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In this issue:

Using Remote Desktop Applications in Education

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Using Remote Desktop Applications in Education

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Abstract

Students often need help outside the traditional classroom when face to face interaction is not possible. This applies even more to students in online courses. The opportunity to obtain help from instructors is limited to class time in face to face classes, office hours in the instructor's office, and online to the extent that instructors are willing to be available through email or other electronic communications channels. This paper discusses the potential use of remote desktop technologies to use remote collaboration on students' computer desktops to demonstrate skills and assist in activities when students are not able to complete work without assistance. The Unified Theory of Acceptance and Use of Technology is used to perform a preliminary study of students' acceptance of these technologies. Using a limited sample of 25 subjects, the data suggest that only the attraction to remote sessions as a technology may influence whether students intend to use them. Based on this limited study, students do not (yet) perceive a performance benefit for their educational work. To increase acceptance of this promising technology, instructors may need to aggressively promote its use.

Keywords: virtual office hours, Remote Desktop Technology, education, assistance, computers, distance education, UTAUT, technology acceptance

1. INTRODUCTION

The educational field is undergoing major changes due to changes in demographics and technological advances. More students have fulltime jobs or family obligations. Decreased time availability and schedule flexibility can negatively affect students' opportunity to visit instructors during office hours. One of the great opportunities of the new technologies lies in the use of desktop sharing to assist students with their academic work. This paper briefly reviews the trend to replace traditional office hours with electronic assistance, followed by a discussion of remote desktop applications and a widely used model for acceptance of new technology. This model is modified for a preliminary study of acceptance of desktop sharing, and the results of the preliminary study are presented and discussed. The paper closes with recommendations and a discussion of future follow-up.

2. LITERATURE REVIEW

Educational Changes

Education is going through major changes at a rapid pace. The proportion of nontraditional students is rapidly increasing. In the academic year 1999-2000, 25.5% of all students in public 4-year institutions worked full-time, and 9.2% were single parents (ICES, 2002). Both categories are examples of students in higher education who may not have the opportunity to be on campus at specific times. Not only does this cause con-

flicts between personal and professional lives on one hand and attending class on the other, but the non-academic commitments may also interfere with interaction with instructors face to face and using office hours to seek assistance. Traditional face to face office hours are further constrained by the location of the instructor and scheduled times when the instructor is available (Wallace and Wallace, 2001).

At the same time, the Department of Education reports rapid growth in the number of online students. In 2002, Director of Education, Workforce, and Security Issues Cornelia Ashbey testified before the GAO that the number of students involved in distance education had tripled in just four years (US-GAO, 2002). Together, the rise of the number of nontraditional and distance education students requires a re-evaluation of the concept of office hours. Students with the highest need for assistance tend to fall not in the A, D or F ranges, but in the B- to C+ range (Karabenick & Knapp, 1988). These are exactly the students who may be at risk of failing if the issue of easy access to assistance is not addressed.

Technological Changes

An additional factor is the rapid rise in the level of technology used in education. This is not a new issue. In 1984, Turner (1984) discussed the concept of electronic hours. As early as 1996, Marsh and Wells (1996) reported that E-mail, ListServs, electronic bulletin boards, and other synchronous electronic interactions were replacing traditional office hours. According to Atamian and DeMoville (1998), students actually preferred using office hours through Email rather than visiting the instructor in the office. Then, in 2001, both Wallace & Wallace (2001) and McKeage (2001) discussed their actual experiences with electronic office hours. Similarly, many students prefer online homework systems due to their convenience and ease of use (Johnson & Conrad, 2001).

Together, the rapid technological changes and the changing student demographics point to a need to revisit the concept of office hours as a means to give assistance to students outside the classroom shared with other students. Wallace and Wallace (2001) list six distinct types of computer-based communication tools; 1) E-mail, 2) newsgroups, 3) text-based computer conferences, 4) video-based computer conferences, 5) computer-based voice communication, and 6) shared applications. With the exception of shared applications, none of these provide an efficient means of giving real-time, graphics-intensive individualized assistance. The first three tools are primarily text based, videoconferencing merely adds a face to the voice, and VOIP and prerecorded messages do not offer visual cues. Even shared applications are very limited in their usefulness, since they cover only part of the desktop and do not allow fast switching between applications. The recent advances in remote desktop protocol (RDP) technologies offer an opportunity to fill this gap.

Remote Desktop Technologies

Using RDP, instructors can offer students assistance to students right where they need this: on their own computer, using their own applications, and using the student's own partially completed files.

Early RDP technologies were developed to fill a need for remote computer management. As networking of computers moved to the mainstream in the 1980s, managing a multitude of clients and the need for access to servers revealed a need for the ability to start and stop services, install software, and supervise the use of machines without physical presence of the administrator. Early remote administration involved command line interfaces and access through web pages, which did not allow the administrator to see the same desktop view as a local user. As systems developed and networked computers' capabilities expanded, and especially with a surge in available bandwidth, the use of remote desktop technologies to share Graphical User Interfaces (GUIs) became feasible and attractive. One of the early applications allowing remote users to share the same desktop was Virtual Network Computing, an open source application now ported to a variety of platforms. Microsoft introduced remote desktop access first only on their servers through the Remote Desktop Protocol in Windows NT 4.0 Terminal Server Edition. Terminal Server was refined in the Windows 2000 Server Series, and expanded in Windows XP to include Remote Assistance where a user can invite any other user to take over control over the machine temporarily to resolve problems and issues. Howev-

er, Remote Assistance required the user on the remote computer to be able to transfer a connection file to the expert helper, using either Microsoft Outlook (Express) or Windows Messenger for authentication.

With increasing use and complexity of computers, a wide variety of commercial remote desktop technologies has now become available. All remote desktop technologies rely on the installation of a server on the local machine (which can be installed as part of the Operating System) and the use of a remote client application. In some cases, the same software acts as server and as client, allowing users to access all machines remotely regardless of their status. Furthermore, some applications allow the use of a web browser as the client, eliminating the need to install a client.

Obstacles to RDP use

In using remote desktop technologies, establishing connections is frequently complicated by the presence of routers and firewalls. In essence, all traffic on networks relies on numerical addressing. Even though users may only be exposed to easy-to-remember URLs (Uniform Resource Locators) such as http://www.cnn.com and http://www.university.edu , traffic is directed using four "octets" for each computer. For instance, the main server at a university may be located at the publicly available address 192.68.4.63. Routers connect separate networks as a larger network, and the main server on the network (which can even be located on the router, as in the case of a router on a home network) allocates four octets to all computers connected to the network it serves. Consequently, a computer outside the router uses the address of the router, which in turn uses the network address of the target computer to send the message. Remote desktop software needs some mechanism to "know" where the target computer is located, or, as an alternative, the router has to be programmed to forward data packets. This configuration of routers will surpass the abilities of the average user, and ordinary users do not have the required permissions to do this on organizational networks.

In addition, many networks are now protected by so-called firewalls. Firewalls are hardware and/or software based information technology (IT) security devices configured to permit or deny data connections based on a security policy. Unfortunately, they can block network traffic needed for remote desktop applications. This can be remedied by changing the security policy, which again is usually beyond the capabilities and permissions of most users. As an alternative, some remote desktop technologies use connections (ports) in the firewall which tend to be open. A good example is the use of port 80 which is used for regular web surfing.

UTAUT

As with any technology to be introduced to new users and for new purposes, user acceptance is essential to sustained adoption of the technology. In the Information Systems literature, the predominant theory used to research adoption of technology is the Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT is presented as "a definitive model that synthesizes what is known and provides a foundation to guide future research in this area (Venkatesh, Morris, Davis, & Davis, 2003)." The model uses four key constructs: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. Together, they influence Use Behavior either directly or through and intermediate Construct, the Behavioral Intention to Use. The influence of the four independent constructs on Behavioral Intention and Use Behavior is modeled as augmented by individual factors of Gender, Age, Experience with Technology, and Voluntariness of Use.

In the UTAUT model, Performance Expectancy (PE) 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 (Venkatesh et al., 2003. In general, PE relates to any anticipated external reward or advantage as a result of using the system. In previous studies using the Technology Acceptance Model, PE was generally the strongest predictor of Behavioral Intention (e.g. Agarwal & Prasad, 1997). Similar to the positive anticipation of benefits resulting from adoption and use, Effort Expectancy (EE) is in essence a positive influence on a decision to adopt or use. Although the term suggests a negative experience (effort is generally something to avoid rather than seek), Venkatesh et al (2003) define the construct as "the degree of ease associated

with the use of the system". A similar focus on ease of use is demonstrated in the items measuring the construct in UTAUT, such as "My interaction with the system would be clear and understandable" (Venkatesh et al., 2003). This is not surprising, since the construct is largely based on Perceived Ease of Use (PEU) in the previous Technology Acceptance Model (TAM), which showed a statistically significant influence on Behavioral Intention only inconsistently. One of the reasons for this inconsistent result may be the timing of measurement in the various studies in the past. Effort-based expectations are likely to be stronger predictors early in the adoption process, whereas the needed effort becomes more predictable over time and habituated. The third major influence on Behavioral Intention in the UTAUT model is Social Influence (SI), defined as "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003). Whether SI should be considered as a positive or a negative experience depends on the viewpoint of the individual adopter. If the result of compliance with the social influence is perceived as pleasing to the important other, SI can be considered as a reward and something to be sought. If, on the other hand, the social influence focuses on the avoidance of displeasure for the important other, it is a punishment to be avoided. In an academic setting, both points of view can be expected in any group of students. Finally, the last major construct influencing adoption, Facilitating Conditions (FC), is considered to be a direct influence on actual behavior and not on behavioral intentions. FC is defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2003). Even though it is a subjective belief and as such could be expected to influence a behavioral intention, the focus appears to be more on the perceived presence of obstacles for implementation once a decision has been made. For instance, a measurement item for FC in UTAUT is the statement "A specific person (or group) is available for assistance with system difficulties". This clearly describes a situation where the decision has been made and an attempt is under way. Together, the previously defined four constructs influence either the Behavioral Intention to Use (BI) and/or the Use Behavior (USE). The constructs of BI and USE are not explicitly defined in UTAUT, but the difference between intention and actual behavior is readily apparent. This is not a theoretical distinction, since a decision to act precedes a deliberate act, and intentions are not consistently followed by action. Moreover, previous research has demonstrated the gap between intentions and actions (Ajzen, Brown, & Carvajal, 2004). For the purpose of this study, the older definition of System Use as "the utilization of information technology by individuals, groups or organizations" (Straub, Limayem, & Karahanna-Evaristo, 1995) will be used. USE is not measured consistently in all technology adoption studies due to the difficulties associated with obtaining data. In the studies where it is measured, data on USE is typically gathered from system logs. For the item statements measuring BI, the intention is measured by items with varying degrees of certainty ("intend to use", "plan to use", and "predict I would use"). Combined, the items merely list the level of commitment and the time frame for realization. The reader, as well as respondents, does not have a clear definition of the actual behaviors which constitute that "use."

In addition to the direct effects of the four main independent constructs, the effect of each is modified by the four factors of AGE, GENDER, Experience with Technology (EXP) and Voluntariness of Use (VOL). EXP and VOL are not explicitly defined in the UTAUT model itself, and the measurement of the construct in the seminal UTAUT studies is not specified. Interestingly, several other constructs are modeled in UTAUT as not having an influence on BI. The first is Attitude toward Using Technology (ATUT), which is defined as "an individual's overall affective reaction to using a system" (Venkatesh et al., 2003). As such, the reaction to the specific system in a study – which is distinct from the response to technology in general – can be expected to overlap with other constructs, such as Effort Expectancy. The second and third constructs from previous research which are expected not to have an influence on intention or behavior, are presented as Self-Efficacy (SE) and Anxiety (ANX). Again, these two constructs have been proven to be non-significant influences due to their variance being captured by especially Effort Expectancy.

The four main constructs and four factors in UTAUT have been used in many studies in the IS field. We will now discuss how we used the theoretical UTAUT model for our study.

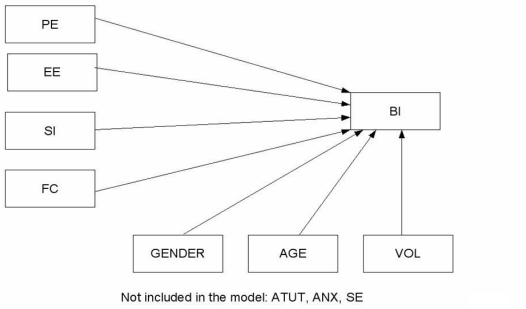
3. METHODOLOGY

This section presents the research model in the study, the hypotheses, and the data collection. As discussed in the previous section, technology adoption models have advanced to using intermediate factors, and state of the art analysis now includes the routine use of Structural Equation Modeling. The research presented in this study is in the early stages, and the current sample size is small. Consequently, the research model and data analysis have to be adjusted to a model that can be analyzed with older statistical techniques based on the General Linear Model such as Multiple Regression.

The research model

Based on these considerations, the research model as stated in UTAUT was modified as follows. The original four major constructs (PE, EE, SI, and FC) were retained but all were modeled as independent constructs influencing one dependent construct, BI. USE was not included in the model. GENDER, AGE, and VOL were included, but as independent constructs influencing BI directly. EXP was not included in the model, since participants in the study were introduced to the technology for the first time. The resulting model is presented in Figure 1.

Figure 1: Research Model



To minimize the need for validating the items measuring the constructs, the original items from the resulting UTAUT model in Venkatesh (2003) were used, with the words "the system" replaced by "remote desktop technologies". In later stages of the research, the current data may be combined with new observations to allow use of SEM. Consistent with UTAUT, the constructs ATUT, ANX, and SE were included in the study to examine if they did not show statistical significance as in earlier studies.

Based on the new model, and consistent with expectations in UTAUT, we formulated the following research hypotheses.

H_1: Performance Expectancy will have a significant positive influence on Behavioral Intent

H_2: Effort Expectancy will have a significant positive influence on Behavioral Intent

H_3: Social Influence will have a significant positive influence on Behavioral Intent

H_4: Facilitating Conditions will have a significant positive influence on Behavioral Intent

H_5: Gender will have a significant influence on Behavioral Intent

H_6: Age will have a significant influence on Behavioral Intent

H_7: Voluntariness will have a significant influence on Behavioral Intent

H_8: Attitude Toward Use of Technology will not have a significant influence on Behavioral Intent

H_9: Anxiety will not have a significant influence on Behavioral Intent

H_{10}: Self-Efficacy will not have a significant influence on Behavioral Intent

Sample

The study was conducted at a regional university in the Midwestern USA. To test the research hypotheses, the authors recruited volunteers from their classes taught in the Spring 2007 and Summer 2007 semesters. Participants earned extra credit towards their final grade in the course. Students, who did not wish to participate or were unable to participate, could earn the same number of extra credit points by completing an alternative assignment, which reduced the potential desirability bias. The total possible extra credit points depended on the total number of points in the course. Students enrolled in more than one section could only participate once, but received the extra credit points in all courses in which they were

enrolled. This eliminated multiple submissions for the same subject. Furthermore, the responses were checked for multiple submissions before analysis. Students, who did not have their own Windows based computer with administrative privileges, could use the office desktop computer of the authors while the authors used a laptop with wireless access. All participants received the same written instructions distributed by email and posted on the BlackBoard website. Instructions included an explanation that the software could not be used as spyware, the promise of confidentiality rather than anonymity because university IDs were needed to award the extra credit, the need to have administrative access to a Windows computer, the right to withdraw, and the availability of an alternative source for extra credit.

Procedures

First, students installed the Crossloop remote desktop application on their own computer from the website at http://www.crossloop.com . Instructions for installation, complete with screen shots, were available at the authors' university website. After installation, which generally took less than five minutes, students dialed the VOIP phone number used by the authors during office hours. This allowed the authors to answer the phones hands-off and concentrate on working with the students with both hands available. The audio quality of the VOIP connection was good throughout. A script of the sessions is included in Appendix A. Students started the Crossloop application. Two students used dial-up connections, all other students used either DSL or cable Internet connections. The authors talked the participants through setting up the joint session on the student's computer and alternated with the student in working on the student's desktop following the protocol. At the end of the session, the authors disconnected the phone call and the remote desktop session to let the participants complete the survey.

4. DATA ANALYSIS

A total of 25 students participated in the study. Distribution by gender was fairly equal with 11 male and 14 female participants. The mean age was 24.6 years (s.d. = 7.98). The survey results were imported into an Excel worksheet and one single missing answer replaced with a value of 3. Reverse item scores were corrected and the average scores for constructs calculated. These scores were imported into an SPSS worksheet and analyzed with Regression Analysis. Stepwise Regression demonstrated a statistically significant model (p = .003).

Table 1: ANOVA (Stepwise Regression)

Model		SS	df	Mean Square	F	Sig.
1	Regression	2.957	1	2.957	8.359	.008
	Residual	8.136	23	.354		
	Total	11.093	24			
2	Regression	4.625	2	2.312	7.865	.003
	Residual	6.468	22	.294		
	Total	11.093	24			

1) Predictors: (Constant), ATUT 2) Predictors: (Constant), ATUT, EE Dependent Variable: BI

Furthermore, the Beta coefficients for Effort Expectancy (p = .026) and Attitude toward Using Technology (p = .001) showed strong statistical significance.

Table 2: ANOVA (Stepwise Regression)

Model		SS	df	Mean Square	F	Sig.
1	Regression	2.957	1	2.957	8.359	.008
	Residual	8.136	23	.354		
	Total	11.093	24			
2	Regression	4.625	2	2.312	7.865	.003
	Residual	6.468	22	.294		
	Total	11.093	24			

1) Predictors: (Constant), ATUT 2) Predictors: (Constant), ATUT, EE Dependent Variable: BI

The Beta coefficient for Effort Expectancy was negative however, indicating against expectation that low expected effort would actually decrease the behavioral intention to use. A positive Beta coefficient for Attitude Towards Using Technology did indicate that participants who consider the technology aspect to be attractive are more likely to use remote sessions. All other constructs did not show any statistical significance. Apparently, participants do not plan to use remote sessions even if they find them beneficial (Performance Expectancy mean = 4.29), do not perceive a climate either favoring or discouraging the use of remote sessions (Social Influence), may not feel the need to have

support for problems (Facilitating Conditions – the application is extremely simple to use), may not see a need to troubleshoot independently (Self-Efficacy – again, the application is extremely easy to use), are not influenced by their perceived expectations of the instructor (Voluntariness), and anxiety may not influence intention to use.

5. CONCLUSIONS AND RECOMMENDATIONS

Based on preliminary results in this small sample, the findings of UTAUT could not (yet) be reproduced. Especially the absence of any influence of Performance Expectancy is surprising, given that this and similar constructs have consistently been the strongest predictor of technology adoption. Equally surprising is the opposite effect of Effort Expectancy. Based on the phrasing of the items measuring the construct, higher scores for what is essentially an expectation of absence of effort should lead to a higher intent to adopt. One explanation may lie in the perceived availability of support using remote desktop technologies. In this study, students were asked to participate during office hours of the researchers. Students may expect instructor availability online 24/7, since they can be online 24/7. With face to face office hours, the availability of the instructor is obviously limited to physical availability in the office. As such, the concept of online support may generate an expectation of continuous availability and the Effort Expectancy score reflect the difficulty establishing contact rather than technical difficulties relating to the software itself. In future data collection, we plan to incorporate open-ended questions regarding impressions of the use of the software, the usefulness of using the software to support students between class sessions, and suggestions for improved use of the technology. Due to the quantitative nature of the data collected in this sample, we can only speculate why the results did not work out as expected.

Gender, age, and voluntariness did not demonstrate an effect either, but this preliminary study did support the absence of influence of anxiety and feelings of self-efficacy. The results of the study are summarized in table 3.

Table 3: Evaluation of Research Hypotheses

H1: Performance Expectancy will have a significant positive influence on Behavioral Intent	Not supported
H2: Effort Expectancy will have a significant positive influence on Behavioral Intent	Not supported, influence in opposite direction
H3: Social Influence will have a significant positive influence on Behavioral Intent	Not supported
H4: Facilitating Conditions will have a significant positive influence on Behavioral Intent	Not supported
H5: Gender will have a significant influence on Behavioral Intent	Not supported
H6: Age will have a significant influence on Behavioral Intent	Not supported
H7: Voluntariness will have a significant influence on Behavioral Intent	Not supported
H8: Attitude Toward Use of Technology will not have a significant influence on Behavioral Intent	Supported
H9: Anxiety will not have a significant influence on Behavioral Intent	Supported
H10: Self-Efficacy will not have a significant influence on Behavioral Intent	Supported

As discussed before, a major limitation in this early study is the limited sample size. The lack of expected effects, and especially the opposite effect for Effort Expectancy, could be artifacts of the small sample size. Other limitations of the current study include the limited exposure to the technology. In this respect, the extreme ease of use of the Crossloop application and the limited duration of the shared desktop sessions – students could usually complete installation of the software and the remote session within twenty minutes – could skew the participants' impressions of the technology. Similarly, the courses from which participants were recruited could influence the results. All students participated in the study at the end of the semester and some courses did not require the use of complicated or unfamiliar software. Software such as Access or Excel tends to generate more need for help. In future semesters, the authors plan to make the first remote session a mandatory assignment at the beginning of the semester, and to offer only the survey as an extra credit opportunity at the end of the semester. Students can elect to use the software voluntarily during the semester, and the time distance between instruction and completion of the survey will allow students to become more experienced in using the software. Actual use will be recorded and used to score the USE construct.

This study has presented an early stage of the adoption of remote assistance for students. The technology has great potential to contribute to the quality of education in a fast changing environment. The authors encourage other researchers to explore issues related to acceptance and dissemination in future studies.

6. REFERENCES

Agarwal, R., & Prasad, J. (1997). The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. Decision Sciences, 28(3), 557-582.

Ajzen, I., Brown, T. C., & Carvajal, F. (2004). Explaining the discrepancy between intentions and actions: The case of hypothetical bias in contingent valuation. Personality and social psychology bulletin, 30(9), 1108-1120.

Atamian, R., & DeMoville, W. (1998). Office hours -- none: An e-mail experiment. College Teaching, 46(1), 31-35.

International Center for Educational Statistics. (2002). Special analysis 2002: Nontraditional undergraduates. Retrieved Jun 28, 2007, from http://nces.ed.gov/programs/coe/2002/analyses/nontraditional/tables/tab02.asp

Johnson, T., & Conrad, C. (2001). Online vs. Pen-and-paper homework methods: Student preferences and performance. Retrieved Mar 17, 2003, from http://www.sbaer.uca.edu/Research/2002/ACME/Papers/02acme156.pdf

Karabenick, S. A., & Knapp, J. R. (1988). Help seeking and the need for academic assistance. Journal of Educational Psychology, 80(3), 406-408.

Marsh, L. C., & Wells, K. L. (1996). Key aspects of a computerized statistics course. Journal of Computing in Higher Education, 8(2), 72-93.

McKeage, K. (2001). Office hours as you like them: Integrating real-time chats into the course media mix. College Teaching, 49(1), 32-38.

Straub, D. W., Limayem, M., & Karahanna-Evaristo, E. (1995). Measuring system usage: Implications for is theory testing. Management Science, 41(8), 1328-1342.

Turner, J. A. (1984). Courses and 'electronic office hours' by computer. The Chronicle of Higher Education, 28.

United States General Accounting Office. (2002). Distance education: Growth in distance education programs and implications for federal education policy (No. GAO-02-1125T).

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

Wallace, F. L., & Wallace, S. R. (2001). Electronic office hours: A component of distance learning. Computers & Education, 37(3-4), 195-209.

APPENDIX A: SCRIPT

A(uthor): This is Dr X. Are you calling for the extra credit study?

A: Let me explain what we are going to do. First, we are going to set up a connection between our computers so we can both work on your computer together. I will get onto BlackBoard in my account, so you can see that I am going to give you your first (..) points for setting up the session. I will then log out from my account and let you log in with your account, so you can check that the extra points are in your grades section. Finally, I will take you to the survey and get you in with the password for the survey, so you can earn the other (..) points. Those points will not show up immediately in your grades because we have to enter them manually, but you should have them the next day. Do you have any questions?

(Opportunity to give clarification as needed)

A: Go ahead and start the Crossloop program. Click on the "Host" tab and tell me the number that you see.

(Student opens application, and tells author the session number. Author enters session number on his computer under the "Join" tab)

A: Please click on the "Connect" button now.

A: You should now see a message that I want to connect and share control over your computer. Go ahead and click on the "Yes" button.

(Author logs student out from his BlackBoard account as needed, logs onto BlackBoard with his instructor account and enters the first extra credit points in the student's grades, with verbal explanations of what is done on the remote screen such as "I am now going to enter my user name and password to log on". Authors logs out from the instructor BlackBoard account).

A: Go ahead and log on to BlackBoard with your own account now.

(Student logs on to BlackBoard and checks his grades in the course, notices the new entry)

A: Let me take over again and take you to the survey. I will have to enter the password for you so you can take the survey and get the other (..) points.

(Author clicks on a button for the survey in the menu on the left)

A: Go ahead and click on the link to open the survey.

(Student comes to the password box)

A: Let me enter the password for you.

(Author enters password, survey screen comes up)

A: This is the point where I am going to leave you alone so you can complete the survey at your leisure. Before I hang up the phone and close the Crossloop program, do you have any questions?

(Author answers questions as needed, then hangs up).

APPENDIX B: SURVEY QUESTIONS

PE - Performance expectancy

I would find remote desktop technology useful in my studies.

Using a remote desktop technology enables me to accomplish tasks more quickly.

Using a remote desktop technology increases my productivity.

If I use a remote desktop technology, I will increase my chances of getting a better grade

EE -Effort expectancy

My interaction with remote desktop technology would be clear and understandable.

It would be easy for me to become skillful at using remote desktop technology.

I would find remote desktop technology easy to use.

Learning to operate remote desktop technology is easy for me

ATUT - Attitude Toward Using Technology

Using remote desktop technology is a good idea.

Remote desktop technology makes work more interesting.

Working with remote desktop technology is fun.

I like working with remote desktop technology.

SI -Social influence

People who influence my behavior think that I should use remote desktop technology.

People who are important to me think I should use remote desktop technology.

The administration of the university has been helpful in the use of remote desktop technology.

In general, the university has supported the use of remote desktop technology

FC -Facilitating conditions

I have the resources necessary to use remote desktop technology.

I have the knowledge necessary to use remote desktop technology.

The system is not compatible with other remote desktop technologies I use (reverse scored)

A specific person (or group) is available for assistance with difficulties

SE -Self-efficacy

I could use remote desktop technology if there was no one around to tell me what to do as I go.

I could use remote desktop technology if I could call someone for help if I got stuck.

I could use remote desktop technology if I had a lot of time

I could use remote desktop technology if I had just the built-in help facility for assistance.

VOL – Voluntariness

Although it might be helpful, using remote desktop technology is certainly not compulsory in my studies.

My instructor does not require me to use remote desktop technology.

My instructors expect me to use remote desktop technology (reverse scored)

My use of remote desktop technology would be voluntary

ANX - Anxiety

I feel apprehensive about using remote desktop technology.

It scares me to think that I could lose a lot of information using remote desktop technology by hitting the wrong key.

I hesitate to use remote desktop technology for fear of making mistakes I cannot correct.

Remote desktop technology is somewhat intimidating to me.

BI - Behavioral Intention to use the system

I intend to use remote desktop technology in the next 12 months

I predict I would use remote desktop technology in the next 12 months.

I plan to use remote desktop technology in the next 12 months

SETUP – Setting up the Sessions

I would prefer setting up remote desktop sessions by using: (A telephone call / An email message / An Instant Message / Other:)

GENDER (Male / Female)

AGE (numerical, not grouped)

University ID – necessary to award extra credit