Using Rogers' Theory to Interpret Instructional Computer Use by COE Faculty

Ismail Sahin
Selcuk University, Turkey

Ann Thompson
Iowa State University

Abstract

The purpose of this research study was to develop a theory-based methodology for exploring instructional computer use by faculty members in one College of Education (COE) and implementing this methodology at an Anatolian university in Turkey. Rogers' (2003) Diffusion of Innovations theory was used as the theoretical framework in the process of instrument development, data collection, and in the interpretation of the results. The faculty members in the study reported low levels of use and expertise in instructional computer technologies. Variables significantly correlated with faculty members' level of computer use were computer expertise, computer access, barriers to computer access, attitude toward computer use, support for computer use, and adopter categories based on innovativeness. The importance of administrative support and the need for faculty development were two major findings from this study. The results from the qualitative data provided information on addressing barriers to faculty computer use and confirmed the characteristics of Rogers' adopter categories. Findings interpreted through Roger's theory suggest that an action plan should take advantage of faculty members' positive computer attitudes and collegial communication to help them move to the higher levels of use and expertise in instructional technologies. Methodology used in this study provides a model for other colleges of education worldwide to obtain information about the needs of their faculty members. (Keywords: computer, college of education, diffusion of innovations, instruction.)

INTRODUCTION

Now that technology is widely available on most campuses (The Campus Computing Project, 2001), the integration of this technology in higher education teaching and learning has become more and more important. Technology serves as a foundation to universities to create the appropriate learning organizations and supports the four components of universities: organization, people, learning, and knowledge (Marquardt & Kearsley, 1999). "Typically, professors use software tools, like word processors, but rarely use technology for teaching or require students to use it for assessment purposes" (Schrum, Skeele, & Grant, 2002, p. 258). McKenzie (2001) and Parisot (1995) criticized the standard approach of higher education institutions and schools – they buy the new and complex technologies and simply make them available to faculty members and teachers. In fact, "if higher education wants to survive in the expansion of technology, then it must be prepared and prepare its faculty to implement the new technologies within their classrooms" (Hagenson & Castle, 2003, p. 2).

Educators in teacher education programs have the special challenge of preparing preservice teachers for the integration of technology into instruction.

Faculty should use instructional technology to help their students achieve curricular objectives (Cagle & Hornik, 2001). While technology is used more often in administration and research, its use is less frequent in instruction (Spotts, 1999; Zhao & Cziko, 2001) because the integration of computer technologies into teaching challenges the traditions and practices of faculty members and universities (Anderson, Varnhagen, & Campbell, 1998; Pope, Hare, & Howard, 2002). In research designed to understand the technology use by College of Education (COE) faculty in the U.S., Sahin and Thompson (in press) analyzed faculty technology adoption levels in general and described the factors that were significant predictors of the technology adoption level. Using Rogers' (2003) Diffusion of Innovations theory as the theoretical framework, the current quantitative study aimed to assess the adoption level of computers for instructional purposes, by faculty members in the COE at an Anatolian university in Turkey. The study also aimed to determine the variables that were significantly correlated with faculty members' use of computers for instructional purposes. Hence, the goal of the current study is to develop theory-based methodology, to better understand specific instructional computer use by COE faculty in Turkey, as a follow-up up on the results from the study in the U.S.

Theoretical Background

A number of theories address some basic elements that directly relate to faculty use of instructional technologies in teacher education programs. Social Learning Theory (Bandura, 1977), Concerns-Based Adoption Model (Hall & Hord, 1987), and Rogers' Diffusion of Innovations theory have been among the most used frameworks in many studies. In Social Learning Theory, Bandura (1977) categorizes the influences on human social behavior as personal, environmental, and behavioral (Dembo, 1994; Schunk, 2000). Similar to Rogers' theory, the Concerns-Based Adoption Model (Hall & Hord, 1987) is another popular adoption model that is used to study the process of adopting innovations (Sherry & Gibson, 2002). In this model, Hall and Hord (1987) described eight different levels of use of an innovation: non-use, orientation, preparation, mechanical use, routine, refinement, integration, and renewal. While the Concerns-Based Adoption Model focuses more on the adoption process of an innovation, Social Learning Theory deals with explaining the observational and social learning that is more related to the diffusion of an innovation. However, Diffusion of Innovations Theory looks at both the adoption and the diffusion of an innovation. We emphasize this theory when examining both faculty use of instructional computer applications and the issues that are experienced in the social environment during the diffusion of the innovation.

The process of adopting innovations has been studied for more than 30 years, and Rogers' model described in his book, Diffusion of Innovations, has been identified as one of the most popular adoption models (Sherry & Gibson, 2002). Much research from a broad variety of disciplines has used the model as a framework. Dooley (1999) and Stuart (2000) mentioned several of these disciplines as political science, public health, communications, history, economics, technology, and education, and defined Rogers' theory as a widely used theoretical framework in the area of technology diffusion and adoption.

Others have also suggested that Rogers' diffusion of innovations theory is the most appropriate for investigating the adoption of technology in higher education and educational environments (Medlin, 2001; Parisot, 1995). In fact, much diffusion research involves technological innovations so Rogers (2003) usually used the word "technology" and "innovation" as synonyms. Although this is certainly not the first technology integration study to use Roger's theory, it is the first study to ground the instrument construction, data collection, data analysis, and data interpretation in this theory. The resulting methodology provides a model for other institutions seeking a theory-based approach to studying faculty adoption and diffusion of instructional technology that leads to obtaining information for assisting faculty movement to higher levels of adoption and diffusion.

THEORETICAL FRAMEWORK

Specifically, Rogers' theory was used in the process of data collection and as a frame to interpret of the findings from this study. The research instrument included items that measured faculty level with respect to the specific elements of this theory. In addition, the results of this study were discussed and summarized using Rogers' theory. For Rogers (2003), the innovation-decision process involves five steps: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. Also, attributes of innovations includes five characteristics of innovations: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability. For instance, "*trialability* is the degree to which an innovation may be experimented with on a limited basis" (Rogers, 2003, p. 16) so the more an innovation is tried, the faster its adoption is. Rogers defined the following five adopter categories on the basis of innovativeness: innovators, early adopters, early majority, late majority, and laggards.

In this survey study, COE faculty members' current computer use and expertise in instructional computer technologies were evaluated to find out where they were in the innovation-decision process. Specifically, Rogers' (2003) attributes of innovations and adopter categories were used in the construction of the research instrument. While the relative advantage, compatibility, and complexity attributes measured faculty attitudes toward instructional computer technologies, the research instrument included the trialability, and observability attributes as the social support variables. Moreover, specific survey items were used to classify the faculty members according to Rogers' adopter categories based on innovativeness. For instance, the following statement determined the innovators' category: "I was using computer technology for instructional purposes before most faculty members in my college knew what it was or before the college purchased equipment." Results from the survey were interpreted using Roger's categories as the frame for both describing the current level of faculty adoption and suggesting interventions for moving the faculty to higher levels.

METHODOLOGY

Research Site and Participants

The participants of this study consisted of COE faculty members of the Anatolian university. This university has an enrollment of 60,000 students. The

COE is one of the 16 colleges in the university, with 8,533 students. It has eight main departments: computer and instructional technologies education, social sciences, art education, primary education, science and mathematics education, educational leadership and policy studies, Turkish education, and foreign languages education.

The research instrument was distributed to 157 full-time COE faculty members. That group had 19 full professors, nine associate professors, 68 assistant professors, and 61 instructors (see Appendix A for the frequencies of faculty demographics). To include all faculty members, whether or not they used computers for instructional purposes, the research instrument was distributed to the faculty in a paper format. Of those who were asked to participate, 117 faculty members responded to the study, for a 74.5% response rate.

Research Instrument

The data collection instrument for this study was a questionnaire originally developed by Isleem (2003). For this research, the survey was modified partially to measure the level of COE faculty computer use for instructional purposes and to include the elements of Rogers' theory. The survey included the following sections: levels of instructional computer use and expertise, access to computers, barriers to computer access, attitudes toward computer use, and computer support. All of these sections used a five-point, Likert-type set of alternatives. As Wetzel (1993) stated, even faculty who have strong technical backgrounds may not have high levels of technology in teaching, if they do not have knowledge of how to use it correctly. Similarly, faculty that has limited knowledge of computer applications in general might show high levels of use of basic computer applications in teaching. Thus, the survey of the current study included two columns for the computer applications, and these columns resulted in two different variables: level of instructional computer use and level of computer expertise (See Appendix B for the instrument).

An additional section added to the questionnaire was originally developed by Less (2003). This fifth section included six items to classify the participants according to Rogers' (2003) adopter categories. This section also includes an open-ended question asking for a reason for the adopter category that the participants selected. Finally, the last section asked about faculty characteristics.

Data Analysis

Since each section of the survey had a list of several items, the current study used the canonical correlation analysis method to determine relationships between the level of computer use for instructional purposes and the selected factors. Canonical correlation (R_c) is a statistical method to measure the relationship between two multidimensional variables (Ashley, 1996). Wilks' lambda (Λ) was used to test the significance of the relationship between the sets of variables. Wilks' lambda is a multivariate statistic ranging between 0 and 1 (Mertler & Vannatta, 2002). Also, the Cronbach alpha value, ranging from 0 to 1, of the reliability test was used to check the survey sections for internal consistency that compares responses to different sets of survey items. Howland and Wedman (2004) suggested that acceptable coefficients for the scales should meet or exceed the .70 criteria for reliability tests. The results of the reliability analyses showed that the value of the Cronbach standardized item alpha for each section of the survey was either moderate or high, confirming the reliability of the survey (see Table 1 and Appendix C for the reliability test results).

FINDINGS AND DISCUSSION

The findings from this study are organized and reported around instructional computer use. After the results related to COE faculty members' use of computers for instructional purposes are presented, the relationship between instructional computer use and the following variables were analyzed: computer expertise, computer access, barriers to computer access, attitude toward computers, support for computer use, and adopter categories. After the findings are reported, the meaning of these results is discussed.

Instructional Computer Use

As seen in Table 1, the findings of this study showed that COE faculty members had high levels of use of just three mainstream and personal computer applications: Internet, word processing, and email. There is a gap between the mean scores of these mainstream computer use applications (M>4.0) and other more specific computer use applications (M<2.9). Literature confirmed the results that the use of more mainstream and personal computer applications was common among faculty and teachers (Aust, Newberry, O'Brien, & Thomas, 2005; Carter, 1998; Howland & Wedman, 2004; Isleem, 2003). However, the level of instructional computer use in general by COE faculty members was very low. These results are consistent with those of Odabasi (2000), who found that while Turkish faculty members use the traditional technologies more often, they lacked experience in the use of more computer-related technologies. Odabasi found that the word processor was the most frequently used computer application among the faculty members.

The open-ended items in the survey provided information for improving faculty use of computers for instructional purposes. COE faculty members indicated that they need support, training, knowledge about appropriate teaching pedagogies, improvement of school and classroom infrastructure, and time release from their teaching workload. These themes showed that COE faculty members should be well supported and trained in instructional computer use (Casmar, 2001) and that higher education should establish structures to encourage the integration of computer technologies into the curriculum (Parisot, 1995).

Computer Expertise and Instructional Computer Use

Similar to the findings reported on the levels of instructional computer use, faculty members had high levels of computer expertise in the three mainstream and personal computer applications, but lacked computer expertise in instructional computer applications and the rest of the computer applications that were more specialized (see Table 1). Overall, these results showed that the COE faculty members' expertise in the computer applications was very low.

Table 1: Mean for Items of Instructional Computer Use[a] and Expertise[b]

Item	Use		Expertise	
	Mean	Std. Dev.	Mean	Std. Dev.
E-mail	4.2	1.1	3.7	1.2
Internet Content	4.1	1.1	3.7	1.1
Word Processing	4.1	1.1	3.5	1.1
Spreadsheets	2.8	1.2	2.8	1.2
Graphics	2.8	1.3	2.8	1.3
Presentation	2.7	1.4	2.7	1.4
Discipline-specific Programs	2.6	1.3	2.6	1.4
CD-ROM, DVD, Web-based Interactive Content	2.5	1.3	2.5	1.3
Database Management	2.4	1.3	2.3	1.3
Data Analysis Software	2.3	1.4	2.2	1.3
Classroom Management	2.2	1.3	2.1	1.3
Drill and Practice	2.2	1.2	2.1	1.2
Authoring	2	1.2	2.1	1.3
Simulations and Games	2	1.2	2	1.1
Tutorials	1.9	1.2	1.9	1.2
Website Design	1.8	1.3	1.8	1.3

[a]Std. Item Alpha (computer use) = 0.93; [b]Std. Item Alpha (computer expertise) = 0.95.

As seen in Table 2, computer expertise is significantly correlated with the level of computer use. Cavanaugh (2002) confirmed the findings that COE faculty members do not have enough knowledge and skills to integrate and model the adoption of technology into instruction.

Literature and the results of this study revealed that computer expertise was the most important factor influencing educators' instructional computer use (Asan, 2002; Braak, 2001; Jenson, Lewis, & Smith, 2002; Zhao & Cziko, 2001). Knowledge is the first stage of the successful adoption of instructional computer technologies (Rogers, 2003). Thus, the knowledge stage is essential for other steps in the innovation-decision process. If COE faculty members do not have enough expertise in computer use, they cannot be expected to adopt computer technologies into their instruction. Without the knowledge of computer technology, COE faculty members might have a high level of uncertainty that influences their opinions and beliefs about the innovation. In addition, Rogers defined three types of knowledge: awareness knowledge, how-to knowledge, and principles knowledge. These knowledge types refer to "what the innovation is and how and why it works" (p. 21). To construct new knowledge,

Table 2: Canonical Correlation between Instructional Computer Use and Independent Variables

Item	Expertise*		Access*		Barriers*		Attitude*		Support*		Adopter Level*	
	R_c [(a)]	R^2 [(b)]	R_c	R^2	R_c	R^2	R_c	R^2	R_c	R^2	R_c	R^2
1	0.986	0.355	0.833	0.320	0.776	0.052	0.847	0.247	0.733	0.219	0.640	0.121
2	0.965	0.088	0.726	0.063	0.680	0.058	0.633	0.061	0.672	0.035	-	-
3	0.943	0.096	0.601	0.009	0.613	0.042	0.601	0.019	0.644	0.022	-	-
4	0.931	0.067	0.341	0.005	0.541	0.014	0.526	0.008	0.547	0.014	-	-
5	0.919	0.032	0.256	0.001	0.519	0.022	0.454	0.005	0.522	0.010	-	-
6	0.839	0.056	-	-	0.477	0.009	0.415	0.006	0.431	0.011	-	-
7	0.815	0.018	-	-	0.382	0.006	0.316	0.002	0.402	0.009	-	-
8	0.769	0.014	-	-	0.280	0.003	0.284	0.002	0.364	0.004	-	-
9	0.728	0.012	-	-	0.221	0.001	0.229	0.002	0.286	0.003	-	-
10	0.714	0.009	-	-	0.167	0.002	0.158	0.001	0.158	0.001	-	-
11	0.683	0.011	-	-	0.125	0.001	-	-	0.142	0.001	-	-
12	0.632	0.009	-	-	-	-	-	-	-	-	-	-
13	0.568	0.006	-	-	-	-	-	-	-	-	-	-
14	0.501	0.009	-	-	-	-	-	-	-	-	-	-
15	0.323	0.003	-	-	-	-	-	-	-	-	-	-
16	0.013	0.000	-	-	-	-	-	-	-	-	-	-

** Independent Variables Significantly Correlated with Level of Computer Use ($p < 0.05$ for the Wilks' Lambda (Λ) value).*
[(a)] Canonical Correlation (R_c). [(b)] R-square for Dependent Variables.

COE faculty should be provided with both a "how-to" experience and a "know-why" experience (Seemann, 2003).

Computer Access and Instructional Computer Use

The COE faculty members reported high levels of computer access in more personalized spaces, such as in their offices and at their homes (see Appendix C for the mean values of the independent variables). However, they stated that there was a lack of computer access in most classrooms where they taught (M=2.3). In the responses to the open-ended questions, the participants mentioned that the school and classroom infrastructure needed to be improved. Specifically, computer access in classrooms is essential for the successful adoption of computers for instructional purposes. Computer access in general is significantly correlated with the level of computer use (see Table 2).

Trialability and observability are the two attributes of an innovation that might increase the rate of adoption of innovations (Rogers, 2003). Thus, computer technologies should be available and accessible to COE faculty members. Then, they will have the opportunity to observe each other's instructional computer uses and to try computers for instructional purposes as needed. In summary, the contextually related literature and the results of this study showed that the accessibility and availability of computers was an important factor affecting the use of computers for instructional purposes (Blankenship, 1998; Medlin, 2001; Surendra, 2001).

Barriers to Computer Access and Instructional Computer Use

The most frequent barriers reported by the survey participants were a lack of support for instructional computer use, a lack of training on existing computers and software, a lack of appropriate instructional software, and a lack of technical support. These findings also were supported by the participants' responses to the open-ended questions. They mentioned (teaching, research, or advising) workload and lack of time as important barriers that limited their learning and abilities to use computer technologies for instructional purposes. In Odabasi's (2003) study, the most important barrier for Turkish faculty members was the lack of easily accessible resources.

The barriers to computer access were significantly correlated with the level of computer use. Therefore, barriers such as lack of support for instructional computer use and lack of training on existing computers and software limiting COE faculty members' integration of computers for instructional purposes should be minimized as these barriers might result in inadequate or lack of use of instructional technologies by faculty members (Anderson et al, 1998; Zakaria, 2001).

Attitude toward Computers and Instructional Computer Use

The faculty members had positive attitudes toward computer use for instructional purposes in general. For instance, they reported that they expect all faculty members in the College of Education to use computers for instruction (*M*=4.3), using computers improved the quality of teaching they do (*M*=4.1), and learning to use computers was easy for them (*M*=4.1). Workload and time required for computer use were a concern among the participants. Reducing the current teaching and advising workload of COE faculty members might positively change their attitudes toward workload increase with computer use. In the responses to the open-ended questions, disciplines not suitable for instructional computer use and unwillingness, especially by older faculty members, were among the negative attitudes toward computer use for instructional purposes.

Rogers' (2003) relative advantage, compatibility, and complexity attributes are related to attitudes of individuals. In this study, the participants reported positive attitudes toward the three attributes of innovations. Faculty members' positive attitudes toward these attributes are very important because these attributes are significant predictors of the diffusion of instructional innovations (Parisot, 1997; Surendra, 2001). It is crucial that faculty should perceive computer technologies as useful instructional tools and as being consistent with their beliefs (Jacobsen, 1998), and that they should not see computers as complex tools for instructional use.

The results of this study showed that attitude was significantly correlated with the adoption of instructional computer applications (see Table 2). The literature confirmed this finding that attitude is an important factor for using or avoiding computer-based technology (Fisher, 2002; Yaghi & Ghaith, 2002; Yildirim, 2000). Moreover, these findings suggest that since faculty members have positive attitudes toward computer technologies at the persuasion stage (the second stage of the innovation-decision process)they will more likely end up adopting these technologies for instructional purposes.

Support for Computer Use and Instructional Computer Use

Faculty members reported a great deal of collegial support in instructional computer use (see Appendix C). In fact, collegial interaction and support were a motivating factor for faculty to use technology (Casmar, 2001; Surendra, 2001). According to Rogers (2003), "Diffusion is a very social process that involves interpersonal communication relationships" (p. 19). In fact, interpersonal channels are very influential in changing strong attitudes held by an individual, so they are effective through the persuasion, decision, and confirmation stages of the innovation-decision process. In particular, if interpersonal channels are localized, that is between individuals of the social system, they become more important at the persuasion stage of the innovation-decision process because close peers' subjective evaluations of the innovation are more powerful in reducing uncertainty about the innovation outcomes.

In the present study, Rogers' (2003) trialability and observability attributes of innovations were included as part of the social support. Trialability and observability are the key motivational factors in the adoption and diffusion of technology (Parisot, 1997; Surendra, 2001). The participants reported that they had enough opportunity to try various computers for instructional purposes although they mentioned lack of observability in instructional computer use in the COE. It is the responsibility of administration to provide faculty with a social environment that includes these attributes of innovations. However, in this study, the participants stated lack of administration support in instructional computer use.

The findings revealed the need for training in the integration of technology in curriculum. As mentioned by the participants in their responses to the open-ended questions, administration could play a significant role in the organization of training programs for COE faculty in instructional computer technologies. In the U.S., one of the most popular faculty technology training programs is the one-on-one mentoring program. Although the one-on-one faculty mentoring program is a successful approach and well-supported in the literature (Beisser, 2000; Chaung, Thompson, & Schmidt, 2002; Smith & O'Bannon, 1999), the majority of faculty members in the present study were not in favor of one-on-one mentoring with undergraduate students (M=2.5). This result shows that the hierarchical relationship between faculty and students is still an issue among the Turkish faculty members and needs to be considered in faculty development programs. Thus, one-on-one mentoring programs need to be modified to meet this particular culture and COE faculty need in Turkey. Because the existence of collegial support is a crucial finding in this study, one-on-one one mentoring programs and administration might use collegial interaction and communication for faculty professional development in these technologies. Faculty development efforts should emphasize collegial support and slowly move toward one-on-one mentoring with undergraduate students.

The results of this study showed that support was significantly correlated with the level of computer use by the faculty members in the COE (see Table 2). The findings of other research studies were consistent with these results. Instructional technology support, including collegial support, administrative support, and training is vital for the successful integration of technology (Gardner & Clarke, 2001; Quick & Davies, 1999; Rogers, Geoghehan, Marcus, & Johnson, 1996).

Adopter Categories and Instructional Computer Use

This study asked the participants about Rogers' (2003) adopter categories based on innovativeness (see Appendix A for the frequencies of adopter categories). According to Rogers, the percentages of innovators, early adopters, early majority, late majority and laggards were 2.5%, 13.5%, 34%, 34%, and 16%, respectively. In the present study, the percentages of innovators (19.7%) and laggards (23.1%) were higher and the percentages of early adopters (6.8%) and late majority (14.5%) were lower than those described by Rogers. When the level of successful instructional computer adoption by COE faculty members increases, the distribution of adopter categories might become closer to those described by Rogers.

Of the participants, 44 faculty members responded to the open-ended question regarding reasons for the adopter category that they selected (see Appendix D for the themes and their frequencies for each category). The participants in the innovators category reported that they owned their personal computers— without any support or funding from the administration or other sources—before many faculty members in the COE had computers. Rogers (2003) confirmed the finding that innovators are the gatekeepers, introducing the innovation to the members of the social system, and they have to deal with difficulties such as unprofitable innovations and a certain level of uncertainty about the innovation. The participants in this category also described their self-motivation and willingness to try new things, which was a typical characteristic of innovators for Rogers. Finally, the participants in the innovators category stated that they had strong experience and background in instructional computer use. This finding was consistent with Rogers' explanation that adventurous innovators are required to have complex technical knowledge.

Although the number of early adopters who participated in this study was low and the number of responses to the open-ended question was low, one participant mentioned his role in establishing computer labs. This finding was consistent with Rogers' (2003) statement that early adopters are more likely to hold leadership roles in the social system. Thus, their attitudes toward and evaluations of an innovation are very critical. Compared to early adopters, early majority do not have a leadership role, but they have good interactions with other members of the social system. In the responses to the open-ended questions, the participants in the early majority category reported positive attitudes toward instructional computer use, so they might eventually reach other faculty members through their interpersonal networks and encourage them to adopt instructional computer technologies. The participants in the late majority category reported that they used computer technologies for instructional purposes later than most of their colleagues. For Rogers, late majority individuals are skeptical about the innovation and its outcomes. Collegial interaction and support mentioned by one participant in this category might be used to persuade the late majority individual to adopt instructional computer technologies. Moreover, the faculty members in the laggards category had concerns similar to those of the late majority category. Laggards are very skeptical about innovations and tend to wait until an innovation works and is successfully adopted by other members of the social system. With the availability of Rogers' five attributes of innovations (relative advantage, compatibility, simplicity, trialability, and observability), COE faculty members' uncertainties about instructional computer technologies might be reduced.

In summary, Rogers' (2003) adopter categories based on innovativeness were significantly correlated with the level of computer use in this study (see Table 2). In general, the findings of this study were consistent with Rogers' explanations regarding the adopter categories. This study and literature verified that innovativeness is a crucial factor in categorizing adopters of innovations (Braak, 2001; Hoerup, 2001; Less, 2003).

SUMMARY AND CONCLUSIONS

In this research, a theory-based approach for studying instructional computer use by the faculty members in the COE at an Anatolian university in Turkey was developed and the variables affecting the faculty members' uses of computers for instructional purposes were analyzed. In the data analysis, the following variables were significantly correlated with the level of computer use by the faculty members in the COE: computer expertise, computer access, barriers to computer access, attitude toward computer use, support for computer use, and adopter categories based on innovativeness. The faculty members reported high levels of computer use and expertise in only three mainstream and personal applications (Internet, word processing, and email) and high levels of computer access in only personal spaces such as their offices and at their homes. However, the findings showed that COE faculty members had low levels of computer use and expertise in instructional computer applications in general. These results along with a low level of computer access in public places indicate the need of instructional computer support for COE faculty members. In fact, the participants also mentioned lack of support and training as important barriers. Specifically, COE faculty members stressed two types of support: administrative and collegial. Although faculty members in the COE stated a great deal of collegial support in instructional computer use, they reported a lack of administrative support in the use of computers for instructional purposes. It is crucial that faculty development efforts in instructional technologies emphasize collegial interaction and communication.

In this study, Rogers' theory was helpful in categorizing and understanding where faculty members were in terms of instructional computer technologies and in suggesting directions for faculty change in these technologies. Faculty members' low levels of instructional computer use and expertise, the majority of the faculty members' self-placement in the last three adopter categories, and their responses to the open-ended question (regarding reasons for the adopter category that COE faculty members selected), showed that they were in the first stage of the innovation-adoption process—the knowledge stage. To increase their instructional computer knowledge and use, administration should organize faculty training programs and minimize barriers to computer access, especially in public spaces such as classrooms that will also lead to the higher level of observability in the technology. Specifically, an action plan should take advantage of faculty members' positive computer attitudes (including the relative advantage, compatibility, and simplicity attributes) and interpersonal communication channels (collegial communication). To diffuse instructional technology in the COE, faculty development efforts should involve early adopters who are more likely to hold leadership roles in the social system. Since results from the current study showed that the hierarchical relationship between faculty and students was still an issue among the Turkish faculty members, this issue needs to be considered in faculty development efforts.

This study provides a theory based model for collecting information on the current level of faculty members' use of technology in a department, college, university, or school. Using both quantitative and qualitative techniques, data were collected and analyzed from one large college of education in a university in Turkey. Results provided context-sensitive recommendations for faculty development work at this university. The methodology from this study will be useful to other institutions interested in collecting data to inform faculty development decisions. Although this research study was not a comparative study, the findings from this study and related literature suggest the similarity of COE faculty members' issues, concerns, and problems with instructional computer technology use in Turkey and the United States and the need to share knowledge in this area across cultures.

Contributors

Ismail Sahin is an assistant professor in the Department of Computer and Instructional Technologies at Selcuk University in Turkey. (Address: Ismail Sahin, Department of Computer and Instructional Technologies, College of Education, Selcuk University, Meram, Konya, Turkey; isahin@selcuk.edu.tr.)

Ann Thompson is a university professor at Iowa State University, Ames in the Department of Curriculum and Instruction, College of Human Sciences. (Address: Ann Thompson, Department of Curriculum and Instruction, College of Human Sciences, Iowa State University, Ames, IA; eat@iastate.edu.)

References

Anderson, T., Varnhagen, S., & Campbell, K. (1998). Faculty adoption of teaching and learning technologies: Contrasting earlier adopters and mainstream faculty. *The Canadian Journal of Higher Education 28*(23), 71–78.

Asan, A. (2002). Preservice teachers use of technology to create instructional materials: A school-college partnership. *Journal of information Technology for Teacher Education 11*(2), 217–232.

Ashley, D.W. (1996). A canonical correlation procedure for spreadsheets.

Annual meeting of the Decision Sciences Institute. Retrieved February 25, 2005, from http://www.sunflower.com/~dashley/Canon.html

Aust, R., Newberry, B., O'Brien, J., & Thomas, J. (2005). Learning generation: Fostering innovation with tomorrow's teachers and technology. *Journal of Technology and Teacher Education, 13*(2), 167–196.

Beisser, S. (2000). Technology mentorships in higher education: An optimal match for expanding educational computing skills. In C. Crawford, D. A. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price, R. Weber, (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference* (pp. 441–447). Chesapeake, VA: Association for the Advancement of Computing in Education.

Blankenship, S. E. (1998). *Factors related to computer use by teachers in classroom instruction* (Doctoral Dissertation, Virginia Polytechnic Institute and State University, 1998), *ProQuest DigitalDissertations*. (UMI No. AAT 9831651).

Braak, J.V. (2001). Individual characteristics influencing teachers' class use of computers. *Journal of Educational Computing Research, 25*(2), 141–157.

Cagle, A.B., & Hornik, S. (2001). Faculty development and educational technology. *T.H.E. Journal 29*(3), 92-96.

Carter, C. W. (1998). *An assessment of the status of the diffusion and adoption of computer-based technology in Appalachian College Association colleges and universities* (Doctoral Dissertation, Virginia Polytechnic Institute and State University, 1998). *ProQuest DigitalDissertations*. (UMI No. AAT 9905169).

Casmar S.P. (2001). *The adoption of computer technology by faculty in a college of education: an analysis of administrative planning issues* (Doctoral dissertation, Washington State University, 2001). *ProQuest DigitalDissertations*. (UMI No. AAT 3025011).

Cavanaugh, C. (2002). Faculty development in educational technology. In C. Crawford, D. A. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price, & R. Weber, (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference* (pp. 621–622). Chesapeake, VA: Association for the Advancement of Computing in Education.

Chuang, H., Thompson, A., & Schmidt, D. (2003). Issues and barriers to advanced faculty use of technology. In C. Crawford, D. A. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price, R. Weber, (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference* (pp. 3449-3452). Chesapeake, VA: Association for the Advancement of Computing in Education.

Dexter, S., Anderson, R. E., & Ronnkvist, A. M. (2002). Quality technology support: What is it? Who has it? and What difference does it make? *Journal of Educational Computing Research 26*(3), 265–285.

Fisher, C. N. (2002). Walking the talk: Faculty development and technology integration (Doctoral dissertation, The University of New Mexico, 2002). *ProQuest DigitalDissertations*. (UMI No. AAT 3056903).

Gardner, B. & Clarke, N. (2001). Helping faculty make technology a part of the curriculum. *SIGUCCS Proceedings,* 44–48. New York: Association for Computing Machinery.

Hagenson, L., & Castle, D. (2003). The integration of technology into teaching by university college of education faculty. In C. Crawford, D. A. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price, & R. Weber, (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference* (pp. 947–952). Chesapeake, VA: Association for the Advancement of Computing in Education.

Hoerup, S. L. (2001). Diffusion of an innovation: computer technology integration and the role of collaboration (Doctoral dissertation, Virginia Polytechnic Institute and State University, 2001). *ProQuest DigitalDissertations*. (UMI No. AAT 3031436).

Howland, J., & Wedman, J. (2004). A process model for faculty development: Individualizing technology learning. *Journal of Technology and Teacher Education, 12*(2), 239–264.

Isleem, M I. (2003). Relationships of selected factors and the level of computer use for instructional purposes by technology education teachers in Ohio public schools: a statewide survey (Doctoral dissertation, The Ohio State University, 2003). *ProQuest DigitalDissertations*. (UMI No. AAT 3124087).

Jenson, J., Lewis, B., & Smith, R. (2002). No one way: Working models for teachers' professional development. *Journal of Technology and Teacher Education 10*(4), 481–496.

Less, K. H. (2003). Faculty adoption of computer technology for instruction in the North Carolina Community College System (Doctoral dissertation, East Tennessee State University, 2003). *ProQuest DigitalDissertations*. (UMI No. AAT 3097072).

Marquardt, M. J., & Kearsley, G. (1999). *Technology-based learning: Maximizing human performance and corporate success*. Boca Raton, FL: CRC Press.

McKenzie, J. (2001). How teacher learn technology best. *From Now On: The Educational Technology Journal, 10*(6). Retrieved March 01, 2005, from http://www.fno.org/mar01/howlearn.html

Medlin, B.D. (2001). The factors that may influence a faculty member's decision to adopt electronic technologies in instruction (Doctoral dissertation, Virginia Polytechnic Institute and State University, 2001). *ProQuest DigitalDissertations*. (UMI No. AAT 3095210).

Mertler, C. A., & Vannatta, R. A. (2002). *Advanced and multivariate statistical methods: Practical applications and interpretation* (2nd ed.). Los Angeles, CA: Pyrczak.

Odabasi, H. F. (2000). Faculty use of technological resources in Turkey. *Innovations in Education and Training International 37*(2), 103–107.

Odabasi, H. F. (2003). Faculty point of view on faculty development. *Hacettepe Universitesi Egitim Fakultesi Dergisi 24*, 86–89.

Parisot, A. H. (1995). *Technology and teaching: The adoption and diffusion of technological innovations by a community college faculty* (Doctoral dissertation, Montana State University, 1995). *ProQuest DigitalDissertations*. (UMI No. AAT 9542260).

Parisot, A. H. (1997). *Distance education as a catalyst for changing teaching in the community college: Implications for institutional policy.* New Directions for Community Colleges, 99, 5–13.

Pope, M., Hare, D., & Howard, E. (2002). *Technology integration: Closing the gap between what preservice teachers are taught to do and what they can do.* Journal of Technology and Teacher Education 10(2), 191–203.

Quick, D., & Davies, T. G. (1999). *Community college faculty development: Bringing technology into instruction.* Community College Journal of Research and Practice 23(7), 641–653.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.

Rogers, E. M., Geoghehan, W. H., Marcus, J., & Johnson, L. (1996). In response: Four viewpoints. *Change 28*(2), 29–31.

Sahin, I., & Thompson, A. (in press). Understanding faculty use of technology with the Learning/Adoption Trajectory Model. *Journal of Technology and Teacher Education*.

Schrum, L., Skeele, R., & Grant, M. (2002). One college of education's effort to infuse technology: A systemic approach to revisioning teaching and learning. *Journal of Research on Technology in Education, 35*(2), 256–271.

Seemann, K. (2003). Basic principles in holistic technology education. *Journal of Technology Education, 14*(2), 28–39.

Smith, S. J., & O'Bannon, B. (1999). Faculty members infusing technology across teacher education: A mentorship model. *Teacher Education and Special Education, 22*(2), 123–135.

Spotts, T.H. (1999). Discriminating factors in faculty use of instructional technology in higher education. *Educational Technology & Society, 2*(4), 92–99.

Surendra, S. S. (2001). Acceptance of Web technology-based education by professors and administrators of a college of applied arts and technology in Ontario (Doctoral dissertation, University of Toronto, 2001). *ProQuest DigitalDissertations*. (UMI No. AAT NQ58603).

The Campus Computing Project. (2001). *The 2001 national survey of information technology in U.S. higher education.* Encino, CA: Green, K. C.

Yaghi, H. M. & Ghaith, G. M. (2002). Correlates of computing confidence among teachers in an international setting. *Computers in the Schools, 19*(1/2), 81–94.

Yildirim, S. (2000). Effects of an educational computing course on preservice and inservice teachers: A discussion and analysis of attitudes and use. *Journal of Research on Computing in Education 32*(4), 479–495.

Zhao, Y., & Cziko, G. A. (2001). Teacher adoption of technology: A perceptual-control-theory perspective. *Technology and Teacher Education 9*(1), 5–30.

APPENDIX A: FREQUENCIES OF DEMOGRAPHICS AND ADOPTER CATEGORIES

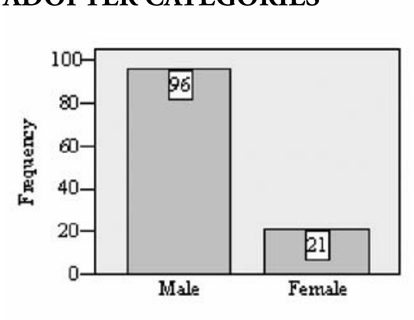

Figure 1: Frequency of Gender

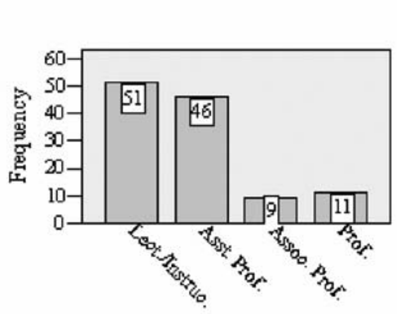

Figure 2: Frequency of Academic Rank

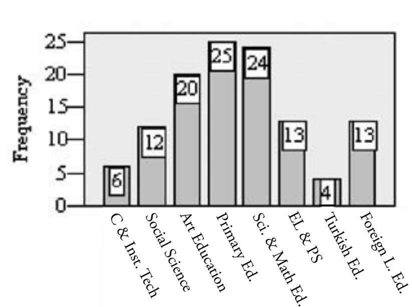

Figure 3: Frequency of Department Affiliation

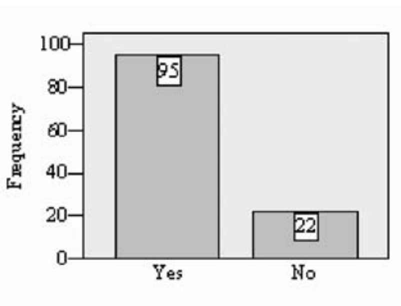

Figure 4: Frequency of Home Computer Ownership

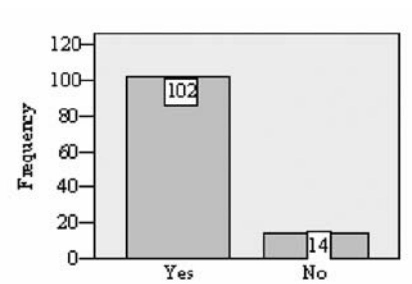

Figure 5: Frequency of Office Computer Ownership

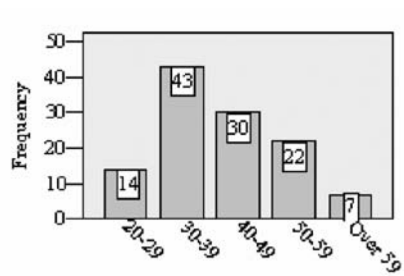

Figure 6: Frequency of Age Groups

APPENDIX A: CONTINUED

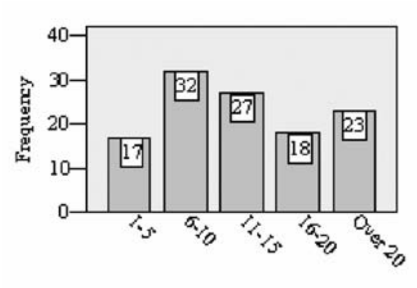

Figure 7: Frequency of Teaching Experience

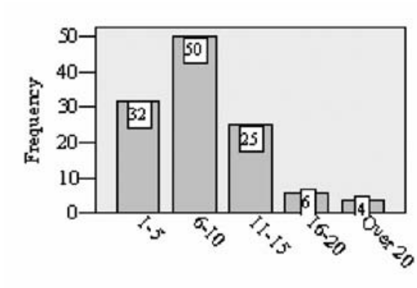

Figure 8: Frequency of Computer Experience

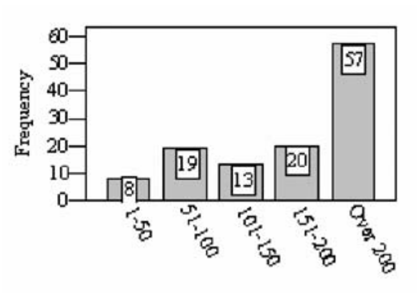

Figure 9: Frequency of Average Number of Students per Semester

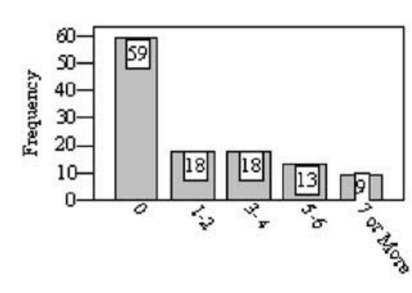

Figure 10: Frequency of Number of Graduate Students Supervised

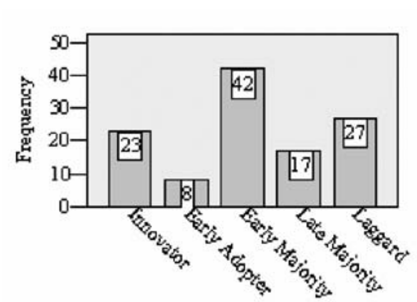

Figure 11: Frequency of Adopter Categories

APPENDIX B: SURVEY OF COMPUTER USE FOR INSTRUCTIONAL PURPOSES

Section 1: For each of the categories listed in items 1-18, please use the columns on the left to indicate your ***current level of computer use*** for instructional purposes (lesson preparation, lesson delivery, evaluation, communication and administrative record keeping), and the columns on the right to rate your ***level expertise*** to use them for instructional purposes. Please consider the following explanations when rating your current level of computer use and your level of expertise:

Rarely: Roughly once a semester.
Sometimes: Approximately once a month.
Often: About once a week.
Very Often: Nearly daily.
Beginner: Learning basic functions of software.
Intermediate: Confident with basic functions of software.
Advanced: Using most of the functions of software.
Expert: Knowing most functions of software and being able to teach them to others.

	Level of Current Use					**Level of Expertise**				
	Never	**Rarely**	**Sometimes**	**Often**	**Very Often**	**No Experience**	**Beginner**	**Intermediate**	**Advanced**	**Expert**
1. Word Processing (i.e. creating, storing, retrieving, and printing electronic text)										
2. Spreadsheets (i.e., manipulating/ organizing numbers)										
3. Database Management (i.e., creating, designing, updating, and querying data)										
4. Classroom Management (i.e., grade books, Blackboard, WebCT)										
5. Graphics (i.e., storing/manipulating pictures, diagrams, graphs, or symbols)										
6. Presentation (i.e., PowerPoint)										
7. Authoring (i.e., creating interactive multimedia programs or CAI)										
8. CD-ROM, DVD, and/or Web-based Interactive content (i.e., maps, dictionaries)										
9. Website Design Software (i.e., FrontPage, Dream Weaver)										

10. E-mail (i.e., sending and receiving electronic messages)										
11. Internet Content (i.e., browsing/searching the World Wide Web)										
12. Data Analysis Software (i.e., SPSS, SAS or JMP)										
13. Simulations and Games (i.e., reproducing the characteristics of a system or process)										
14. Drill and Practice (i.e., using software for repetitive practice)										
15. Tutorials (i.e., providing instruction that uses exercise and practice)										
16. Discipline-specific Programs (i.e., your academic subject)										
17. Windows Operating System										
18. Macintosh Operating System										
Other:										
Other:										
Other:										

<u>Section 2:</u> Please identify ***<u>how often</u>*** you have ***<u>computer access</u>*** in the following contexts for the current semester. Please consider the following explanations when rating your level of computer access: *Rarely:* Roughly once a semester. *Sometimes:* Approximately once a month. *Often*: About once a week. *Very Often:* Nearly daily.	**Never**	**Rarely**	**Sometimes**	**Often**	**Very Often**
1. In your office					
2. In most classrooms where I teach.					
3. In your home					
4. In a computer lab					
5. In a library/media center					
Other					
Other					
Other					

<u>Section 3:</u> Please rate the ***<u>extent</u>*** to which you think the following factors ***<u>limit your access</u>*** to computers for instructional purposes.	**Not at all**	**Rarely**	**Sometimes**	**Often**	**Very Often**
1. Not enough computers					
2. Not enough software licenses					
3. Outdated/incompatible computers					
4. Outdated/incompatible software					
5. Unreliable computers and/or software					
6. Lack of appropriate instructional software					
7. Internet is not easily accessible					
8. Lack of support regarding ways to integrate computers into the curriculum					
9. Lack of technical support					
10. Lack of time in schedule to use computers for instructional purposes					
11. Lack of training on existing computers and software					
Other					
Other					
Other					

<u>Section 4:</u> Items 1-11 ask for your ***<u>attitudes</u>*** toward computers as tools for instructional purposes; and items 12-22 ask about the ***<u>support</u>*** you receive to use computers for instructional purposes. Please respond to each statement by marking the option that most closely matches your level of agreement or disagreement.	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. I think that using computers improves the quality of teaching I do.					
2. I think that using computers fits well with the way I like to teach.					
3. I think that learning to use computers is easy for me.					
4. I feel comfortable using computers.					
5. Computers make learning easier and more efficient.					
6. I prefer to deliver lessons using computers.					

7. The use of e-mail gives me easier access to colleagues, administration, and students.					
8. I am fearful about computer use.					
9. I expect all faculty members in the College of Education to use computers for instruction.					
10. Computer use increases my usual workload.					
11. My students expect me to use computers for instruction.					
12. I have had a great deal of opportunity to try various computers for instructional purposes.					
13. In the College of Education, many people use computers for instructional purposes.					
14. The administration does not provide consistent hardware and software updates.					
15. The administration offers timely technical support and maintenance of computers.					
16. The administration provides workshops and/or training on computer use.					
17. Overall, the administration feels that computers are important for instructional purposes.					
18. My colleagues provide assistance with hardware and/or software updates and/or technical support.					
19. My colleagues discourage computer use.					
20. My colleagues share information and ideas about computer use.					
21. My colleagues model a good example of computer use.					
22. When learning new uses of computers, I prefer one-on-one assistance from undergraduate students.					

Section 5: Please mark with an "X" the response below that best describes ***your computer use*** for instructional purposes. ***(Please choose only one response)***	Best Describes Me
I was using computer technology for instructional purposes before most faculty members in my college knew what it was or before the college purchased equipment.	
I was one of the first faculty members in my college to use computer technology for instructional purposes when the college first purchased equipment.	
I was not one of the first faculty members in my college to begin using computer technology for instructional purposes, but used it ahead of most of my colleagues.	

I used computer technology for instructional purposes later than most of my colleagues.	
I was among the latest faculty at my institution using computer technology for instructional purposes.	
I have not used computer technology for instructional purposes.	

Please give a reason for the category you have selected:

____
____
____
____

<u>Section 6:</u> Please provide the demographics information below.

1. What is your ***gender***? Male ☐ Female ☐	**4.** Do you have a computer in your home? Yes ☐ No ☐
2. What is your ***academic rank***? Lecturer/Instructor ☐ Assistant Professor ☐ Associate Professor ☐ Professor ☐	5. Do you have a computer in your office? Yes ☐ No ☐ **6.** What is your ***age***? 20-29 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ Over 59 ☐
3. What is your ***department***? Computer and Instructional Technologies ☐ Social Sciences ☐ Art Education ☐ Primary Education ☐ Science and Math. Education ☐ Educational Leadership and Policy Studies ☐ Turkish Education ☐ Foreign Languages Education ☐	**7.** Including the current year, how many ***years*** have you been ***teaching*** in higher education? 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ Over 20 ☐ **8.** Including the current year, how many ***years*** have you been ***using computers*** in general? 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ Over 20 ☐ **9.** What is the average number of students that you teach in one semester? 1-50 ☐ 51-100 ☐ 101-150 ☐ 151-200 ☐ Over 200 ☐ **10.** How many graduate students do you currently supervise? 0 ☐ 1-2 ☐ 3-4 ☐ 5-6 ☐ 7 or More ☐

If you have additional comments on faculty use of computer technologies for instructional purposes, please include those here:

END OF THE SURVEY - Thank you very much for your participation in this study…

APPENDIX C: RESULTS FOR DESCRIPTIVE ANALYSIS AND RELIABILITY TEST

Table C.1: Mean for Items of Computer Access[a]

Item	Mean	Std. Dev.
Office	4.3	1.1
Home	3.5	1.4
Library/media Center	2.4	1.2
Most classrooms where they teach	2.3	1.3
Computer Lab	2	1.3

aStd. Item Alpha = 0.69.

Table C.2: Mean for Items of Barriers to Computer Access[a]

Item	Mean	Std. Dev.
Lack of Support for Computer Integration into Curriculum	3.1	1.2
Lack of Training on Existing Computers and Software	3	1.4
Lack of Appropriate Instructional Software	2.9	1.2
Lack of Technical Support	2.9	1.3
Lack of Time for Instructional Computer Use	2.8	1.3
Not enough computers	2.7	1.3
Outdated/incompatible Computers	2.6	1.3
Outdated/incompatible Software	2.6	1.3
Unreliable Computers/Software	2.5	1.2
Internet is not Easily Accessible	2.5	1.2
Not enough software licenses	2.4	1.1

aStd. Item Alpha = 0.92.

Table C.3: Mean for Items of Attitudes toward Computer Use[a]

Item	Mean	Std. Dev.
Email Usefulness	4.4	0.9
Attitude towards Colleagues' Instructional Computer Use	4.3	0.9
Computer Anxiety[b]	4.2	1.2
Relative Advantage of Instructional Computer Use	4.1	0.9
Simplicity of Computer Use	4.1	0.9
Computer Usefulness	4	0.9
Computer Use in Class	3.8	1
Compatibility of Instructional Computer Use	3.7	0.9

Confidence in Computer Use	3.7	1.1
Workload Increase with Computer Use[b]	3.4	1.3

aStd. Item Alpha = 0.83; bItems were reverse-coded.

Table C.4: Mean for Items of Support for Computer Use[a]

Item	Mean	Std. Dev.
Sharing Information and Ideas about Computer Use among Colleagues	3.6	0.9
Computers as Important Tools for Administration	3.5	1
Hardware and Software Updates, and Technical Support from Colleagues	3.4	1
Colleagues' Discouragement of Computer Use[b]	3.4	1
Trialability of Computers	3.3	1.2
Colleagues' Good Modeling of Computer Use	3.2	0.9
Support for Consistent Hardware and Software, and Updates from Administration[b]	3.1	1.1
Timely Technical Support and Maintenance of Computers from Administration	3.1	1.1
Observability of Computer Use	2.8	1.1
Workshops and Training on Computer Use from Administration	2.6	1.2
One-on-one Assistance from Undergraduate Students in Computer Use	2.5	1

aStd. Item Alpha = 0.70; bItems were reverse-coded.