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INTRODUCTION

The proliferation of personal computers throughout business environments will continue to place demands on workers at all levels to develop proficient computer skills. A variety of training mechanisms exist that allow workers to introduce, develop, and hone any needed computer skills. Identical training mechanisms, however, are nonetheless likely to result in individuals with different computer abilities (Hicks, Hicks, and Senn, 1991).

Existing research has examined differences in demographic factors (Dambrot, Silling, and Zook; 1988) as well as differences in attitudes (Torkzadeh and Koufteros, 1993). Much of the research that has examined this area has focused on the changes in attitudes (e.g. computer anxiety) that occur due to a training intervention. Research to date, however, has not extended this effect of training on attitudes as well as to performance.

The theory of reasoned action (TRA) (Fishbein and Ajzen, 1975) suggests that attitudes will influence behavior, including performance. The Technology Acceptance Model (TAM) (Davis, Bagozzi, and Warshaw, 1989) also suggests that attitudes towards use directly influence intentions to use the computer and ultimately actual computer use. Davis et al. demonstrate that an individual's initial attitudes regarding a computer's ease of use and a computer's usefulness influence attitudes toward use. In addition to the attitudes of computer ease of use and computer usefulness, a number of other attitudes related to computer use have been identified in the research literature.

Items measuring attitudes examined in this study have been previously defined and used in other studies. The attitudes and measures used in this study were perceived usefulness , perceived ease of use (Davis et al. 1989), computer anxiety (Loyd and Gressard, 1984), anticipation of computer use (Heinssen, Glass, and Knight, 1987), fear of computer use (Heinssen et al.,1987), and attitude toward previous academic achievement.

Computer anxiety has been an attitude of primary focus that corresponds closely to the concept of math anxiety (Torkzadeh and Angulo, 1992). Although computer anxiety has definitions ranging from psychological, physical or sociological discomfort to fear. The definition of anxiety in this research referred to the psychological discomfort that might

come from using a computer. This discomfort might come from using something unknown, concern over making mistakes or destroying pertinent information. In addition to measuring computer anxiety, we also wanted to measure computer fear. Although extreme anxiety might become fear, there is a distinction between the two constructs. Fear was defined as a trepidation that computers would change something about the individual, such as making the person too dependent on computers. Anticipation was defined as comfort with the idea of learning and using computer skills (Harrison and Ranier, 1992). Academic achievement provided a perceived measure of a subject's past performance in both math and other academic endeavors.

The perceived ease of use and usefulness constructs have been well established in the work by Davis et al. (Davis, 1989; Davis, Bagozzi, and Warshaw, 1992). Perceived usefulness was defined as "the degree to which a person believes that using a particular system would enhance his or her job performance". Perceived ease of use was defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, pg. 320).

RESEARCH STUDY

Subjects in this study were students enrolled in an introductory computer course at a large midwestern university. The course consists of class time in a computer laboratory two days a week to provide hands on training of computer skills (DOS, Windows, Lotus 1-2-3, and Paradox). In addition, a one day per week lecture is required that provides conceptual information pertaining to technology and the use of computers. Subjects were given a questionnaire the first day of class before students had any class exposure to computers. A second questionnaire was used to collect data after fifteen weeks of training. At this point, students had completed eight DOS/Lotus/Paradox assignments in addition to performing two 2 hour practical examinations. The examination scores (averaged and converted to a z-score) as a measure of performance were the dependent variable in this study. A total of 959 subjects completed both exams and both questionnaires.

RESULTS

Factor analysis was performed on the items used in the questionnaire. The following factors were identified along with the corresponding reliability coefficient: 1) perceived ease of use (.95), 2) perceived usefulness (.96), 3) anxiety (.92), 4) fear (.76), 5) anticipation (.74), and 6) academic achievement (only two items so reliability could not be calculated). The minimal factor loading was .50 with most factor loadings .70 or greater. The psychometric properties of the instrument were considered acceptable (Nunnally, 1978).

In order to examine the effect of training on attitudes as well as the effects of attitudes on performance, correlation techniques were used. Table 1 illustrates the correlation coefficients of attitudes at each time period and attitudes and performance. All of these correlations were significant at the .05 level.

In order to better understand the effect of training and its effect on potential changes in attitudes over time, t-tests were run between initial and final attitudes on performance. These results are contained in Table 2.

Table 1

Correlation Matrix of Attitudes After Training and on Performance

Attitude (Time 1) Attitude (Time 2)		Attitude (Time 1) Performance		Attitude (Time 2) Performance	
Ease of Use	.36*	Ease of Use T1	.15*	Ease of Use T2	.28*
Usefulness	.14*	Usefulness T1	.15*	Usefulness T2	.17*
Anxiety	.66*	Anxiety T1	-.17*	Anxiety T2	-.32*
Fear	.38*	Fear T1	-.12*	Fear T2	-.14*
Anticipation	.49*	Anticipation T1	.11*	Anticipation T2	-.19*
Achievement	.38*	Achievement T1	-.19*	Achievement T2	-.14*

Table 2

Changes in Attitudes Related to Training and Computer Use

t-test comparison	Mean Time 1	Mean Time 2	t-value	p-value
Ease of use	3.44	3.66	5.835	.000*
Usefulness	4.40	4.36	.941	.347
Anxiety	3.44	3.73	-11.515	.000*
Fear	4.02	4.05	-.867	.386
Anticipation	2.07	2.11	-1.677	.094
Achievement	2.07	2.19	-3.860	.000*

DISCUSSION

All of the attitudes examined exhibit a significant relationship with performance. Subjects who perceive computers to be easier to use and who perceive computers as useful tend to exhibit greater skill performance. The ease of use/performance relationship is significant across the two time periods where training and computer use occurred. The relationship between ease of use and performance almost doubles across the training intervention (correlation of.15 to .28).

In addition, our results increased fear and anxiety are related to decreases in skill performance. This finding is particularly interesting when examined over time and training. The negative correlation between anxiety an performance actually increased over fifteen weeks of training and mandatory system use and is highly significant as indicated by the t-test results. This finding suggests that subjects who exhibit computer anxiety prior the class are likely to continue to be anxious about computer use after going through training (correlation of .66). This suggests that training and use of a computer does not mitigate subject anxiety. Training and computer use may reinforce anxiety in students who indicated high initial anxiety and ultimately results in poor performance.

These findings have direct ramifications for both student and end-user computer performance. Although training techniques differ (and some training techniques may result in different findings), these findings would suggest that to facilitate the successful teaching of computer skills, a given training method should include a component to focus on attitude change. Specifically, training mechanisms should emphasize the ease with which work can be accomplished using a specific computer tool.

Another component of training should focus on attitudes related to computer anxiety. It may be appropriate to measure initial anxiety in order to identify those students high in computer anxiety early in the training process. If these students are identified, an intervention, such as increased one-on-one instructor and student training might be considered to overcome the feelings of computer anxiety. Future research in this area should try to ascertain what factors cause students to be anxious as well as methods which can be used to reduce computer anxiety.

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