

# FACTORS INFLUENCING THE ACCEPTANCE OF COLLABORATION TECHNOLOGY WITHIN THE CONTEXT OF VIRTUAL TEAMWORK TRAINING

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## ABSTRACT

The purpose of this study 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. All 108 participants 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.

## KEYWORDS

Online collaboration technology; virtual teamwork training

## 1. 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). The research described in the present paper incorporated a model for implementing virtual teamwork activities into the college curriculum (Chen et al., 2008) along with a second model, one that combined the technology acceptance model (TAM) (Davis, 1989) with seven other prominent theories in user behavior to form 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, a number of factors may influence the level of acceptance of the technology (Davis, 1989). The theoretical foundation of the present study is technology acceptance research, chosen for the robustness and preeminence of the models and theories found within this research domain.

## 1.1 Conceptual Framework

Two theoretical frameworks were incorporated into this study. The first was a model for including virtual teamwork training in Management Information Systems curricula (Chen et al., 2008). The participants in this study engaged in activities 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 involving abstract conceptualization, active and concrete experimentation, and observational reflection.

The second theoretical framework, UTAUT (Venkatesh et al., 2003), was used to identify the factors that influence the use of electronic collaboration technologies. The UTAUT model was modified for use in this study. Figure 1 shows graphically the derived model used in this study. The dependent variable for the model is the users' Intention to Use Collaboration Technology.

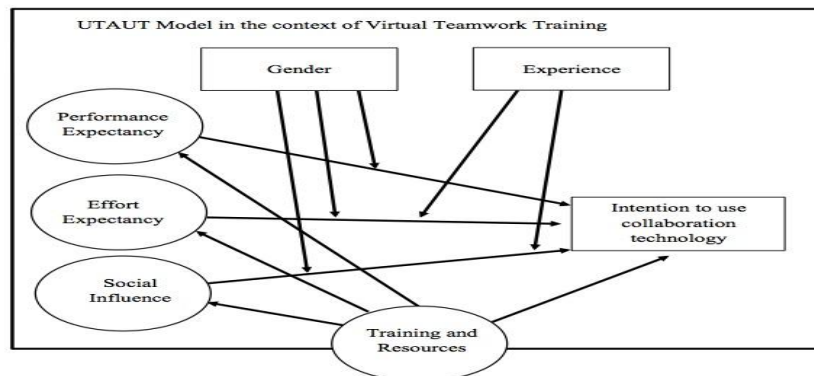


Figure 1. UTAUT model within the context of virtual teamwork training

Three of the independent variables in the model are Performance Expectancy, Effort Expectancy, and Social Influence. 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 model for this study, performance expectancy is defined as the degree to which an individual believes that using virtual team collaboration tools will result in successful project development. Effort expectancy was defined in the UTAUT study as "the degree of ease associated with the use of the system" (Venkatesh et al., 2003, p. 450). In the present study, effort expectancy is defined as the degree of ease associated with the use of the electronic collaboration system. Social influence was 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 study, 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.

In the model used in the present study, Performance Expectancy, Effort Expectancy, and Social Influence are moderated by Gender and Experience and mediate Training and Resources. Moderator variables change the strength of an effect or relationship between two variables (Baron & Kenny, 1986). Researchers have found gender to be an important moderating factor of performance expectancy, effort expectancy, and social influence (Venkatesh et al., 2003). The UTAUT study showed that experience moderates the effects of effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). Experience in this study is defined as the amount of experience one has with computers.

Mediator variables explain how or why an effect occurs between an independent and dependent variable (Baron & Kenny, 1986). Venkatesh (2000) found evidence for mediation by the variable effort expectancy of the effect of facilitating conditions, which is referred to as training and resources in the present study, on the dependent variable actual technology use. 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). In this study, training and resources refers to the degree to which individuals believe they have been trained to participate in virtual teamwork activities and have adequate resources to accomplish tasks virtually. All three of the other independent variables in this model mediate the effects of training and resources on intention to use the collaboration technology.

## 2. PROCEDURES AND MEASURES

### 2.1 Procedures

Undergraduate college of business students in Principles of Information Systems courses participated in virtual team projects using a web-based video conferencing technology, WebEx. The instructor placed students in virtual teams of four students each. Students in the courses participated in four team projects. 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. In the problem-solving meeting, the participants developed a database proposal for their business.

The students were trained by the instructor to use WebEx. Based on a modified version of Harvey Daniel's (1994) literature circles, individuals in the teams were each given unique pre-discussion and during-discussion activities. In the first virtual team meeting, the students were instructed to discuss an article. During the meeting, each team participant executed his or her during-discussion activity. Following the meeting, each participant wrote on a discussion forum responses to questions related to the article that the team members had discussed during their meeting and a reflection on the virtual meeting experience. The team leader was asked to post a summary of the meeting. The role of team leader was rotated among the team members. This meeting process was repeated for two additional articles. The students then participated in a virtual team meeting to plan a database project. They worked together in WebEx to design the tables for a database they would develop later. Then each student wrote a reflection of this final virtual meeting.

### 2.2 Measures

After the team activities were completed, the students responded to the technology acceptance survey. The survey was given in class and extra credit was awarded to students who completed the survey. The items on the survey were created using preexisting scales from the UTAUT model (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). A pilot study was conducted to test the survey's reliability, and modifications were made to improve reliability to an acceptable level. Cronbach's  $\alpha$  values ranged from .79 to .93 on the five constructs (variables) and the student perceptions of the virtual teamwork training, into which the survey items were categorized as shown below. The items on the modified survey administered to the students are listed below, under the six categories.

#### Intention to Use Collaboration Technology:

- 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:

- 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:

- 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:

- 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:

- 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 items were taken directly from the virtual teamwork-training model (Chen et al., 2008). Those items are listed in Table 4 in the Data Analysis and Results section of this paper.

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: \_\_\_\_\_”

## 2.3 Research Questions

The research questions and hypotheses are as follows:

3. 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.

4. 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.

5. 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.

6. How do students perceive virtual team training?

## 3. DATA ANALYSIS AND RESULTS

### 3.1 Demographics

Out of 127 participants in the study, 108 (85%) surveys were completed. The demographics of those that responded included that 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 majority, 96 (89%) of the respondents reported that they had moderate to very strong computer experience. The majority of the participants that reported were Management 37 (34.26%), Marketing 33 (30.55%), and Accounting 25 (23.14%) majors.

### 3.2 Analysis of the PLS model

Using PLS analysis procedures (Henseler, Ringle, & Sinkovic, 2009), the measurement instrument (technology acceptance survey) was found to be both valid and reliable, with acceptable Cronbach  $\alpha$  values and composite reliability for each construct. Partial least squares (PLS) structural equation modeling (SEM) was used to test the structural model with the defined variables. SmartPLS was used to estimate the model (Ringle, Wende, & Wills, 2005).

PLS analysis was used to test the study hypotheses for research questions one and two. PLS analysis revealed the dependent variable, intention to use the collaboration technology, exhibited an  $R^2$  value of .64. This  $R^2$  value indicated that 64% of the variance in the dependent variable was explained by the independent variables performance expectancy, effort expectancy, and social influence.

The first four hypotheses were then tested. The total effects are reported in Table 1. The results show that training and resources (TR) had a significant effect on the intention to use the collaboration technology (IU). Hypothesis 1 was supported (H1:  $\beta = 0.44$ ,  $t = 5.08$ ,  $p < .001$ ). Performance expectancy also had a significant effect on the intention to use the collaboration technology. Hypothesis 2 was 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 was not supported. Social influence did have a significant effect on the intention to use the collaboration technology. Hypothesis 4 was supported (H4:  $\beta = .34$ ,  $t = 2.85$ ,  $p < .01$ ).

Table 1. Results of testing hypotheses 1, 2, 3, & 4 (N= 108)

	Original sample (O)	Sample Mean (M)	Standard deviation (STDEV)	Standard error (STERR)	t-stat (O/STERR)
TR → IU	.44	.44	.09	.09	5.08
PE → IU	.45	.47	.10	.10	4.48
EE → IU	-.14	-.16	.14	.14	1.02
SI → IU	.34	.29	.12	.12	2.85

The results for testing hypotheses 5, 6, and 7 are shown in Table 2. 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. Neither gender nor computer experience moderated the effect of effort expectancy on the intention to use the collaboration technology. Hypothesis 6 was not supported. Neither gender nor computer experience moderated the effect of social influence on intention to use the collaboration technology. Hypothesis 7 was thereby not supported.

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. To assess for mediation, Soper's Sobel test calculator was used in this study (Sobel, 1982). A summary of the mediating effects of the independent variables on the effect training and resources had on the dependent variable, intention to use the collaboration technology, is shown in Table 3.

Table 2. Results of testing hypotheses 5, 6, and 7 (N= 108)

	Original sample (O)	Sample Mean (M)	Standard deviation (STDEV)	Standard error (STERR)	t-stat (O/STERR)
PE * Gender → IU	-.09	-.04	.12	.12	0.75
EE * Gender → IU	-.05	-.04	.10	.10	0.52
EE * Experience → IU	.13	.14	.11	.11	1.17
SI * Gender → IU	.16	.13	.12	.12	1.34
SI * Experience → IU	-.14	-.11	.12	.12	1.19

Table 3. Summary of the mediating effects (N= 108)

	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 **	

\*\*  $p < .001$

### 3.3 Virtual Teamwork Training Survey Items

Descriptive statistics were used to analyze the students' perceptions of the virtual teamwork. Table 4 displays the results for the five items included on the survey. The survey items used a 7-point Likert scale with 1 representing strongly disagree and 7 representing strongly agree. Each of the virtual teamwork items had response means of 5.59 or higher, indicating that the students agreed to strongly agreed for each item.

Table 4. Virtual teamwork-training item descriptive statistics (N= 108)

Survey Items	<i>M</i>	<i>SD</i>
Q16 My understanding of virtual teamwork has increased as 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

## 4. DISCUSSION

### 4.1 Factors that Influence Students' Intention to Use Collaboration Technology

Training and available resources had 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, Dennis, and Venkatesh (2010) that found facilitating conditions had a significant effect on intention to use. This 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.

Students who believed they would perform well using the collaboration technology also intended to use the technology. The results support the UTAUT (Venkatesh et al., 2003) study's finding that performance expectancy will have a significant effect on a person's intention to use a technology. If students believe they will perform well with technology they will be more likely to use it. Faculty may wish to demonstrate the collaboration systems in their courses and assure students that those systems are not difficult to use. WebEx is much like many of the systems that students might already be familiar with, such as Google Hangout and Skype.

Effort expectancy did not have a significant effect on intention to use the collaboration technology. This was in contrast to the findings of Brown et al. (2010) and the original findings in the UTAUT model (Venkatesh et al., 2003). Effort may be irrelevant with today's students, since they are so immersed in technology. Effort may not play as significant a role in determining whether they intend to use a technology as it has for past generations.

Social influence had a positive significant effect on the students' intentions to use the collaboration technology. This supports both the findings in the Brown et al. (2010) study and the UTAUT model (Venkatesh et al., 2003). This effect indicates that students who believe that future employers think that they should be able to use virtual collaboration technologies will be more inclined to use the technology in the future. It is important for faculty who are planning to incorporate virtual team learning activities to relay to students the need for learning these 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, videos are available that demonstrate how virtual teams work in business and industry using various technologies such as Second Life, WebEx, and other group systems.

## **4.2 Moderators of Factors Influencing Intention to Use Collaboration Technology**

Gender was not a significant moderator of performance expectancy in this study. While it contrasted with previous studies (Brown et al., 2010), this finding is particularly interesting. Participants in this study were traditional-aged college students. Today's generation of students, both males and females, are increasingly computer savvy. 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 technologies of this age, including smart phones, tablet computers, and social networking applications, have contributed to this new gender-neutral phenomenon of computer application expertise.

Effort expectancy was not a significant factor in this study. Therefore, gender and computer experience could not be considered moderators for effort expectancy. Gender and computer experience were also not found to be significant moderators for social influence. This may be due to the age of the participants, which appears to have limited both gender differences and the range of computer experience.

## **4.3 Mediation of Effects of Training and Resources on 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 indicates that training and resources increases students' performance expectancy and positively impacts their intention to use the collaboration technology. While teaching virtual teamwork skills to students, it is important to reiterate to them how learning such a skill will help them in the future. Providing examples of how such systems are used in business and 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 was also not a significant mediator. As mentioned above, effort may be irrelevant with today's students since they are so immersed in technology.

Social influence was found to significantly mediate the effects of training and resources on intention to use the collaboration technology. This indicates that training and resources increase students' perceptions that future employers may believe they should learn to use collaboration technology. Such perceptions, in turn, positively impact students' intentions to use the technology. Students may not be aware of how prevalent virtual meetings and virtual teams have become in today's work force. 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, and development of software applications.

## **4.4 Student Perceptions of Virtual Teamwork Training**

Five survey questions dealt with student perceptions of the virtual teamwork. The responses indicate that the students believed the virtual teamwork-training model was successful. The students also provided positive comments in their reflections of their meetings. It was evident from their discussions in class and the reflections that substantial improvement from the previous meeting was noticed each time they participated in a new meeting. Having multiple meetings provided value to the participants. These activities were also more representative of how actual virtual teams work in business and industry.

Harvey Daniel's (1994) literature circle activity was adapted and used in conjunction with the virtual teamwork training. One important finding of this study is that the 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 positive behavior was an outcome from incorporating the pre-discussion and during-discussion activities of the literature circle activity sheet. These study results underline the importance of providing training to help students to learn to collaborate in virtual environments. The virtual teamwork-training model could be adapted to classes in a wide spectrum of subject areas, not just in business or information systems courses.

## 4.5 Limitations

While it was interesting to apply the UTAUT model to a college environment with traditional-aged college students, the findings might have been different with a wider spectrum of ages. 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 had participated in the study, its generalizability could have been improved.

## 4.6 Suggestions for Future Research

A number of suggestions can be provided for future research as a result of this study. First, it would be interesting to conduct the study by including graduate students and participants from business and industry with a wider range of ages represented. Gender and computer experience could play a greater role with individuals who are not digital natives.

Virtual teamwork is not just a skill that could be taught in business schools; it could be taught in other disciplines as well. Faculty researchers could implement virtual teamwork training in a variety of courses from various colleges to see if there were differences among students from various disciplines.

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. Through observation and other data-collection methods, future studies could assess the quality of the virtual meetings and the quality of the products created by the team members.

## REFERENCES

- Baron, R., et al. (1986). The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*, 51, 1173-1182.
- Bower, M. (2011). Synchronous Collaboration Competencies in Web-Conferencing Environments – Their Impact on the Learning Process. *Distance Education*, 32, 63-83.
- Brown, S. A., et al. (2010). Predicting Collaboration Technology Use: Integrating Technology Adoption and Collaboration Research. *Journal of Management Information Systems*, 27, 9-53.
- Chen, F., et al. (2008). Incorporating Virtual Teamwork Training into MIS Curricula. *Journal of Information Systems Education*, 19, 29-29-41.
- Daniels, H. (1994). *Literature Circles – Voice and Choice in Book Clubs and Reading Groups*. Portland, Maine: Stenhouse Publishers.
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13, 319-340.
- Friedman, T. L. (2005). *The World is Flat: A Brief History of the Twenty-First Century*, Release 3.0, 2007. New York: Picador.
- Hensler, J., et al. (2009). The Use of Partial Least Squares Path Modeling in International Marketing. *New Challenges to International Marketing Advances in International Marketing*, 20, 277-319.
- Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. New Jersey: Prentice-Hall.
- Lepsinger, R., et al. (2010). *Virtual Team Success: A Practical Guide for Working and Leading from a Distance*. San Francisco: Jossey-Bass.
- Ringle, C. M., et al. (2005). *SmartPLS 2.0 (M3) Beta*. Retrieved from <http://www.smartpls.de>
- Sobel, M. E. (1982). Asymptotic Intervals for Indirect Effects in Structural Equations Models. In S. Leinhardt (Ed.), *Sociological Methodology 1982* (pp. 290-312). San Francisco: Jossey-Bass.
- Terris, D. (2011, October). Teaching Virtual Teamwork. *Inside Higher Ed*. Retrieved from [http://www.insidehighered.com/views/2011/10/14/essay\\_calls\\_for\\_more\\_of\\_an\\_emphasis\\_on\\_teaching\\_virtual\\_team\\_work](http://www.insidehighered.com/views/2011/10/14/essay_calls_for_more_of_an_emphasis_on_teaching_virtual_team_work)
- Venkatesh, V. (2000). Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into Technology Acceptance Model. *Information Systems Research*, 11, 342-365.
- Venkatesh, V., et al. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27, 425-478.
- Zofi, Y. (2011). *A Manager's Guide to Virtual Teams*. Atlanta, Georgia: American Management Association.