

Pedagogical Strategies to Increase Pre-service Teachers' Confidence in Computer Learning

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ABSTRACT

Pre-service teachers' attitudes towards computers significantly influence their future adoption of integrating computer technology into their teaching. What are the pedagogical strategies that a teacher education instructor or an instructional designer can incorporate to enhance a pre-service teacher's comfort level in using computers? In this exploratory report, the researcher synthesizes related literature, provides a comprehensive list of theory-based instructional strategies, and describes a study of the perceptions of 189 pre-service teachers regarding strategies related to increasing their comfort in using computers.

Keywords

Pedagogical strategy, Pre-service teacher, Computer learning, Confidence levels

Introduction

The emergence of computers and information systems is certainly the single biggest factor impacting education during the past couple of decades. Despite the proliferation of computers, there continues to exist a large number of teachers who are very uncomfortable with computers (Bohlin, 2002; Cradler & Cradler, 2001; Fletcher & Deeds, 1994; Gordon, 1995; US Department of Education, 2001). For instance, the U.S. Department of Education (2001), in their 1999-2000 Annual Performance Reports for Preparing Tomorrow's Teachers to Use Technology (PT3), emphasized that "preparing teachers to use technology effectively to improve students' learning is a major challenge facing our nation's schools." Cradler & Cradler (2001), reporting for a technology challenge grant, indicated that less than 20% of California teachers feel comfortable using technology.

Widespread teachers' discomfort regarding computers contrasts with the belief that computers hold great promise for enhancing teaching and learning. The millions of dollars being poured into the purchase of computers for schools may be wasted if large numbers of teachers avoid using computers. To properly and effectively integrate computer technology into the classroom daily curriculum, teachers need to have the confidence and positive attitudes toward computers that will motivate them to integrate computers into their instructional strategies.

It is true that simply making technology available does not produce an appropriate use of technology. Assuming that a sound teacher education program with a couple of required computer courses will change pre-service teachers' anxiety, confidence level, or attitude towards computers is a big mistake.

Obviously, pre-service teachers' attitudes are strong predictors of their future actual voluntary behaviors or decisions regarding the integration of technology into their teaching. If computer anxiety is combined with low confidence, low motivation, or negative attitudes, individuals will strive to avoid interactions with computers (Bohlin, 2002).

Students' achievements in computer skill learning are certainly associated with their anxiety or avoidance levels. Researchers (Morgan, 1997) have firmly claimed that stress and anxiety reduce performance effectiveness. Although a moderate level of anxiety can be healthy in most students as it indicates an interest in what they are doing, students certainly will gain the most through learning computer skills with comfort and confidence. Therefore, it is imperative for computer teachers or instructional designers to know the pedagogical strategies that can reduce students' anxiety/avoidance in learning computer skills and increase their comfort level.

Purpose of the Study

The purpose of the study is twofold: to provide systematic theory-based pedagogical strategies that are believed to be able to make positive changes on learners' attitudes towards computers, and investigate practical instructional strategies that can increase pre-service teachers' comfort levels toward computers. Understanding theory-based pedagogical strategies to increase computer learners' learning with technology is essential; however, it is even more important to identify which practical instructional strategies are needed by computer learners. The practical instructional strategies include tactics that have helped computer instructors or instructional designers to better assist their students in learning with computer technology as well as the methods that computer instructors can provide for pre-service teachers to better prepare themselves in learning with new computer skills. Specific research questions consist of the following:

1. What theory-based pedagogical strategies for reducing learners' anxieties in learning computers have been offered in the literature?
2. What pedagogical strategies can an instructor incorporate to alleviate pre-service teachers' avoidance of computers and what advice or method can a computer instructor provide to increase students' comfort levels in using computers?

Affective Constructs toward Computers

A review of the literature suggests two major affective constructs regarding learners' computer use: positive feelings and negative feelings. Positive constructs include motivation, confidence, satisfaction, and so forth. On the other hand, students' negative feelings associated with computers include anxiety, frustration, stress, fear, embarrassment, irritation, and so on. Investigating both perspectives of the literature could offer some insight into ways that instructors and instructional designers might help learners to better adopt computers as tools to enhance teaching and learning.

Most of the literature related to learners' affective feelings toward the computer focuses on studying the impact of computer anxiety (Bohlin, 2002; DeLoughry, 1993; Elder et al., 1987, Howard & Smith, 1986; Igbaria & Chakrabarli, 1990; Morgan, 1997; Orr, 1997; Tseng et al., 1997). Similar terms, such as "computer avoidance" (Bohlin, 2002), "computer aversion" (Bohlin, 2002), and computer stress, were used to investigate the associated issues. Few researchers investigated the impact of learners' positive feelings such as motivation, confidence levels, and a satisfaction index toward computers. The most popular theory on the impact of positive affection in learning with computers was the ARCS (Attention, Relevance, Confidence, and Satisfaction) model proposed by Keller (1987; 1999). To better address the impact of learners' affective constructs on their learning with computers, the author reviewed literature from both viewpoints.

Negative Attitudes: Computer Anxiety/Avoidance/Aversion

Although computer anxiety plays a powerful influence on a learner's use of computers, there has been little or no agreement on the definition of computer anxiety. Howard & Smith (1986) defined computer anxiety as the "fear of impending interaction with a computer that is disproportionate to the actual threat presented by the computer." Orr (1997) indicated that "those who are computer anxious may experience fear of the unknown, feeling of frustration, possible embarrassment, failure and disappointment."

Bohlin (2002) used the term "computer avoidance" instead of computer anxiety. He defined computer avoidance as "an overall feeling of aversion to using computers based upon the emotions, attitudes, and motivation levels of the individual." Computer stress is another similar term borrowed from the physical sciences and refers to a situation containing stimuli that arouse uneasiness (or "tension") in a person while dealing with a computer. When this uneasiness is the result of a specific, known, and immediate threat, it is called "computer fear" (Bohlin, 2002).

Bohlin (2002) concluded that the link from the factors of negative attitudes and high anxiety to an individual's avoidance of computers was known to be a strong one. Researchers (Howard & Smith, 1986; Igbaria & Chakrabarli, 1990; Morgan, 1997) have also established firmly that stress and anxiety reduce performance effectiveness, and stress might cause some individuals to avoid using computers completely.

A literature review on teachers' computer anxieties indicates that a great number of K-12 teachers have been influenced by uncomfortable feelings toward computers. For example, Fletcher and Deeds (1994), in their study

with secondary agriculture teachers, found that 40.9% of them suffered from computer anxiety. Another study by Gordon (1995) also found that 46% of technical education teachers suffer from computer anxiety. Medcalf-Davenport (1998) studied the attitudes, beliefs, and preparation of in-service teachers, pre-service teachers, and student teachers regarding the uses and integration of technology into the classroom and curriculum in elementary, middle, and high schools in four school districts in San Antonio, Texas. She found that there was still resistance and fear in the integration of anything new into the classroom. Moreover, teachers did not recognize the usefulness or necessity of using technology for teaching and learning. Bohlin (2002) further concluded that computer avoidance was very common in teachers and could strongly interfere with their instructional choices.

Yet, with the gradual rise in popularity of computer technology in libraries, classrooms, and school settings, teachers with negative feelings toward computers find it more and more difficult to work in environments that are free of computers. Furthermore, there is a strong demand for enhanced pre-service and in-service computer training (US Department of Education, 2001; Cradler & Cradler, 2001).

Research indicates that teachers' confidence levels towards computer use can be increased by experience and training. Bradley and Russell (1997) found that computer anxieties were inversely related to the quality of prior computer learning experiences. Dyke & Smither (1992) similarly concluded that students' negative feelings would decrease by increasing their computer experience. Shirley (1996), in her study of the computer literacy and computer anxiety of junior high teachers, emphasized the importance of training and continuous on-site support.

Positive Feeling: Computer Attitudes/ Confidence

A review of the literature indicates that there has not yet been a study of learners' positive feelings toward computer use. However, some educational theorists and researchers have provided different theory-based pedagogical strategies to increase learners' motivation or confidence levels in learning computers. Researchers used the term "computer attitudes" or "computer confidence" instead of learners' positive feelings toward computers. Bohlin (2002), defined attitude as "a way of being set for or against something." He emphasized that the definition includes a motivational perspective, e.g., the individual's beliefs and cognitions. "In this sense, learned cognitions have colored an individual's perceptions about computers; a change in the individual's attitude toward and response to computers will require a change in the individual's cognitions about them (Bohlin, 2002)." Therefore, understanding theories and factors related to attitude change could assist in identifying strategies and prescriptions for changing learners' attitudes towards computers.

Theory-based Pedagogical Strategies

The importance of designing instruction to reduce anxiety-related fears toward computers has been stressed in the literature. Theory-based strategies include Bandura's confidence-building strategies (1988), Martin and Briggs' social learning theory (1986), and Keller's ARCS model (1987). A few other researchers, such as Bohlin (2002), Tobias (1979), and Bohlin, Milheim and Viechnicki (1993), have also proposed some instructional strategies to increase computer learners' motivation in using computers. The literature review provides pedagogical strategies for computer education instructors to increase pre-service teachers' attention, alleviate pre-service teachers' avoidance of computers, and increase pre-service teachers' confidence in working with computers.

Bandura (1989) argued that an important factor in the reduction of anxiety was confidence in one's ability to cope with a stressful situation. "People tend to avoid activities and situation they believe exceed their coping capabilities" (Bandura, 1989, p. 1178). Bandura (1988) identified several strategies to increase learners' levels of coping efficacy, including modeling of coping strategies, breaking steps into progressively more easily mastered steps, and providing guided mastery experiences. He emphasized that guided mastery experiences were especially effective after learners had gained the ability to exercise personal control under the stress. He suggested when introducing new computer skills, instructors should provide assignment guidance for their learners, should break each computer skill into several specific steps, and should make sure learners have mastered the newly introduced skill before another skill would be introduced.

Martin and Briggs' (1986) social learning theory was one of the most widely recognized theories of behavior change and attitude change. Their theory defined attitude as one type of behavior that heavily depended on

individuals' interaction with each other or with the environment. The theory focused on the importance of reinforcement and cognitive processes such as attention, remembering, and motivation that helped the individual define, discriminate, and generalize environmental stimuli. The theory suggested that behavior change could occur as a result of (1) directly experiencing the consequences of one's behavior, e.g., by direct reinforcement or by extinction; (2) watching the consequences of someone else's behavior, called modeling or vicarious learning; (3) reading or hearing about the consequences of a behavior and inferring a causal relationship; and (4) making associations that arouse emotions. They recommended that computer education instructors should apply strategies that could attract learners' attention, provide opportunities to discuss ways of coping with negative emotions about computers, and encourage learners to express a range of emotional reactions to situations.

Keller (1987) identified four categories of motivation in learning situations: Attention, Relevance, Confidence, and Satisfaction (ARCS). Keller's ARCS model contained specific methods or strategies that were aimed at producing motivational outcomes when learners were lacking sufficient interest or motives. The pedagogical strategies in his ARCS model included strategies to increase learners' attention, strategies to increase the relevance of subject matter, strategies to increase learners' confidence, and strategies to increase learners' satisfaction.

On the other hand, Bohlin (2002) also suggested several pedagogical strategies to decrease learners' anxiety when working with computers. The pedagogical strategies that he recommended could be classified into five categories: strategies to stimulate the learners' interest, strategies to meet the learners' personal needs, strategies to satisfy the learners and promote continuing motivation, strategies to relieve learners' anxiety, and strategies to decrease negative attitudes toward computers.

Although the pedagogical strategies proposed in Keller's ARCS model and Bohlin's model had different focuses (Keller's proposed strategies could be used for any instruction; however, Bohlin's strategies intended for decreasing learners' anxiety when working with computers.), there were several common pedagogical practices in their models. Table 1 illustrates the common pedagogical strategies in Keller's ARCS model and Bohlin's model.

Table 1: The Common Pedagogical Strategies in Keller's ARCS Model and Bohlin's Model

Strategies to increase learners' attention and motivation	Strategies to increase the relevance of subject matter and to meet the learners' personal needs	Strategies to increase learners' confidence and relieve learners' anxiety	Strategies to increase students' satisfaction
Instructors should 1. provide information that captures the interest and attention of the learner. 2. use problem solving activities or let learners choose topics for study or projects.	Instructors should: 1. show the learners how the material they learn would be useful to them, 2. allow opportunities for practical application of the content, 3. demonstrate to the learners how they will personally benefit from the knowledge acquired in the class, 4. provide opportunities to work with other learners to provide for those with a high need for affiliation, and 5. make the subject matter seem important, and make learners feel curious about the subject matter.	Instructors should: 1. give clear and thorough feedback to work, 2. provide positive consequences be a part of good performance, and 3. make sure that the difficulty level stretches the learners but doesn't create too much stress.	Instructors should: 1. provide small easily managed sections with frequent opportunities for hands-on practice to reduce dependence upon memory and improve expectancy for success. 2. provide early experiences that are in a low-risk environment, and 3. state clearly the requirements for successful completion.

Tobias (1979) suggested that anxiety interferes most with learning before and during information processing by the learner. She explained that before the learner processed information, anxiety acted as a diversion away from attention. During information processing, anxiety directly interfered with cognitive processing by the learner. At

post-processing, anxiety played a much lesser influence on the learner's learning. Based on her theory, Tobias made recommendations regarding instruction that were expected to reduce the anxiety effects on learning. She suggested that instruction for anxious learners should allow learners to repeat content and reduce the extent to which learners must rely on memory. Providing opportunities for learners to do hands-on experiences could reduce the learners' anxiety towards the computer.

Bohlin, Milheim and Viechnicki (1993) suggested that instructional strategies for the motivation of pre-service and in-service teachers should focus on how to make learning about and using computers more interesting. Their proposed strategies were aimed at clearly communicating the benefits of using computers and matching experiences with learners' personal needs.

The theory-based pedagogical strategies related to increasing learners' confidence levels in using computers primarily came from the theorists' belief (Bandura, 1988; Bohlin, Milheim, & Viechnicki, 1993; Bohlin, 2002; Keller, 1987; Tobias, 1979), yet no research has been found to investigate computer learners' beliefs. Specifically, researches on pre-service teachers' perspectives regarding what effective instructional strategies or activities and what methods a computer instructor could apply to increase their confidence levels in learning with the technology have not been found. This was why the current research was conducted.

Methodology

The Development of the Survey

To study the pedagogical strategies that instructors can incorporate into their teaching and the advice that instructors can give to their students, the author designed and developed a questionnaire to collect information from the two perspectives: the instructors' pedagogical strategies and the methods of improving learners' learnabilities. Therefore, questions in the survey (See Appendix A.) were divided into two categories: pedagogical strategies that a computer instructor may apply, and methods that computer learners should use to increase their comfort level towards the technology.

There were nine popular strategies in the first category. The nine popular pedagogical strategies listed in the first session of the questionnaire were based on instructional activities proposed by theorists in the literature review. The seven methods in the second category were based on a pilot interview with a small group of pre-service teachers. At the end of each category in the survey, an open-ended area that allowed participants to fill in their thoughts was provided. Participants were asked to check the three most essential strategies in each category.

Data Collection

The survey was given to pre-service teachers who were taking one of seven sessions of advanced classroom computer technology classes in the summer and fall of 2002 at a large state university in Northern California. On the first day of each class, the author asked pre-service teachers to complete voluntarily an anonymous questionnaire regarding strategies to increase learners' comfort levels in using computers. There were approximately 30 students in each class. 189 pre-service teachers completed the questionnaire, a response rate of 90%.

All of the 189 pre-service teachers took a beginning computer literacy course prior to the survey. In fact, all California pre-service teachers are required to take two different levels of computer classes before they can receive their teaching credentials. The author believed that with prior computer experience, the learners would be able to provide more accurate and concrete ideas about what they believed to be the effective pedagogical strategies to increase their positive attitude towards computers.

Results

According to the collected data, most of the pre-service teachers (92.6%) believed that demonstrating computer assignment samples was the most important strategy that an instructor should apply. The second important pedagogical strategy (81.4%) was that computer instructors should let students do individual hands-on computer engagement activity. Third, 77.7 % believed that visual demonstration of the computer skills with a data

projector was an important pedagogical strategy. Having students do cooperative group computer activity or working with a partner was considered by 74.7% of the participants to be important.

Table 2 indicates the specific findings regarding the importance of various instructional pedagogies from the survey.

Table 2: Percentage of pre-service teachers' ranking of the importance of instructional pedagogies that an instructor should use in a computer course

Pedagogical Strategies	Percentage of pre-service teachers considering the importance of the strategies
Demonstrate computer assignment samples.	92.6%
Have students do individual hands-on computer engagement activity.	81.4%
Give a visual demonstration of the computer skills with a data projector.	77.7%
Have students do cooperative group computer activity, working with a partner.	74.7%
Before new computer skills are introduced, the instructor reviews related computer skills first.	48.1%
Give an oral demonstration of the computer skills.	44.4%
Provide oral support in the use of computers.	33.3%
The instructor applies a humorous tone in his/her teaching.	22.2%
The computer skill that the instructor demonstrates is useful in the job market.	22.2%

As to what advice a computer instructor could give students to better prepare for the course, pre-service teachers had a greater diversity of opinions than they did regarding the importance of instructor's pedagogical strategies. Nearly three-quarters of the participants believed that it was very important for learners to have prior knowledge about certain computer skills. 70.3% of participants believed that having a nice computer at home that could do the tasks that the computer course required, and having a friend or relatives who knew computers well were very helpful in increasing their comfort levels in using computers. It was interesting to find that 44.4% of pre-service teachers believed that it was important to understand what computer skills you already knew, and what new computer skills that you needed to know. 40.7% of students considered it important to have taken computer classes before, and only 22.2% of students believed having prior experiences of playing computer games was important. Table 3 is a list of the percentages and associated methods or status.

Table 3: Percentage of pre-service teachers considering the importance of methods or status that they should possess in order to increase their comfortable levels in using technology

Methods that make students feel comfortable in learning with computers	Percentage of pre-service teachers considering the importance of the methods
Have prior knowledge about certain computer skills.	74.1%
Have a nice computer at home that can do the work that a computer instructor requires.	70.3%
Have a relative or a friend who knows computers well.	70.3%
Understand what computer skills you know, and what new computer skills that you need to know.	44.4%
Have taken computer classes before.	40.7%
Have prior experiences playing computer games.	22.2%

Discussion

Since the study investigated teaching strategies that a computer instructor should apply and methods that a learner could use in order to increase their confidence levels in using computers, the author discussed the finding from the two perspectives

Teaching Strategies for Computer Instructors

Although there were a lot of teaching strategies being considered important for computer instruction, the following discussion of the study only focuses on the four most important pedagogies that were found in this study. That is because findings in this study indicated that the four strategies were considered imperative by over 50% of the participants.

The study found that pre-service teachers considered that demonstrating computer assignment samples was the most important pedagogical strategy that a computer instructor should apply. Most of them commented that through demonstrating the assignment samples, they gained a concrete idea about what they needed to do and what were the instructor's expectations. The finding corresponds to Keller's ARCS model that suggested applying "expectations" as a strategy to increase learners' confidence. Keller defined expectations as instructors letting learners set realistic goals and know the likelihood for success at different levels of difficulty. Bohlin (2002) also suggested that to relieve learners' anxiety when working with computers, one of the strategies was to state clearly the requirements for successful completion.

The second important teaching strategy found in this study was to have students do individual hands-on computer engagement activities. Participants in the study responded that individual hands-on computer activities allowed them to practice, engage, and reinforce the newly introduced skills. Researchers such as Keller (1999), Bohlin (2002), and Tobias (1979) also suggested similar pedagogical strategies. Keller indicated that allowing learners to practice under safe conditions could help them to build self-confidence. Bohlin and Tobias both also suggested using the strategy; however, they emphasized the importance of allowing learners to repeat content and reduce the extent to which learners had to rely on memory.

The third important teaching strategy found in this study was that the instructor should visually demonstrate the computer skills that were going to be introduced with a data projector. The visual demonstration of a new computer skill helped learners understand the process and procedure to operate or manage the new skill. Some participants stated that it was very good for visual learners. The strategy was also reflected in Keller's ARCS model, which indicated that to increase learners' confidence, instructors should specify learning requirements. According to Keller's interpretation, learning requirements mean that when teaching, instructors should make sure that all of the learners clearly know the lesson that is being taught.

The fourth important pedagogical strategy found in this study was to have students do cooperative group computer activities. Participants in the study commented that doing group computer activities allowed team members to brainstorm the new computer skills and to learn from each other. The findings responded to the social learning theory proposed by Martin and Briggs (1986). Social learning theory focuses on interaction among learners. Interaction facilitates learners' behavior and attitude changes. By adapting cooperative group activities, computer instructors could help pessimistic computer learners in changing their attitudes toward the use of computers.

Table 4 provides a comparison between findings of the pedagogies and those of theory-based strategies:

Table 4: A comparison of theory-based strategies and practical pedagogical strategies

Important pedagogical strategies found in this study	Corresponding theory-based strategies suggested by other theorists
To demonstrate computer assignment samples.	<ol style="list-style-type: none"> 1. Keller's ARCS model suggested applying "expectations" as a strategy to increase learners' confidence. Keller defined expectations as instructors let learners set realistic goals and know the likelihood for success at different levels of difficulty. 2. Bohlin (2002) suggested that to relieve learners' anxiety when working with computers, one of the strategies should be to state clearly the requirements for successful completion.
To have students do individual hands-on computer engagement activity.	<ol style="list-style-type: none"> 1. Keller indicated that allowing learners to practice under safe conditions could help them to build self-confidence. 2. Bohlin and Tobias both suggested the strategy to allow learners to repeat content and reduce the extent to which learners had to rely on memory.
To visually demonstrate the computer skills.	Keller's ARCS model indicated that to increase learners' confidence, instructors should specify learning requirements. This means that when

	teaching, instructors make sure that all of the learners clearly know the lesson that is being taught.
To have students do cooperative group computer activities.	Martin and Briggs' (1986) social learning theory emphasized the importance of modeling to facilitate students' behavior change.

Methods of Improving Computer learners' Learnability

Discussion of methods or means for computer learning only focused on the three most important strategies found in this study because findings in this study indicated over 50% of the participants believed that the strategies were essential to increase learners' confidence levels in using computers.

The most important means of reducing a computer learner's anxiety was to provide them with knowledge about certain computer skills. Participants in the study indicated that having prior knowledge about computers helped them feel comfortable enough to learn new computer skills. This implied that computer instructors could advise their students to prepare themselves by playing with computers prior to taking a computer course or before each class meeting period. The finding reflected one of the suggested activities in Keller's ARCS model. The strategy is that an instructor should let learners know how the lesson will utilize their present skill or prior knowledge to increase the relevance of subject matter.

The second important means that pre-service teachers believed would increase their confidence levels in learning with computer skills was to have a nice computer at home that could do the work that the instructor required. Participants indicated that being able to practice the newly introduced computer skills from a home computer made them feel comfortable and allowed them to practice at a convenient time. A participant commented: "It makes a big difference to have a powerful computer at home that can do all of the assignments required in a computer class." The finding justified the reason that more and more universities, colleges, or even high schools have programs to loan out laptop computers for their students.

The third important means of improving learning new computer skills was to have a relative or a friend who knows computers well. Pre-service teachers in this study stated that having a relative or a friend who knew computers well could assure their home computers function as required so that they were able to complete their assignments. Sometimes, friends or relatives who were competent with computers could serve as a mentor to help them in advancing their assignments. Ages of friends or relatives who were competent with computers were not an issue. A few participants indicated that they even got assistance from their school-age children.

Implications and Conclusions

It was important to understand theory-based pedagogical strategies to increase computer learners' learning with technology; however, it was even more important to identify essential practical instructional strategies needed by computer learners. The argument was based on two reasons. First, theory-based strategies provided a list of detailed, inclusive, and systematic methods for instructors and instructional designers; however, practical strategies offered just-in-time methods. Second, theory-based strategies did not prioritize the importance of different strategies; yet the importance of different pedagogical strategies varies in real life teaching, particularly teaching with computers.

This study ranked the importance of different pedagogical strategies. It offered computer instructors and instructional designers a quick solution to design and carry out effective instruction. Theory-based strategies provided a comprehensive list of inclusive systematic pedagogical strategies instead of the most needed strategies in daily teaching. Teaching is an ongoing, reciprocal, creative, and time consuming process. Most of the time, teachers do not have time to review all of the theory-based strategies before they design and carry out their lessons.

On the other hand, pedagogical concepts, such as student-centered learning and meta-cognition, which address the importance of learners being aware of what they have known and have not known in their learning processes, are very popular at present. If a computer instructor could provide advice or methods to empower his/her learners' learning with computers, the advice certainly would increase their confidence levels in integrating computers for their future teaching.

The study concluded that when teaching pre-service teachers computer skills, a computer instructor should:

1. demonstrate computer assignment samples which provide guidance for learners and help learners to clarify requirements for successful completion of assignments,
2. have students do individual hands-on computer engagement activities,
3. provide visual demonstration of the computer skills with a data projector, and
4. have students do cooperative group computer activities.

To increase students' confidence in using computers, instructors could also provide helpful advice for their students, such as:

1. having prior knowledge about certain computer skills: to have prior knowledge about certain computer skills, pre-service teachers could take a preliminary computer class first, or self practice computer skills before each class.
2. having a nice computer at home that can do the works that the instructor requires: a nice home computer should have pre-installed software that allow pre-service teachers to practice the newly introduced computer skills. If a pre-service teacher does not have a computer at home, he/she might consider using some computer loan-out programs provided by universities or schools; or he/she should try to have easy access to a computer that could do the course work.
3. having a relative or a friend who knows computers well: a relative or a friend who is competent in computers should be able to assure a pre-service teacher's computer function as required and should have an understanding of computer skills introduced in computer courses. With possession of such computer skills, a relative or a friend could offer assistance for a pre-service teacher to successfully complete their assignments.

References

- Bandura, A. (1988). Self-efficacy conceptions of anxiety. *Anxiety Research, 1*, 77-98.
- Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44*, 1175-1184.
- Bohlin, R. (2002). Avoiding Computer Avoidance, Retrieved on July 19, 2004 from <http://it.coe.uga.edu/itforum/paper35/paper35.html>.
- Bohlin, R. M., Milheim, W., & Viechnicki, K. (1993). Factor analysis of the instructional motivation needs of adult learners. *15th Annual Proceedings of Selected Research and Development Paper Presentations at the 1993 Annual Convention of the Association for Educational Communications and Technology*, 177-191.
- Bradley, G., & Russell, G. (1997). Computer experience, school support, and computer anxiety. *Educational Psychology; 17* (3), 267-84.
- Brosnan, M. (1998). The impact of psychological gender, gender-related perceptions, significant others, and the introducer of technology upon computer anxiety in students. *Journal of Educational Computing Research, 18* (1), 63-78.
- Cambre, M. A., & Cook, D. L. (1984). Computer Anxiety: Definition, Measurement, and Correlates. *Paper presented at the Annual Meeting of the American Educational Research Association*, April 23-27, 1984, New Orleans, LA, USA.
- Cradler J., & Cradler, R. (2001). *Improving California Schools: Meeting the Challenge with Technology*, Atlanta, Georgia: NetSchools Transforming Education.
- Deloughry, T. J. (1993). Researchers Say "Technophobia May Afflict Millions of Students". *The Chronicle of Higher Education*, April 28, A25-A26.
- Dyck, J. L., & Smither, J. A. (1992). Computer Anxiety and the Older Adult: Relationships with Computer Experience, Gender, Education and Age. *Proceedings of the Human Factors Society 36th Annual Meeting*, Atlanta, GA.
- Fletcher, W. E., & Deeds, J. P. (1994). Computer anxiety and other factors preventing computer use among United States secondary agricultural educators. *Journal of Agricultural Education, 35* (2), 16-21.

- Gaudry, E., & Spielberger, C. (1971). *Anxiety and Educational Achievement*, Sydney: Wiley.
- Gordon, H. R. (1995). Analysis of the computer anxiety levels of secondary technical education teachers in West Virginia. *Journal of Studies in Technical Careers*, 15, 21-29.
- Howard, G. S., & Smith, R. (1986). Computer anxiety in management: Myth or reality? *Communications of the ACM*, 29, 611-615.
- Igbaria, M., & Chakrabarti, A. (1990). Computer anxiety and attitudes towards microcomputer use. *Behavior and Information Technology*, 9, 229-241.
- Igberia, M., Pavri, F., & Huff, S. (1989). Microcomputer applications: an empirical look at usage. *Information and Management*, 16, 187-196.
- Johanson, R. P. (1985). School computing: Some Factors affecting student performance. *Paper presented at the meeting of the American Educational Research Association*, April, 1989, Chicago, IL.
- Keller, J. M. (1983). Motivational design of instruction. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: An overview of their current status*, Hillsdale, NJ: Lawrence Erlbaum.
- Keller, J. M. (1987). Development and Use of the ARCS Model of Motivational Design. *Journal of Instructional Development*; 10 (3), 2-10.
- Keller, J. M. (1999). Using the ARCS Motivational Process in Computer-Based Instruction and Distance Education. *New Directions for Teaching and Learning*, 78, 39-47.
- Keller, J. M., & Kopp, T. (1987). Applications of the ARCS model of motivational design. In C. M. Reigeluth (Ed.), *Instructional theories in action: Lessons illustrating theories and models*, Hillsdale, NJ: Lawrence Erlbaum.
- Keller, J. M., & Suzuki, K. (1988). Use of the ARCS model in courseware design. In D. H. Jonassen (Ed.), *Instructional designs for computer courseware*, New York: Lawrence Erlbaum.
- Martin, B. L., & Briggs, L. J. (1986). *The affective and cognitive domains: Integration for theory and research*, Englewood Cliffs, NJ: Educational Technology.
- McInerney, V., McInerney, D. M., & Sinclair, K. E. (1990). Computer Anxiety and Student Teachers: Interrelationships between Computer Anxiety, Demographic Variables and an Intervention Strategy. Paper presented at the Australian Association for Research in Education Annual Conference, Sydney, Australia.
- Medcalf-Davenport, N. A. (1998). Historical and Current Attitudes Toward and Uses of Educational Technology: A Work in Progress. *Paper presented at the 3rd World Conference of the WWW, Internet and Intranet*, November 7-12, 1998, Orlando, FL.
- Morgan, A. (1997). *Computer Anxiety: A Survey of Computer Training, Experience, Anxiety, and Administrative Support Among Teachers*, Retrieved July 19, 2004 from <http://oas.okstate.edu/ojas/amorg.htm>.
- Orr, L. (1997). *Computer Anxiety*, Retrieved July 19, 2004 from <http://www.usm.maine.edu/~com/lindap~1.htm>.
- Rosen, L. D., Sears, D. C., & Weil, M. M. (1987). Computerphobia. *Behavior Research Methods, Instruments and Computers*, 19,167-179.
- Shirley, R. (1996). Improving Junior High School Teacher Computer Literacy through the Use of an Electronic Gradebook. *Eric Digest 394515*.
- Tobias, S. (1979). Anxiety research in educational psychology. *Journal of Educational Psychology*. 71, 573-582.
- U.S. Department of Education (2001). *Analysis of the 1999-2000 Annual Performance Reports for Preparing Tomorrow's Teachers to Use Technology*, Retrieved July 19, 2004 from <http://www.ed.gov/offices/OUS/PES/higher.html#pt3>.

Appendix A: Technology Survey

In what way, you will feel more comfortable in using computers?

(Mark all that apply and rank the top three activities that you believe can most reduce your anxiety in working with computers, and please state your reasons.)

a) Instructor's pedagogy

Pedagogy	Why do you think it is important?
<input type="checkbox"/> Oral demonstration of the computer skills.	_____
<input type="checkbox"/> Give a visual demonstration of the computer skills with a data projector.	_____
<input type="checkbox"/> Have students do individual hands-on computer engagement activity.	_____
<input type="checkbox"/> Have students do cooperative group computer activity.	_____
<input type="checkbox"/> Provide oral support in the use of computers.	_____
<input type="checkbox"/> Demonstrate computer assignment samples.	_____
<input type="checkbox"/> The instructor applies a humorous tone in his/her teaching.	_____
<input type="checkbox"/> Before new computer skills are introduced, the instructor reviews related computer skills first.	_____
<input type="checkbox"/> The computer skill that the instructor demonstrates is useful in the job market.	_____
<input type="checkbox"/> Others, please list:	_____

b) Students' Perspectives

Methods/Status	Why do you think it is important?
<input type="checkbox"/> Have a nice computer at home that can do the work that the instructor requires.	_____
<input type="checkbox"/> Have a relative or a friend who knows computers well.	_____
<input type="checkbox"/> Have prior experiences playing computer games.	_____
<input type="checkbox"/> Have prior knowledge about certain computer skills.	_____
<input type="checkbox"/> Understand what computer skills you have known, and what new computer skills that you need to know.	_____
<input type="checkbox"/> Took other computer classes before.	_____
<input type="checkbox"/> Took two or more computer classes at the same time.	_____
<input type="checkbox"/> Others, please list:	_____