

Factors Influencing Computer Anxiety and Its Impact on E-Learning Effectiveness: A Review of Literature

Tien-Chen Chien
Da-Yeh University

Computer is not only a powerful technology for managing information and enhancing productivity, but also an efficient tool for education and training. Computer anxiety can be one of the major problems that affect the effectiveness of learning. Through analyzing related literature, this study describes the phenomenon of computer anxiety, investigates factors influencing computer anxiety, and discovers proper treatments for reducing it. The effect of computer anxiety on e-learning effectiveness is also discussed.

Keywords: Computer Anxiety, E-Learning, Training Effectiveness

The prevalent usage of computer technology in today's society has enabled people to access much more information than ever before. Computers have been recognized as not only a powerful technology for managing information and enhancing productivity, but also an efficient tool for education and training. In the Information Age, people are coping with the growing demand of being computer literate. They need to be able to operate these machines to function at work and school. As people are pushed into the increasing interaction with computers, some respond with enthusiasm and a desire to become the master of the machines; others, however, approach the situation with fear and apprehension. The anxiousness about using computers troubles numerous people, it can affect their training effectiveness and job productivity.

Schools and businesses spend a great amount of money on computer-based education and training each year. Computer anxiety can be one of the major problems that affect the effectiveness of learning. Computer anxiety is a phenomenon which accompanies the growing use of computers in our society. Though this topic has drawn researchers' attention for over three decades, the nature of this phenomenon remains unclear. There have been mixed findings on the causes of computer anxiety. As far, successful treatments to reduce the anxiety have not been developed.

Problem Statement

This study intends to obtain a better understanding of the nature of computer anxiety, investigate factors influencing computer anxiety, and discover proper treatments for reducing the anxiety through critically analyzing previous literature related to this area. This study also discusses the effect of computer anxiety on the effectiveness of e-learning.

Theoretical Framework

Several studies have established that individuals often exhibit a complex array of emotional reactions in situations requiring the utilization of computer technology. Computer anxiety is caused by exposure to computer technology (North & Noyes, 2002). It can be defined as "fear of impending interaction with a computer that is disproportionate to the actual threat presented by the computer" (Howard, 1986, p. 18). Appelbaum and Primmer (1990) pointed out that "cyberphobia" is more common than other phobias in business and industry. This phobia is "an intense anxiety about computers that can produce physical symptoms ranging from sweaty palm to dizziness, shortness of breath, heart pounding, and feelings of unreality" (p. 8). This anxiety is also referred to as technophobia about being present or future interactions with computers or computer-related technology (McIlroy et al. (2001).

Since the 1970s, many researchers have been interested in investigating people's negative reactions to computer technology. A number of studies have examined the relationship between computer anxiety and a variety of variables. Some researchers investigated the relationship between computer experience and computer anxiety, others looked into relationship to gender, age, or personality traits.

Factors Influencing Computer Anxiety

Computer experience. Researchers have found that experienced computer users have higher computer self-efficacy and lower computer anxiety (Decker, 1999; Hasan, 2003; Thatcher & Perrew, 2002). Computer experience has a negative relationship with an individual's computer anxiety (Beckers & Schmidt, 2003). Individuals who have computers at home or have used computers have lower computer anxiety than those who do not (Chu & Spires, 1991; Hayek & Stephens, 1989). Chu and Spires (1991) found that college students who had taken two or more computer courses were less anxious about computers than those who had taken fewer than two courses. After taking a computer course, students who had previous high computer anxiety experienced a great decrease in their anxiety (Chu & Spires, 1991; Leso & Peck, 1992). Broos (2005) also found computer use and self-perceived computer experience have a positive impact on decreasing computer anxiety.

Rosen and Weil (1995a) studied computer availability, computer experience, and computer anxiety among school teachers in southern California. They reported that despite that computers were available at all schools, they were not being used by many teachers. Teachers who used computers less were found to have higher computer anxiety. These studies suggested that computer anxiety was associated with computer experience and/or exposure. However, this does not explain whether less computer anxiety enables people to get more computer experience, or more computer experience causes less computer anxiety.

Some researchers reported that individuals' previous computer experience was not associated with their computer anxiety. Experienced users suffered from computer anxiety as much as novice users (Marcoulides, 1988; Rosen, Sears & Weil, 1987). It is not the amount of computer experience that affect people's anxiety but positive experiences reduced the anxiety (Beckers & Schmidt, 2003).

Computer anxiety is often considered as an attitude toward computers. A person's negative attitude towards computers was identified as a characteristic of a person with computer anxiety. Computer experience could be a poor indicator of computer attitudes if it did not cover a wide range of use and skills measures (Garland & Noyes, 2004). Some researchers suggested that individuals' computer anxiety and attitudes toward computers are related but should be treated as separate constructs (Harrison & Rainer, 1992; Whitely, 1997). Kernan and Howard (1990) also found that individuals who suffered high computer anxiety did not necessarily have negative computer attitudes.

Gender. Many studies have found that females are more anxious about computers than males (Broos, 2005; Brosnan, 1998; Chua, Chen, & Wong, 1999; Schottenbauer, Rodriguez, Glass, & Arnkoff, 2004). A meta-analysis also concluded that women in general had stronger negative attitudes toward computers (Whitely, 1997). Schumacher and Morahan-Martin (2001) stated that the increasing overall computer use in the United States did not diminish gender differences in computer experiences. Their study found that gender differences continually exist among college students. Female college students have higher computer anxiety than male students. They also have more negative attitudes toward computers.

Gender bias could affect the results of these studies. Since parents tend to purchase more computers for sons than for daughters, male and female youth do not have equal access to computers in the home (Campell, 1989). Since boys spend more time using computers, they have more computer experience than girls. They also have more interest in computer-related activities (Bannert & Arbinger, 1996; Beentjes et al., 1999).

Age. Some studies (Cambre & Cook, 1987; Todman & Lawerson, 1992) found that adults were more fearful about using computers than children and teenagers. When older adults (55 years and older) were compared to younger adults (30 years and under), older adults were less anxious about computers than younger adults (Dysk & Smither, 1994). Older adults also had more positive attitudes toward computers though they had less computer experience than younger adults (Dysk & Smither, 1994). However, other researchers found that older adults had higher anxiety than younger adults while taking computer-based cognitive test. Older adults also generally had less computer experience than younger adults (Laguna & Babcock, 1997).

Personality traits. Some researchers examined the relationship of personality traits to computer anxiety. Winer and Bellando (1989) measured college students' computer anxiety using the Holland Model which categorized vocational personality into six types. The results suggested that artistic and social types had higher computer anxiety than other four types: realistic, investigative, enterprising, and conventional. Lankford, Bell and Elias (1994) stated that: "standardized normative distributions on personality tests may not be applicable to computerized personality tests" (p. 497). Different methods of measurement lead to different results. They suggested that an applicable instrument should be designed to examine the relationship of personality traits to computer anxiety.

Math anxiety. Some researchers examined the relationship of math anxiety to computer anxiety. It was found that students' math ability affected math anxiety and computer anxiety. Students who had high math ability had low math anxiety and computer anxiety (Lindbeck & Dambrot, 1986). However, other researchers found that math ability had no effect on computer anxiety (Fletcher & Deeds, 1994). Students' math anxiety was not related to computer anxiety either (Todman & Lawerson, 1992).

Social-economic background. Individuals' social-economic background has a positive relationship with computer experience. People who are social-economically privileged have low computer anxiety (Bozionelos, 2004). This can be explained by that "individuals who have been raised within higher social-economic status families are more likely to have a computer available at home, to attend schools with better computer equipment, and to have teachers with better computer skills" (Bozionelos, 2004, p. 727).

Cross-cultural comparison. Collis and Williams (1987) examined Canadian and Chinese high-school students and found that Chinese students to have more positive attitudes toward computers. Allwood and Wang (1990) compared Swedish and Chinese college students and found that Chinese students had more optimistic conceptions of computer technology. Marcoulides and Wang (1990) compared American and Chinese college students and found that there was not much difference in computer anxiety between these two groups of students.

Rosen and Weil (1995b) developed a three-factor model of computer anxiety and compared college students in the United States and nine other countries, including Japan, Australia, Germany, Hungary, Spain, Yugoslavia, Italy, Israel, and Czechoslovakia. They reported that each country had a unique culture-dependent model of computer anxiety and there were some similarities and differences in factor structures. As far there have not been enough studies to prove the relationship of various cultural backgrounds to computer anxiety. In order to provide more evidence, more studies need to be done in this area.

Computer Anxiety and E-Learning

E-learning is considered to have the potential to significantly improve workforce development. "It includes diverse learning strategies and technologies, from CD-ROMs and computer-based instruction to video conferencing, satellite-delivered learning, and virtual educational networks" (Pantazis, 2002, p. 22). Since it can reduce costs and time of training, businesses are attracted to adopt e-learning into their workforce training. Therefore, how to maximize the effectiveness of e-learning has become an important issue. One of the focuses has been on how to meet individual needs and learning styles (Pantazis, 2002).

As researchers examining e-learning and individual characteristics, it is found that computer anxiety played a significant role in the learning process (Fuller et al., 2006). Individuals with high computer anxiety are likely to remain in that state of high computer anxiety in the future, and experience greater anxiety with repeated exposure to computers. They are at risk for "resisting the use of computer technology" and "an inability to gain learning benefit over the anxiety cost of an e-Learning environment" (Fuller et al., 2006, p. 105).

Studies have found that demographic and situational variables, personality variables, and cognitive style influence learner computer anxiety and further influence their attitudes toward computers (Igbaria & Chakrabarti, 1990; Igbaria & Nachman, 1990). Computer anxiety can affect learner acceptance of computer-based training support tool (Wagner & Flannery, 2004). The perceived ease of use and usefulness of e-learning among learners are important factors that affect the effectiveness of e-learning (Jashapara & Tai, 2006; Lim et al., 2007). It is found that computer anxiety can mediate the effect of perceived ease of use of e-learning (Jashapara & Tai, 2006).

Results and Findings

From the studies reviewed, it is found that no matter whether males or females, experienced users or novices, they all can suffer from computer anxiety. Since individuals who have computer anxiety are scattered among various age groups and social-cultural background, it is difficult to develop one treatment that serves to reduce everybody's anxiety. Howard (1986) summarized some important aspects of computer anxiety and categorized them into three types according to the roots of the anxiety: (1) psychological root, (2) knowledge root, and (3) operational root. It is suggested that each type of computer anxiety needs a certain treatment. Sometimes a combination of two or three treatments may be needed. (1) To treat the psychological root of computer anxiety, the first thing is to change individuals' technological attitudes and beliefs. This is difficult and usually takes a long time. (2) Since the cause of knowledge root of computer anxiety is lack of computer knowledge, the best way to treat it is to impart computer knowledge. The degree of difficulty is moderate and the time needed is intermediate. (3) To treat operational root of computer anxiety is relatively easy, individuals' computer anxiety can be reduced by providing enough hands-on experience. The time needed to treat operational root computer anxiety is short in comparison to others.

Many researchers focused on the effect of providing computer knowledge and experience to reduce computer anxiety; however, the results are mixed. Leso and Peck (1992) pointed out that some computer courses helped reduce individuals' computer anxiety, but some had no effect of reducing it. What to teach and how to teach in an introductory computer course became another issue. They compared different types of computer course and found that a software applications course is more effective in reducing computer anxiety than a programming course. They also suggested that in order to achieve better results, individuals who have higher computer anxiety are recommended to attend other computer-related activities designed especially to reduce anxiety at the same time.

Additionally, it is advised to take introductory course which help to establish basic skills and concepts before learners take programming course.

Some people hesitate in using computers for fear of making mistakes. Some people think they may break the machines if they do not operate them correctly. Teachers should explore the learners' worst fears; then give proper treatment. For example, if computer users hit a wrong key, there will be a beep sound or error message. Teachers can demonstrate hitting the wrong key purposefully, and let students see what will happen if they do so. Thus students understand they will not break the machines by doing this. While students are experiencing making mistakes, teachers can show them that it is not worth it to be nervous as much as they thought (Lewis, 1988).

Pina and Harris (1994) provided several tips to avoid computer anxiety in classroom for students. At the beginning of training, teachers can give students an overview of the training, and ask them why he/ she is taking the training. Teachers should avoid using difficult terms or jargon. Try to speak their language as much as possible. If there are enough computers available, teachers can let students find the friendliest computer. Ask them use the one that he/she feels most comfortable using. Have them play, and let them know that they will not break the machines if they hit the wrong key. Demonstrate how to adjust computer monitor and keyboard. Let students understand they can operate computer instead of being controlled by the machine.

Conclusions and Recommendations

Computer anxiety has affected many computer users since the technology was introduced into schools, workplaces and homes decades ago. Many studies have assessed the relationship of computer anxiety to factors such as computer experience, age, gender, or personality traits. However, the results of these studies are mixed. In order to obtain a better understanding of this problem, we should do more research. New instruments need to be developed to measure this construct precisely. More research about details of the factors that cause computer anxiety needs to be done. Therefore, effective methods of reducing computer anxiety can be designed. Maurer(1994) pointed out that there are some common problems in this area "(a) often the research questions are not clearly defined, building on previous research; (b) the treatments used are often ill defined; and (c) the studies in this area do not seem to from a trust toward answering larger questions' (p. 374). These commands may be helpful for future studies to avoid making the same mistakes and add more useful information to this body of research.

In reviewing previous studies, it is found that most researchers have studied the construct of computer anxiety among groups of people in the United States, such as college students, school teachers, or business managers. Only few studies have assessed computer anxiety across more than one country (Allwood & Wang, 1990; Collis & Williams, 1987; Marcoulides & Wang, 1990; Rosen & Weil, 1995). There has been a lack of studies to prove the relationship of various cultural backgrounds to computer anxiety. More studies need to be done in this area. This will be helpful to enable training program designers to develop techniques that address the unique needs of different groups of computer users.

Implications for HRD

Findings of the current study provided a better understanding of the nature of computer anxiety. The study identified important factors influencing computer anxiety and discussed its impact on the effectiveness of computer-based training and e-learning through critically analyzing previous literature in this area.

Based on findings of previous studies, individuals' computer anxiety can affect their learning effectiveness. HRD practitioners should pay more attention to this anxiety and adopt proper treatments of reducing the anxiety, so that positive e-learning experiences can be created. If computer anxiety can be successfully reduced, it will benefit numberless computer users. Then the improvement of effectiveness of knowledge/skills training via computers can be possibly reached.

References

- Allwood, C. M., & Wang, Z. (1990). Conceptions of computers among students in China and Sweden. *Computers in Human Behavior*, 6(2), 185-199.
- Appelbaum, S. H., & Primmer, B. (1990). A HRx for computer anxiety. *Personnel*, 67(9), 8-11.
- Bandalos, D., & Benson, J. (1990). Testing the factor structure invariance of a computer attitude scale over two grouping conditions. *Educational and Psychological Measurement*, 50(1), 49-60.
- Bannert, M., & Arbing, p. R., (1996). Gender related differences in exposure to and use of computers: Results of a survey of secondary school students. *European Journal of Psychology of Education*, 11(3), 269-282.

- Beckers, J. J., & Schmidt, H. G. (2003). Computer experience and computer anxiety. *Computers in Human Behavior*, 19(6), 785-797.
- Beentjes, H. J., Haenens, L., & van der Voort, T. H. (1999). Dutch and Flemish children and adolescents as users of interactive media. *Communications*, 24, 145-166.
- Bozionelos, N. (2004). Socio-economic background and computer use: The role of computer anxiety and computer experience in their relationship. *International Journal of Human-Computer Studies*, 61(5), 725-746.
- Broos, M. A., (2005). Gender and information and communication technologies (ICT) anxiety: Male self-assurance and female hesitation. *Cyber Psychology & Behavior*, 8 (1), 145-166.
- Brosnan, M. J. (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. (1987). Measurement and remediation of computer anxiety. *Educational Technology*, 27 (12), 15-20.
- Campell, N. J. (1989). Computer anxiety of rural middle and secondary school students. *Journal of Educational Computing Research*, 5 (2), 213-220.
- Chu, P. C., & Spires, E. E. (1991). Validating the computer anxiety scale: Effects of cognitive style and computer courses on computer anxiety. *Computers in Human Behavior*, 7(1), 7-21.
- Chua, S. L., Chen, D. T., & Wong, A. F. L. (1999). Computer anxiety and its correlates: A meta-analysis. *Computers in Human Behavior*, 15(5), 609-623.
- Collis, B. A., Williams, R. L. (1987). Cross-cultural comparison of gender differences in adolescents' attitudes toward computers and selected school subjects. *Journal of Educational Research*, 81 (1), 17-27.
- Decker, C. A. (1999). Technical education transfer: Perceptions of employee computer technology self-efficacy. *Computers in Human Behavior*, 15(2), 161-172.
- Dysk, J. L., & Smither, J. A. (1994). Age difference in computer anxiety: The role of computer experience, gender, and education. *Journal of Educational Computing Research*, 10(3), 239-248.
- Fuller, R. M., Vician, C., & Brown, S. A. (2006). E-Learning and individual characteristics: The role of computer anxiety and communication apprehension. *The Journal of Computer Information Systems*, 46(4), 103-115.
- Garland, K. J., & Noyes, J. M. (2004). Computer experience: A poor predictor of computer attitudes. *Computers in Human Behavior*, 20(6), 823-840.
- Harrison, A. W., & Rainer, R. K. (1992). An examination of the factor structures and concurrent validities for the computer attitudes scale, the computer anxiety rating scale, and the computer self-efficacy scale. *Educational and Psychological Measurement*, 52(3), 735-745.
- Hasan, B. (2003). The influence of specific computer experiences on computer self-efficacy beliefs. *Computers in Human Behavior*, 19(4), 443-450.
- Hayek, L. M., & Stephens, L. (1989). Factors affecting computer anxiety in high school computer science students. *Journal of Computers in Mathematics and Science Teaching*, 8(4), 73-76.
- Howard, G. S. (1986). *Computer anxiety and management use of microcomputers*. Ann Arbor: UMI Research press.
- Igbaria, M., & Chakrabarti, A. (1990). Computer anxiety and attitudes towards microcomputer use. *Behavior Information Technology*, 9(3), 229-241.
- Igbaria, M., & Nachman, S. A. (1990). Correlates of user satisfaction with end-user computing: An exploratory study. *Information & Management*, 19(2), 73-82.
- Jashapara, A., & Tai, W. C. (2006). Understanding the complexity of human characteristics on e-learning systems: An integrated study of dynamic individual differences on user perceptions of ease of use. *Knowledge Management Research and Practice*, 4(3), 227-239.
- Kernan, M., & Howard, G. S. (1990). Computer anxiety and computer attitudes: An investigation of construct and predictive validity issues. *Educational and Psychological Measurement*, 50(3), 681-690.
- Lankford, J. S., Bell, R. W., & Elias, J. W. (1994). Computerized versus standard personality measures: Equivalency, computer anxiety, and gender differences. *Computers in Human Behavior*, 10(4), 497-510.
- Laguna, K., & Babcock, R. L. (1997). Computer anxiety in young and older adults: Implications for human-computer interactions in older populations. *Computers in Human Behavior*, 13(3), 317-326.
- Leso, T., & Peck, K. L. (1992). Computer anxiety and different types of computer courses. *Journal of Educational Computing Research*, 8(4), 469-478.
- Lewis, L. H. (1988). Adults and computer anxiety: fact or fiction? *Lifelong Learning*, 11(8), 5-8.
- Lim, H., Lee, S. G., & Nam, K. (2007). Validating e-learning factors affecting training effectiveness. *International Journal of Information Management*, 27(1), 22-35.

- Lindbeck, J. S., & Dambrot, F. (1986). Measurement and reduction of math and computer anxiety. *School Science and Mathematics*, 86(7), 567-577.
- Marcoulides, G. A. (1988). The relationship between computer anxiety and computer achievement. *Journal of Educational Computing Research*, 4, 151-158.
- Marcoulides, G. A., & Wang, X. B. (1990). A cross-cultural comparison of computer anxiety in college students. *Journal of Educational Computing Research*, 6(3), 251-264.
- Maurer, M. M. (1994). Computer anxiety correlates and what they tell us: a literature. *Computers in Human Behavior*, 10(3), 363-376.
- McIlroy, D., Bunting, B., & Tierney, K., (2001). The relation of gender and background experience to self-reported computer anxieties and cognitions, *Computers in Human Behavior*, 17(1), 21-33.
- North, A. S., & Noyes, J. M., (2002). Gender influences on children's computer attitudes and cognitions, *Computers in Human Behavior*, 18(2), 135-150.
- Overbaugh, R. C., & Reed, W. M. (1993). The effects of prior experience and instructional format on teacher education students' computer anxiety and performance. *Computers in the Schools*, 9(2), 75-89.
- Pantazis, C. (2002). Maximizing e-learning to train the 21st century workforce. *Public Personnel Management*, 31(1), 21-25.
- Rosen, L. D., Sears, D. C., & Weil, M. M. (1987). Computerphobia. *Behavior Research Methods, Instruments, and Computers*, 19(2), 167-179.
- Rosen, L. D., & Weil, M. M. (1995a). Computer availability, computer experience and technophobia among public school teachers. *Computers in Human Behavior*, 11(1), 9-13.
- Rosen, L. D., & Weil, M. M. (1995b). Computer anxiety: A cross-cultural comparison of university students in ten countries. *Computers in Human Behavior*, 11(1), 45-64.
- Schottenbauer, M. A., Rodriguez, B. F., Glass, C. R., & Arnkoff, D. B. (2004). Computers, anxiety, and gender: An analysis of reactions to the Y2K computer problem. *Computers in Human Behavior*, 20(1), 67-83.
- Thatcher, J. B., & Perrewe, P. L. (2002). An empirical examination of individual traits as antecedents to computer anxiety and computer self-efficacy. *MIS Quarterly*, 26(4), 381-396.
- Todman, J., & Lawerson, H. (1992). Computer anxiety in primary school children and university students. *British Educational Research Journal*, 18(1), 63-72.
- Wagner, G. D., & Flannery, D. D. (2004). A quantitative study of factors affecting learner acceptance of a computer-based training support tool. *Journal of European Industrial Training*, 28(5), 383-399.
- Whitley, B. E. (1997). Gender differences in computer-related attitudes and behavior: A meta-analysis. *Computers in Human Behavior*, 13(1), 1-22.
- Winer, J. L., & Bellando, J. (1989). Computer anxiety, mathematics anxiety, and Holland vocational-personality types. *Journal of Computers in Mathematics and Science Teaching*, 8(3), 22-24.