Computer Anxiety, Training and Education: A Meta Analysis

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INTRODUCTION

The extensive use of computers in daily life and the overwhelming growth of information technology have created an intellectual stress and psychological pressure often called "computer anxiety." It is crucial that educators and trainers realize the adverse implications of computer anxiety on user performance. Although several researchers have studied computer anxiety, their primary focus has been on the relationship of differences such as gender, race, age, attitudes toward computers, math aptitude and math anxiety, [1,2, 3, 4, 5, 6, 7, 8, 9, 10,11, 12, 13, 14]. Although some generalizations can be drawn from previous research studies, clear relationships have not been sufficiently established between computer anxiety and performance.

This paper proposes a relationship model between computer anxiety and performance and suggests how this relationship model can be used to improve individual performance. This study defines computer anxiety as a psychological pressure on an individual due to lack of understanding of technology, its applications, and its method of operation. Performance is defined as the ability to complete manual or behavioral tasks in an effective and efficient manner using a microcomputer, keyboarding skills, a microcomputer mouse, graphical user interfaces, and other microcomputer control mechanisms.

METHODOLOGY

A three-step process was used to identify the relationship between computer anxiety and performance. Based on a review of the literature the first step was to examine the relationship between math and test anxieties and performance. The second step in this analysis was to identify the relationship between math anxiety and computer anxiety. The first two steps were achieved by conducting a meta-analysis of existing literature. The third step was to propose a relationship between computer anxiety and performance, based on the meta-analysis, and to develop a model which demonstrates this relationship.

META-ANALYSIS

Math anxiety has been reported in a number of studies as a significant correlate of computer anxiety [1, 15, 16, 11]. In addition several researchers and educators have identified computer anxiety as comparable to math anxiety [17, 5, 18, 19]. A number of software applications, such as graphical analysis, spreadsheets, databases, and simple query scripts for data access, have a "mathematical" orientation. Software applications such as word processing may not require mathematical skills; however, interpretation of operational and control commands requires manipulation ability for successful use. An individual with computer anxiety may fear that the system will crash if the proper commands are not used in running an application and, as a result, perform computing tasks with a lack of confidence.

Step 1: Math anxiety and performance

The effect of math anxiety on the behavior and performance of individuals has been highlighted in previous studies [20, 21, 17,

22, 23, 24, 25, 26]. For example, [27] study found that the most math-anxious teachers avoid teaching math even though they may be as competent in math as their less-anxious peers. A study by [16] found that students who have low anxiety toward math and are knowledgeable about computers, were more likely to enroll in science courses. Math anxious students suffer anxiety from both math and computers. Results of a study by [25] confirmed earlier research indicating that there is an inverse relationship between math anxiety and performance. [26] who explored the relationship between test anxiety and math anxiety based on the cognitive theories of test anxiety, found that test anxiety and math anxiety are significantly correlated. [24] concluded that test anxiety has a greater effect on the math achievement of remedial math students than either math anxiety or teacher feedback. Table 1 summarizes significant research findings which indicate a relationship between math anxiety and performance.

Table 1: Summary of Findings - Relational of Math Anxiety and Performance

[22]	Math anxiety directly related to students' math ability perceptions, performance expectancies, and value perceptions
[23]	Attitudes/affect toward math are important influences on the development of gender differences in math performance
[24]	Achievement in mathematics is related to mathematics ability, test anxiety, and mathematics anxiety
[25], [26]	Test anxiety inversely related to performance
[42]	the effects of goals may be non-linear
[53]	Anxiety inhibits not original learning but performance
[54], [55]	Math anxiety measures are more closely related to each other than test anxiety

It is evident from the results of the studies, noted in Table 1 that an inverse relationship exists between math anxiety and performance. It can be concluded from these studies that individuals with math anxiety tend to avoid math and tests due to some unknown fear such as poor performance.

Step 2: Math anxiety and computer anxiety

The role of computer anxiety as an intervening variable has been confirmed by a number of studies. [15, 28, 11] found that education, external locus of control, and math anxiety influence attitudes toward microcomputers indirectly through their effects on computer anxiety. [17] studied the relationships between anxiety toward computers with trait anxiety, anxiety toward mathematics, perceived impact of computers on society, and experience in using computers. All of these variables were found to be positively correlated with computer anxiety. Results of a study by [12] found that computer aptitude is related to mathematical achievement at the junior-high level. Computer aptitude refers to an individual's ability to use a variety of applications, such as databases, word processors, presentation packages, and spread sheets.

Psychologists and educators have identified the concept of computer anxiety as comparable to test anxiety and math anxiety. For example, [29] found computer anxiety to be significantly correlated with the other anxiety indices, state anxiety, trait anxiety, and math anxiety. In another study, [18] found that computer aptitude is related to math ability and experience, whereas attitude toward computers is related to math anxiety and computer experience. A moderating relationship between the math anxiety and computer anxiety was discovered by [30]. [19], who examined the definition, measurements, and correlates of computer anxiety, also found that computer anxiety is similar in nature to math anxiety and test anxiety. On the other hand, [31, 32, 30] found a moderate relationship between math anxiety and computer anxiety. It can generally be concluded from the results of the majority of these studies that a positive correlation exists between math anxiety and computer anxiety. Table 2 summarizes the results of previous studies on the relationship between math anxiety and computer anxiety.

Table 2: Summary of Findings - Relational of Math Anxiety and Computer Anxiety

[16]	Students with low anxiety toward mathematics and computers prefer science courses
[15], [11]	Mathematics anxiety and Math anxiety are similar
[17], [18]	Computer anxiety and Math anxiety are similar
[30]	A moderate relationship was found between math and computer anxiety
[32], [19]	Relationship between math and computer anxiety is not strong Computer anxiety is similar in nature to math/test anxiety

Step 3: Computer anxiety and performance

The review of a number of studies indicates conflicting results regarding the relationship between computer anxiety and performance. For example, [33, 20] found that performance on examinations was not unduly affected by computer administration of the tests. [34] found that extroverts and subjects with low computer anxiety obtained significantly lower scores on a computer version of the GRE than did their counterparts.

[35] who investigated the effects of a computerized test incorporating traditional test formats on student performance, anxiety level, or attitude toward the computer, found no difference in student performance but a significant difference in anxiety level among students. [36] conducted two experiments to determine whether scores on computerized tests would significantly differ from scores of tests using a paper-and-pencil format. Their results showed reduced performance on computerized tests. However, the student's reduced performance was not related to computer anxiety or computer familiarity.

[37] who examined factors related to computer anxiety as measured by the Computer Anxiety Index (CAIN), found that performance was inversely related to computer anxiety. They further discovered that students with more computer experience had lower computer anxiety than did students with less experience. The results of both studies indicate that students with a more positive attitude toward computers and calculators perform better than do students with more negative attitudes [38]. Feelings

of anxiety toward computers were also found to negatively influence students' computer use [39] and subsequent performance. [39] further found that computer self-efficacy (judgment of one's ability to use a computer) provides additional insight into an individual's willingness to use computers.

[40] demonstrated the use of command lines and a graphical interface in a communication research course in order to compare the anxiety level of users. The subjects in Caplan's study ran a computer program using either command lines or a graphical interface. Pre-tests and post-tests measured the participants' computer anxiety. Results indicated that the interface type did not have an effect on subjects' level of computer anxiety for novice users.

These results show that the relationship between computer anxiety and performance is unclear. Reduced performance can be attributed to factors other than computer anxiety. For example, an individual taking a test using a computer may have more anxiety due to the test rather than using the computer. The cause of reduced performance in such a case is not apparent. However, using the results of steps 1 and 2, a relationship between computer anxiety and performance can be hypothesized. Table 3 summarizes the research findings regarding the relationship between computer anxiety and performance.

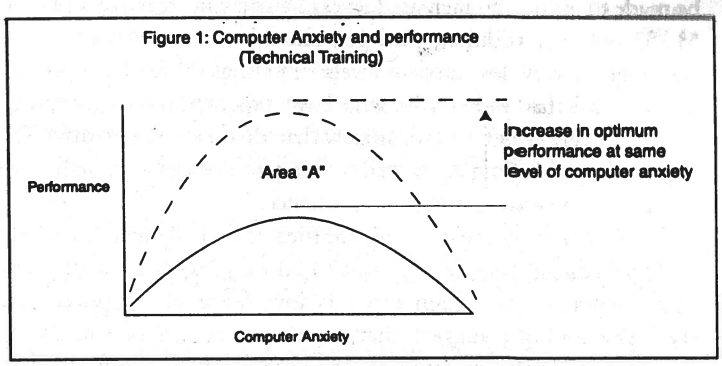
Table 3: Summary of Findings - Relationship between Computer Anxiety and Performance

[36]	Reduced performance is not related to computer anxiety or computer familiarity
[56]	Teaching anxiety management skills may be most appropriate when software is relatively difficult to use
[57]	Computer anxiety is a valid construct and it can affect performance by serving as a stressor and possibility it can be lowered in certain training situations
[45]	Expanded instructional format does not significantly affect computer anxiety/performance
[58], [37]	Computer anxiety and performance are inversely related
[46]	Familiarity with keyboarding skills increases awareness and understanding about computers and decrease anxiety
[35]	Computerized tests produced no differences in performance but a significant differences in anxiety levels
[5]	No significant relation between computer anxiety, performance, or the use of microcomputer
[1]	Computer Anxiety does not affect the ability of individuals to use computers
[29]	An unwillingness to learn about computers is not related to negative attitudes or beliefs about computers
[59]	How long computer anxiety persists is a function of the work environment and the training received, rather that a lack of desire
[3]	Gender, age, and job title are related significantly to computer anxiety
[2], [60]	gender is highly correlated with computer anxiety. Computer training decreased computer anxiety and had an indirect effect on attitude toward microcomputers

Proposed relationship model between computer anxiety and performance

Because math anxiety and performance are negatively related and math anxiety and computer anxiety are positively related, it is reasonable to posit that a negative relationship exists between computer anxiety and performance. However, studies of computer anxiety and performance indicate contradictory results. Thus, there is reasonable doubt concerning a definitive relationship between the computer anxiety and performance. Also, in all the studies, the effects of anxiety were assumed to be linear. However, the effect of test anxiety may depend on the amount of anxiety experienced [22]. Moderate levels of math anxiety may facilitate achievement striving, whereas extremely high levels of anxiety levels may disrupt performance.

It is reasonable to deduce, based on these studies, that computer anxiety and performance are related in a shape of an inverted cup (see Figure 1). Very low levels and very high levels of computer anxiety produce low levels of performance, whereas moderate levels of computer anxiety appear to provide the best performance.



DISCUSSION AND RECOMMENDATIONS

Inverted cup relationships are not uncommon and have been suggested in goal setting theory and achievement motivation research, [14, 42, 43]. The relationship between computer anxiety and performance is similar to the relationship previously proposed by [44]. These relationships are not unlike those found during Locke's research on goal setting [44]. [44] found that very difficult and very easy goals produce lower levels of performance then do moderate goals; that is, moderate goals produce the best performance.

Causes and Remedies for reducing computer anxiety

[45] concluded that although prior computer use does not affect computer anxiety or performance, training instruction is effective in reducing computer anxiety. [46], who investigated the relationship between keyboarding skills and computer anxiety, found that keyboarding is a basic skill related to the efficient use of computers. Familiarity with the keyboard stimulates the interests and enables an individual to improve his or her awareness and understanding of computers. Thus, familiarity results in reduced anxiety and a potential for improved performance. [1] study results do not support the contention that women generally exhibit higher levels of computer anxiety than do men. [1] also found that perceived knowledge rather than experience is a predictor of computer anxiety.

Several other researches have suggested various techniques for treating high levels of anxiety and improving performance [14, 48, 10, 49]. [49] found that computer anxiety stems from three roots: psychological, educational, and operational. All three roots are treated differentially. While it is difficult to treat psychological roots, educational roots can be treated by providing related education and training. Operational roots can be treated by providing hands-on training in new technology.

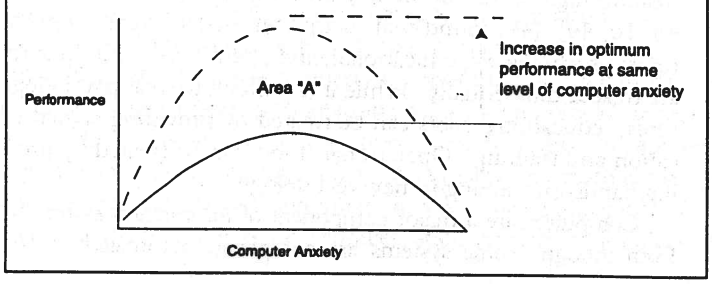
Computers are a major component of information systems (IS). Even though some systems are completely automated, there are

applications of computers in IS where human interaction is inevitable (e.g., banking, manufacturing, reservation and inventory systems). In operating these systems, human intervention is critical to monitoring proper operation of the computer programs. Individuals with high levels of computer anxiety using these applications may not perform at the optimum level. In such cases it is important to take remedial action to reduce their computer anxiety. If a moderate level of anxiety produces highest levels of performance, then an attempt should be made to induce an increased level of anxiety in employees [47, 50, 51, 52, 48]. In addition, managers should be careful not to create very high or very low anxiety levels. Findings of this meta analysis also indicate that individuals who have experience with computers show relatively lower level of anxiety than do their counterparts. This implies that providing additional training to novices with high levels of anxiety may enhance their performance.

These findings create opportunities and challenges for industrial and educational institutions to create jobs, assignments, and tasks, that avoid very high and very low levels of computer anxiety. The authors suggest that an empirical test of this model should include the measure of task complexity, individuals' ability and experience, education level, and general anxiety level. One issue that needs examination is the two types of anxiety: state anxiety, which is caused by the situation at hand and trait anxiety, which is defined as the disposition to react with worry, tension, and fear of failure in an evaluative situation [7, 8].

Performance could be improved in two ways: technical training and psychological training. For example, state anxiety could probably be treated using various techniques such as extensive training based on an explanation of the reason for using a computer and how it can help alleviate tedious elements of the task (see Figure 1, Area A). However, trait anxiety requires special attention because it is more than a situational phenomenon. Further research is needed to determine the interaction of trait anxiety and computer-related performance. In order to sustain the performance of an individual at an acceptable level for a longer period (see Figure 2, Area B), an individual could be given behavioral and rigorous technical training in various computer applications. There appears to be two separate areas of research in treating computer-related anxiety and its effect on an individual's performance. One is the behavioral training; the other is technical training. Behavioral training research will provide a better understanding of how to maintain an individual's performance level at higher levels of anxiety. Technical training research will help managers in the design of training programs that will enhance an individual's performance at a certain level of anxiety.

Figure 1: Computer Anxiety and performance (Technical Training)



CONCLUSION

Industry and academia are working jointly in defining the curriculum for students so that students are prepared for the new technology when they join the work force. In addition managers require that their employees keep up with technological change by upgrading their skills through internal and external training programs. This paper serves as a guide for these trainers and educators who provide adequate training for those individuals who have high levels of computer anxiety. A key to the successful transition to a new computer environment is to identify factors that invoke anxiety and reduce their effects. One viable solution is to provide both behavioral training and technical training to those individuals who are better performers but have a high level of anxiety. A study by [51] suggests that in business environments, adult workers should be trained to become proficient in the areas of word processing, communications, and data unloads. The way to achieve this is to provide formal classroom training, training literature and computer-based training. If new hardware and software create special anxieties, the companies should provide customized training where the instructors draw on real tasks as examples [50]. In conclusion, for better productivity and profitable business, organizations should not overlook any indications of anxiety among employees during transition to and implementing of a new information technology.

BIBLIOGRAPHY

1. Anderson, Alastair A. "Predictors of Computer Anxiety and Performance in Information Systems.@ Computers in Human Behavior L2.1 (1996): 61-77.
2. Colley, Ann M., Matthew T.Gale, and Teri A. Harris, "Effects of Gender Role Identity and Experience on Computer Attitude Components.@ Journal of Educational Computing Research 10.2 (1994): 129-137.
3. Dyck, Jennifer L. and Janan Al Awar Smither, "Age Difference in Computer Anxiety: The Role of Computer Experience, gender and education.@ Journal of Educational Computing Research 10.3 (1994): 239-248.
4. Lankford, J. Scott and Others. "Computerized versus Standard Personality Measures: Equivalency, Computer Anxiety, and Gender Differences.@ Computers in Human Behavior 10.4, (Winter 1994): 497-510.
5. Charness, Neil, Cynthia E. Schumann, and Gayla M. Boritz, "Training Older Adults in Word Processing: Effects of Age, Training Technique, and Computer Anxiety.@ International Journal of Technology and Aging 5.1 (SpringSummer 1992): 79-106.
6. Chin, Christine H., Stuart J. Donn, and Robert F. Conry, "Effects of Computer-Based Tests on the Achievement, Anxiety, and Attitudes of Grade 10 Science Students.@ Educational and Psychological Measurement 51.3 (Fall 1991): 735-745.
7. Mikulincer, Mario, Peri Kedem, and Dov Paz, "Anxiety and Categorization- I. The Structure and Boundaries of Mental Categories.@ Personality and Individual Differences 11.8 (1990): 805-814.
8. Mikulincer, Mario, Dov Paz, and Peri Kedem, "Anxiety and Categorization-2. The Structure and Boundaries of Mental Categories.@ Personality and Individual Differences 11.8 (1990): 815-821.

9. Parasuraman, Saroj, and Magid Igbaria, "An examination of gender differences in the determinants of computer anxiety and attitudes toward microcomputers among managers.@ International Journal Man-Machine Studies 32.3 (March 1990): 327-340.

10. Gilroy, F.D., and H.B. Desai, "Computer anxiety: sex, race, and age.@ International Journal Man-Machine Studies 25 (1986): 711-719.

11. Igbaria, Magid and Saroj Parasuraman, "A Path Analytic Study of Individual Characteristics, Computer Anxiety and Attitudes Toward Microcomputers.@ Journal of Management 15.3 (September 1989): 373-388.

12. Hearne, Dixon J., Mary S. Poplin, and Jim Lasley, "Predicting Mathematics Achievement From Measures of Computer Aptitude in Junior High Students.@ Educational Research Ouarterly 10.4 (1986-1987): 18-24.

13. Schmidt, Frank L., John E. Hunter, and Alice N. Outerbridge, "Impact of Job Experience and Ability on Job Knowledge, Work Sample Performance, and Supervisory Ratings of Job Performance.@ Journal of Applied Psvchology 71.3 (1986): 432-439.

14. Waldman, David A. and Bruce I. Avolio, "A Meta-Analysis of Age Differences in Job Performance.@ Journal of Applied Psvchology 71.1 (1986): 33-38.

15. Shashaani, Lily. "Gender Differences in Mathematics Experience and Attitude and Their Relation to Computer Attitude.@ Educational Psvchology 35.3, (May-June 1995): 32-38.

16. Livingston, Mary M., Margaret W. Maxfield, Billy J. Attebery,and Theodore R. Portis, "Who Takes Science: Preliminary Findings Regarding Changing Perceptions of Computers.@ Psychological Reports 67.3 Part I (December 1990): 1057-1058.

17. Farina, Francisca, R. Arce, J. Sobral, and R. Carames, "Predictors of anxiety towards computers.@ Computers in Human Behavior 7.4 (1991): 263-267.

18. Dambrot, Faye-H. "Correlates of Sex Differences in Attitudes toward and Involvement with Computers.@ Journal of Vocational Behavior 27.1 (Aug 1985):71-86.

19. Cambre, Marjorie A. and Desmond L. Cook, "Computer Anxiety: Definition, Measurement, and Correlates.@ Journal of Educational Computing Research 1.1 (1985):37-54.

20. Kim' JinGyu and James E. McLean, "The Relationships between Individual Difference Variables and Test Performance in Computerized Adaptive Testing.@ Paper Presented at the Annual Meeting of the Mid-South Educational Research Association, Nashville, TN, (November 9-11, 1994):13.

21. Yeaman, Andrew R. J. "Seven Myths of Computerism.@ TechTrends 37.2 (1992): 22-26.

22. Meece, Judith L., Allan Wigfield, and Jacquelynne S. Eccles, "Predictors of Math Anxiety and its Influence on Young Adolescents' Course Enrollment and Performance in Mathematics.@ Journal of Educational Psychology 82.1 (March 1990): 60-70.

23. Hyde, Janet S., Elizabeth Fennema, Marilyn Ryan, and Laurie A. Frost, AGender Comparisons of Mathematics Attitudes and Affect: A Meta-Analysis.@ Psychology of Women Ouarterly 14.3 (September, 1990): 299-324.

24. Green, LuEthel T. "Test Anxiety, Mathematics anxiety, and Teacher Comments: Relationships to Achievement in Remedial Mathematics Classes.@ Journal of Negro Education 59.3 (1990): 320-335.

25. Engelhard, George. "Math Anxiety, Mother's Education, and the Mathematics Performance of Adolescent Boys and Girls: Evidence from the United States and Thailand.@ Journal of Psychology 124.3 (May 1990): 289-298.

26. Hunsley, John. "Cognitive Processes in Mathematics Anxiety and Test Anxiety: The Role of Appraisals, Internal Dialogue, and Attributions.@ Journal of Educational Psychology 79.4 (December 1987): 388-392.

27. Trice, Ashton D. and Epp D. Ogden, "Correlates of Mathematics Anxiety in First Year Elementary School Teachers.@ Educational Research Ouarterly 11.3 (1986-1987): 2-4.

28. Schumacher, Phyllis and Others. "Computer Experiences, Attitudes, Computer and Mathematical Anxiety, and Grades of MBA Students.@ Collegiate Microcomputer 11.3, (Aug 1993): 183-193.

29. Sievert, Mary Ellen, Rosie Albritton, Paula Roper, and Nina Clayton, "Investigating Computer Anxiety in an Academic Library.@ Information Technology & Libraries 7.3 (September 1988): 243-252.

30. Bellando, Jayne and Jane Winer, "Computer Anxiety, Mathematics Anxiety, and Holland Vocational Personality Types.@ The Journal of Computers in Mathematics and Science Teaching, 8. I (1989): 22-24.

31. Fletcher, William E. And Jacquelyn P. Deeds. "Computer Anxiety and Other Factors Preventing Computer Use among United States Secondary Agricultural Educators.@ Journal of Agricultural Education 35.2, (1994): 16-21.

32. Todman, John and Helen Lawrenson. "Computer Anxiety in Primary School Children and University Students.@ British Educational Research Journal 18.1, (1992): 63-72.

33. Powers, Donald E. And Katheleen O'Neill. "Inexperienced and Anxious Computer Users: Coping with a Computer--Administered Test of Academic Skills.@ The Praxis Series: Professional Assessments for Beginning Teachers Educational Testing Service, Princeton, NJ(1992).

34. Vogel, Lora Ann. "Explaining Performance on P&P versus Computer Mode of Administration for the Verbal Section of the Graduate Record Exam.@ Journal of Educational Computing Research 11.4 (1994): 369-383.

35. Ward, Thomas J. "The Effects of Computerized Tests on the Performance and Attitudes of College Students.@ Journal of Educational Computing Research 5.3 (1989): 327-333.

36. Dimock, Paul H. and Pierre Cormier, "The effects of format differences and computer experience on performance and anxiety on a computer-administered test.@ Measurement and Evaluation in Counseling and Development 24.3 (Oct 1991): 119-126.

37. Hayek, Linda M. and Larry Stephens, "Factors Affecting Computer Anxiety in High School Computer Science Students.@ Journal of Computers in Mathematics and Science Teaching 8.4 (Sum 1989):73-76.

38. Munger, Gail F. and Brenda H. Loyd, "Gender and Attitudes toward Computers and Calculators: Their Relationship to Math Performance.@ Journal of Educational Computing Research 5.2 (1989): 167-77.

39. Compeau, Deborah R. and Christopher A. Higgens, "Computer Self-Efficacy: Development of a Measure and Initial Test.@ MIS Ouarterlv (1995): 189-206.

40. Caplan, Richard E. "An Analysis of the User of Command Line Graphic Interface in Computer Instruction for the Communication Research Course.@ Annual Meeting of the Central States Communications Association, Chicago, April, 1991.

41. Chesney, Amelia, and Edwin A. Locke, "Relationship Among Goal Diffficulty, Business Strategies, and Performance on a Complex Management Simulation Task.@ Academv of Management Journal 34.2 (June 1991): 400-424.

42. Shapira, Zur. "Task Choice and Assigned Goals as Determinants of Task Motivation and Performance. "Organizational Behavior & Human Decision Processes 44.2 (October 1989): 141-165.

43. Wood, Robert E., Anthony J. Mento, and Edwin A. Locke, "Task Complexity as a Moderator of Goal Effects: A Meta-Analysis.@ Journal of Applied Psychology 72.3 (1987): 416-425.

44. Locke, E. A. "Relationship of Goal Level to Performance Level.@ Psychological Reports 20 (1967): 1068.

45. Overbaugh, Richard C. and Michael W. Reed, "The Effects of Brief Instructional Activities on Teacher Education Students' Computer Anxiety and Performance.@ Paper presented at the Eastern Educational Research Association (Clearwater, FL, March 1990):14.

46. Artwohl, Mary Jane. "What Research Says about Keyboarding Skills and Computer Anxiety.@ ERIC, 1989, ED312444.

47. Kliem, Ralph L. "What Happens After Software Training?" Office 113.2 (February 1991): 16-18,30.

48. Castellano, Mary and Elias M. Awad, "Computer Phobia: Four-Point Approach Helps End Users Overcome Anxieties.@ Data Management 25.9 (September 1987): 12-14.

49. Howard, G. S. and R. Smith, "Computer anxi,' in management reality?@ Communications of the ACM 29.7 (1986): 611-615.

50. First, Sharon Efroymson. "All Systems Go: How to Manage Technological Change.@ Working Woman 15.4 (April 1990): 47-54.

51. Steizer, Patrick T. and Robert A. Gray, "Training Adults to Use Microcomputers: A Technical and Psychological Approach.@ Government Accountants Journal 37.3 (Fall 1988): 35-39.

52. Brown, Jane L. "Emphasizing Revision with Word Processing in Freshman English Classes.@ Paper presented at the Annual Meeting of the Southeastern Writing Center Association (5th, Atlanta, GA, April 18-20, 1985): 11.

53. Covington, Martin and Carol L. Omelich, Al Knew It Cold Before the Exam': A Test of the Anxiety-Blockage Hypothesis.@ Journal of Educational Psychological 79.4 (1987): 393-400.

54. Dew, Kathleen H., John P. Galassi, and Merna D. Galassi, "Math Anxiety: Relation with Situational Test Anxiety, Performance, Physiological Arousal, and Math Avoidance Behavior.@ Journal of Counseling Psychology 31.4 (October 1984): 581-584.

55. Dew, Kathleen H. and John P. Galassi "Mathematical Anxiety: Some Basic Issues.@ Journal of Counseling Psvchology 30.3 (July 1983): 443-448.

56. Bloom, Arvid J. and Jacob E. Hautaluoma, "Anxiety management training as a strategy for enhancing computer user performance.@ Computers in Human Behavior 6.4 (1990): 337-349.

57. Harrington, Kermith V. "Computer anxiety: A cloud on the horizon of technological interventions.@ Organization Development Journal 6.3 (Fall 1988): 51-55.

58. George, Clay E., Scott J. Lankford, and Sheri E. Wilson, "The effects of Computerized versus Paper-and-Pencil Administration on Measures of Negative Affect.@ Computers in Human Behavior 8.2,3 (1992): 203-209.

59. Torkzadeh, Gholamreza, and Imma E. Angulo, "The concept and correlates of computer anxiety.@ Behavior and Information Technology 11.2 (Mar-Apr 1992): 99-108.

60. Igbaria, Magid and Alok Chakrabarti, "Computer anxiety and attitudes towards microcomputer use.@ Behavior and Information Technology 9.3 (May-June 1990): 229-241.

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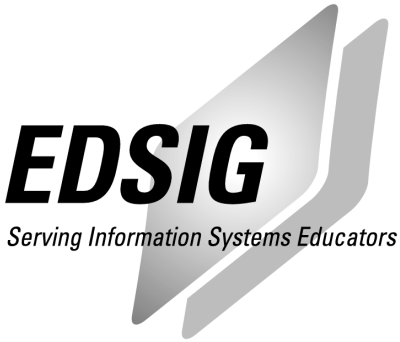

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ISSN 1055-3096