

Technology Acceptance and Social Networking in Distance Learning

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Abstract

This study examines the use of integrated communication and engineering design tools in a distributed learning environment. We examined students' attitudes toward the technology using two different approaches. First, we utilized the technology acceptance model to investigate the attitude formation process. Then, to investigate how attitudes changed over time, we applied social information processing model using social network analysis method. Using the technology acceptance model, we were able to demonstrate that students' initial expectation affected the perceptions of, attitudes toward, and use of the system. With social network analysis, we found that one's attitude change was significantly influenced by other students' attitude changes. We discussed the uniqueness of distance learning environments in the context of social influence research and how studies of distance learning could contribute to the research on the social influence of technology use.

Keywords

Technology acceptance model, Social influence, Network analysis, Attitude, Distance learning

Introduction

Advances in computing and information technology are changing the way people meet and communicate. People can meet, talk, and work together outside traditional meeting and office spaces. The introduction of software designed to help people schedule meetings and facilitate decision or learning processes is weakening geographical constraints and changing interpersonal communication dynamics. Information technology is also dramatically affecting the way people teach and learn (DeLacey & Leonard, 2002; Radcliffe, 2002; Starr, 1997). As new information technologies infiltrate workplaces, home, and classrooms, research on user acceptance of new technologies has started to receive much attention from professionals as well as academic researchers. Developers and software industries are beginning to realize that lack of user acceptance of technology can lead to loss of money and resources.

User acceptance is defined as “the demonstrable willingness within a user group to employ information technology for the tasks it is designed to support” (Dillon & Morris, 1996, p.4). Although this definition focuses on planned and intended uses of technology, studies report that individual perceptions of information technologies are likely to be influenced by the objective characteristics of technology, as well as interaction with other users. For example, the extent to which one evaluates new technology as useful, s/he is likely to use it. At the same time, her/his perception of the system is influenced by the way people around her/him evaluate and use the system (Rogers, 1986; Trevino, Lengel, and Daft, 1987).

Studies on information technology continuously report that user attitudes are important factors affecting the success of the system (Burkhardt, 1994; Davis, 1989; Garcia, 2001; Lucas, 1981; Rice & Adyn, 1991). For the past several decades, many definitions of attitude have been proposed. However, all theories consider attitude to be a relationship between a person and an object (Woelfel, 1995). In the context of information technologies, there have been two distinctive approaches to the study of attitude- the technology acceptance model (TAM) and the social information processing model (SIPM). While the TAM suggests users formulate a positive attitude toward the technology when they perceive the technology to be useful and easy to use (Davis, 1989), the SIPM assumes that attitudes toward technology are influenced by opinions, information, and behaviors of salient others (Salancik and Pfeffer, 1978).

The purpose of this study is to examine factors affecting user acceptance of new collaboration technology in a distance learning (DL) class. Specifically, this study investigates how students’ attitudes toward a new system form and change. One key factor to successful DL is seamlessly integrating the resources and technology introduced to the class. The United States Distance Learning Association (USDLA) defines DL as the delivery of education or training through electronically mediated instruction including satellite, video, audio graphic, computer, multimedia technology and other forms of learning at a distance. As such, the fundamental function of DL is delivering resources to students with the help of electronic technology. Hence, there is no doubt that information technology plays an essential role in DL environments. However, we have more questions than answers about the determinants of the use and acceptance of collaborative technology (Constant, Sproull, and Keisler, 1996). We believe that theories such as the TAM and SIPM can help us understand how students form attitudes and use technologies in DL environments (Segrest, Domke-Damonte, Miles, and Anthony, 1998).

Although the TAM and SIPM have been extensively tested and validated in areas other than education, we believe that applying the models to the study of DL can offer unique benefits. While the TAM can shed light on the way students form attitudes based on the characteristics of technologies, the SIPM can explain how attitudes are influenced by other users and change over time. Because interactions with remote classmates are limited by the capability of the technology being used for the class, the way students are affected by others should be different from effects in other environments, such as face-to-face. During the past several decades, many studies assessed and tested the SIPM in various settings. However, it is difficult to find research conducted in mediated environments. This study offers an opportunity to assess the validity and usefulness of the SIPM in a mediated environment. In the following sections, the TAM and SIPM will be introduced in greater detail, and the research questions of this study will be presented.

Technology Acceptance Model

In studying user acceptance and use of technology, the TAM is one of the most cited models. According to the TAM, ‘perceived usefulness (PU)’ and ‘perceived ease of use (PEoU)’ are primary motivational factors for accepting and using new technologies. PU is the degree to which a person believes that use of technology will produce better outcomes (Davis, 1989). ‘Useful’ refers to ‘capable of being used advantageously.’ In contrast,

PEoU is the perception about the degree of effort needed to use a particular system. In this case, 'ease' is conceptualized as 'freedom from difficulty or great effort.'

According to the TAM, if a user perceives a specific technology as useful, s/he will believe in a positive use-performance relationship. Since effort is a finite resource, a user is likely to accept an application when s/he perceives it as easier to use than another (Rander and Rothchild, 1975). As a consequence, educational technology with a high level of PU and PEOU is more likely to induce positive perceptions. The relation between PU and PEOU is that PU mediates the effect of PEOU on attitude and intended use (Moon & Kim, 2001). In other words, while PU has direct impacts on attitude and use, PEOU influences attitude and use indirectly through PU. Based on these prior findings, we hypothesize the following.

H1: In a DL environment, PEOU will have indirect effects on attitude and use.

H2a: In a DL environment, PU will have direct effects on attitude.

H2b: In a DL environment, PU will have direct effects on technology use.

H3: In a DL environment, positive attitudes towards technology will lead to increase of technology use.

Extension of the TAM

Expectation

Previous research has continuously reported that the TAM was very useful in predicting and explaining technology use in various situations (Dillon and Morris, 1996). However, Davis (1989) argued that research should explore other variables that could affect PU, PEOU, and use. Dishaw and Strong (1999) noted that one of TAM's weaknesses is its lack of explicit inclusion of external variables. As an extension of the TAM, they suggested a model including the relation between task-technology fit and PU/PEOU. They found the extended TAM explained the variance of the dependent variable better than the original TAM.

In fact, many scholars have proposed various extended TAMs. For instance, Moon and Kim (2001) suggested a model where perceived playfulness was described as one of the antecedents of attitude toward Web surfing. They noted that most prior TAM research had focused only on extrinsic motivation, not on intrinsic motivation. According to Deci (1975), extrinsic motivation refers to the performance of an activity. Extrinsic motivation is perceived to help achieve valued outcomes that are distinct from the activity itself, such as improving job performance, pay, etc. Intrinsic motivation refers to the performance of an activity for no reason other than the process of performing it. In the case of technology acceptance studies, PU is an example of extrinsic motivation, while perceived fun, playfulness, and enjoyment are examples of intrinsic motivation. Davis, Babozzi, and Warshaw (1992) found that perceived enjoyment was significantly related to PEOU.

Similarly, Bandura (1982) distinguished self-efficacy judgments from outcome judgments in his social cognitive theory. Outcome judgments indicate the extent to which successful behavior is linked to valued outcomes. Applying Bandura's arguments to the TAM, Compeau, Higgins, and Huff (1999) proposed a model where performance outcome expectations and personal outcome expectations were related to technology use. Based on these studies, we decided to include two dimensions of expectation in the TAM. Similar to extrinsic motivation and intrinsic motivation, we conceptualized performance expectation as the expectation about individuals' performance gains from using the technology, and social expectation as the expectation about social and entertainment experiences from using the technology. As extrinsic motivation is related to usefulness and intrinsic motivation to PEOU, we hypothesized that performance expectation will influence PU and social expectation would impact PEOU.

H4a: Performance expectation will have positive influences on PU.

H4b: Social expectation will have positive influences on PEOU.

Satisfaction

Although a large number of studies have been conducted to evaluate user satisfaction regarding the use of systems, it is surprisingly difficult to find TAM studies that explicitly considered user satisfaction. Most studies simply assume that user satisfaction could be manifested by acceptance and use of technology, neglecting satisfaction as an outcome variable. Since one of our research goals is to evaluate factors affecting satisfaction with the distant learning class, we decided to measure students' satisfaction with the DL class explicitly. In a

distant learning class, communications with remote class members occur electronically and thus the quality of communication tends to be influenced by the technological system used. As such, we expected that students' attitudes and technology use would affect the satisfaction with the DL class. Hence, we developed the hypotheses below. Figure 1 summarizes research hypotheses proposed in this section.

H5a: Attitudes will affect satisfaction with the DL class.

H5b: Technology use will affect satisfaction with the DL class.

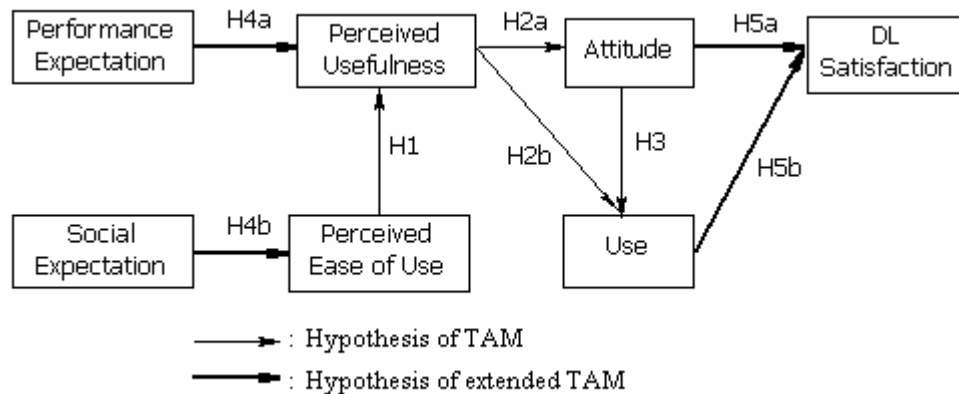


Figure 1. TAM and Research Hypotheses

Social Information Processing and Social Influence Model

A consistent finding from prior research on technology use is that user attitude toward new technology is the key factor for successful deployment. Findings suggest that attitude formation is influenced by the objective characteristics of the system, the extent of use, and individual user differences. However, studies also continuously report that people are not always rational in selecting and using technologies, and attitudes toward and use of technology are influenced by culture, norms, social contexts, or salient others (Fulk, Schmitz, and Schwartz, 1992; Rice & Love, 1987). As an explanation of such confounding results, Salancik and Pfeffer (1978) developed the SIPM. According to the SIPM, individuals' perceptions of technologies are also influenced by the opinions, information, and behaviors of people they communicate with. Similarly, using the SIPM (or Social Influence Model (SIM) in general) Fulk, Steinfield, Schmitz, and Power (1987) reported that technology-related attitudes are often influenced by social interactions and psychological processes rather than directly by objective and independent assessments of technical characteristics.

According to Salancik and Pfeffer (1987), individuals may be influenced by cues from others about what to attend to, how to value the salient dimensions of workplace phenomena, and how to evaluate the same phenomena. In this regard, when people collaborate with others using technology, exposure to social information may lead to change in attitude. Technology in DL does more than just supplementing traditional communication. Gay and Lentini (1995) described that learning is built through conversations between persons or among groups, involving the creation and interpretation of meaning. Although the TAM is useful in determining factors affecting technology acceptance and use, it is not capable of examining the effect of user communication patterns. In fact, TAM's referent theory, the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975) includes social influence via a construct called subjective norm. However, the social influence construct has received little attention in the context of TAM research.

Because of its unique nature, social network analysis has been widely adopted and used for the study of SIPM, or SIM (Burkhardt, 1994; Burkhardt & Brass, 1990; Rice and Adyn, 1991). In the present study, we will also assess social information processing with social network analysis. An extensive discussion of social network analysis is outside the scope of this paper. Briefly, social network analysis is the study of social relations among a set of actors, focusing on patterns of relations (Wasserman and Faust 1994). Using social network analysis to study collaboration technology in DL environments allows us to understand communication patterns among students and to examine changes in these communication patterns over time. In this study, we test the extended TAM in a longitudinal context. While the TAM can explain how initial expectations lead to actual technology

use, and, in turn, satisfaction over time, social network analysis reveals how changes in communication patterns occur in the DL class, and how such changes affect individuals' perceptions of technology. In the following section, we will provide descriptions about the DL collaboration system used for this study and details about the research design. Analysis and results are then presented, followed by the discussion and conclusion sections of this study.

Method

Research Environment

This study was based on a DL project for designing future aerospace systems. The overall goal of the project was to develop the capability for students at distributed geographic locations to interact effectively on the development of aerospace systems. As a means of achieving this goal, a new collaboration system was developed and introduced to the class. The central part of the system was a Web-based application called "Advanced Interactive Discovery Environment" (AIDE). The AIDE is a virtual environment containing application-specific content, application-appropriate simulation and software packages, distributed learning modules, expert systems, knowledge bases, and synchronous and asynchronous communication tools, including message boards, instant messaging, chat, and multi-point audio and video (see Figure 2).

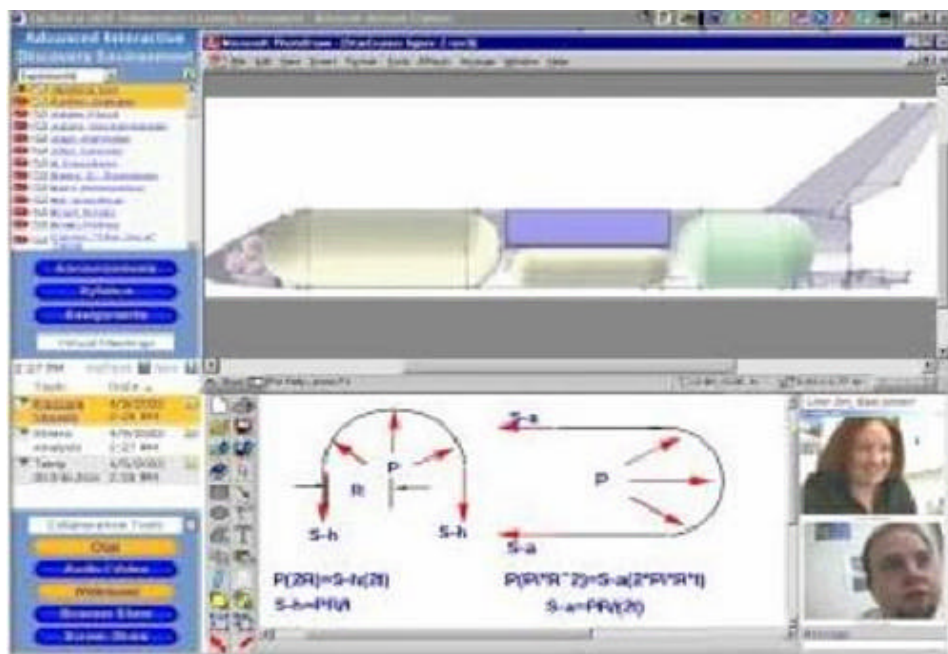


Figure 2. The screenshot of the Advanced Interactive Discovery Environment (AIDE)

Participants and Data Collection

A DL engineering class using the AIDE was offered at two universities. Participants of the current study were 31 senior students (17 and 14 from each university, 23 males and 8 females). Over the course of the study we conducted three surveys. The first survey was administered before the introduction of the AIDE system, measuring students' expectations toward the AIDE. During the course of the semester, students formed groups for the final class design project. The second survey was performed after group formation, measuring student experience with the AIDE system and interaction with group members. The third survey, administered at the end of the semester, measured students' overall perception about and satisfaction with group interaction and the course.

At the start of the semester, two distinct social networks were evident (divided between universities). As the semester progressed, however, students were required to interact with each other to complete their class projects. As such, it was expected that they would form a communication network mediated by the collaboration system. To measure how students' communication network changed over time, we collected data for social network

analysis in the first and third survey. In the network survey, we asked participants to report names of people they talked to and how frequently they communicated.

Measurement Scales

The three questionnaires contained multiple measurement items related to each of the constructs in the research model. Consistent with research literature in the area, multi-item self-report Likert type scales (ranging from 1 to 7) were used to measure all variables. The scales include:

Outcome Expectations (Survey 1): Outcome expectation was defined as the perceived likely consequences of using the collaboration technology. In this study, we used two dimensions of outcome expectation. Performance-related outcome expectations concerned the improvements in study performance associated with using the technology. Social outcomes were those associated with social experiences (i.e., having relationships and fun with others) associated with using the technology. Based on outcome expectation measures of Compeau et. al (1999), we developed and used a 9-item performance expectation scale and a 4-item social expectation scale. The reliability coefficient (Chronbach's alpha) of each scale was .90 and .84 respectively.

PU (Survey 2): This scale consisted of six items from Davis (1989), measuring the extent to which a person believed that the technology was capable of being used advantageously and provided positive expected outcomes (alpha = .91).

PEoU (Survey 2): This scale measured the degree to which a person believed that using a particular technology system would be free of cognitive effort. The scale consisted of six items, developed and validated by Davis (1989) (alpha= .92).

Technology Use Level (Survey 2): Use of collaborative tools was measured by a scale consisting of four items adapted from Cheung, Chang, and Lai (2000). The scale measured the frequency and intensity of technology use and the extent to which students used the technology for various purposes (alpha = .75).

DL Satisfaction (Survey 3): We developed a three-item scale assessing the degree of satisfaction with the lectures, students, and course quality in the DL class (alpha = .84).

Change of Attitude Toward Technology (Survey 2&3): Taylor and Todd (1995) devised and validated the 4-item attitude scale, which measured whether individuals like/dislike using the technology and how they felt using the technology (i.e., pleasant/good). Since we were interested in examining attitude change over time, we measured attitude in both the 2nd and 3rd survey (alpha=.87 and .89 respectively), and calculated the difference. The resulting variable was labeled attitude change. (Attitude measured in the 2nd survey was used for testing the TAM.)

Group Satisfaction (Survey 3): This scale, validated by Campion, Medsker, and Higgs (1993), consisted of seven items measuring the extent to which a group member was satisfied with group collaboration, social interactions, and outcomes (alpha = .81). (This variable was used for testing SIPM.)

Other Variables: In addition to the measurement scales mentioned above, we asked students if they had experienced difficulties with the AIDE (2 items, alpha=.79). Also, Internet apprehension (6 items, alpha=.91), Internet efficacy (5 items, alpha=.96), and perceived behavioral control (3 items, alpha=.82) were measured. Internet apprehension measures the degree to which students are apprehensive of using the Internet. Internet efficacy is the self-judgment of how well one can execute courses of actions required to deal with Internet-related technologies. Perceived behavioral control measures the availability of skills, resources, and knowledge to use the AIDE.

Analysis

To test the research hypotheses, we ran a path analysis based on a series of regressions. In the path analysis, we regressed each variable in turn onto the set of variables preceding it in the model. For example, when testing the possible influence of expectations on PEoU, a regression analysis was performed predicting PEoU from performance and social expectation. When determining the influence of expectations and PEoU on PU, a regression analysis was performed predicting PU from performance expectation, social expectation, and PEoU.

By repeating these types of regressions, we created an output path diagram by drawing an arrow for each significant relation.

For network analysis, we used UCINET (Borgatti, Everett, and Freeman, 2002) for analyzing data and producing network diagrams. Centrality of a network indicates who has the most influential connections to and from other actors. Of the many centrality measures available, we used degree centrality. Degree centrality was determined by individuals' frequencies of (incoming/outgoing) communications with others. It is assumed that when an actor has a high degree centrality, the actor is playing an important role (such as an opinion leader) in the social network (Freeman, 1979).

UCINET can calculate inter-network comparisons, such as Quadratic Assignment Procedure (QAP) correlations. QAP calculates Pearson's correlation coefficient (as well as simple matching coefficient) between corresponding cells of the two data matrices. By repeating such calculations thousands times, QAP tests if the association between two networks is statistically significant. Since network data do not hold the independent measurement assumption, usual parametric method is not appropriate for network comparisons. We used the QAP method to compare the social networks at two different time frames.

Results

Table 1 summarizes descriptive statistics for variables used in the analyses. Each scale is based on a seven-point Likert scale. While all other variables showed positive mean values, attitude change had a negative mean value. It seemed that students' attitudes have decreased as the semester progressed. Figure 3 illustrates the results of the path analysis. Each arrow (except for dotted arrows) in the diagram represents a statistically significant relationship ($p < .05$) between variables. Note that social expectation did not produce a significant relationship with PEOU while performance expectation produced a meaningful relationship with PU. All hypotheses of the original TAM (i.e., H1, H2a, H2b, H3) were supported. However, of the four hypotheses developed for the extended TAM, only H4a and H5a were supported. We found a strong direct influence of PU on attitude. Attitude then affected technology use and satisfaction with the DL class. However, technology use and satisfaction showed no significant relationship. With the help of the longitudinal setting of this study, the path diagram clearly shows that when students have goal-oriented expectations (i.e., performance expectation), they form positive attitudes through their perceptions about practical functionalities of the technology (i.e., usefulness). If a user has a positive attitude toward the technology, s/he is likely to use the technology and to be satisfied with the DL class.

Variable	Mean	Std. Dev.
Performance expectation	5.28	1.01
Social expectation	4.92	1.06
Perceived usefulness	3.86	1.12
Perceived ease of use	3.71	1.28
Use	2.98	0.87
DL satisfaction	4.41	1.04
Group satisfaction	4.65	1.12
Attitude change	-0.85	2.07

Table 1. Descriptive Statistics for Main Variables

As expected, network analysis of the first survey illustrated that there existed two large subnetworks (one from each university) at the beginning of the semester. However, the two subnetworks merged as the semester continued, as shown in Figure 4. No isolated people were found in the network. In other words, everyone communicated with at least one person. To examine changes of roles and positions in the social network, degree centralities from the two social networks were compared. The result revealed that central actors occupied similar positions in both of the networks in terms of centrality ($r = .40$, $p < .05$). To explore how similar/different the two networks were, we ran the QAP correlation analysis. The QAP correlation between the two networks was 0.18 ($p < .01$). The result indicated that, despite convergence of the two subnetworks, the internal characteristics of each subnetwork remained structurally similar.

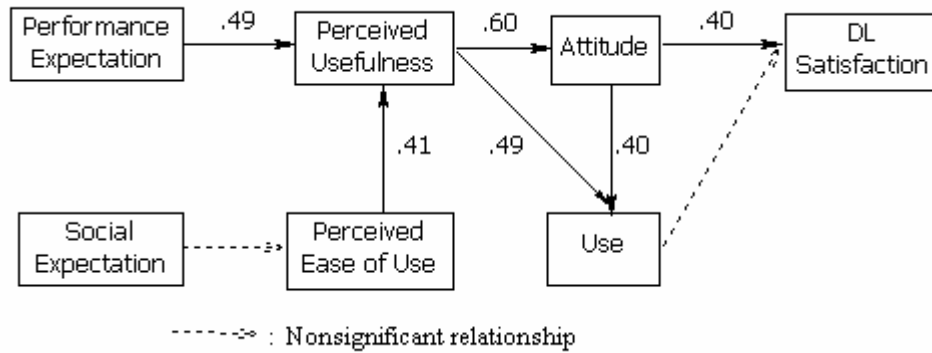


Figure 3. Path Analysis Result

We ran an additional analysis to further examine which internal characteristic was still remaining. UCINET provides autocorrelation analysis for examining the subnetwork structure. Autocorrelation analysis can test whether a network can be divided by actor attributes such as gender or school membership. We used school membership as the actor attribute. The result revealed that the social network at the end of the semester was composed of two subnetworks based on school membership ($p < .05$) implying that the significant QAP correlation came from school membership.

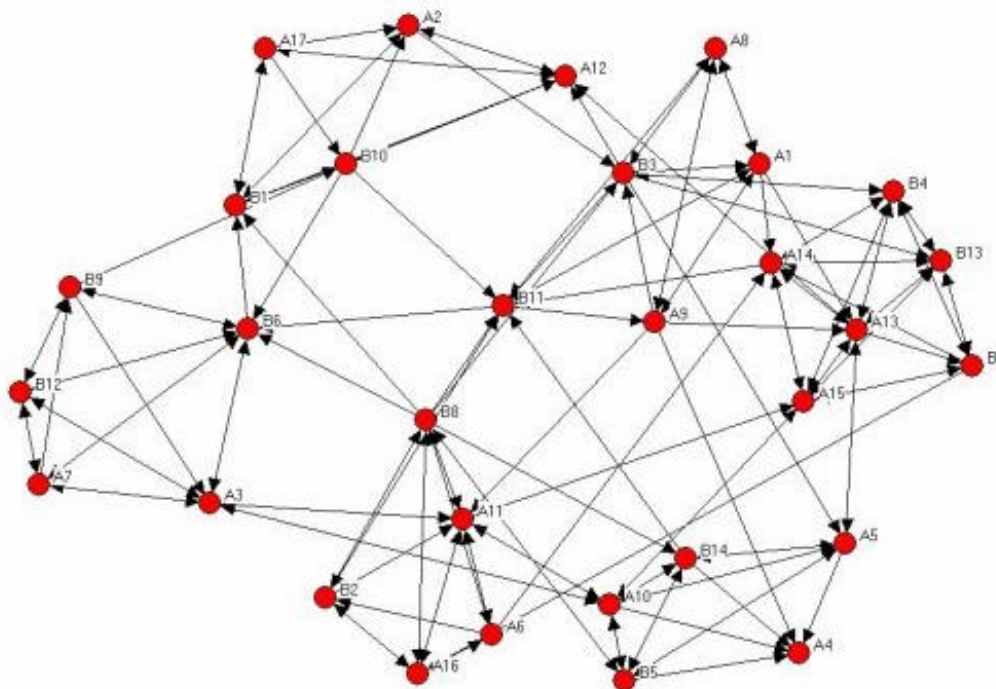


Figure 4. Social Network Diagram at the End of the Semester

To test how students' attitudes were affected by other classmates, we calculated social influence with the following formula. The intuition is that as the amount of communication increases, the likelihood of influence also increases. According to the equation, when person j has no communication with person i , influence is zero. In contrast, when person j has frequent communications with person i , influence is weighted by the frequency of communication.

$$\text{Social influence to } j = \text{Sum} [(\text{attitude change of } i) * (\text{communication frequency between } i \text{ and } j)]$$

(note: i represents all other class members except for j)

The correlation between individuals' attitude change and social influence was very high ($r=.72$, $p<.001$). This indicates that social influence played a fundamental role in changing students' attitude. To further examine how attitude change was affected by satisfaction with group activities, we ran a regression analysis predicting attitude change from social influence and group satisfaction. The result demonstrated that both group satisfaction ($\beta=.31$, $p<.05$) and social influence ($\beta=.58$, $p<.001$) predicted attitude change fairly well. The two variables explained 55.4% of the variance of attitude change.

Finally, we ran correlation analyses to examine how central people perceived the collaboration environment. We used students' outdegrees for the calculation. An individual with a high outdegree is a person who talked "to" others frequently. In the setting of the current study, most communication occurred electronically using email, instant messaging, and/or AV conferencing. Since people with higher outdegrees were believed to have used the technology more frequently than others, we compared outdegrees of the second network with other variables. As expected, results indicated that students with high outdegrees had used the AIDE system frequently ($r=.40$, $p<.05$), experienced difficulties with the system ($r=.52$, $p<.01$), and, thus, felt the system was not under their control ($r=-.43$, $p<.05$). They were the people who have less apprehension about communicating over the Internet ($r=-.45$, $p<.05$) and believed themselves to be knowledgeable of Internet technology ($r=.43$, $p<.05$).

Discussion

When the AIDE was first introduced, students were informed that the AIDE would provide various tools for managing and storing information online. Because many of AIDE's promised functions were not easily available even from commercial packages, students were excited about using the AIDE for their work. As shown in Table 1, expectations (performance and social) were the two variables with the highest mean values.

As the semester went along, students seemed to have evaluated the usefulness of the AIDE based on how well the AIDE supported increasing their performance. Although previous research reported that entertainment elements such as playfulness and fun were important motivational factors for successful acceptance of new technology (Moon and Kim, 2001), expectation for social experience and fun did not play a role in the present study. In this study, the AIDE was implemented to a DL class and students' primary concerns about the AIDE were receiving needed information and effectively communicating with others. Hence, students' attitudes toward the AIDE were primarily determined based on how useful the AIDE was in fulfilling their intended tasks efficiently.

General findings of this study were similar to findings of prior research to the extent that while PU exerted a direct influence on attitudes, PEoU had an indirect effect on attitudes through PU. It should be noted that while there have been many studies assessing the acceptance of new technologies with the TAM, it is difficult to find studies that explicitly included satisfaction in the model. In this study, we extended the model to show the relationship between attitudes and satisfaction with the DL class.

In a DL class, technology is essential to the success of the class. Without the technology, it is virtually impossible to have interactions with remote teachers and students. Although students initially had both performance and social expectations for the technology, they became more interested in how to increase their performance using the technology as the semester went along. As such, students seemed to have formed their attitudes based on their perceived characteristics of the technology.

The TAM model explained how individual perceptions influenced attitudes. Students were somewhat rational in determining the usefulness of technology. However, we found that attitudes toward technology are not fixed. As students gained exposure to the technology, they may have experienced failure of the system or their friends may have praised the usefulness of the system. Our results clearly illustrate that, although students initially formed attitudes based on their PU of the system, influences from their communication partners significantly affected their attitude change. The regression result revealed that the degree of attitude change was determined by the amount of social influence and the degree of satisfaction with group members. Hence, it seems that as group cohesiveness increases, and as exposure to social information increases, student attitudes are more likely to become homogenous. This result is intriguing in that while students' initial attitudes were formed in a rather subjective way, the change of thus formed attitudes were socially influenced.

As shown in Table 1, the mean DL satisfaction was relatively low compared with two expectation dimensions. Additional analysis revealed that DL satisfaction was significantly lower than performance expectation ($t=3.14$, $p<.01$). It is well known that central actors in social networks tend to be information gateways, opinion leaders,

and early adaptors of innovations. For the successful diffusion of a new technology, it is important to form positive impressions to central actors of a social network (Burt, 1987; Papa and Tracy, 1988). As mentioned, central people in the class were heavy users of the AIDE, experienced technical difficulties, and thought the AIDE was not under their control. Note that central people had good knowledge of Internet technologies and did not have apprehension of Internet communication. It seems that they experienced difficulties and received negative impressions from the AIDE. These results suggest the reason why attitude change had a negative mean value and why technology use was not related to satisfaction. Heavy users of the AIDE received negative impressions from the system and they exerted greater influence than others resulting in negative attitude change overall.

In summary, we have examined how students formed attitudes toward new information technology in a DL class, and how attitudes changed over time. We approached our research questions from two directions: the TAM and the SIPM. While the TAM illustrated how students' attitudes have formed, the SIPM showed how attitudes have changed over time. The results indicated that the negative influence from central people might have caused an overall decrease of attitudes.

In measuring the amount of social influence, we simply multiplied the amount of attitude change and the strength of ties in the social network. However, there are many ways to determine the level of social influence using proximity measures from social networks. Examples include relational, positional, and spatial proximity (Burt, 1987; Burkhardt, 1994; Festinger, Schacter, and Back, 1950; Hackman, 1983; Rice and Adyn, 1991). Relational proximity is similar to what we used in this study but it can be weighted by a measure of actor importance. Positional proximity primarily concerns whether two actors in a network occupy similar network positions. Many studies have found that people with similar positions are structurally proximate and may have similar attitudes (Burt, 1987). Spatial proximity is based on physical locations such as office locations. Positional and spatial proximities can also be weighted by certain measures of actor importance.

It is believed that all the three mechanisms introduced above are valid sources of social influence. Many studies attempted to determine the relative influence of different mechanisms (Burkhardt, 1994; Rice and Adyn, 1991). However, little attempt has been made to test the effect of the medium through which social influence flowed. For example, in the case of this study, the QAP correlation between two networks and the correlation result of centralities from the two networks illustrate that the network structure and the roles of actors in social networks have not changed dramatically over time. In other words, despite new emergent communication patterns, students in both locations maintained their initial relationships to a significant degree. Hence, we expect that both spatial and relational mechanisms played roles in the social influence process. Spatial influence tends to manifest itself through face-to-face communication. However, relational influence should result from the interaction between face-to-face communication with co-located students and computer-mediated communication with remote students. Hence, it would be worth testing how the use of different media for communication results in the differences of the social influence level. Future research is needed to validate this speculation.

Conclusion

Literature on the use of information technology within the context of DL is ample. We know from research on DL, as well as from other areas, that for successful deployment and acceptance of technology, it is important to develop positive attitudes toward technology. Some have argued that attitudes are formed by the usefulness evaluation of technology while others advocated the importance of influence from other people. Both claims have developed their own theoretical models and proved to be useful in explaining related phenomena.

In this study, we tried to test the user acceptance of the technology in a DL environment with two different theoretical approaches. We attempted to identify the process in which attitudes were formed and changed over time. Because of the nature of this study, we were able to test our research questions in a longitudinal fashion and to make strong casual arguments about our findings. We discussed limitations of the method we used for determining the level of social influence. We then introduced various methods to test the effect of social influence and the possible effect of communication channels on social information processing for future research. Although there is much research based on the user acceptance of technology and the social influence model, questions remain regarding how previous research findings could be applied in DL environments. Results of this study are a valuable addition toward the continuing integration of findings from existing research in the context of DL.

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