to influence intention to use the collaboration technology. Additionally, training and resources is hypothesized to moderate performance expectancy, effort expectancy, (Marshall, Mills, & Olsen, 2008) and social influence. Therefore, 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.

The modified UTAUT constructs were measured while in the context of the virtual teamwork training model (Chen et al., 2008). The fourth research question was “How do students perceive virtual team training?” The survey questions to evaluate the students’ perceptions of the virtual team training were adapted from the Chen et al. (2008) model.

## **METHODOLOGY**

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 & Schmelkin, 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 pilot study included 63 undergraduate business students enrolled in Principles of Information Systems. The participants were chosen based on the researcher’s 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). The pilot study incorporated a cross-sectional. The researcher administered surveys to the participants at the end of the course. The cross-sectional approach was used because the researcher 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.

### Procedures

Virtual team groups were assigned by the instructor, at the beginning of the semester. Complying with the abstraction conceptualization learning process of the virtual teamwork training model (Chen et al, 2008), lectures, articles, videos, and classroom discussions about participating in virtual teams were provided. 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 ([www.webex.com](http://www.webex.com)) 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.

The participants were shown how to set up a WebEx meeting and some students were allowed 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 simulate more accurately a virtual meeting environment.

The first virtual meeting was an article discussion activity, specifically a literature circle activity. Using a modified version of 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 the pre-meeting activity. The article was related to globalization and virtual teams. During the virtual meeting, 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 participant answered online discussion questions about the article. Additionally, team members were asked to reflect on the virtual team meeting. Students, using an online discussion forum, were required to reflect on the effectiveness/ineffectiveness of the virtual team meeting. Observational reflection is the final phase of the model (Chen et al., 2008).

The teams repeated this process with two additional articles relating to the course objectives. After completing three discussions-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, Fuller, & Valacich, 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.

### Instruments and Measures

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

## PILOT STUDY

The survey was administered to the 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 2 shows the Cronbach alpha for each construct. The results indicate that all of the instrument items had high reliability with the exception of one construct, effort expectancy ( $\alpha=.663$ ). 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."

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

**Table 2: Cronbach's Alpha Reliability Test Results for the Pilot Study.**

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 factors and the revised questions that were used to measure each latent variable are presented in Table 3. The first five constructs measured—intention to use, performance expectancy, effort expectancy, social influence, and training and resources—were from the UTAUT study (Venkatesh, et al., 2003) and the predicting collaboration technology use model (Brown, et al., 2010). The sixth factor, virtual teamwork training perceptions, was adapted from virtual teamwork training model (Chen et al., 2008).

<p><b><i>Intention to Use.</i></b> Intention to use was measured by the following three questions:</p> <ol style="list-style-type: none"> <li>1. I intend to use WebEx, or a similar collaboration technology, in the future.</li> <li>2. I predict I would use WebEx, or a similar collaboration technology, in the future.</li> <li>3. I plan to use WebEx, or a similar collaboration technology, in the future.</li> </ol>
<p><b><i>Performance Expectancy.</i></b> Performance expectancy was measured by the following three questions:</p> <ol style="list-style-type: none"> <li>1. I believe WebEx, or a similar collaboration technology, will be useful for communication.</li> <li>2. Using WebEx, or a similar collaboration technology, will enable me to accomplish future work tasks more quickly.</li> <li>3. Using WebEx, or a similar collaboration technology, will increase my productivity.</li> </ol>
<p><b><i>Effort Expectancy.</i></b> Effort expectancy was measured by the following three questions:</p> <ol style="list-style-type: none"> <li>1. Using WebEx, or a similar collaboration technology, requires little mental effort.</li> <li>2. I believe WebEx, or a similar collaboration technology, will be easy to use.</li> <li>3. Using WebEx, or a similar collaboration technology, will be easy for me.</li> </ol>
<p><b><i>Social Influence.</i></b> Social influence was measured by the following three questions</p> <ol style="list-style-type: none"> <li>1. Future employers, people who will influence my behavior, will think I should use WebEx or a similar collaboration technology.</li> <li>2. People who are important to me think I should use WebEx.</li> <li>3. My instructor thinks I should use WebEx.</li> </ol>
<p><b><i>Training and Resources.</i></b> Training and resources were measured by the following three questions:</p> <ol style="list-style-type: none"> <li>1. I have the resources necessary to use WebEx.</li> <li>2. I have the knowledge necessary to use WebEx.</li> <li>3. I received adequate training on how to use WebEx.</li> </ol>
<p><b><i>Virtual Teamwork Training.</i></b> The following questions were taken directly from the virtual teamwork training model (Chen et al., 2008):</p> <ol style="list-style-type: none"> <li>1. My understanding of virtual teamwork has increased as a result of this class.</li> <li>2. My ability to work in a virtual environment has been enhanced as a result of taking this class.</li> <li>3. This class was useful in terms of preparing me to work in virtual teams at some future time.</li> <li>4. Virtual teamwork training is an important component of business school curriculum.</li> <li>5. I have a good basic understanding of virtual teamwork.</li> </ol>
<p><b><i>Moderating Variables.</i></b> Moderating variables, experience and gender, were collected by the following items:</p> <ol style="list-style-type: none"> <li>1. “How would you rate your computer experience?” (1-5, 1 = no experience...5 = expert)</li> <li>2. “Gender: _____.”</li> </ol>

**Table 3: Latent Variables and Survey Items.**

### 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 in the full study will be 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 will show the demographics of the respondents, including statistics regarding gender and computer experience. A correlational matrix (Fraenkel & Wallen, 2009) will be used to test the different hypotheses in the research model. The matrix will show the influence each construct has on the dependent variable and how the variables correlate. A structural equation modeling tool, partial least squares (PLS), will be 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).

## **CONCLUSION**

This pilot study provided a review of a model for incorporating virtual teamwork training and identified factors that could possibly contribute to behavioral use of an electronic collaboration system. The research model and 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 pilot study participants were trained to participate in virtual teams; additionally, each student participated in four virtual team meetings. The survey was administered over the course of a semester and the instrument was tested for reliability. A description of how future study results will be analyzed using descriptive statistics, correlational analysis, and SEM was also described.

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