# Motivational influences on computer-related affective states

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## Abstract

Previous studies have established the importance of computer-related affective variables in predicting user satisfaction, frequency of use, and students academic performance. This study examined the effects of motivation to learn to use computers, and previous experience with computers on three computer-related affective states: anxiety, attitudes, and self-efficacy. Participants included 59 male and 52 female university and college students enrolled in introductory computer programming and fundamental courses. Gender differences were found in previous experience with computers, as well as most of the motivation, and all of the affective variables. A path analysis was used to further investigate these relations and to examine their effect on academic performance in introductory computer classes. Results supported the theoretical model, with some modifications. Gender differences in structure were negligible. Finally, students were grouped according to reasons for taking the course: intrinsic, extrinsic, or both. Significant differences among the three groups were found for six of the 10 variables, in all cases favoring an intrinsic motivational orientation. © 1999 Elsevier Science Ltd. All rights reserved.

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## 1. Introduction

Computers are rapidly becoming an important component within peoples lives today. Whether at home, school, or at work, many people today are required to use computers or computer based information systems, and need computing skills, to perform effectively at a variety of different tasks (Harrison & Rainer, 1992a; Rainer & Harrison, 1993; Rockart & Flannery, 1983). However, studies have indicated that

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many students and employees have difficulty, and even resist, using computers (Alavi & Henderson, 1981; Heinssen, Glass & Knight, 1987; Nickerson, 1981; Swanson, 1988). In fact, according to Swanson (1988), understanding why people accept or reject computer technology has proven to be one of the most important issues in information systems research. Harrison and Rainer (1992b) point to three main causes of such resistance toward computer technology: negative attitudes toward computers, anxiety toward computer use, and low computer self-efficacy. The purpose of this study was to examine how motivation to learn to use computers affects computer-related attitudes, anxiety, and self-efficacy.

## 1.1. Attitudes toward computers

Of these three factors, attitudes towards computer technology has been most extensively studied. Previous research suggests that attitudes play a key role in predicting user satisfaction (Bailey & Person, 1983; Ives, Olson & Baroudi, 1983), frequency of use (Baroudi, Olson & Ives,1986; Lucas, 1978; Robey, 1979; Swanson, 1982), and students academic performance (Al-Nahar, 1992; Anderson & Hornby, 1996; Mickelson, 1990; Multon, Brown & Lent, 1991). Many studies have also focused on the effects of gender on attitudes toward computers (Colley, Gale & Harris, 1994; Gressard & Loyd, 1987; Loyd & Gressard, 1984a; Pope, Donald & Twing, 1991; Whitley, 1997). Although these studies have generally found that males hold more positive attitudes toward computers than do females, other studies, such as that by Anderson and Hornby (1996), have found no direct relationship between gender and attitudes.

Attitudes and beliefs have long been known to play an integral role in predicting human behavior (Ajzen & Fishbein, 1980). Ajzen and Fishbeins' (1980) theory of reasoned action has been successful in explaining behavior across a wide variety of situations. In general, the theory of reasoned action proposes that attitudes toward an object arise from the relevant beliefs about that object. According to the theory of reasoned action, an individual's attitude toward a given behavior is a function of his or her salient beliefs about the consequences of performing that behavior, multiplied by the evaluation of those consequences. This attitude is combined with subjective norms, which are one's beliefs about the behavior desired by others and one's motivation to comply. This combination of attitudes and subjective norms leads to behavioral intentions, which in turn influence actual behavior toward the target. For example, based on this theory, whether or not a student learns a new computer application would be a function of his/her attitude. This attitude would be comprised of beliefs such as "the application is useful" (positively evaluated), "learning is enjoyable" (positively evaluated), "the application is time consuming to learn" (negatively evaluated), and so on. These beliefs interact with beliefs about what important others wish the student to do and the students motivation to do what those persons favor (e.g. "my professor and my best friend said that I should learn it and I think I should comply"). The combination of these facets produce the intention to learn the computer application. This intention then leads to action. While the theory of reasoned action is a very general model for explaining

behavior, it was, "...designed to explain virtually any human behavior" (Ajzen & Fishbein, 1980, p. 4), and has been useful in explaining the link between computer attitudes and computer usage (Rainer & Miller, 1996).

Studies of information systems have used behavioral intention models drawn from social psychology as potential theoretical foundations for research on the determinants of user behavior (Christie, 1981; Swanson, 1982). An adaptation of the theory of reasoned action, Davis' (1986) technology acceptance model, has been useful in explaining computer user's behavior. This model was designed specifically to explain and predict computer use—tracing the impact of external factors on internal beliefs, attitudes, and intentions (Davis, Bagozzi & Warshaw, 1989). According to the technology acceptance model, computer attitudes are determined both by the perceived ease of use, and the perceived usefulness of the system (Davis et al., 1989). This model suggests that external variables, such as motivation, influence user attitudes indirectly; that is by altering the users perception of ease of use and usefulness.

## 1.2. Self-efficacy and computer-related anxiety

Based on Bandura's (1977,1982) theory of self-efficacy, it follows that the easier a system is to use, the greater should be ones' perception of self-efficacy, and personal control over computer-related knowledge and skills. Bandura (1986, p. 391) defines self-efficacy as a "generative capability in which cognitive, social, and behavioral subskills must be organized into integrated courses of action to serve innumerable purpose". Murphy, Coover and Owen (1989) define computer-related self-efficacy as ones' perception of their capabilities regarding specific computer-related knowledge and skills. According to Bandura (1986), it is one's self-efficacy beliefs that significantly determine performance outcomes, not necessarily the underlying skills one possesses with regards to the task. For example, even a computer-proficient individual might perform a job poorly, quit at the first sign of difficulty, or avoid computer usage because he or she lacks the confidence that comes from self-efficacy beliefs. Studies have shown that self-efficacy influences choice of behavioral activities, effort expenditure, persistence, and task performance (Multon, et al., 1991).

In addition to attitudes towards computers and computer self-efficacy, computer anxiety is also thought to have an impact on computer usage. Raub (1981), describes computer anxiety as a form of "state anxiety", with the computer representing a personally threatening stimulus. She conceptualizes computer anxiety to be a multi-dimensional construct composed of appreciation for computers, computer usage anxiety, and anxiety concerning the negative impact of computers on society. Weinberg (1980, as cited by Harrison & Rainer 1992, p. 736), further describes computer anxiety as "a response to interaction or anticipation of interaction with automated data or information processing systems". Students experience varying degrees of anxiety when required to use or even learn about computers—sometimes referred to as "computer phobia" (Jay, 1981). According to Rosen, Sears and Michell (1987, p. 179), in addition to anxiety, "computerphobics" often display negative attitudes toward computers, and may even engage in internal self-critical dialogues when interacting with computers.

The majority of the research conducted to explain computer anxiety has focused on its relation to math anxiety, with some researchers reporting significant positive correlations between computer anxiety and math anxiety (Dambrot, Watkins-Malek, Sillings, Marshall & Garver, 1985; Marcoulides, 1988). However, the majority of this research is only successful in explaining anxiety experienced in the area of advanced computer programming, and fails to explain the relationship between math anxiety and computer anxiety for those who are not involved with high level programming (Bandolas & Benson, 1990).

Bandura (1977, 1982, 1986) has developed an extensive theory aimed at explaining the role of self-referent thought in guiding human action and change. In this model, he explains that anxiety reduction is, in part, the result of strengthening one's efficacy expectations. In the present study, self-efficacy expectations for learning were measured along with perceptions of computer-related self-efficacy, and it was hypothesized that strong self-efficacy expectations for learning would lead to lower computer-related anxiety. Furthermore, some researchers have extended Bandura's self-efficacy theory into areas such as the understanding and prediction of academic achievement and performance in the work place. Results have shown that a strong positive relationship exists between self-efficacy beliefs, and both academic performance (Brown, Lent & Larkin, 1989; Multon et al., 1991), and performance in the work place (Harrison, Rainer, Hochwarter & Thompson, 1997). Given the importance of computers in both of these areas, it was hypothesized that computer-related self-efficacy would be a strong predictor of academic performance in computer classes.

In an unpublished study Gressard and Loyd (1984) found computer anxiety to be highly correlated with computer confidence and computer liking. Subsequent research has also found that persons with more computer experience show significantly higher levels of computer confidence, computer liking, and lower computer anxiety, than do subjects with little experience (Loyd & Gressard, 1984a). Therefore, it was predicted that computer anxiety would be negatively related to previous experience, as well as attitudes toward computers, and computer self-efficacy.

Similar to the research on attitudes toward computers, studies have shown that gender differences exist in computer-related self-efficacy and computer-related anxiety. More specifically, studies have found that compared to females, males tend to hold higher perceptions of self-efficacy (Busch, 1995; Whitley, 1997) and experience lower levels of anxiety (Okebukola & Woda, 1993; Whitley, 1997).

The majority of the previous research on computer attitudes, computer self-efficacy, and computer anxiety has attempted to demonstrate their effect on variables such as computer usage, performance in the work place, and academic performance. The present study attempts to expand the explanation of such factors by examining the possible antecedent factors that predict computer attitudes, self-efficacy, and anxiety. It is proposed that computer attitudes, anxiety, and self-efficacy stem from a combination of experience with computers and motivation to learn computers.

Previous research into the factors determining student attitudes toward computers has generally found that one of the most important factors is prior experience using computers (Anderson, 1996; Anderson & Hornby, 1996; Arthur & Olson, 1991; Colley et al. 1994; Hawk, 1989). Although, as Anderson and Hornby (1996) point

out, it is unclear whether computer experience produces more positive attitudes or that people with positive attitudes toward computers tend to seek out more computer experience. Hence, further investigation into the external and internal factors affecting computer attitudes and related variables is necessary.

Another factor known to influence attitudes, anxiety, and self-efficacy is motivation. However, there has been very little research done on the effects of motivation to learn to use computers on subsequent usage. Davis, Bagozzi and Warshaw (1992), have reported that the perceived usefulness of the system (extrinsic motivation), and perceived enjoyment (intrinsic motivation), have a significant effect on intentions to use a word processing system. Also, Coovert and Goldstein (1980) found a direct relationship between locus of control and attitudes toward computers. In particular, they reported that persons with an internal locus of control displayed more positive attitudes than those with an external locus of control (Coovert & Goldstein, 1980).

## 1.3. The present study

The present study examined motivation to learn to use computers from a cognitive perspective; with a focus on the relationship between two motivational constructs (expectancy, and value), and computer-related attitudes, anxiety, and self-efficacy. The expectancy-value approach to understanding motivation can be traced back to the theories of Tolman (1932) and Lewin (1938). The basic idea underlying this cognitive approach to motivation is that motivated behaviors result from the combination of individual needs, and the value of goals available in the environment. Expectancy-value theories stress the idea that the probability of behavior depends not only on the value of a goal, but also upon the expectancy of obtaining that goal.

In this study the two motivational constructs were broken down further into five different components, two expectancy-related components and three value-related components—based on Pintrich, Smith, Garcia and MacKeachie's (1991) approach to learning in an academic setting. The two expectancy related components are: (1) control beliefs for learning and (2) expectancy for success and self-efficacy for learning (Pintrich et al., 1991). Control beliefs for learning refers to a persons' belief that higher efforts to learn will result in more positive outcomes. It concerns the belief that outcomes are contingent upon one's own effort, in contrast to external factors. Expectancy for success refers to performance expectations, and self-efficacy for learning refers to one's perception of his/her ability to accomplish a task.

The three value related components include: (1) task value, (2) intrinsic goal orientation, and (3) extrinsic goal orientation. Task value refers to one's perception of how interesting, important, and how useful the task is. However, goal orientation (intrinsic or extrinsic) refers to why the person participates in the task in the first place (Pintrich et al., 1991). Intrinsic goal orientation concerns the degree to which a person is participating in a task for reasons such as challenge, curiosity, and mastery. Intrinsically motivated individuals participate solely for the experience inherent in the task itself (Reeve, 1992). Extrinsic goal orientation refers to the degree to which a person is participating in a task for reasons not directly related to the task

itself (e.g. grades, rewards, evaluation by others, competition; Pintrich et al., 1991). Here the individual's participation in a task is simply a means to an end (Reeve, 1992). In this study, the interest was in measuring why a particular student is learning to use computers, as well as how important or interesting learning to use computers is for that person.

In many cases extrinsic motivation decreases initial intrinsic motivation, and may even interfere with the process of learning (Condry, 1977, 1987; Condry & Chambers, 1978; Harter, 1978; Shapira, 1976). This effect—known as "the over-justification effect"—commonly occurs when both intrinsic and extrinsic reasons for participating in the task are present; because there is more than enough justification, the attribution of intrinsic interest is discounted by the presence of the external reason. In general, this occurs because extrinsic rewards can distract attention away from the interest, and enjoyment of the task, as well as the process of learning itself. Therefore, in the present study it was predicted that extrinsic motivation would lead to poorer performance in computer classes. In addition, because extrinsic motivation often interferes with interest and enjoyment, it was hypothesized that extrinsic goal motivation would be associated with more negative attitudes, higher anxiety, and lower self-efficacy, in comparison with those who are intrinsically motivated.

In order to integrate the combined relations among the motivational constructs, the computer-related affective states, previous experience with computers, and academic performance a structural model was proposed (Fig. 1). This model was tested using a path analysis—the reasoning underlying the paths is presented later.

First, it was predicted from previous research on computer-related affective states, that there would be strong relations among computer-related attitudes, anxiety, and self-efficacy. Based on Bandura's (1982) theory of self-efficacy it was hypothesized that self-efficacy would be the most proximal influence on academic performance. Bandura also maintained that self-efficacy beliefs are strengthened by anxiety
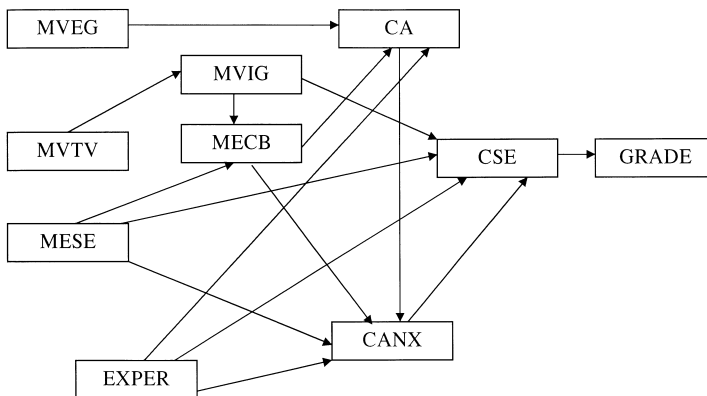


Fig. 1. Proposed path model describing the relations among variables. CANX, computer-related anxiety; CA, attitudes towards computers; CSE, computer-related self-efficacy; MVIG, intrinsic goal orientation; MVEG, extrinsic goal orientation; MECB, control beliefs for learning; MESE, motivation for success and self-efficacy; MVTV, perceptions of task value; EXPER, previous experience with computers; GRADE, final course grade.

reduction; this relationship is expected to apply to corresponding the computer-related variables. Finally, it was proposed that computer attitudes would influence anxiety levels, as attitudes toward computers become more positive, anxiety about computers likely would be reduced, perceived self-efficacy strengthened, leading ultimately to enhanced academic performance in computer classes.

It was also proposed that, consistent with prior research, previous experience would be a strong predictor of students' attitudes toward computers, computer-related anxiety, and computer-related self-efficacy. More specifically, it was hypothesized that as students gain more experience with computers their attitudes towards computers should become more positive, their anxiety should decrease, and their perceptions of computer-related self-efficacy should increase.

It was also proposed that the three affective states would be influenced by one's motivation to learn to use computers. In particular, it was hypothesized that higher perceptions of task value in learning to use computers would lead to an intrinsic goal orientation, and that these two factors, in combination with strong control beliefs for learning to use computers, should lead to more positive attitudes toward computers and, in turn, lower levels of computer-related anxiety, higher levels of computer-related self-efficacy and higher grades in computer classes. Thus, students who view learning to use computers as interesting, important, and useful are more likely to be learning for intrinsic reasons, such as challenge, curiosity, and mastery. Subsequently, the more these students believe the outcomes of their learning are contingent upon their own effort, the more likely they are to have positive affect towards computers.

It was proposed that having a high expectancy for success and self-efficacy (self-efficacy for learning), in combination with strong control beliefs for learning, would lead to more positive attitudes towards computers. According to Pintrich et al. (1991), individuals with high self-efficacy for learning are generally motivated to succeed; they are confident in their ability to master a task and expect to perform well. Therefore, it was also proposed that expectancy for success and self-efficacy would have a direct positive influence on one's perception of their capabilities regarding specific computer-related knowledge and skills (computer-related self-efficacy), and have the inverse effect on one's level of computer anxiety.

In contrast, it was predicted that those with an extrinsic orientation (participating in the task for reasons not directly related to the task itself), would be more likely to possess more negative attitudes toward computers and, in turn, experience higher levels of computer-related anxiety, lower levels of computer-related self-efficacy, and ultimately receive lower grades in computer classes.

## 2. Method

### 2.1. Research design and data analysis

The study will employ path analysis procedures to examine the relations among several computer-related affective variables. Path analysis employs a set of regressions

conducted to test the significance of relations (paths) between variables proposed in a theoretical model. The model is tested against a correlation matrix. The model is judged to 'fit' the data to the extent that its paths reproduce the correlation matrix with little residual correlation. The model tested here will examine computer-related attitudes, anxiety, and self-efficacy, their motivational antecedents, and impact on grades in computer courses.

## 2.2. Participants

The participants included 111 volunteers ranging in age from 17 to 45, with an average age of 21.3 (SD = 4.6). They were predominately Caucasian (88%; 4% Asian, 2% Aboriginal Canadian), male ($n = 59$) and female ($n = 52$) undergraduate students from a small Canadian university and a private business college. Students were selected from various introductory computer programming and computer fundamental courses.

## 2.3. Materials

The survey instrument consisted of a total of 100 questions. The final page of the survey was a demographic page, the other 94 items were taken from eight scales and were mixed at random. All were answered on a seven-point Likert scale with scores ranging from 1 (strongly disagree) to 7 (strongly agree). Chronbach's alpha reliability coefficient was calculated, using the present data, for each of the scales described:

1. Computer Attitudes Scale (Nickell & Pinto, 1986; $\alpha = 0.77$) was used to assess respondents' attitudes toward using the computer. An example item would be "The use of computers is enhancing our standard of living."
2. The Computer Self-efficacy Scale (Murphy et al., 1989; $\alpha = 0.95$) was used to evaluate the perceptions of subjects' capabilities regarding specific computer-related knowledge. An example item would be "I feel confident troubleshooting computer problems."
3. Computer Anxiety Rating Scale (Heinssen et al., 1987; $\alpha = 0.95$) was used to measure the amount of anxiety and apprehension experienced by the respondent when using the computer. An example item would be "I feel apprehensive about using computers."

The following five scales (4–8) were taken from Pintrich et al. (1991) and measure the expectancy (4 and 5) and value (6, 7, and 8) components of academic motivation.

4. Self-Efficacy for Learning ($\alpha = 0.93$) measures the degree to which respondents' are self-confident in their ability to learn the material in the present course. An example item would be "I am confident that I can learn the basic concepts taught in this course."
5. Control Beliefs for Learning ($\alpha = 0.83$) measures the degree to which the respondents' expect to be able to control their learning versus control from an

external source. An example item would be "If I study in appropriate ways, then I will be able to learn the material in this course."

6. Intrinsic Goal Orientation ($\alpha = 0.56$) assess the degree to which respondents' are learning to use computers for intrinsic reasons, such as challenge and enjoyment. An example item would be "In a class like this, I prefer course material arouses my curiosity even if it is difficult to learn."

7. Extrinsic Goal Orientation ($\alpha = 0.71$) assess the degree to which respondents' are learning to use computers for extrinsic reasons, such as good grades and employment. An example item would be "Getting a good grade in this class is the most satisfying thing for me right now."

8. Task Value Beliefs ($\alpha = 0.83$) measures the degree to which respondents' find learning to use computers has specific value. An example item would be "I think the course material in this class is useful for me to learn."

The final page of the questionnaire included demographic information on participants' age, sex, year of study, ethnicity, and degree/diploma program. In addition, the following two measures were assessed using single-item questions:

9. Experience with Computers. Respondents chose one of five options: no experience, a little experience, some experience, a lot of experience, a great deal of experience.

10. Motivational Orientation. Respondents were asked about six potential "reasons for taking this course," responding "yes" or "no" for each. The six reasons were: fulfills distribution requirement, content seems interesting, is a required course, will be useful in other courses, will improve career, and fits into schedule. The second and third items were combined as a measure of motivational orientation, yielding four groups: (1) those enrolled in the course simply because the content seemed interesting but the course was not required (intrinsic orientation), (2) those who enrolled because it was a required course but did not see it as interesting (extrinsic orientation), (3) those that took it for a combination of both interest and requirements (combined orientation), and (4) those who responded "no" to both items (unmotivated). Preliminary analysis revealed that only three of participants responded negatively to both of these items, therefore the 'unmotivated' group was dropped from further analyses.

11. Grades in Computer Course. Finally, participants were presented with a form that gave permission for the researchers to obtain students' grades in the course. Final marks were obtained several weeks after the questionnaire was completed for students who gave their consent (63.3%).

## 2.4. Procedure

After obtaining permission to conduct the study from course instructors, questionnaires were distributed in class to students who consented to take part in the study. Courses selected for study were two sections of Introduction to Computer

Programming (a first-year course required for students in a Bachelor of Science program) and several sections of Introduction to Computer Applications (a first year course required for students in an Information Technology program at a private, specialty college). The questionnaire included a standard consent sheet with a detachable grade release form, followed by the 94 scale items and a demographics page. Course instructors supplied the students' final grades at the end of the course.

## 3. Results

The objectives of this study were: (1) to investigate possible differences between males and females on levels of previous experience, computer-related affective states, the expectancy-value motivation variables, and academic performance, (2) to test a structural model illustrating the relations among these variables, (3) to test for gender differences in the structural model, and (4) to examine differences among motivational orientation groups on levels of each of the nine dependent variables.

### 3.1. Gender differences

In order to investigate differences between male and female students in mean scores on the motivation variables (intrinsic goal, extrinsic goal, task value, self-efficacy for learning, and control beliefs), the affective variables (computer attitudes, computer anxiety, and computer self-efficacy), and previous experience with computers, a multivariate $t$-test was conducted. The results show a significant multivariate effect for sex (Hotellings $= 0.2351$, $F$ $(9,86) = 2.25$, $p < 0.05$), as well as significant univariate effects for eight of the nine variables.

The significant univariate results indicate that, on average, males experience less computer related anxiety, hold more positive attitudes towards computers, higher perceptions of computer-related self-efficacy, are more intrinsically motivated, hold stronger control beliefs for learning, higher perceptions of task value, have a higher expectations for success and self-efficacy, and have more experience with computers, than do females. The means, standard deviations, and $F$ statistics from this analysis are presented in Table 1.

A separate $t$-test was conducted to examine differences between males and females in academic performance because approximately two-thirds of students consented to the release of their grades. The results indicate no significant difference between males ($M = 70.90$, $n = 41$), and females ($M = 71.58$, $n = 33$) in academic performance ($F(1, 72) = -0.14$, $p > 0.05$).

### 3.2. Structural model

The main purpose of this study was to develop a hypothetical structural model that would illustrate the relations among the five motivation variables, three affective variables, previous experience, and academic performance. A path analysis,

Table 1
Results from multivariate analysis of differences between males and females on levels of the computer-related affective variables, motivation variables, and previous experience[a]

| Variable | Male | | Female | | $F$ | $p$ |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| CANX | 44.71 | 15.12 | 56.84 | 13.37 | 17.16 | 0.000 |
| CATT | 101.29 | 14.44 | 93.73 | 13.46 | 6.98 | 0.010 |
| CSE | 178.08 | 28.48 | 156.73 | 31.90 | 11.99 | 0.000 |
| MVIG | 16.73 | 3.26 | 15.33 | 3.28 | 4.34 | 0.040 |
| MVEG | 20.06 | 6.11 | 20.64 | 4.90 | 0.26 | 0.609 |
| MESE | 41.14 | 7.45 | 35.56 | 8.96 | 11.10 | 0.047 |
| MECB | 28.47 | 6.34 | 25.91 | 6.06 | 4.06 | 0.047 |
| MVTV | 28.69 | 5.16 | 24.73 | 6.69 | 10.62 | 0.002 |
| EXPER | 3.14 | 1.25 | 2.53 | 0.96 | 6.87 | 0.010 |
| $n$ | 51 | | 45 | | | |

[a] CANX, computer-related anxiety; CATT, attitudes towards computers; CSE, computer-related self-efficacy; MVIG, intrinsic goal orientation; MVEG, extrinsic goal orientation; MECB, control beliefs for learning; MESE, motivation for success and self-efficacy; MVTV, perceptions of task value; EXPER, previous experience with computers.

using a maximum likelihood solution from AMOS 3.51 (Arbuckle, 1995), was conducted on the correlation matrix (Table 2) for this purpose. The base model (Fig. 1) shows a reasonable fit to the data, although the chi-square was significant ($\chi^2(22, N = 96) = 93.82$, $p < 0.001$). Thirteen of fourteen predicted paths from the proposed model were significant ($t > 2.0$); the only non-significant path being from control beliefs for learning to computer-related anxiety.

The significant chi-square test from the proposed model indicated that there was additional variability left over within the correlation matrix that could be accounted for if new paths were added. Accordingly, additional 'data-driven' paths were added one at a time, based on the modification indices[2]. These included a correlation between self-efficacy for learning and previous experience with computers, along with a correlation between task value and self-efficacy for learning. Also, the non-significant path between control beliefs for learning and computer-related anxiety was eliminated from the analysis. The results from this analysis show a better fit to the data, as shown by the fit indicies and $\chi$/df ratio (Table 3), although the chi-square is still significant ($\chi^2(29, N = 96) = 62.24$, $p < 0.001$). The four-step sequence of results in going from the base model to the final model are shown in Table 3. The standardized solution of the final model is shown in Fig. 2.

The last variable in the chain is academic performance, and is shown to be predicted directly by computer-related self-efficacy. Computer-related self-efficacy shows four significant paths, three of which are positive. One path leads directly from self-efficacy for learning, one directly from previous experience, and another

[2] Modification indices represent the reduction in chi-square that would be obtained if a given path were added to the model. Larger modification indices indicate stronger paths.

Table 2
Obtained correlation matrix for entire sample[a]

| Variable | Mean | SD | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) CANX | 49.813 | 15.33 | 1.00 | | | | | | | | | |
| (2) CATT | 98.47 | 14.56 | −0.7088 | 1.00 | | | | | | | | |
| (3) CSE | 169.07 | 31.53 | −0.7043 | 0.5234 | 1.00 | | | | | | | |
| (4) MVIG | 16.03 | 3.376 | −0.2965 | 0.2732 | 0.5604 | 1.00 | | | | | | |
| (5) MVEG | 20.52 | 5.41 | −0.0112 | −0.0957 | 0.1193 | 0.1570 | 1.00 | | | | | |
| (6) EXPER | 2.88 | 1.12 | −0.5299 | 0.3235 | 0.5748 | 0.1446 | 0.0435 | 1.00 | | | | |
| (7) MECB | 27.35 | 6.20 | −0.5157 | 0.4525 | 0.5286 | 0.5544 | 0.1549 | 0.2527 | 1.00 | | | |
| (8) MESE | 38.93 | 8.39 | −0.6706 | 0.4684 | 0.7142 | 0.5249 | 0.0759 | 0.4372 | 0.5895 | 1.00 | | |
| (9) MVTV | 26.98 | 6.07 | −0.5038 | 0.4774 | 0.6165 | 0.6817 | 0.1215 | 0.2298 | 0.4828 | 0.6168 | 1.00 | |
| (10) GRADE | 71.02 | 2.29 | −0.1534 | 0.1229 | 0.3603 | 0.5737 | 0.1737 | −0.0515 | 0.2756 | 0.3318 | 0.5248 | 1.00 |

[a] CANX, computer anxiety; CATT, computer attitudes; CSE, computer self-efficacy; MVIG, intrinsic goal motivation; MVEG,extrinsic goal motivation; MECB, control beliefs for learning; MESE, expectancy for success and self-efficacy for learning; EXPER, previous experience with computers; MVTV, task value; GRADE, final course grade.

Table 3
Fit indices for the four step sequence in going from the base model to the final model, and male and female comparison analysis[a]

| Model | $\chi^2$ | df | GFI | Adj. GFI | CFI | RMR | NFI | $\chi^2$/df |
|---|---|---|---|---|---|---|---|---|
| Base Model | 122.28 | 30 | 0.81 | 0.65 | 0.799 | 0.226 | 0.758 | 4.08 |
| Revision 1 | 76.81 | 29 | 0.87 | 0.76 | 0.90 | 0.15 | 0.85 | 2.65 |
| Correlation added for MESE to MVTV | | | | | | | | |
| Revision 2 | 61.51 | 28 | 0.90 | 0.79 | 0.93 | 0.13 | 0.88 | 2.58 |
| Correlation added for MESE to EXPER | | | | | | | | |
| Final Model | 62.24 | 29 | 0.89 | 0.80 | 0.93 | 0.12 | 0.88 | 2.15 |
| Path deleted from MECB to CANX | | | | | | | | |
| Comparison analysis | 121.47 | 60 | 0.82 | 0.67 | 0.86 | 0.14 | 0.52 | 2.03 |

[a] MESE, expectancy for success and self-efficacy; MECB, control beliefs for learning; EXPER, previous experience with computers; CANX, computer-related anxiety.
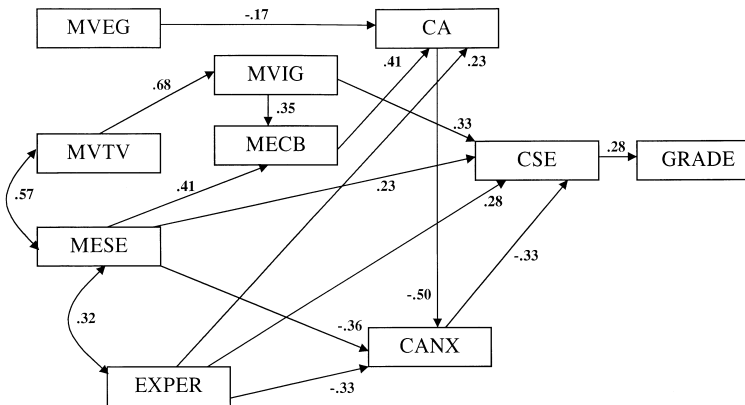


Fig. 2. Revised path model, including significant path coefficients. Note: Significant ($p < 0.05$) standardized path coefficients are displayed. CANX, computer-related anxiety; CA, attitudes towards computers; CSE, computer-related self-efficacy; MVIG, intrinsic goal orientation; MVEG, extrinsic goal orientation; MECB, control beliefs for learning; MESE, motivation for success and self-efficacy; MVTV, perceptions of task value; EXPER, previous experience with computers; GRADE, final course grade.

from intrinsic goal orientation. Computer self-efficacy was also shown to be negatively predicted by computer-related anxiety, which is shown to be influenced by three negative paths. One path leads from self-efficacy for learning, another from previous experience, and the strongest path leads from attitudes toward computers.

Attitudes toward computers are shown to be directly influenced through three paths, one of which is negative. The negative path leads directly from extrinsic goal motivation showing that stronger extrinsic motivation is associated with more

negative attitudes. The two positive paths lead from experience with computers and control beliefs for learning.

The revised model also shows positive correlations between self-efficacy for learning, and both task value and prior experience. The two additions to the model were made based on the modification indices. To avoid generating a post-hoc hypothesis, these two relationships are shown as correlations, rather than as directional paths.

### 3.3. Gender differences in the structural model

A second path analysis was performed in order to test the null hypothesis that although differences may exist between males and females in levels of the computer-related affective states and motivation for learning to use computers, the underlying relations, as proposed in the structural model, may be similar for both. The revised model (Fig. 2) was tested on the correlation matrices for the data from the male and female participants[3] simultaneously for the purpose of examining any differences in parameters between the two groups. The fit indices from this analysis are shown at the bottom of Table 3.

The results from the comparison analysis indicated that only the path leading from extrinsic goal motivation to computer attitudes was significantly different ($t > 2.0$). In particular, these results show that while extrinsic goal orientation has a significant negative influence on attitudes toward computers for males, that path is not significant for females.

### 3.4. Motivational orientations

The participants in this study were all students enrolled in courses designed to give them a better understanding of computers. A one-way, multivariate analysis of variance was conducted in order to investigate possible differences among three orientation groups (intrinsic orientation, extrinsic orientation, and combined orientation) on levels of the nine dependent variables. The results show a significant multivariate effect (Hotellings $= 0.05419$, $F(18, 162) = 2.44$, $p < 0.05$), as well as significant univariate effects for five of the nine dependent variables. Significant univariate effects were found for attitudes towards computers, computer self-efficacy, intrinsic goal motivation, task value motivation, and self-efficacy for learning.

Post-hoc analysis (Tukey's HSD) revealed that those with an intrinsic orientation had significantly more positive attitudes toward computers ($Q$ (2,90) $= 3.46$, $p < 0.05$), higher perceptions of computer-related self-efficacy ($Q$ (2,90) $= 4.36$, $p < 0.05$), a higher expectancy for success and self-efficacy for learning ($Q(2, 90) = 4.60$, $p < 0.05$), and higher perceptions of task value ($Q(2, 90) = 7.34$, $p < 0.05$), than

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[3] The correlation matrices, as well as the standardized solutions from the male and female comparison analysis are available upon request from the authors.

those with an extrinsic orientation. The results also indicated that those with a combined orientation (both intrinsic and extrinsic) were significantly higher in intrinsic goal motivation than those with an extrinsic orientation ($Q(2, 90) = 3.44$, $p < 0.05$). All other differences were found to be non-significant. The means, standard deviations, and $F$ values from this analysis are shown in Table 4.

Finally, a one-way analysis of variance was conducted in order to examine possible differences in academic performance among the three orientation groups[4]. The results indicated a significant difference in academic performance among the three groups ($F(2, 69) = 4.26$, $p < 0.05$). The intrinsic orientation group had the highest average grade ($M = 76.21$, $n = 14$), followed by the combined orientation group ($M = 75.05$, $n = 21$), and the extrinsic orientation achieved the lowest grades group ($M = 60.90$, $n = 37$). Post hoc analysis (Tukey's HSD) indicated that the combined orientation group had significantly higher grades than the extrinsic orientation group. However, no significant difference was found between the intrinsically orientated group and the other two groups. This might appear to be an illogical finding, given that the intrinsic orientation group's mean grade was higher than the combined orientation group. However, the formula for Tukey's HSD takes into account the sample size ($n$) in each group and the relatively small $n$ in the intrinsic orientation group is responsible for the anomalous results in the post hoc tests of significance.

Table 4
Mean scores and standard deviations on each of the nine dependant variables for the three orientation groups[a]

| Variable | Orientation 1 (Intrinsic) | | Orientation 2 (Extrinsic) | | Orientation 3 (Combined) | | $F$ | $p$ |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | | |
| CANX | 44.17 | 14.06 | 53.88 | 17.12 | 51.44 | 14.86 | 2.65 | 0.076 |
| CATT | 102.9 | 12.59 | 92.84 | 13.12 | 97.33 | 15.45 | 2.99 | 0.050 |
| CSE | 182.44 | 23.02 | 155.08 | 35.35 | 168.38 | 31.35 | 4.75 | 0.011 |
| MVIG | 16.74 | 3.69 | 14.64 | 3.69 | 16.58 | 2.72 | 3.44 | 0.036 |
| MVEG | 20.04 | 4.84 | 20.00 | 5.42 | 21.07 | 5.69 | 0.434 | 0.649 |
| MECB | 27.91 | 6.46 | 25.48 | 6.87 | 28.09 | 5.83 | 1.51 | 0.226 |
| MESE | 42.26 | 5.87 | 34.48 | 10.65 | 38.97 | 7.70 | 5.46 | 0.006 |
| MVTV | 29.74 | 5.18 | 21.68 | 5.93 | 28.27 | 5.15 | 16.45 | 0.000 |
| EXPER | 2.91 | 1.08 | 2.80 | 1.08 | 2.82 | 1.28 | 0.06 | 0.939 |
| $n$ | 23 | | 25 | | 45 | | | |

[a] CANX, computer-related anxiety; CATT, attitudes towards computers; CSE, computer-related self-efficacy; MVIG, intrinsic goal orientation; MVEG, extrinsic goal orientation; MECB, control beliefs for learning; MESE, motivation for success and self-efficacy; MVTV, perceptions of task value; EXPER, previous experience with computers.

[4] This analysis was separated from the multivariate analysis because less than two thirds of the students consented to the release of their mid-term grades.

## 4. Discussion

The main purpose of this study was to examine the effects of previous experience with computers, and motivation to learn to use computers, on three computer-related affective states, and to examine the effect of these variables on academic performance in computer classes. It was hypothesized, based on the results of previous research on computer-related affective states, that there would be strong relations among computer-related attitudes, anxiety, and self-efficacy. These relations were examined within the path model, and were proposed as being in the sequence of attitudes—anxiety—and self-efficacy. Based on Bandura's (1982) theory of self-efficacy, it was proposed that computer-related self-efficacy would be the most proximal influence on academic performance. Bandura also proposed that self-efficacy beliefs were strengthened by anxiety reduction so it was believed that, when both variables were specifically related to the computer, they would maintain the same relationship. Finally, computer attitudes were proposed to influence anxiety levels. The path analysis is consistent with the suggestion that as attitudes toward computers become more positive, anxiety about computers is likely to be reduced, perceived self-efficacy strengthened, and academic performance improved.

The results from the path analysis confirmed the main hypothesis that computer-related affective states may be influenced by one's motivation to learn to use computers. In particular, the results show that students who have high perceptions of task value in learning to use computers are more likely to have an intrinsic goal orientation, and these two factors, in combination with strong control beliefs for learning to use computers, lead to more positive attitudes towards computers, reduced computer-related anxiety, increased computer-related self-efficacy, and ultimately higher grades in computer classes. Thus, students who view learning to use computers as interesting, important, and useful, are more likely to be learning for reasons such as challenge, curiosity, and mastery. Also, the more these students believe the outcomes of their learning are contingent upon their own effort, the more likely they will be to hold positive attitudes toward computers, have reduced computer-related anxiety, increased computer-related self-efficacy, and higher grades in computer classes.

The path analysis also shows a strong correlation between task value and self-efficacy for learning, and so it is not surprising that students with a high expectancy for success and self-efficacy, along with strong control beliefs for learning to use computers, also had more positive attitudes towards computers, lower levels of computer-related anxiety, higher perceptions of computer-related self-efficacy, and eventually better academic performance in computer classes.

According to Pintrich et al. (1991), individual's with a high expectancy for success and self-efficacy are generally motivated to succeed; they are confident in their ability to master a task, and expect to perform well. Therefore, it was also predicted that expectancy for success and self-efficacy would have a direct, positive influence on one's perception of their capabilities regarding specific computer-related knowledge (computer-related self-efficacy), and an inverse effect on one's

level of anxiety with regards to computers. The results from the path analysis confirmed these predictions—adding further support to the more general thesis that: those highly motivated to understand computers should experience less anxiety, have higher perceptions of self-efficacy, and have more positive attitudes toward computers.

The path analysis also indicated that there is a strong positive correlation between efficacy expectations for learning, and previous experience with computers. It is not surprising then that, consistent with previous research, the results from this study also show previous experience with computers to be an important factor in determining students attitudes, anxiety, and self-efficacy in regard to computers. More specifically, the results show that as students gain more experience with computers their attitudes towards computers should become more positive, their anxiety decreases, and their perceptions of computer-related self-efficacy increase.

This study also found a direct positive relation between intrinsic goal motivation and perceptions of computer related knowledge and skills. The results from the path analysis show that intrinsically orientated students are more likely to have high perceptions of computer-related self-efficacy, which leads to higher grades in computer classes. Furthermore, this study found that students learning to use computers for interest alone (an intrinsic reason) have a higher efficacy expectations, higher perceptions of task value, hold more positive attitudes toward computers and have higher perceptions of computer-self efficacy than do students who were learning because the course was required.

The results from the path analysis show that those with an extrinsic orientation, (participating in the task for reasons not directly related to the task itself), are more likely to hold negative attitudes towards computers, experience higher levels of computer-related anxiety, have lower perceptions of computer-related self-efficacy, and, in turn, receive lower grades in computer classes. This finding might suggest that extrinsic motivation detracts attention away from the interest and enjoyment of the task itself. However, other results show that those enrolled for extrinsic reasons tend to be significantly lower in intrinsic goal motivation and receive significantly lower grades in computer classes than students who enrolled in computer courses for a combination of both extrinsic and intrinsic reasons. This result contradicts the common effect of over-justification, wherein intrinsic reasons are discounted in the presence of external reasons. It simply may be that the key motivating factor is an intrinsic one, and at the introductory level at least, extrinsic rewards are not necessarily distracting from intrinsic ones. Future research might investigate whether the over-justification effect appears in upper-level computer courses, where competition for grades, and eventually for jobs, is more intense.

Overall, the results provide support for the proposed underlying motivational structure influencing computer-related affective states (Fig. 1). However, the model presented in this study could be expanded by adding other types of variables, such as those that would predict academic motivation (e.g. intelligence, personality, socioeconomic status, etc.). A model such as the present one is limited by the variables in this study, which is a necessary limitation of path analysis.

Consistent with previous research, this study found gender differences in levels of the computer-related affective states. Specifically, males reported having significantly more positive attitudes towards computers, higher perceptions of computer-related self-efficacy, and lower levels of computer-related anxiety than did females. This study also found that males are generally more highly motivated to learn to use computers than females. The results show that males place significantly more value in learning to use computers, have higher expectations for success and self-efficacy when learning to use computers, and express stronger control beliefs about learning to use computers than do females. These differences might be related to experience with computers, as males also reported having had more experience than females.

The results from the analysis comparing male and female path coefficients suggested that, although significant differences do occur between male and female students on mean levels of motivation to learn to use computers and computer-related affective states, the underlying structure relating these variables is very similar for both males and females. Based on this, we would suggest that as the female students catch up in experience, sex differences should almost completely disappear.

The only significant gender difference in structure was found for the path leading from extrinsic goal motivation to attitudes toward computers. The path was found to be significant for males, but non-significant for females. This indicates that extrinsic motivation has a negative influence on attitudes toward computers for males, but not for females. One possible explanation for this result may be that males can be more inclined to get caught up in the extrinsic rewards of the task (such as, grades and competition), and can be more easily distracted from the intrinsic value of the task itself. However, females may not be as easily distracted by extrinsic rewards, and thus may not lose sight of the intrinsic value of the task itself. Fazio (1981) pointed out that external rewards are less likely to undermine the intrinsic interest if a person continually keeps in mind their initial level of intrinsic interest. Furthermore, Reeve (1992) argues that certain external rewards may actually promote intrinsic interest, such as those that reflect competence (e.g. verbal praise). It may be that there is a difference in the types of external rewards received by male and female students. Future research may wish to examine further the differences in the effect of extrinsic motivation for males and females on computer-related affective states.

In summary, it is clear that the three main causes of resistance towards computer technology cited by Harrison and Rainer (1992b), negative attitudes, low self-efficacy, and high levels of anxiety, are related to a combination of inexperience with computers and a lack of intrinsic motivation to learn to use computers. Over time, as people gain positive experience using computers, their attitudes can be expected to become more positive, their anxiety to decrease, and their perceptions of computer-related self-efficacy to increase—leading ultimately to improved performance with computers. The findings of this study also indicate that the more students become aware of the value of learning to use computers, the more likely it is that they will develop an intrinsic orientation in learning to use them, and eventually become more comfortable, confident, and skilled in using them.

## Acknowledgements

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