December 2004

Understanding the role of anxiety and self-efficacy within a computing-intensive learning environment

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ABSTRACT

Public and private organizations continue to invest heavily in electronic communication technologies for individual, group, organizational, and inter-organizational communication and learning activities. However, this investment approach appears to neglect individual characteristics with respect to communication and computer attitudes. In particular, the effects of individual characteristics of computer anxiety and computer self-efficacy upon computer technology usage are often overlooked in most adoption and deployment activities of information systems functions. To help us gain a better understanding of individual factors that can influence usage and outcomes of computer technologies for communication and learning purposes, this research-in-progress examines the levels of computer anxiety and computer self-efficacy and their relationships to individual performance in a computing-intensive course. The initial investigation results and implications for research and practice will be presented at the conference.

Keywords

Computer anxiety, computer self-efficacy, learning, performance

INTRODUCTION AND RATIONALE

Popular press reports state that approximately thirty to forty percent of adult Americans are fearful of using computers (Miles, 1998). Empirical research indicates a similar phenomenon in managerial work situations (Bozionelos, 1996; Howard & Smith, 1986). Researchers have provided a number of labels to describe this condition, including *technophobia*, *computerphobia*, *computer anxiety*, and *computer avoidance* (Igbaria & Parasuraman, 1989; Rosen, Sears, & Weil, 1987, 1993; Weil, Rosen, & Wugalter, 1990). Whatever the term used to label the condition, scientific research indicates that individuals with such adverse psychological reactions to computing technologies will generally under-utilize computing-intensive environments or avoid interacting with computing technologies. For a thriving, global economy that is steadily increasing its dependence on computing technologies, this is an alarming situation.

In most higher education curricula, an entry-level course exists to provide students with the skills and knowledge necessary to achieve basic computer literacy. The entry-level course generally requires that students actively utilize computing technologies. Many upper-level courses further utilize computing technologies to support instructional and pedagogical goals. Yet, research suggests that an individual's adverse psychological reactions to the use of computing technologies may place the learner at a significant disadvantage relative to his/her peers with more positive psychological reactions (Maurer, 1994; Weil, Rosen, & Sears, 1987). In the least negative consequence, an individual's psychological reactions can get in the way of a learner's ability to master topical material. At the other end of the spectrum, an individual's adverse psychological reactions could hinder his/her future performance in a degree program or in actual work assignments. Therefore, the question remains: How can educators "level the playing field" in a computing-intensive course, such that all students benefit from computing-intensive learning environments?

Prior attempts to address this situation have included: providing more time in hands-on exposure to computers (Maurer, 1994; Rosen & Maguire, 1990), making the hands-on computer training more playful (Webster & Martocchio, 1993), and providing differential motivational responses during computer training sessions (Martocchio, 1994). These approaches have had some success in improving the usage levels of computing technologies, but have little to say in relation to their influence (if any) on computer anxiety or computer self-efficacy levels. In particular, educators need to be aware that although these approaches may increase computer usage (even temporarily for a course), an individual's psychological state or personal judgment may not be influenced by the experience.

Weil, Rosen, & Wugalter (1990) suggest that a negative reinforcement loop between emotional arousal, computer anxiety, and repeated computer exposure can occur for a highly computer anxious individual in the absence of an anxiety

management intervention. Thus, the danger of not addressing adverse psychological states and negative judgments about computing technologies is that an individual may re-experience a state of high computer anxiety or low computer self-efficacy in a future computer-intensive situation and thus negatively affect one's ability to master topical material and/or to perform activities. Computer anxiety is considered to be a state, not a trait, and as such is subject to change under the right circumstances (Rosen et al., 1993). Computer self-efficacy is one's judgment about his/her capability to use computing technology (Compeau & Higgins, 1995) and is generally believed to be susceptible to influence from personal performance accomplishments, observations of others' successes and failures, verbal persuasion, and physiological indices (Bandura, 1997). Developing a computing-intensive learning environment that can address the variations among individuals in computer anxiety and computer self-efficacy will be key to providing a beneficial situation for all learners. However, before such an environment can be created, additional knowledge regarding the relationships of computer anxiety, computer self-efficacy, and performance in a computing-intensive environment is necessary.

This study provides an early investigation of the levels of computer anxiety and computer self-efficacy and their relationships to individual performance in a computing-intensive course. Initial and final levels of computer anxiety and computer self-efficacy are investigated along with midterm and final course performance. The objectives of this study are to examine these antecedents to performance and gain a deeper understanding of their contribution to an individual's performance in computer-intensive situations.

THEORETICAL BACKGROUND

Prior research on computer anxiety and computer self-efficacy is relevant to investigate the antecedents of an individual's performance in a computer-intensive situation. In this section the relevant research in those areas is briefly summarized.

Computer Anxiety

Computer anxiety is "the tendency of individuals to be uneasy, apprehensive, or fearful about current or future use of computers" (Igbaria and Parasuraman 1989, p. 375). Computer anxiety is generally held to be a state, rather than a trait, which suggests that it is malleable given the appropriate conditions and/or anxiety interventions (Rosen, Sears, and Weil 1993; Weil, Rosen, and Wugalter 1990). Numerous studies indicate that prior computer experience is inversely related to computer anxiety (Heinssen, Glass, and Knight 1987; Igbaria and Parasuraman 1989; Rosen and Maguire 1990; Todman and Monaghan 1994), though solely providing additional exposure to computers is unlikely to reduce computer anxiety (Bloom and Hautaluoma 1990; Rosen, Sears, and Weil 1987, 1993; Weil, Rosen and Sears 1987). Computer anxiety has been associated with decreased use, and even avoidance, of information technology (Igbaria and Parasuraman 1989; Igbaria, Schiffman, and Wieckowski 1994; Weil, Rosen, and Wugalter 1990). Further, certain studies have demonstrated a negative relationship between computer anxiety and achievement/performance outcomes (Keeler and Anson 1995; Webster, Heian, and Michelman 1990) though some studies have shown no relationship (Kernan and Howard 1990).

These findings, taken as a whole, have serious implications for the information society. The computer anxiety research clearly shows that a highly computer anxious individual, in the absence of anxiety management interventions, is likely to: (1) remain in that state of high computer anxiety in the future, and; (2) experience greater anxiety with repeated exposure to computers. A dangerous, negative reinforcement loop between emotional arousal, computer anxiety, and repeated computer exposure (see Weil, Rosen, and Wugalter 1990) may be the unintended result of a computer-intensive environment for a highly computer anxious individual. Technology-supported learning situations, for instance, require multiple uses of computer technology over an extended time period. Thus, the highly computer anxious individual would appear to be at a significant disadvantage relative to his or her peers with lower levels of computer anxiety. The highly computer anxious individual may be at risk of: (1) resisting the use of computer technology and thus, endangering his or her educational attainment or job opportunities, and; (2) demonstrating an inability to gain benefit over the anxiety cost of an computing-intensive environment.

Computer self-efficacy

Computer self-efficacy (CSE) is one's judgment about his/her capability to use computing technology (Compeau & Higgins, 1995) and is generally believed to be susceptible to influence from personal performance accomplishments, observations of others' successes and failures, verbal persuasion, and physiological indices (Bandura, 1997). In the educational arena, Karsten & Roth (1998) found that CSE may be a useful means of assessing computer training outcomes in an introductory IS course. They did not, however, investigate any relationship with computer anxiety. Marakas, Yi, and Johnson (1998) provide an extensive review of completed studies of this important individual characteristic and propose a new model for understanding how CSE can affect performance. In short, Marakas et al.'s (1998) review of existing studies has shown a need to further

explicate the construct of CSE, such that future studies can be more directly comparable, with results being more cumulative in their explanatory power. Of particular note in the review is the following observation regarding CSE and computer anxiety research to date:

> "Somewhat counterintuitive, however, is the apparent lack of global recognition by the CSE literature of the importance of the anxiety relationship and by the computerphobia literature of the potential value of the CSE manipulation and enhancement in reducing anxiety." (Marakas, et al., 1998, p. 148).

These findings indicate a great need to explore the construct of computer self-efficacy in conjunction with computer anxiety.

Synthesis of Prior Research

There are few empirical studies examining the simultaneous relationship of computer anxiety, computer self-efficacy, and performance in an information technology environment. Computer anxiety and computer self-efficacy have traditionally been studied in isolation from other antecedent factors (e.g., Compeau & Higgins, 1985, Heinssen, Glass and Knight 1987; Igbaria and Chakrabarti 1990; Igbaria and Parasuraman 1989; Karsten & Roth, 1998; Marakas, Yi, & Johnson, 1998). This study represents an early investigation in this area.

RESEARCH QUESTIONS

The primary research questions of this study include:

RQ1: How does computer anxiety change in a collegiate computing-intensive course?

RQ2: How does computer self-efficacy change in a collegiate computing-intensive course?

METHODOLOGY AND PROJECT STATUS

A survey methodology is used to capture self-report variables of computer anxiety, computer self-efficacy, and demographic information. Computer anxiety measures were drawn from Heinssen, Glass, and Knight (1987). The computer self-efficacy measure utilized the questionnaire instrumentation from Compeau & Higgins (1995). Performance is measured by instructor percentage values at midterm and final timelines. One hundred and twelve students enrolled in 4 sections of an introductory information systems course participated in this study.

By the time of the conference, the data will be analyzed and results will be available for discussion and presentation.

POTENTIAL CONTRIBUTION AND FUTURE DIRECTIONS

As an initial phase of work about interventions in computing-intensive learning environments, this study provides three contributions. First, this study allows us to determine if initial levels of computer anxiety and computer self-efficacy change during the nature of a course. If these initial levels are high, and tend to decrease over time, then educators may wish to look at the types of educational activities that can support this trend. If these initial levels are low, and tend to increase over time, educators will want to review the types of educational activities in use. Secondly, this study will provide empirical evidence of what occurs to initial levels of computer anxiety and computer self-efficacy in the absence of any specific intervention. Thirdly, this study will help to shed light upon the differential influences of computer anxiety and computer self-efficacy upon groups of learners.

Future directions for research will depend upon the results of this study, but potential directions include: further refinement of initial assessment instrument to determine learner readiness for computing-intensive activities, development of a practical intervention to address high computer anxiety and/or low computer self-efficacy, and empirical testing of assessment and intervention mechanisms.

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