THE EFFECT OF INCREASING A PERSON'S COMPUTER SELF-EFFICACY ON HIS OR HER INTENTIONS TO USE A COMPUTER

by

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(ABSTRACT)

In this research, I attempted to show that increasing a person's computer self-efficacy is a viable route to making that person more likely to use a computer tool when given the opportunity to do so. I also show the strong link between a person's computer self-efficacy and intentions to use a computer. Computer self-efficacy is a person's belief about his or her ability to successfully use a computer.

Subjects in this field experiment were 193 students in eight introductory computer classes at two colleges. I attempted to increase their computer self-efficacy through their participation in a self-efficacy increasing strategy that used goal-setting, self-reinforcement, and feedback. Half of the subjects randomly received this strategy, and half received a placebo strategy, which was not expected to have any influence on the subjects' computer self-efficacy. Due to the subjects' insufficient use of the strategies, I was unable to increase the computer self-efficacy of the subjects through this strategy.

Although the subjects' computer self-efficacy was not increased, I was still able to see the effect of computer self-efficacy on a person's intentions to use a computer. Of all the variables tested in this study, computer self-efficacy was the best predictor of intentions to use a computer–better than computer experience, computer ownership, academic major (computer-related vs. not computer-related), instrumentality beliefs about computers, and others. This finding showed that computer self-efficacy is a construct that people should pay attention to, particularly people who design computer tools, those who choose which

tools to use, and those who train others on new computer tools. These people should particularly understand the needs of users with low computer self-efficacy and how to best meet those needs.

Additionally, I tried to find out why the subjects did not participate in the use of the strategy. It appears that the main problem in my implementation of the self-efficacy strategy was in not providing the subjects the proper amount of time, encouragement, and incentive for learning and practicing the strategy. My results also showed that those who used the strategy had higher computer self-efficacy than those who didn't use the strategy; that is, those who could benefit most from the self-efficacy strategy (those with low computer self-efficacy) were less likely to use it. This finding underscores the importance of providing a supportive environment for people to learn and practice the strategy, so those with low computer self-efficacy will be able to use the strategy successfully, rather than avoid the strategy before they even get a chance to learn or use it.

ACKNOWLEDGMENTS

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I'd like to thank my advisor, Dr. Harold Kurstedt, for supporting me throughout this research process, and especially for his willingness to cater to several crises on my behalf, whether it's helping me stay funded or proofing my documents at the eleventh hour. I'd also like to thank him for founding MSL, an organization that has been rich in its support to me and my research, especially through providing two of my committee members, Dr. Betty Koball and Dr. Brian Kleiner. Betty truly helped me get this thing off the ground (where it had been sitting far too long!) and has gone out of her way in more ways than I can mention to help me in nearly every stage of this research. She is a living example of the quote on her office wall which says, "Inspire, don't expire." Brian, too, has been a great source of encouragement and help to me throughout this whole research process. He has always made it clear that I'm "the customer" and he's willing to do whatever he can to serve me. My only regret is that I didn't go to him more for help early on. Finally, I'd like to thank Dr. Scott Sink for serving on my committee and offering constructive advice on both my research and my presentation demeanor; constructive feedback like this can only help me improve.

I have greatly appreciated the friendliness and cooperation of Ms. Bonnie Skelton, Ms. Georgiana Baker, and Mr. Kurk Lew. Each of these three instructors were extremely generous in letting me use students in their classes as my subjects at several points throughout the semester.

I'd like to thank the many of those at MSL who have encouraged me just by being friendly and sympathizing with me in my many struggles along the way. A special thanks goes to Sheila Winett for taking on the difficult task of helping me find my way to a research topic and also for allowing me to use the students in her class for an initial study on computer self-efficacy. Theresa Ramsey also deserves a special thanks for helping to give me the idea for this research topic.

And most of all, I'd like to thank Jesus Christ, for giving me an example to follow, for His selfless love for me, for being my best friend, and for making these last six years of my life the best (though hardest) ones ever. When times got tough, He was always there for me.

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INTRODUCTION

Problem Statement

In this research, I investigate (conceptualize, demonstrate, test, and analyze) how a person's computer self-efficacy can be increased. I also investigate how a person's computer self-efficacy affects his or her intentions to use a computer.

Self-Efficacy Explained

This research is largely based on the concept of self-efficacy. Self-efficacy is someone's belief in his or her ability to perform a certain task. The term comes from Albert Bandura, who explains self-efficacy as follows:

> An outcome expectancy is defined as a person's estimate that a given behavior will lead to certain outcomes. *An efficacy expectation is the conviction that one can successfully execute the behavior required to produce the outcomes* [italics mine]. Outcome and efficacy expectation are differentiated, because individuals can believe that a particular course of action will produce certain outcomes, but if they entertain serious doubts about whether they can perform the necessary activities such information does not influence their behavior.
>
> In this conceptual system, expectations of personal mastery affect both initiation and persistence of coping behavior. The strength of people's convictions in their own effectiveness is likely to affect whether they will even try to cope with given situations. At this initial level, perceived self-efficacy influences choice of behavioral settings. People fear and tend to avoid threatening situations they believe exceed their coping skills, whereas they get involved in activities and behave assuredly when they judge themselves capable of handling situations which would otherwise be intimidating.
>
> (Bandura, 1977, pp. 193-4)

Self-efficacy is often compared with self-confidence. The similarity of these two terms depends on the definition of self-confidence being used. If self-confidence refers to a person's confidence in his or her ability *with regard to a specific task*, then self-confidence is the same as self-efficacy. If, however, self-confidence refers to a person's *overall* confidence in his or her ability *to achieve tasks in general,* then self-confidence is not the same as self-efficacy. Self-efficacy, by definition, must have a task associated with it. Self-confidence, however, is often used in a more global sense, without reference to a specific task, and therefore should not be confused with self-efficacy.

Computer self-efficacy is a person's belief in his or her ability to successfully use a computer. The task that computer self-efficacy refers to is computer tasks in general. Although this definition may seem broad, since "computer tasks in general" is not a very specific task, Gist, Schwoerer, & Rosen (1989) used this definition and found it sufficiently specific, as have others (Jorde-Bloom, 1986; Kinzie & Delcourt, 1991; Murphy, Coover, & Owen, 1989). Gist, et al. (1989) also used the term "software self-efficacy" to refer to the subjects' self-efficacy for a specific software package the subjects were being trained on. Thus, they used different kinds of self-efficacy that varied in their level of task specificity. I make this distinction to justify my use of computer self-efficacy in the more general form, where it refers to computer tasks in general. The definition is specific enough to be useful (as in Gist, et al., 1989), but not so specific that it focuses on only one use of the computer. Additionally, this more general definition is more suited to this study, since there is no one specific computer task that I am testing the subjects on.

Relevance of the Study to Management Systems Engineering

The relevance of this study to management systems engineering is best introduced by a short scenario that prompted this research. As I describe this scenario, I will list in parentheses the corresponding parts of the Management System Model (MSM) (Kurstedt, 1993), shown in Figure 1.

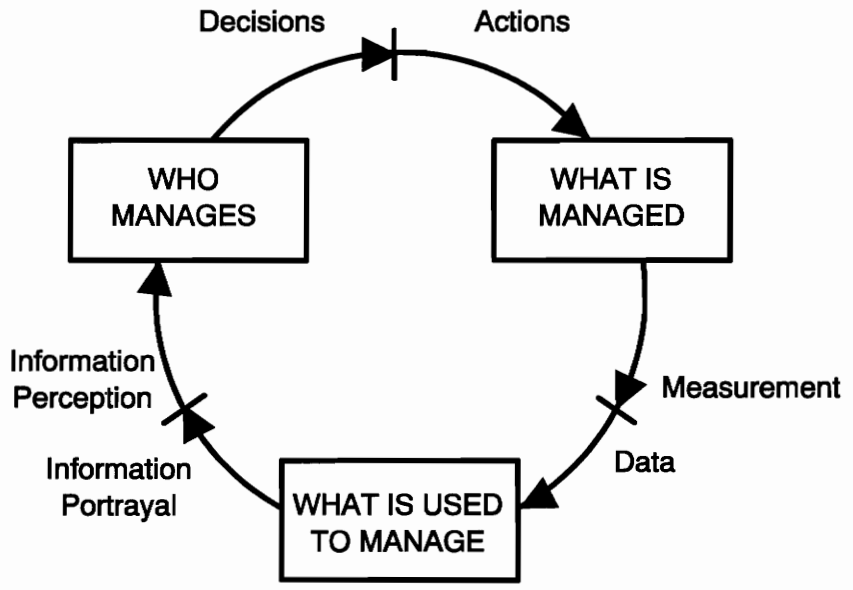

Figure 1: Management System Model (Kurstedt, 1993).

Part of a manager's (the "Who Manages" component) job was to make forecasts (the "Information Portrayal/Information Perception" interface) for the various resources she was responsible for (the "What Is Managed" component). However, these forecasts, when done by hand, using a calculator (containing the "What Is Used to Manage" component), took her so long there was almost no time left to use the forecasts to make decisions (the "Decisions/Actions" interface). When given the choice to use a computer (containing the "What Is Used to Manage" component) to speed things up, she was

hesitant at first, not being convinced the computer would make things any faster, even though others could easily see that using the computer would dramatically save time. Those trying to convince her to use a computer sensed she was nervous about using a computer because she didn't know how. At a later time, she admitted that her initial hesitancy was in part due to her belief that she wouldn't be able to use a computer to perform her job. In other words, the manager's low computer self-efficacy was affecting her choice of what tool to use, which affected the decisions she was able to make using the information she generated. Thus, research addressing the role of computer self-efficacy in the choice to use computers is within the domain of Management Systems Engineering, as shown by the connection between this short scenario and Kurstedt's Management System Model (1993).

The scenario described above is typical. Although computer use is becoming more prevalent in today's workplace, the people using computers are not necessarily comfortable doing so. A 1985 study by Jones & Wall reported that "by 1990 between 50% and 75% of all jobs will require computer utilization" (cited in Weil, Rosen, & Wugalter, 1990, p. 378). At the same time, between 10% and 40% of the population experience some form of computerphobia, ranging from mild to severe discomfort (Weil, et al., 1990). Computerphobics tend to avoid computer interaction whenever possible, and when they must use a computer, they experience distress (Rosen & Maguire, 1990).

Many people believe that once these computerphobics gain more experience using a computer, their computerphobia will subside. Unfortunately, research shows that experience alone does not cure computerphobia (Rosen, Sears, & Weil, 1987). In fact, if the experience continues to be filled with anxiety and distress, then the continued

experience will only reinforce the problem. In Rosen & Maguire's meta-analysis of computerphobia, they explain this well:

> ...computer experience does not "cure" computerphobia. Past experience *is* inversely related to computerphobia, but this is hardly surprising when you consider that computerphobics actively avoid computer interaction whenever possible. During "forced" computer interaction computerphobics take more time, make more errors and perform more poorly than noncomputerphobics. Rather than "curing" their computerphobia, each additional computer experience strengthens their negative affective reaction and promotes further computer avoidance.
> (1990, p. 187)

Instead of just offering computer experience to help a computerphobic, the right kind of experience is needed, one that addresses the root causes of the problem (Weil, Rosen, & Sears, 1987). Thus, self-efficacy is a valuable construct, since it is potentially one of the root causes of computerphobia. The symptoms of low self-efficacy are similar to those of computerphobia. For example, when compared with people with high self-efficacy, those with low self-efficacy for a specific task will tend to avoid that task, become more easily discouraged when performing the task, are more likely to slacken their efforts or give up in the face of difficulty, and do not perform as well on the task (Bandura, 1986). The few studies on self-efficacy specific to computer related tasks show similar results (e.g., Hill, Smith, & Mann, 1987; Gist, Schwoerer, & Rosen, 1989). Several studies have shown that self-efficacy can be effectively increased, and that these increases lead to proportional changes in behavior. (See Bandura, 1986, or Gist & Mitchell, 1992 for an overview of these studies.) The studies mentioned here are described in detail later in the "Literature Review" chapter.

Again, this study is important because lack of computer self-efficacy may prove to be a significant reason why people are reluctant or afraid to use computers. By understanding ways to increase others' computer self-efficacy, we can help people (like the manager in

the above scenario) have a greater confidence in their ability to use computers, which should result in them being more likely to use computers when they have the opportunity to do so, rather than avoiding computers.

Research Questions

1. How can a person's computer self-efficacy be increased?

2. How does a person's computer self-efficacy affect his or her intentions to use a computer?

Research Purpose

The purpose of this research is to help fill the gap in the body of knowledge about how computer self-efficacy can be raised to increase the likelihood of a person using a computer.

Research Objectives

1. To help people (e.g. managers, tool trainers, educators) understand how to increase an individual's computer self-efficacy.

2. To demonstrate the relationship between a person's computer self-efficacy and his or her intentions to use a computer.

Delimitations

1. Although I am interested in influencing computer self-efficacy to increase the adoption and use of a computers over the long term, my study is limited to people's intentions to use computers at one point in time.

2. The more user-friendly a computer is perceived to be, the higher a person's computer self-efficacy will be for that computer (Ellen, Bearden, Sharma, 1991). Thus, a person's computer self-efficacy can be influenced by making the computer more user-friendly. However, in this research, I look at how to change the *person* to increase computer self-efficacy, not how to change the computer. Thus, differences in different kinds of computers, although certainly important, are not discussed here.

3. I am ultimately interested in how computer self-efficacy affects a person's *choice* to use a computer (a behavioral measure) and not just his or her *intentions* to use a computer (a non-behavioral measure). However, due to the constraints in this study, I was not able to obtain this behavioral measure, and thus I use intentions to use a computer as a surrogate measure for choice to use a computer.

Conceptual Model

Figure 2 shows the conceptual model for this study. The central focus of this model is the construct of computer self-efficacy. All the other components in the model are shown in their relationship to computer self-efficacy, either by the their direct influence on computer self-efficacy, or by their indirect influence through the loop shown on the right side of the model. I adapted this model primarily from Gist & Mitchell (1992), who portrayed a similar model for self-efficacy. Thus, this model is general enough to be used

for self-efficacy in general and need not be restricted to computer self-efficacy as I have done for this study. I will briefly describe the various components in this model and the relationships between the components. I will then show the relationship of the conceptual model to the MSM, as shown in Figure 3. Finally, I will explain the components of this model that are relevant to this study, as shown in a modified conceptual model in Figure 4.

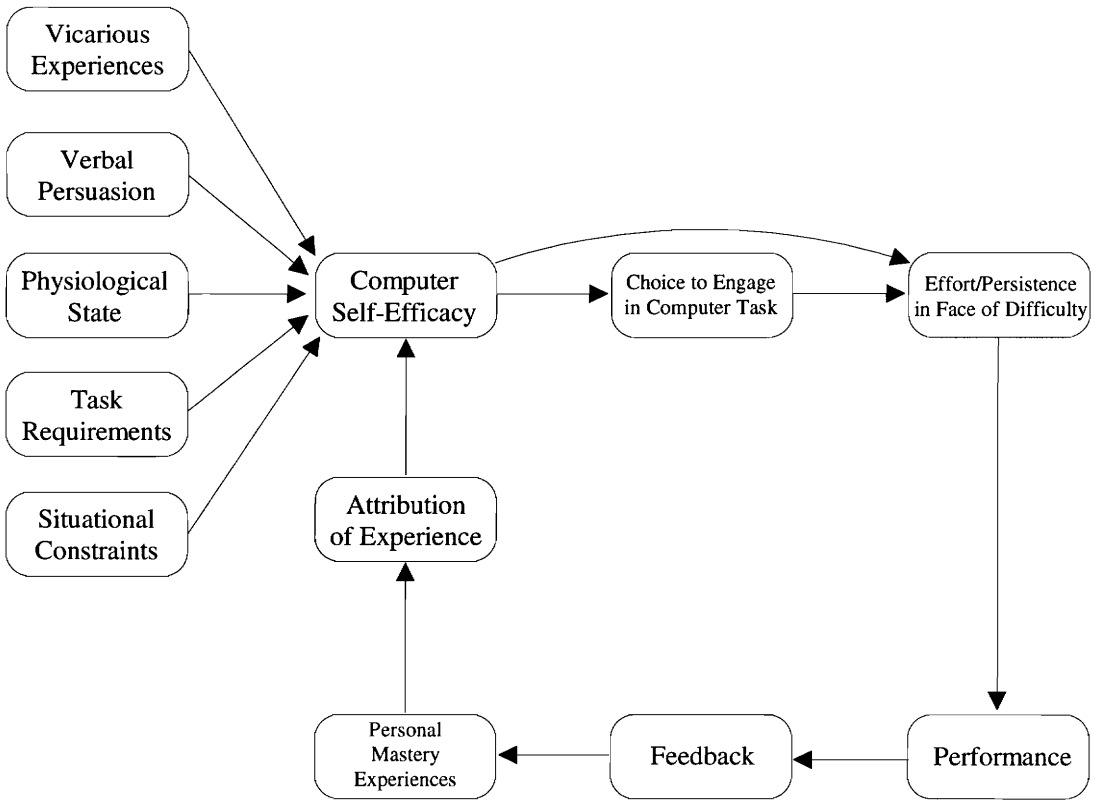

Figure 2: My Conceptual Model

In explaining the components of my conceptual model in Figure 2, I'll begin with computer self-efficacy and work my way around the loop. Computer self-efficacy is shown to affect a person's choice to engage in a computer task. For example, a person with high computer self-efficacy (whom I'll call a "high CSE") will be more likely to

initiate a new task that involves using a computer than a person with low computer self-efficacy (whom I'll call a "low CSE"). Once a person has engaged in a computer task, a high CSE will be more likely to persist in the face of difficulty without giving up than a low CSE. The relatively greater effort of a high CSE as compared with a low CSE will generally result in higher performance than the low CSE. As the high CSE becomes aware of his or her performance, this feedback gives him or her information to assess his or her personal mastery of the task. If the feedback is positive, the person concludes that he or she has some level of personal mastery for that task. These personal mastery experiences are the single most powerful form of information used in determining computer self-efficacy (Bandura, 1986). However, for personal mastery experiences to influence computer self-efficacy, the success on the task must be attributed to the person and not to the task. That is, if the person attributes his or her success to the fact that the task was overly simple ("Any fool off the street could have done that."), then the personal mastery experience will not affect computer self-efficacy. However, if the person attributes his or her success to himself or herself (e.g., "I did it!"), then this personal mastery experience should result in an increase in computer self-efficacy. Attributional processes can be more complicated than described here, but since this is not the main focus of my research, I will not discuss these processes further. Depending on the attributional process, personal mastery experiences can have a powerful effect on computer self-efficacy, more powerful than any of the other components shown on the left side of the model. Thus, I will focus on this self-reinforcing loop in attempting to increase computer self-efficacy. However, to be complete, I will briefly discuss the other components affecting self-efficacy, shown on the left side of the model.

A person can assess his or her computer self-efficacy through vicarious experiences; that is, by watching someone else perform a task. Being verbally persuaded by someone can

also affect a person's self-efficacy. (e.g., "Come on, you'll be great at that! I know you will.") A person's physiological state can also affect his or her self-efficacy. For example, a person who experiences feelings of anxiety while attempting a task may attribute these feelings to a lack of ability to perform the task. The final two components influencing self-efficacy are different than the ones mentioned thus far. Personal mastery experiences, vicarious experiences, verbal persuasion, and physiological state are all sources of information a person uses in assessing his or her self-efficacy for a particular task. However, self-efficacy will obviously be different for different tasks, and so an understanding of the task and its requirements will also affect self-efficacy. Similarly, situational constraints (e.g., having competing demands, being in a noisy environment) will affect a person's self-efficacy for the task at hand.

Relating the Conceptual Model to the MSM

Figure 3 shows that changing a manager's computer self-efficacy affects the management system by affecting the "Who Manages" component. Because the management system is (obviously) a system, affecting the manager will have effects on the other components in the system. A manager's computer self-efficacy can influence the choice of the management tool used ("What Is Used to Manage"), and the management tool used influences the information the manager receives, which in turn influences the decisions and actions the manager makes about the "What Is Managed" component. The scenario described earlier, in the section "Relevance of the Study to Management Systems Engineering," was a good example of how the manager's computer self-efficacy affected the various components of the MSM in the way described here. Thus, the approach I use here to make a change in the management system is to influence the computer self-efficacy of the manager.

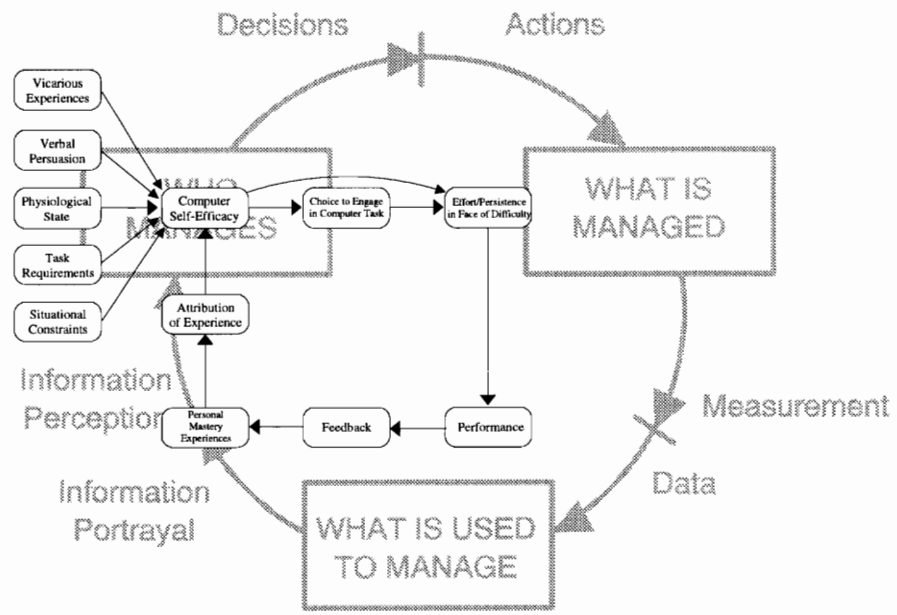

Figure 3: Relating the Conceptual Model to the MSM.

Relating the Conceptual Model to this Study

The conceptual model relates to this study in two ways, as shown in Figure 4. First, I test the relationship between computer self-efficacy and intentions to use a computer. Because I cannot obtain a behavioral measure of subjects' actual choice to engage in a computer task, I use intentions to use a computer as a surrogate measure. Second, I attempt to increase computer self-efficacy by using a strategy that addresses all the components shown in the loop. This strategy employs short-term goal setting, self-reinforcement, and feedback. The subjects assigned to this strategy, who are students in a introductory computer class, are to set daily goals for themselves relating to the class. The subjects are then to decide on a reward or punishment they can self-administer, which is contingent upon their success or failure in achieving the short term goal they set for themselves. Finally, the subjects are to keep track of the goals and rewards or

punishments on a sheet they are to update daily. Updating this sheet provides them with frequent feedback showing them how they are doing on the goals they've set.

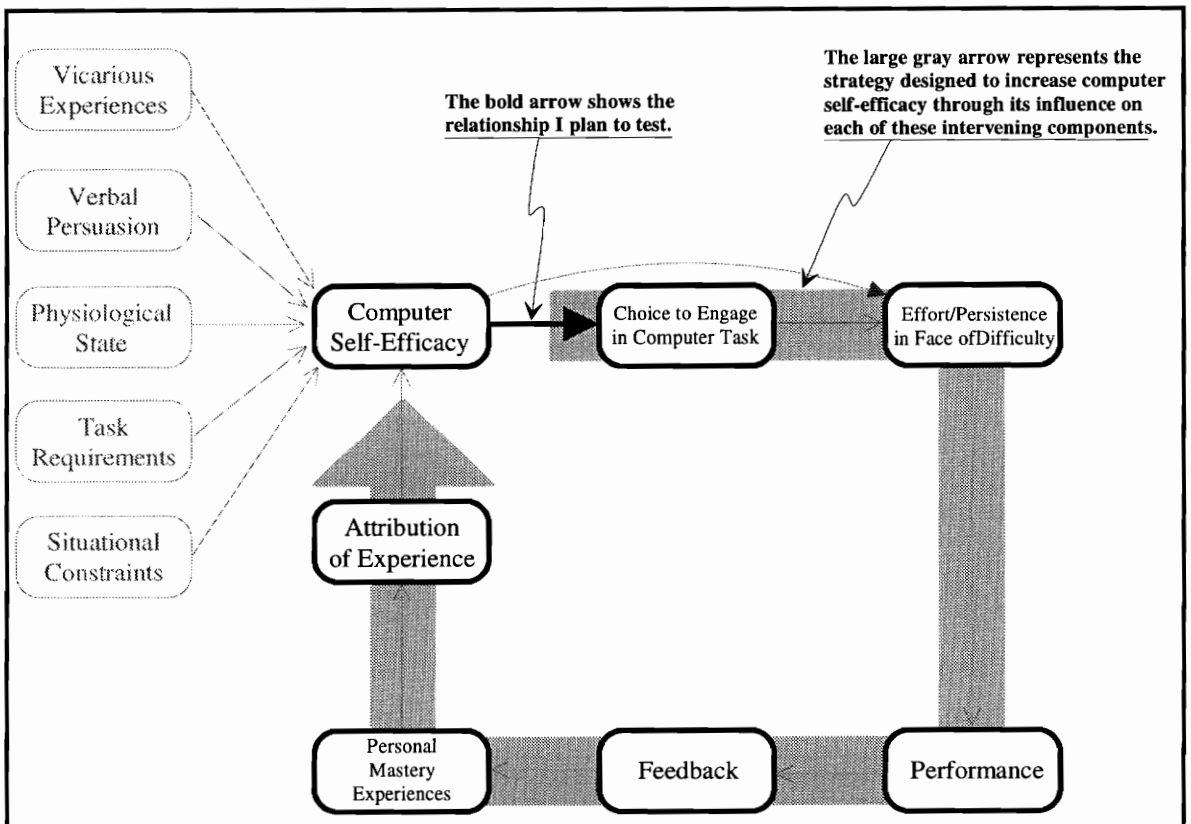

Figure 4: Relating My Conceptual Model to this Study

Here's how the strategy potentially affects the different components in the loop, beginning with choice to engage in a computer task. Setting short-term goals should help the subjects be more proactive in engaging in computer tasks than they would otherwise be (at least for mandatory tasks, like homework assignments). Once subjects have engaged in the task, they'll be less likely to give up on the task because of the rewards or punishments they've set for themselves. These rewards or punishments will motivate the subjects to follow through on the goals they've set. The subjects' proactive engagement on the task and persistence should lead to a good performance (or at least better than their

performance would otherwise have been). Recording the successful completion of the goal will provide feedback, reminding the subjects of their performance. Although the goals may be small, as long as they are somewhat challenging, successful completion of these goals should translate into personal mastery experiences, which the subjects should attribute to their effort and ability. The positive attribution of the personal mastery experience results in an increase in computer self-efficacy, making the subjects more confident in their computer ability for the next computer task they encounter.

The strategy is expected to increase self-efficacy primarily because the strategy should lead to personal mastery experiences, which are the most powerful sources of self-efficacy information. Although the strategy relates to each component in the loop, I do not test the effect of the strategy on each component. Rather, I am primarily interested in the strategy's effect on computer self-efficacy and how the strategy may indirectly affect a person's intentions of engaging in new computer tasks through the strategy's effect on self-efficacy.

Research Hypotheses

1. A strategy including goal-setting, self-reinforcement, and feedback will positively affect a person's computer self-efficacy, computer performance, and intentions to use a computer.

   (This hypothesis relates to the large gray arrow shown in Figure 4.)

2. A strategy including goal-setting, self-reinforcement, and feedback will increase a person's computer self-efficacy, which will in turn increase his or her intentions to use a computer.

   (This hypothesis relates to the bold black arrow shown in Figure 4.)

LITERATURE REVIEW

Overview

Self-efficacy is a person's belief about his or her ability to perform a certain activity. A person's belief in his or her ability may not necessarily be the same as his or her ability. For example, a person may have high mathematical ability, yet believe he or she has almost no ability in mathematics. This person would have low mathematical self-efficacy in spite of his or her high ability.

This study looks specifically at a person's beliefs about his or her ability to effectively use computers; that is, a person's computer self-efficacy. In this review of the literature, I'll look at both the findings in the general self-efficacy literature as well as the few studies that relate specifically to computer self-efficacy. The effects of self-efficacy have been generally the same when applied to many different areas (including computers), and so the findings in the general self-efficacy literature should also be relevant to computer self-efficacy.

Why is Self-Efficacy Important?

The main reason self-efficacy is important is that self-efficacy is related to other important factors, such as effort, persistence in the face of difficulty, task interest, and performance (Bandura, 1986; Gist & Mitchell, 1992). The literature shows that even when other factors, like ability and skills, are controlled for, differences in self-efficacy

still have a significant effect on a person's behavior, which often results in a difference in performance (Bandura, 1986).

The following example should help illustrate the potential significance of self-efficacy. All the points made in this example are supported by research, which I will explain in detail following the example. Suppose two workers, "Hi" and "Lois," are the same in ability, experience, and skills with regard to task A, but differ in self-efficacy for task A, with Hi having high self-efficacy and Lois having low self-efficacy with regard to task A. (See Figure 5.) The literature on self-efficacy predicts the following results:

1. If they both have an opportunity to engage in task A, Hi will generally be more likely to do so than Lois.

2. Even if both workers engage in task A, Hi will persist more in the face of difficulty and exert more effort than Lois, who will be more likely to give up or lower her efforts when difficulties arise.

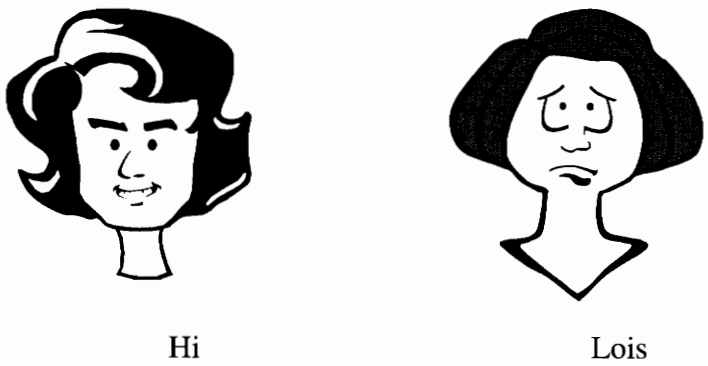

Figure 5: These workers initially have the same ability, experience, and skills, but differ in self-efficacy.

3. Hi will generally perform better than Lois due to her greater effort, even though they were the same on other dimensions, such as ability.

4. The higher performance of Hi serves to reinforce her original beliefs that she does have the ability to perform task A successfully, and thus her high self-efficacy is strengthened. Similarly, Lois's lower performance reinforces her initially low self-efficacy. Thus over time, self-efficacy, effort, and performance continue to reinforce each other in either a positive or negative direction. (See Figure 6 and compare the figure to my conceptual model in Figure 2, p. 8.)

Now let's examine the research that supports these claims. The four claims are substantiated in the four sections that follow.

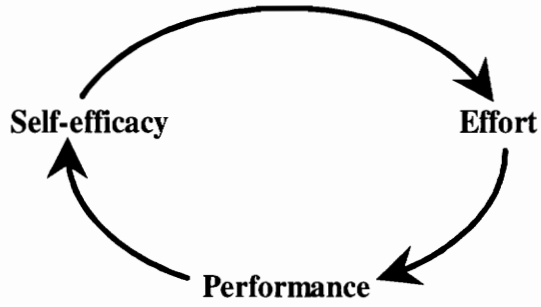

Figure 6: Self-efficacy influences effort, which influences performance, which in turn reinforces self-efficacy. Thus, initially high or low self-efficacy can have a snowballing effect.

Self-Efficacy and Choice of Task or Environment

The first claim was that Hi (in Figure 5) would be more likely to engage in a task due to her increased self-efficacy. The research consistently shows that self-efficacy positively correlates with a person's likelihood of engaging in a task. Ozer & Bandura (1990) state, "people tend to avoid activities and situations they believe exceed their coping capabilities, but they readily undertake activities and select social environments they

judge themselves capable of handling" (p. 472). The following brief explanations of research studies support the first claim.

In a study by Eden & Kinnar (1991), self-efficacy was related to the willingness of candidates to volunteer for the special-service forces within the Israeli military. Also, an intervention designed to increase self-efficacy resulted in an increase in self-efficacy as well as a corresponding increase in volunteering. While the control group volunteered at a rate of 76%, which was also the prior year's average, the experimental group had a volunteering rate of 84% ($p<.02$). These results are especially significant when looked at from a different perspective: The rate of *non-volunteers* decreased from 24% to 16%, a 33% decrease. Again, this study gives evidence that self-efficacy has an effect on a person's choice to engage in a particular task.

In another example that supports the first claim, Ellen, Bearden, & Sharma (1991) in two studies compared the effects of self-efficacy on the willingness to adopt a new innovation. In the first study, a treatment was designed to give different groups different perceptions of a new computer tool. This treatment created varying levels of self-efficacy within the subjects, and the group with higher self-efficacy indicated a greater willingness to use the new computer tool. The second study was similar, with two exceptions: 1) the innovation was a automated telephone course registration system, and 2) the treatment failed to produce the significant differences in self-efficacy desired. However, the subjects' natural levels of self-efficacy had enough variation to divide them into groups of high and low self-efficacy. Using these groupings, the results showed again, self-efficacy is related to willingness to use a new innovation. Thus, whether self-efficacy is influenced by a treatment or is "naturally" existing, it is related to the willingness to adopt a new innovation.

Frayne & Latham (1987) studied methods to increase work attendance of employees with irregular attendance. They found workers generally wanted to be more consistent in their attendance, but felt incapable of coping with problems in their work environment (i.e., they had low self-efficacy relative to their ability to deal with these problems). By offering training sessions that helped them deal with these problems, their self-efficacy increased and their attendance did also. Thus, here, self-efficacy was shown to relate to whether or not employees would go to work.

In a study by Hill, Smith, & Mann (1987), a questionnaire was used to examine the relationship between computer self-efficacy, previous experience with computers, and the decision to use a computer in the future. The most significant finding was that self-efficacy significantly predicted the decision to use a computer, but previous experience predicted the decision to use a computer only when self-efficacy was influenced also. Thus, self-efficacy was shown to mediate the relationship between experience and the decision to use a computer.

In a field study, Jorde-Bloom (1986) examined the factors that influenced administrators' decisions to implement the use of computers in the workplace. Using childhood education administrators as subjects, Jorde-Bloom found self-efficacy to correlate highly with the level of implementation of computers within the domain of the administrators ($r = .69, p < 0.001$).

Locke, Frederick, Lee, & Bobko (1984) examined the relationship between self-efficacy and goal setting. Pertinent to this discussion, self-efficacy was shown to be a major predictor of goal choice ($r = .53, p < 0.01$). That is, the higher someone's self-efficacy, the more likely that he or she will set higher goals for himself or herself. Although this study doesn't directly support the claim that those with higher self-efficacy will be more

willing to engage in an activity, it does give indirect support, since setting a goal is often the first step in engaging in an activity.

In yet another example that supports the first claim, Ozer & Bandura (1990) showed that women's self-efficacy relative to their ability to defend themselves if attacked is significantly related to the kind of activities they would choose to engage in (the correlations range from $r = .29, p < .10$ to $r = .59, p < .0001$). That is, if the subjects had high self-efficacy, they would be more likely to engage in a wider variety of activities and less likely to avoid certain activities. Ozer & Bandura concluded:

> Enhanced self-efficacy was reflected in expanded freedom of action. Subjects participated more actively in outdoor recreational activities, they used public transportation more readily, and they felt freer to attend evening cultural and educational events and social activities.... Their avoidant behavior was markedly reduced.
>
> (1990, p. 484).

In this study, the women's self-efficacy was not raised to the point that they would be willing to engage in excessively threatening activities, but instead they were more able to distinguish between truly threatening activities and ones they had control over but were previously afraid to engage in.

All of the studies described here show the relationship between self-efficacy and the likelihood of engaging in a task. As shown in these studies, this relationship holds across a variety of conditions: in controlled experiments and real world situations; when self-reports are used and when behavior is measured; in situations where self-efficacy has been influenced by an intervention and in situations where self-efficacy was not influenced.

The literature reviewed in this section supports the proposed relationship between computer self-efficacy and choice to engage in a computer task as shown in my conceptual model. (See Figure 2, p. 8.) This literature also suggests that increasing self-efficacy is a valid approach to help people be more likely to engage in tasks they might otherwise avoid, such as using a computer. Thus, this literature forms the basis for my hypothesis that an increase in computer self-efficacy will result in an increase in a person's intentions to use a computer.

Self-Efficacy and Effort

The second claim in my example was that when engaging in a task, Hi (in Figure 5) will exert more effort and persist more in the face of difficulties than Lois, who will be more likely to give up or reduce her efforts when difficulties arise. This claim is almost a logical extension of the first: if someone is more likely to put themselves in a situation as a result of higher self-efficacy, it seems he or she would also be more likely to try harder once in the situation. In Bandura's review of the literature, he states, "When beset with difficulties, people who are plagued by self-doubts about their capabilities slacken their efforts or give up altogether, whereas those who have a strong sense of efficacy exert greater effort to master the challenge (Bandura & Cervone, 1983, 1986; Brown & Inouye, 1978; Schunk, 1984b; Weinberg, Gould, & Jackson, 1979)" (1986, p. 394).

Please note that the relationship between self-efficacy and effort is expected to hold for tasks of sufficient difficulty, not necessarily for overly simple tasks. For example, on a relatively easy task, a person's low effort may simply mean that not much effort was required to perform the task, not that he or she harbored self-doubts about his or her abilities. But on difficult tasks, a person's self-efficacy should positively relate to effort.

Thus, studies examining the relationship between self-efficacy and effort should measure effort only on relatively difficult tasks.

In one example, Bandura & Cervone showed that self-efficacy was correlated with an increase in effort on a strenuous physical task (1983). In this study, effort was operationalized as the amount of work done for 5 minutes on an exercise bike. Interestingly, this relationship was found in the conditions where goal setting was used (*r's* were .45 and .57 in the two conditions that used goal setting; $p<.03$, $p<.01$, respectively), but not in the conditions where goal setting was not used.

In a study by Bandura & Schunk (1981), mathematical self-efficacy was increased in children by the use of proximal (short-term) goals. Of all the conditions in this experiment, the proximal goals group had an increase in self-efficacy significantly higher than in all the other groups. This group was also shown to persist longer on more difficult math problems before either giving up or solving them. They showed a 90% increase in effort after the treatment ($p<.005$), whereas the other groups showed no significant increase. However, when effort was measured for easier problems, there were no significant differences between the groups.

A study by Andrews & Debus (1978) gives indirect evidence for the relationship between self-efficacy and effort. In this study, subjects were asked the reason for their failures on a certain task. The more the subjects rated lack of effort as a reason for failure, the more they persisted at the task (*r's* range from .52 to .80, all *p's* <.01). Also, the more the subjects rated lack of ability as a reason for failure, the less they persisted at the task (*r's* range from -.21 to -.38, all *p's* < .05). Although not specifically mentioned in this study, self-efficacy appears to be related to the measures used here. Subjects believing they lack the ability to succeed at a task would have low self-efficacy, whereas those who believe

they need more effort to succeed would most likely believe they have the ability—meaning they probably have high self-efficacy. A study by Collins (cited in Bandura, 1986) supports this link, showing that those with high self-efficacy were more likely to attribute failure to lack of effort, whereas those with low self-efficacy were more likely to attribute failure to lack of ability. Thus, those with "high self-efficacy" persisted more, and those with "low self-efficacy" persisted less.

In the second phase of this study, those with "low self-efficacy" were randomly allocated to one of two treatment groups or a control group. In the treatment groups, the subjects were given positive reinforcement for making effort attributions for success or failure. Following the treatment, all groups were given a task that was insoluble. The treatment groups attributed failure at this task to effort significantly more than did the control group ($p < .01$). More importantly, the treatment resulted in increased persistence on this task relative to persistence measures taken before training ($p < .01$). These results give more evidence for the causal link between attribution of success or failure (and indirectly, self-efficacy) and effort or persistence.

Together, the studies in this section support the relationship between self-efficacy and effort as shown by the curved arrow in my conceptual model. (See Figure 2, p. 8.)

Self-Efficacy and Performance

The third claim in my example was that Hi (in Figure 5) will generally perform better than Lois as a result of her higher self-efficacy. Successful performance is more than simply having the ability and skills necessary for a task. Success often requires persistence over a long period of time. Proper motivation is necessary for a person to sustain effort at an activity over a long period of time, otherwise, he or she may give up

early. High self-efficacy, the belief that a person *can* and *will* eventually succeed, is necessary for him or her to put forth the effort that leads to success. In this case, the relationship between self-efficacy and performance is mediated by persistence or effort.

The relationship between effort and performance may also be mediated by thought patterns. Bandura says that "those who judge themselves inefficacious in coping with environmental demands dwell upon their personal deficiencies and cognize potential difficulties as more formidable than they really are (Beck, 1976; Lazarus & Launier, 1978; Meichenbaum, 1977; Sarason, 1975a)" (1986, p. 394). These thought patterns may lead these people to focus their attentional resources on their inadequacies, taking away their ability to focus on the task. "By contrast, persons who have a strong sense of efficacy deploy their attention and effort to the demands of the situation" (Bandura, 1986, p. 394).

Several studies have shown the relationship between self-efficacy and performance across a wide variety of situations. Barling & Beattie (1983) showed that even when other factors were controlled for, self-efficacy was correlated with sales performance of life insurance salesmen. Garland (1984) and Locke, Frederick, Lee, & Bobko (1984) show that in goal-setting studies, the higher the self-efficacy, the better the performance (when other variables were controlled for). In Gist & Mitchell's review of the literature, they cite several other studies that link self-efficacy with work-related performance: "faculty research productivity (Taylor, Locke, Lee, & Gist, 1984), coping with difficult career-related tasks (Stumpf, Brief, & Hartman, 1987), career choice (Lent, Brown, & Larkin, 1987), learning and achievement (Campbell & Hackett, 1986; Wood & Locke, 1987)" (1992, p. 183). Gist (1987) cites many other studies that show self-efficacy and task performance to be correlated.

Gist, Schwoerer, & Rosen (1989) tested the effects of a specific training method designed to increase self-efficacy with regard to a new computer software package. This method showed a significant increase in self-efficacy and performance on a subsequent test. This study shows that focusing on increasing self-efficacy is a legitimate route to improving performance. This study also shows that those who had higher computer self-efficacy coming in performed better, even when previous computer experience was accounted for. So, whether self-efficacy already existed or was manipulated, the relationship to performance still holds.

These studies support the indirect effect of computer self-efficacy on performance as shown in my conceptual model. (See Figure 2, p. 8.)

The Cyclic Effect of Self-Efficacy, Effort, and Performance

The fourth claim in my example was that the differences between Hi and Lois in self-efficacy, effort, and subsequent performance will tend to reinforce the original beliefs of self-efficacy. Gist states this relationship well:

> Those with moderate to high self-efficacy tend to engage more frequently in task-related activities and persist longer in coping efforts; this leads to more mastery experiences, which in turn enhance self-efficacy. Those with low self-efficacy tend to engage in fewer coping efforts; they give up more easily under adversity and evidence less mastery, which in turn reinforces their low self-efficacy (Bandura, 1977a, 1982; Bandura & Schunk, 1981; Brown & Inouye, 1978)...
>
> (Gist, 1987, p. 474)

Because personal mastery experiences are the most powerful source of efficacy information, a person's performance will have a significant influence on his or her subsequent self-efficacy. Thus, self-efficacy has an influence on performance (among other things), and performance has an influence on self-efficacy. There is a reciprocal

and reinforcing relationship between the two. This cyclic effect is the basis for the self-reinforcing loop shown in my conceptual model. (See Figure 2, p. 8.) This effect also suggests that intervening anywhere on the loop to positively influence one of the components can potentially have an effect on self-efficacy. Thus, an intervention that addresses all of the components on the loop would seem to be the most promising way to influence self-efficacy, since such an intervention would take every advantage of the potential "snowballing" effect built into the loop. In accordance with this reasoning, I selected an intervention that addressed each component in the loop. (See "Relating the Conceptual Model to this study" on p. 11.) This intervention is a strategy using goal setting, self-reinforcement, and feedback. (This strategy is discussed further in the section entitled "Strategy Packet (treatment & placebo)" on p. 49.)

Self-Efficacy Mediating Other Important Relationships

Self-efficacy is also important because it has been found to mediate other well-known relationships. For example, self-efficacy mediates the relationship between abilities (or skills) and performance. Ability alone does not give rise to successful performance. A person who has the requisite ability for a task may fail to perform well if he or she harbors self-doubts about his or her abilities (Ozer & Bandura, 1990). In one study, when children's mathematical ability was controlled for, those with higher self-efficacy performed better on many dimensions. Citing this study, Bandura says, "While mathematical ability contributed to performance, at each ability level children who regarded themselves as efficacious were quicker to discard faulty strategies, solved more problems, chose to rework more of those they failed, did so more accurately, and displayed more positive attitudes toward mathematics," (Bandura, 1986, p. 391). Thus, abilities and skills should be accompanied by self-efficacy for a person to perform well.

The role of self-efficacy as a mediator shows us the importance of not only helping people by increasing their ability or skills, but also by making sure there is a corresponding increase in self-efficacy as well. One practical implication is if you're going to train somebody to do a task, you should not only focus on imparting the relevant skills, but also design the training with the aim of increasing self-efficacy in proportion to those skills.

Self-efficacy also mediates the relationship between anxiety and behavior. Anxiety only has an effect on behavior when self-efficacy is affected by the anxiety (Ozer & Bandura, 1990). Locke, Frederick, Lee, & Bobko (1984) found that the relationship between goal setting and performance is mediated by self-efficacy. These examples show that self-efficacy may be an important, yet "hidden" reason why other well-known relationships work the way they do.

In this study, I propose that the strategy (i.e., the intervention I use to increase self-efficacy) will influence intentions to use a computer indirectly through its influence on computer self-efficacy. Thus, I expect self-efficacy to mediate the relationship between the strategy and intentions to use a computer.

How Does Self-Efficacy Develop?

Bandura (1986) gives four sources of information that people use to make self-efficacy judgments regarding their ability to perform a task. These four sources of efficacy information are 1) personal mastery experiences, 2) vicarious experiences, 3) verbal persuasion, and 4) physiological state (e.g. anxiety). In this study, the strategy I use to increase self-efficacy is designed to make use of personal mastery experiences, since this source is the most powerful source of self-efficacy information.

Personal Mastery Experiences

In personal mastery experiences, self-efficacy is changed through personal experience. For example, if a person continually performs well at an activity, most likely (though not certainly) he or she will develop high self-efficacy for that task. Of the four sources of self-efficacy information, this source has been shown to produce the most significant results, since it is based on personal experience (Bandura, 1986). Research has also shown that a person's early experiences at a task carry the most weight and are difficult to change once established (Bandura, 1986). Thus, if a person initially develops high self-efficacy for a task and then experiences occasional failures, he or she is more likely to attribute those failures to insufficient effort, poor strategies, or bad luck rather than lack of ability. Similarly, if initial experiences are negative, it is unlikely that occasional successes will do much to enhance self-efficacy. These examples show the importance of providing others with positive experiences when they are first becoming acquainted with a task.

In this study, I use a strategy aimed at giving the subjects personal mastery experiences. The subjects are encouraged to challenge themselves through setting short-term goals, and the use of self-reinforcement provides motivation to meet those goals. If the goals are challenging but not overwhelming (as I explain in the description of the strategy), this strategy should lead to many personal mastery experiences, which in turn will increase computer self-efficacy.

Vicarious Experiences

Because people don't always have personal experiences to base their self-efficacy judgments on, they often rely on learning from other people's experiences. In this case,

they judge their own ability to perform a task by comparing themselves to the person they have seen model the task; that is, they rely on vicarious experiences in forming their self-efficacy judgments. For vicarious experiences to have the most influence, people must perceive the model as similar to themselves on important characteristics (e.g., ability) (Bandura, 1977). In addition, the more people can observe which of the model's behaviors led to successful performance on a task, the more powerful the information will be (Gist, 1987). Although not as powerful as enactive attainments, vicarious experiences are a significant source of self-efficacy information, especially when no personal experience is available.

Verbal Persuasion

Verbal persuasion is essentially when someone tries to talk a person into believing that he or she is capable of performing some task. Because verbal persuasion relies neither on personal experience nor watching someone else model the task, this source of information is a relatively weak form of self-efficacy information and is not likely, by itself, to produce enduring effects in behavior (Bandura, 1986). However, if someone is harboring self-doubts about his or her ability to perform an activity, verbal persuasion can be used to temporarily boost his or her self-efficacy, resulting in increased effort on the activity, which may then lead to increased performance. This personal mastery experience will then have a longer lasting influence on the person's self-efficacy than the verbal persuasion that initiated the efforts. So verbal persuasion may be helpful only to the extent that it leads to personal mastery experiences (Bandura, 1986). However, if verbal persuasion leads someone to do a task far beyond their ability and he or she fails miserably at the task, this may lower self-efficacy and also undermine the trust in the persuader (Bandura, 1986). In such a case, verbal persuasion can produce seemingly

positive short-term effects by giving people the confidence to engage in new activities, but can backfire when failure at the task occurs.

Physiological State

Perhaps the best example of a physiological state that influences self-efficacy is anxiety. In cases where a person experiences anxiety when confronted with a task, it is common for him or her to attribute that anxious feeling to a lack of ability (Bandura, 1977).

How Is Self-Efficacy Different from Other Expectancy Theories?

Because self-efficacy is often confused with other expectancy theories, I'll briefly discuss the differences here. I do not use or test these theories in this study. I include these theories here only to compare and contrast them with self-efficacy.

Locus of Control

According to this theory, people can generally be categorized as having either an internal or external locus of control. Those with an internal locus of control believe that rewards are contingent on personal performance, whereas those with an external locus of control believe that external factors (i.e., those unrelated to the person's behavior) determine rewards. As would be expected, internals will generally (though not always) exert more effort and thus perform better on various tasks than externals. Many studies have shown this effect (Phares, 1976). Although this theory has similarities with self-efficacy theory, it is different in that self-efficacy theory focuses on whether or not the person can perform the task successfully and not whether or not rewards or outcomes are associated with the

task. (See Figure 7.) To illustrate locus of control, suppose a second grader Fred believes his math grades are entirely dependent on his performance and luck has little to do with it. With regard to this math test, Fred has an internal locus of control. However, Fred has no confidence in his ability to perform even if he exerts effort, and therefore, Fred has low self-efficacy for this task, which will generally result in low effort. In this case, Fred's low effort is due to his low self-efficacy, not due to an external locus of control. Similarly, if Fred has high math self-efficacy, but believes that the test score does not depend on good performance, but rather luck, he may also put forth little effort. So self-efficacy theory and locus of control are both important. They may lead to similar results, but for different reasons; and, therefore, we must differentiate between the two.

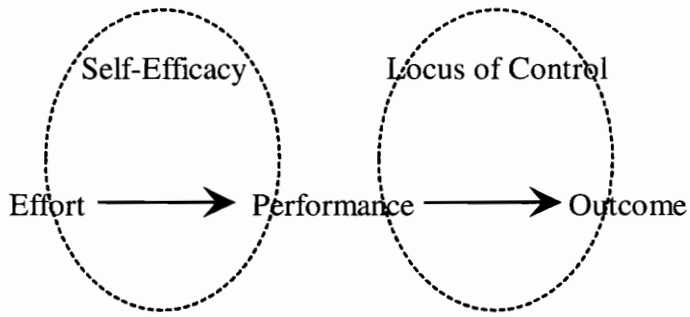

Figure 7: Self-efficacy and locus of control are two different kinds of expectancy. Self-efficacy asks, "Can I perform it?" Locus of control asks, "Is the outcome dependent on me?"

Another technical difference is that locus of control is generally used as a global measure rather than a task specific measure. (Although I used locus of control as being specific to a task in my example above to illustrate a point, it is not typically used this way.) Self-efficacy, however, is typically specific to a task, and is generally not used in a global sense (although some have conceptualized self-efficacy that way).

Expectancy Theory

Expectancy theory, as proposed by Vroom (cited in Muchinsky, 1990), explains that a person's motivation will depend on two different kinds of expectations. These are expectations about 1) the degree of relationship between effort and performance, and 2) the degree of relationship between performance and outcome. (See Figure 8.) Additionally, motivation will depend on how much the person values the outcomes or rewards available.

As you can see, E1 is similar to self-efficacy. There are differences, however. Locke (1984) states, "Bandura (personal communication) views self-efficacy as a much wider concept than effort-performance expectancy. He believes that self-efficacy is determined by many factors other than effort, (e.g., ability to function under stress, ingenuity, adaptability.)" (p. 248). Another difference is in the way self-efficacy is measured (Gist & Mitchell, 1992). For example, self-efficacy is usually measured in terms of its magnitude and strength, where magnitude is the level of performance a person believes he or she can achieve, and strength is how sure the person is that he or she can achieve that level. Measures of E1 expectancy are generally not as detailed as measures of self-efficacy. Self-efficacy does not seem to be a separate concept from E1, but rather is a more detailed, accurate, and thorough description of E1.

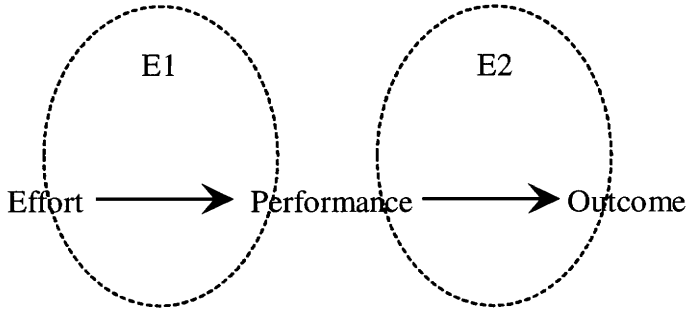

Figure 8: Expectancy theory says that motivation depends on both effort-performance expectations (E1) and performance-outcome expectations (E2). E1 is similar to self-efficacy.

Self-Esteem

Self-efficacy is often confused with self-esteem. The main difference between the two is that self-esteem is a person's global feelings of self-worth or self-liking, whereas self-efficacy is task specific and not inherently evaluative (Gist & Mitchell, 1992). Gist & Mitchell (1992) give a good example of this: "A rocket scientist may have very low self-efficacy with regard to dancing, yet may decide on reflection that this is satisfactory and that it does not diminish his or her overall evaluation and feelings about the self" (p. 185).

How Can Self-Efficacy Be Increased?

Self-efficacy becomes a particularly valuable construct as we understand how we can increase it. However, although several studies have shown self-efficacy can be increased, little has been done to systematically study how best to do this. Gist & Mitchell (1992) review the literature on the malleability of self-efficacy and conclude that "the extent to which self-efficacy and performance can be raised and the overall malleability of self-efficacy still are unresolved issues. Little attempt has been made to understand systematically which determinants might be altered to yield the greatest change in self-efficacy and which change strategies should be used" (p. 198).

In choosing an intervention to increase self-efficacy in this study, I had little to choose from, since there has been only little research in this area. In addition to this limited selection of interventions, I had to find one that would work within the constraints of this study. The major constraint in this study was that I had very little contact with or control over the subjects, since I only have access to them for a few minutes at the beginning of a few classes during the semester. In my literature review on increasing self-efficacy, most of the studies increased self-efficacy using methods requiring much time and involvement with the subjects. Given my constraints, I could feasibly use only two methods. The first method suggested by the literature was based on a study by Eden & Ravid (1982) and would have involved simply telling some students that, based on their questionnaire responses from the prior week, they had a high (or regular) potential for success in the class. Assuming the students would have believed this assessment, self-efficacy would have been directly induced through deception. I did not choose this method primarily because inducing self-efficacy through deception alone doesn't have much applied value.

The second method from the literature that was feasible for my study was based on studies by Bandura & Schunk (1981) and Frayne & Latham (1987). Although these studies used different methods, they were easily combined into one package that could be used in my study. Bandura & Schunk's intervention used proximal subgoals (short-term goals) and had the advantage of being relatively easy to administer. (The study is described in more detail below.) Frayne & Latham's intervention included short-term goals, feedback, and self-reinforcement, but was extremely time consuming. I decided the concepts that seemed so useful in both of these interventions could be incorporated into a short strategy document with relative ease. Thus, the intervention to increase computer self-efficacy was a strategy that included short-term goal-setting, self-reinforcement, and feedback. A copy of the strategy is included in Appendix C. The two

studies this strategy was based on are described below. Other studies that have successfully increased self-efficacy (There are few.) are also briefly described to show some of the different strategies researchers have used to influence self-efficacy.

Bandura & Schunk (1981)

Bandura & Schunk (1981) used proximal goals to increase mathematical self-efficacy in children. In this study, children with gross mathematical deficits were put in one of the following four conditions: proximal subgoals, distal goals, no goals, or control. For all the groups except the control group, the subjects were given a self-instructional set of 42 pages of math problems to work designed to help them with their subtraction skills. The proximal goals group was told to try to complete six pages every day (each day consisted of a 30 minute session). The distal goals group was told to try to complete the entire 42 pages in seven days (which is the equivalent of six pages per day). The no goals groups were told simply to complete as many pages per day as possible. The control group did not use the self-instructional material at all. The results showed that self-efficacy was raised significantly more in the proximal goals condition than in the other conditions, and that the distal goals and no goals conditions were not significantly different from each other, although self-efficacy was increased in each case. The control group showed no change in self-efficacy. It appears that the increase in self-efficacy was in part due to the lessons provided by the workbook, since all groups using the workbook showed an increase in self-efficacy, and the control group did not. However, the proximal goal condition yielded an increase in self-efficacy higher than that of the other conditions using the workbook, which seems to indicate that the use of proximal goals is an especially effective method of increasing self-efficacy.

Frayne & Latham (1987)

Frayne & Latham (1987) used self-management training to increase the attendance of 20 unionized state government workers. They explain the link between self-efficacy and poor job attendance as follows: "The implicit theory underlying the present study with regard to job attendance is that many people judge themselves as inefficacious in coping with environmental demands that prevent them from coming to work" (p. 387,388). Thus, their intervention was focused on increasing these workers' beliefs that they can cope with various job demands that had formerly kept then from coming to work, and that this increase in self-efficacy would lead to increased job attendance.

Forty workers who had poor job attendance were randomly assigned to an experimental group (n = 20) or a control group (n = 20). The experimental group received an eight-week self-management training program, and the control group was told they would receive the training at a later date. Each week the trainees met in a group for one hour, and met one-on-one with the trainer for 30 minutes. The outline of the content of the sessions is as follows (Only seven sessions were given.):

Week 1: orientation–explaning the principles of self-management

Week 2: self-assessment–describing reasons for not coming to work, identifying problem behaviors

Week 3: goal-setting–setting both distal goals and proximal goals

Week 4: self-monitoring of one's behavior–using charts and diaries

Week 5: identification of reinforcers and punishers–self-administered as a result of achieving or failing to achieve the proximal goals

Week 6: review of previous sessions

Week 7: maintenance (of the self-management techniques)

The results showed that the experimental group, when compared with the control group, had significantly higher self-efficacy ($p < .05$) and higher attendance over the 12 weeks following the training ($p < .05$). Additionally, self-efficacy and attendance were highly correlated ($r = .49$, $p < .05$). Insight on why this training worked is offered by the trainees responses: "[They] reported that the training enabled them to identify obstacles that prevented them from coming to work; it helped them overcome these obstacles; it led them to set specific goals for increasing job attendance; and it increased their confidence in their ability to control their own behavior" (p. 389).

Sims & Lorenzi explain why a behaviorally based approach has important cognitive outcomes: "Behavioral success with a task leads to increased self-efficacy. Physical acts produce cognitive consequences; enhanced self-efficacy may be the single most meaningful outcome of self-management" (1992, p. 189).

Bandura (1977)

Bandura (1977) increased self-efficacy in snake phobics by using systematic desensitization, slowly introducing the subjects to experiences that are progressively more threatening. In one group, the subjects personally experienced each of the progressively threatening situations (personal mastery experience), and in another group, the subjects only watched the therapist perform the tasks (vicarious experience). A control group experienced none of these. The results showed that the personal mastery produced a greater increase in self-efficacy than the vicarious experience, which in turn was greater than the control group. The resulting levels of self-efficacy were highly correlated with subsequent behavior around snakes ($r = .83$ and $r = .84$ for personal mastery and vicarious experiences, respectively).

Eden & Ravid (1982)

Trainees in a military training course ($n = 8$) had their self-efficacy increased by having a military psychologist tell them in a personal five-minute interview that, based on information from the military psychological unit, the trainees had a high potential for success. The control group ($n = 8$) were told they had a regular potential for success. Both groups were taking the same class. Results showed that test scores were significantly higher for the experimental group ($p < .01$).

Eden & Kinnar (1991)

In this study, the researchers tried to increase volunteering for special-forces service in the Israel Defense Forces by increasing efficacy through modeling and verbal persuasion. Prospects for the special forces were brought to a pre-induction program to help them learn about the special forces and to encourage them to volunteer. These prospects were the cream of the crop within the Israeli military. The control group went through the normal induction process, and the experimental group had the same process, but they were 1) verbally persuaded by an officer that, according to their prior tests, they had what it took to succeed, and 2) given a vicarious experience by a colleague close to their age who had been in the program for a while. (Rather than just give "dry" information as is the normal procedure, the colleague gave personal examples of what he went through.) Results showed that volunteering was 84% in experimental group and 76% in the control group. ANOVAs for both self-efficacy and willingness to volunteer showed significantly higher results for the treatment group (p's $< .01$).

Gist (1989)

On an idea generation task for managers, a training method composed of cognitive modeling with practice and reinforcement generated significantly higher self-efficacy than a training method using lecture and practice alone. Interestingly, the knowledge gained was the same in both groups.

Gist, Schwoerer, & Rosen (1989)

This study looks at the effects of alternative training methods on self-efficacy and performance in computer software training. Two types of training approaches were compared as subjects learned how to use a financial software package: behavioral modeling (show and tell method) and a computer-based tutorial (tell method). In both cases, subjects had the opportunity to practice the responses. The primary dependent variables were performance and software self-efficacy. Modeling was found to be superior in both of these measures. Also, those who had higher computer self-efficacy coming in performed better, even when previous experience was accounted for.

Ozer & Bandura (1990)

The authors explain that women often avoid going to certain places for two reasons: their inability to defend themselves if assaulted, and their inability to control their negative thoughts. They successfully increased self-efficacy in both of these areas through a self-defense program.

Summary

This chapter summarized the literature on self-efficacy, its effects, and how it can be increased. In this study, I intend to further the research on how to increase self-efficacy, particularly computer self-efficacy. In addition, I intend to strengthen the connection between a person's computer self-efficacy and his or her intentions to use a computer.

RESEARCH APPROACH

Type of Research

This research can be classified as applied research, as opposed to basic research. The goal of this research is to address a practical problem: How can computer self-efficacy be effectively raised to increase a person's likelihood of using a computer? Although this research may be helpful for other researchers in formulating, expanding, an developing theories related to self-efficacy and computer self-efficacy, theory formulation is not the goal of this research.

This research can also be classified as primarily using a deductive approach. That is, I began with hypotheses and then I collected data to test my hypotheses. However, once the data were collected and I ran some post hoc tests to explain the data in ways not addressed by the original hypotheses, I was using an inductive approach. That is, at that point, I began with the data and tried to formulate empirical generalizations to explain them.

This research can also be classified as a field experiment using a pretest-posttest control group design (Leedy, 1989). This research was a field experiment as opposed to a laboratory experiment because it was carried out during a computer course over a period of several weeks, and I did not have control over this course or the period of time intervening the various stages of my research. However, because the subjects were randomly assigned to conditions, this research can be classified as an experiment.

Variables

The primary variables of interest in this study are strategy, computer self-efficacy, instrumentality beliefs, intentions to use a computer, and performance. I discuss each of these variables below. (For a more thorough description on how these variables were measured in the different questionnaires, see the sections describing Questionnaires 1 and 4 on pages 48 and 51, respectively.) The relationships between these variables that I planned to test are shown in the research models (Figures 9, 10, and 11) described in the following section, "Research Models," on page 43.

Strategy

The strategy variable refers to the strategy condition the subjects were assigned to. One strategy was designed to increase computer self-efficacy, and one was designed to be a "placebo" strategy that was not expected to increase computer self-efficacy. I will call those who received the first strategy the treatment group and those who received the second strategy the control group. (The strategy designed to increase computer self-efficacy was the one I was testing, and this strategy is the one I have been referring to throughout this document when I mention "the strategy." I designed the other strategy only to be a placebo, and thus this strategy has therefore not been mentioned until now.) The subjects knew they received different strategies. However, the subjects were led to believe they were receiving different strategies based on an analysis of their responses on Questionnaire 1, when in actuality the strategies were assigned randomly. (For a description of the strategies I used, see page 49 in the "Methodology" section.)

Computer Self-Efficacy

Computer self-efficacy refers to a person's belief in his or her ability to successfully use a computer. Someone who believes very strongly in his or her ability to use a computer would have high computer self-efficacy. This measure was made by asking the subjects their perceptions on a questionnaire.

Instrumentality Beliefs

Instrumentality beliefs are a person's beliefs about whether or not computers are useful to him or her or instrumental in gaining desired outcomes. A person having high instrumentality beliefs about computers would be someone who believes strongly that computers are useful to him or her. Instrumentality beliefs were assessed by asking subjects their beliefs on a questionnaire.

Intentions to Use a Computer

Intentions to use a computer are the subjects' intentions to use a computer as measured by their responses to several items on a questionnaire. These items asked the subjects about their intentions to use and own a computer in the future, and also about the subjects' likelihood of using a computer versus a more "manual" method for several different tasks.

Performance

Performance refers to the subjects' performance in the introductory computer class. Performance was measured by asking the subjects their grades in the course.

Research Models

My research models show the relationships between the variables I planned to test. I include three research models to reflect the three different ways I planned to analyze the data. In Research Model 1 (See Figure 9.), the arrows show the expected influence of the strategy on computer self-efficacy, intentions to use a computer, and performance. In Research Model 2 (See Figure 10.), the arrows show all the possible relationships between the variables I planned to test in a path analysis of the model. In this research model, I did not have any a priori hypotheses about which relationships I expected to be significant; the path model analysis would test all the relationships for significance. Thus, the arrows in Research Model 2 only represent possible relationships between the variables, not necessarily relationships I expected to be significant. In Research Model 3 (See Figure 11.), I show three variables of particular interest: strategy, computer self-efficacy, and intentions to use a computer. Using a path model analysis, I expected to find that the strategy has an indirect effect on intentions to use a computer through its influence on computer self-efficacy. This expected relationship is shown by the two bold arrows in Figure 11.

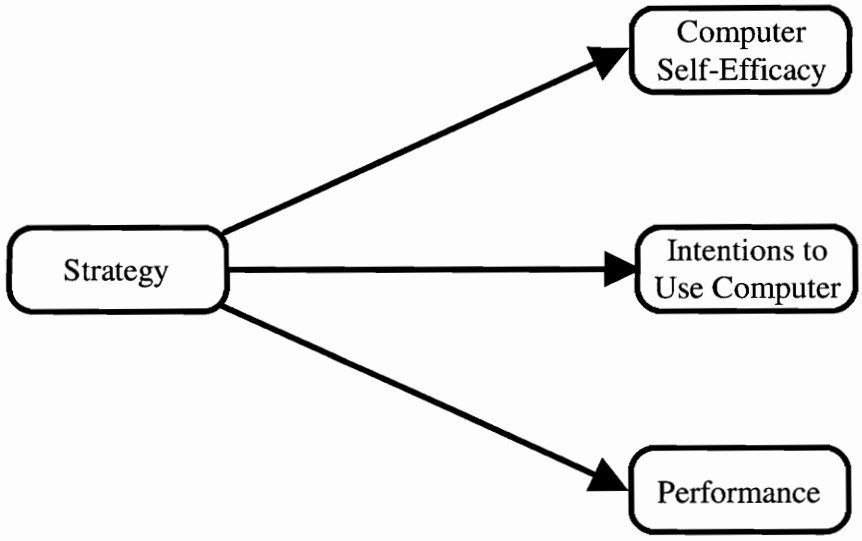

Figure 9: Research Model 1. The arrows show the relationships I expected to find through a multivariate analysis of variance.

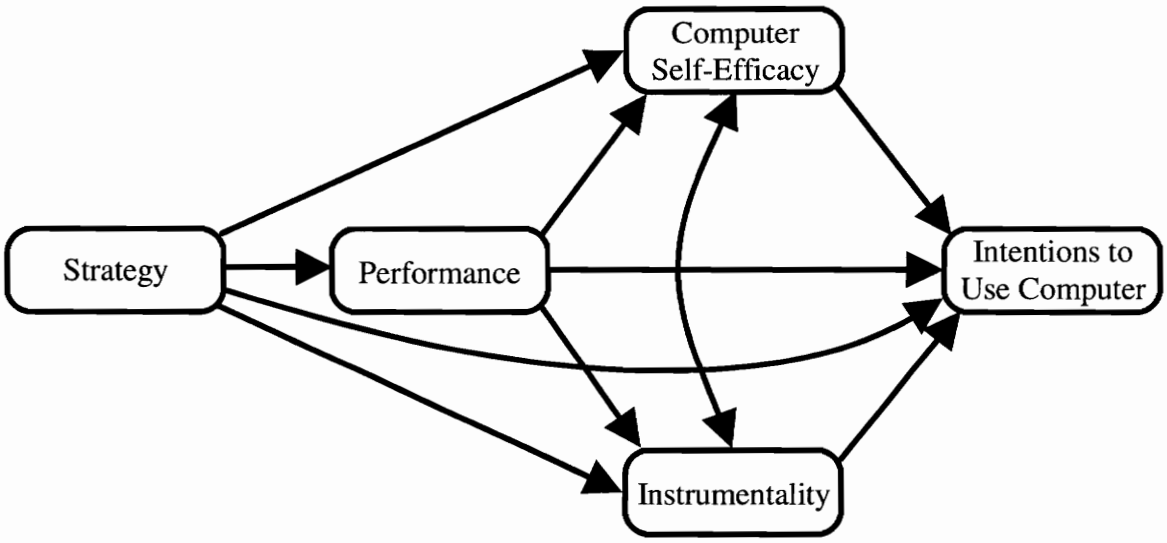

Figure 10: Research Model 2. The arrows show all possible relationships to be tested by a path analysis. I had no a priori hypotheses about which relationships would be significant.

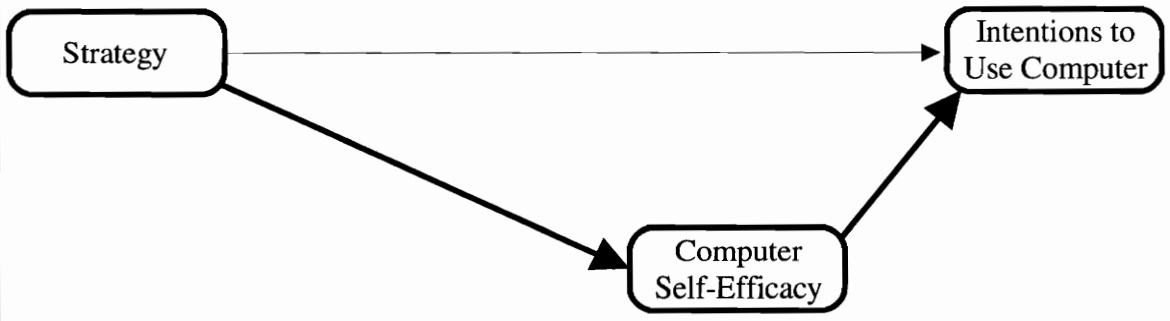

Figure 11: Research Model 3. The arrows show all the possible relationships between these three variables of interest. The bold arrows show the relationships I expected to be significant when tested by a path analysis.

Testable Hypotheses

Testable Hypotheses 1, 2, and 3 correspond to Research Models 1, 2, and 3, respectively.

1. The two strategy groups will differ in computer self-efficacy, intentions to use a computer, and performance.

2. Research Model 2 (shown in Figure 10) will be supported by a path analysis of the model.

3. The strategy will have an indirect effect on intentions to use a computer through the strategy's influence on computer self-efficacy.

METHODOLOGY

Subjects

The subjects were students from eight introductory computer classes. The total number of students in these classes was about 270, but due to absences and non-participation, I did not get responses from all students. One-half of the subjects in each class were randomly selected to receive the self-efficacy strategy, and the other half were randomly selected to receive the placebo strategy. The subjects' participation was voluntary, and no incentives were used to gain their participation. The instructors of these classes allowed me to make use of class time to administer the various materials required for the study.

Of the eight classes, two were computer science classes taught at New River Community College, and the other six were information systems classes taught at Radford University. Both sets of classes covered how to use word processors, database management systems, and spreadsheets. Radford classes also covered Microsoft Windows, and the New River classes also covered Microsoft DOS and desktop publishing. A major difference between the classes was that the New River classes did not require the students to use a computer; it was a lecture class only. Students could get hands-on experience in a lab class that was associated with the class, but students were not required to take these two classes at the same time. The Radford classes, on the other hand, required extensive computer use as a part of the class.

Materials

I used several materials for this study. In order of presentation, they include:

- Consent Form
- Identification Code
- Questionnaire 1
- Strategy Packet (treatment & placebo)
- Questionnaire 2
- Questionnaire 3
- Questionnaire 4

Consent Form

Before any participation in this study, the subjects were given a consent form to read over and sign to indicate that they understood the conditions of this study. The consent form emphasized that their responses would be confidential and that their participation was voluntary. A copy of the consent form is included in Appendix A.

Identification Code

To maintain the subjects' confidentiality, I used a special eight-digit identification code. This code was necessary to match their responses on the several different questionnaires. Because I wanted to give the subjects complete confidence their instructor would not and could not know their responses, I chose not to use their social security number. The code I used was based on their mother's and father's birthday. Instructions were provided to help the subjects fill out this code correctly. The instructions and code were pilot tested for clarity and were revised accordingly. See Appendix H for a summary of this pilot test. Copies of the instructions and code were at the top of every questionnaire. For example, see Questionnaire 1 in Appendix B.

Questionnaire 1

Questionnaire 1 had 61 items. This questionnaire was designed to measure the subjects' computer self-efficacy (26 items), instrumentality beliefs about computers (5 items), future intentions to use and own a computer (2 items), computer experience (4 items), and demographic and background information (12 items). The questionnaire also included 12 items designed to enhance the face validity of the research. Because the subjects would later receive a letter telling them that a strategy was selected for them based on an analysis of their questionnaire responses, I wanted to include these "credibility" items that would make this claim believable. A copy of Questionnaire 1 is included in Appendix B.

I constructed the 26 computer self-efficacy items in a variety of ways. I adapted 9 items from Murphy, Coover, & Owen (1989) and 4 items from Merritt & Koball (1993). The Cronbach's α for the scales that these items came from were .96 and .82, respectively. I generated the other 13 self-efficacy items specifically for this study. There was no reliability statistic associated with these items since they were new. (However, a reliability analyses of these items will be discussed in the "Results" chapter.) Many of the new items I generated related specifically to the content of the course, and so the computer self-efficacy items the Radford classes and New River classes received were slightly different (for only 2 of the 26 self-efficacy items), reflecting the different content of the two courses. The instrumentality beliefs items were also based on the literature (Hill, Smith, & Mann, 1987; Merritt & Koball, 1993), being adapted from a scale with a Cronbach's α of .82 (Merritt & Koball, 1993). The future intentions to use and own a computer were adapted from Hill, Smith, & Mann (1987). These two items had no reliability statistics associated with them. The four computer experience items were generated for this study and had no reliability statistic associated with them. The

demographic and background items covered a variety of areas including gender, age, educational level, and others. I pilot tested Questionnaire 1 for clarity, but not for reliability. The results of this pilot test are summarized in Appendix H.

Strategy Packet (treatment & placebo)

The strategy packet included a one page cover letter and a four page document explaining one of two strategies. The treatment group received a document entitled "Computer Performance Improvement Strategy," and the control group received a "placebo" strategy entitled "Computer Instrumentality Strategy."

The cover letter was the same for both groups and essentially says the following two things: 1) the strategy they are receiving was selected for them based on an analysis of their responses from Questionnaire 1, and 2) using the strategy is expected to improve their performance in the class. Thus, the subjects knew they were not all receiving the same strategy, but they did not know that the selection of the strategy was random. In the letter, I told the subjects that the strategy should help improve their class performance to increase the likelihood that they would try the strategy.

I designed the "Computer Performance Improvement Strategy" (CPIS) to increase subjects' computer self-efficacy as they used this strategy. The CPIS incorporates goal setting, self-reinforcement, and feedback. The CPIS is primarily based on Frayne & Latham's (1987) method of increasing self-efficacy through principles of self-management. The CPIS also incorporates Bandura & Schunk's (1981) use of proximal subgoals to increase self-efficacy (except I call them short-term goals). Of the studies that demonstrate an increase of self-efficacy (of which there are few), the studies by

Frayne & Latham (1987) and Bandura & Schunk (1981) were the most applicable and relevant to my setting.

My method for constructing the CPIS was simply to explain goal setting, self-reinforcement, and feedback in a way that students in an introductory computer course would understand and be able to easily use. The result was a short document with several "work spaces" where the subject is asked to write down goals and methods for reward or punishment as he or she reads the document. In addition, a separate worksheet is included as the last page for the subject to use on a regular basis. The CPIS was pilot tested on five subjects. See Appendix H for a description of this pilot test.

I designed the "Computer Instrumentality Strategy" (CIS) to be a "placebo" strategy. That is, I had two aims in mind for this strategy: 1) I did not want the strategy to increase computer self-efficacy, and 2) I wanted the strategy to have face validity to the subjects. Hill, Smith & Mann (1987) show that instrumentality beliefs about computers is a construct independent from computer self-efficacy, so this gives me confidence that the CIS is not likely to increase computer self-efficacy. I also believed the CIS would have face validity to the subjects because it deals with their beliefs about the usefulness of computers. Also contributing to the face validity of the CIS is the fact that several items on Questionnaire 1 related to the subjects' beliefs about the usefulness of computers combined with the fact that the subjects were told this strategy was selected for them based on an analysis of Questionnaire 1.

Essentially, the CIS asks the subjects to list ways computers are useful to them, both in their daily life and in the future. Each time they went to class or did homework for the class subjects were to asked to add to this list. Should the CIS have increased the subjects' instrumentality, this increase in instrumentality may have resulted in an increase

in the subjects' intentions to use a computer. However, a path model analysis would be able to separate out the effect each variable had (e.g., self-efficacy and instrumentality) on each other variable (e.g., intentions to use a computer). The CIS was pilot tested for clarity. See Appendix H for a description of the pilot test.

A copy of each strategy packet (including the cover letter) is included in Appendix C.

Questionnaires 2 & 3

I designed Questionnaires 2 and 3 with two main questions in mind: 1) Are the subjects using the strategy? and 2) Why or why not? Because participation in this study was voluntary, there were no incentives I could offer to gain the subjects' participation; I depended on their voluntary participation. The instructors of these classes warned me that I may have a hard time getting the students to use the strategies. For this reason, I decided to determine who was and wasn't using the strategies and why or why not. These questionnaires are included in Appendices D and E, respectively. These two questionnaires differ only in the title ("2" and "3") and in the last two lines, which gave the subjects information about the their future involvement in the study. Questionnaire 2 was pilot tested for clarity, and minor changes were made as a result of these tests. Because Questionnaire 3 was essentially the same as Questionnaire 2, it was not pilot tested separately.

Questionnaire 4

Questionnaire 4 had 57 items. This questionnaire was designed to measure the subjects' computer self-efficacy (26 items), intentions to use a computer (11 items), instrumentality beliefs about computers (5 items), class performance (4 items), and use of the strategy (4

items). In addition, 7 items addressed why the subjects didn't use the strategy (if they didn't use it). A copy of the questionnaire is included in Appendix F. The construction of each of these sets of items is described below.

All the items for computer self-efficacy and instrumentality beliefs and two of the items for future intentions were identical to those used in Questionnaire 1. Because intentions to use a computer is a primary dependent variable in this study, I constructed five new items designed to tap this construct more fully. To generate these questions, I surveyed several computer users, asking them what things they used a computer for that they used to do "by hand," or by some method other than a computer. I used these responses to generate ten different scenarios, asking how likely the subject was to use a computer in a certain situation. A sample item is given below.

> You've been keeping track of your personal finances (checkbook, bills, etc.) by hand, and you now have easy access to a spreadsheet program (in your home) that is supposed to make this easier for you. How likely is it that you'll use this program to keep track of your personal finances instead of continuing to do it by hand?

For each of the ten items, the subject is asked to respond on a scale from 0 to 10 indicating how likely he or she is to use a computer in different situations. These ten items were then pilot tested on 33 individuals to test the reliability of this scale. From these ten items, the five that formed the most reliable scale were chosen as the items to be used on the questionnaire. This five-item scale demonstrated good reliability (Cronbach's $\alpha = .83$).

I constructed four items to measure class performance. To construct the four class performance items, I asked the class instructors how the students would be evaluated during the course (tests, assignments, projects, etc.), and I constructed four items that asked the subjects what their grades were for each of these areas. These grades were

specific to the class, and so the four items differed for the classes at the two schools. (For example, for the Radford classes, I asked for the homework assignment grade, and in the New River classes, I asked for the quiz grade.) These four items on performance were reviewed by the instructor for clarity and proved to be clear.

Because I knew that not many subjects were using the strategy they had received (based on their responses from Questionnaires 2 and 3), I constructed several items for Questionnaire 4 to find out why the subjects weren't using the strategy. On one of these items, I listed several possible reasons that the subjects may not have used the strategy and asked the subjects to check for each possible reason whether it was or was not a reason they did not use the strategy. I compiled this list of reasons from a content analysis of the reasons the subjects gave to open-ended questions on Questionnaires 2 and 3. Five items were constructed to see if the three components of the expectancy theory of motivation may have explained why the subjects didn't use the strategy. Finally, one open-ended question asked the subjects under what conditions they would use a strategy given to them. All of these items went through several phases of pilot testing and refining until the items proved to be clear. The final items were then pilot tested on six individuals. Brief interviews with each of these six individuals indicated that these items were sufficiently clear.

Finally, I used a different four items to measure the subjects' use of the strategy. I asked if the subjects had been using the strategy since the last questionnaire they received, and also if they planned to use the strategy in the future. These four items on strategy use were adapted from Questionnaires 2 and 3.

Table 1: Summary of Procedure

Week No.	Subjects Receive:	Description of What the Subjects Receive:	Returned to me:
1	**Consent Form** **Questionnaire 1**	Subjects signed the consent form indicating they understood the voluntary, confidential nature of the research. Items included computer self-efficacy, instrumentality, future intentions, computer experience, "credibility" items, background information, and demographics.	**Consent Form** **Questionnaire 1**
2	**Strategy Packets**	Subjects randomly received one of two strategies: one was designed to increase computer self-efficacy (treatment); one was designed as a placebo (control). Although assignment was random, subjects are led to believe the strategy they received was based on an analysis of their responses to Questionnaire 1.	——
3	**Questionnaire 2**	Items asked if the subjects were using the strategy and why or why not.	**Questionnaire 2**
4	**Questionnaire 3**	Items asked if the subjects were using the strategy and why or why not.	**Questionnaire 3**
5-9	——		——
10	**Questionnaire 4**	Items included computer self-efficacy, instrumentality, class performance, intentions to use a computer, reasons for not using the strategy, and use of the strategy.	**Questionnaire 4**

Procedure

This research was carried out over a period of ten weeks in eight introductory computer classes. Thus, the most logical way for me to break down the procedure was in weeks. The week numbers I use correspond to my research and not to the school semester. For example, "Week 1" refers to the first week of data collection for my research, but may be the third week of the class. A summary of the procedure that shows the flow of my methodology is shown in Table 1. A more detailed description of the procedure follows the table. See Appendix G for the scripts I used each week as I administered the materials for this study.

Week 1: Consent Form & Questionnaire 1

1. At the beginning of the class period, the instructor introduced me as a graduate researcher from Virginia Tech and then left the classroom until I had collected my data.

2. I handed out the consent forms to the subjects. The consent form explained the voluntary and confidential nature of this research. When everyone had read and signed the consent forms, I collected the forms face down.

3. I handed out Questionnaire 1, read the instructions, and then asked the subjects to begin the questionnaire.

4. When everyone finished, I collected the questionnaires face down, thanked the subjects for their participation, and left the classroom. The instructor then returned and began class.

Week 2: Strategy Packets

1. At the beginning of the class period, the instructor introduced me and then left the classroom until I had handed out the strategy packets.

2. I said the following to the class:

   "Last week most of you filled out questionnaires for me. Those have been analyzed; and, based on your responses, I have some information for you this week that I believe you'll find both interesting and helpful.

"Because the information you're getting is specific to you, based on your questionnaire responses, and because you are only identified by your code, I'll need to have you pick out your own packet with your code on it."

I then explained how the subjects' codes were ordered (by mother's and father's birthdays) so they could find their packet easily. I also told them to read the one-page cover letter as soon as they picked up their packet, and to read the rest of the information packet after the class was over.

Note: Although I led the subjects to believe they were receiving strategies based on an analysis of their responses from the prior week's questionnaire, they actually received one of two strategies based on a random selection.

3. The subjects picked up their strategy packets and read the cover letter.

4. When everyone was finished, I told the subjects I'd see them next week and then left the classroom. The instructor then returned and began class.

Week 3: Questionnaire 2

1. At the beginning of the class period, the instructor introduced me and then left the classroom until I had collected my data.

2. I handed out Questionnaire 2, read the instructions, and then asked the subjects to begin the questionnaire.

3. When everyone was finished, I collected the questionnaires folded in half, thanked the subjects for their participation, told them I'd see them next week, and left the classroom. The instructor then returned and began class.

Week 4: Questionnaire 3

1. At the beginning of the class period, the instructor introduced me and then left the classroom until I had collected my data.

2. I handed out Questionnaire 3 and let the subjects begin as soon as they received the questionnaire.

3. When everyone was finished, I collected the questionnaires folded in half, thanked the subjects for their participation, told them I'd see them later in the semester, and left the classroom. The instructor then returned and began class.

Weeks 5-9

I didn't collect any data or have any other contact with the classes for these five weeks. This allowed time for the subjects to use the strategies they had received. Since I wanted to see how the strategies influence the subjects' class performance, I scheduled Questionnaire 4, the final questionnaire, after the subjects would receive test and project grades in the course.

Week 10: Questionnaire 4

1. At the beginning of the class period, the instructor introduced me and then left the classroom until I had collected my data.

2. I handed out Questionnaire 4 and let the subjects begin as soon as they received the questionnaire.

3. When everyone was finished, I collected the questionnaires face down, thanked the subjects for their participation, and then left the classroom. The instructor then returned and began class.

Questionnaire 4 concluded the subjects' involvement in this research.

RESULTS

This chapter summarizes the results of my data analysis. This chapter is divided into three main sections. The first section involves several reliability analyses on the scales I used for this study. The second section is the test of my hypothesis. The third section is the longest and includes the results of many exploratory analyses. This chapter presents the results of the tests I have performed; the interpretation and discussion of the results will be found in the "Discussion" chapter which follows.

Reliability Analyses

Questionnaire 1

I performed a factor analysis on the scales used in Questionnaire 1. This test helped me see which items statistically clumped together to form a scale. This was a good test to see if the items formed the scales I intended. The items I included in the factor analysis were all the 11-point likert-type items (items 1 to 43) as well as the two items asking about the subjects' expectations of their grades in the course (items 44 and 45). I used the ordinary least squares (PCA) and varimax rotation and set the minimum eigenvalue to 1. This method yielded 11 factors with an explained variance of 0.7126. The factors selected by the factor analysis are shown in order of descending explained variance in Table 2 below. I assigned each item to the factor that it loaded on highest. I assigned the names of each factor based on what the factor items seemed to have most in common. In most cases the name the factor should have was obvious. For example, items 2 to 7 all began, "After this class, I will be able to...," and thus I simply named this factor "class."

Table 2: Factors Selected by the Factor Analysis

#	Factor	Items included in factor
1	Advanced skills/learning	1, 10, 32, 33, 34, 40, 41, 42, 43
2	Class	2, 3, 4, 5, 6, 7, 8, 9
3	Instrumentality	14, 15, 16, 17, 18
4	Knowledge	26, 35, 36, 37, 38
5	Commitment to do well	21, 22, 23, 31
6	Grades	11, 44, 45
7	Procrastination	24, 27, 28, 30
8	Getting help for computer problems	39
9	Hesitancy to use a computer	12, 13
10	Perseverance	25, 29
11	Plans to own or use a computer	19, 20

The scale I had created to measure computer self-efficacy was split into six factors by the factor analysis: advanced skills/learning (#1), class (#2), knowledge (#4), grades (#6), getting help for computer problems (#8), and hesitancy to use a computer (#9). Instrumentality (#3) and plans to own or use a computer (#11) each formed single factors as expected. The other factors were formed from items that I did not intend to be a part of any scale. These items were what I called "credibility" items, designed to make the subjects believe that the strategy they would receive the next week was based on relevant items from this questionnaire. The factors formed from these items were: commitment to do well (#5), procrastination (#7), and perseverance (#10).

Based on the factors suggested by the results of the factor analysis, I tested the scales for reliability, obtaining a Cronbach's α statistic. However, I made some minor modifications to some of the factors suggested by the factor analysis before I tested them for reliability. For example, I did not use the factor getting help for computer problems, since it only included one item, and I added this item to the advanced skills/learning factor, since this was the factor it loaded on next highest. I also reverse coded any items

that correlated negatively with their respective factors before I tested them for reliability. The same reliability test that gives Cronbach's α also shows which items (if any) can be removed from a scale to improve its reliability. Based on these tests, I removed items from scales that decreased the reliability of the scales. The scales that resulted are the ones I use throughout the remainder of my data analyses, and they are shown in Table 3. The scales measuring some form of computer self-efficacy are preceded by the initials "CSE."

Table 3: The Questionnaire 1 Scales I Use

Questionnaire 1 scale	Questionnaire 1 items	Cronbach's α
CSE (overall)	1-11, 32-38, 40-43, 45	0.95
CSE (advanced skills/learning)	1, 10, 32, 33, 34, 38, 40, 41, 42, 43	0.92
CSE (class)	2, 3, 4, 5, 6, 7, 8, 9	0.93
CSE (knowledge)	35, 36, 37	0.87
CSE (grades)	11, 45	0.81
Instrumentality	14, 15, 16, 17, 18	0.85
Hesitancy to Use a Computer	12, 13	0.81
Commitment to Do Well	21, 22, 23	0.79
Procrastination	24, 27, 28 (reversed), 30	0.66

I created an overall computer self-efficacy scale based on all the items in the four computer self-efficacy subscales. (See Table 3.) These four subscales formed a reliable overall computer self-efficacy scale with a Cronbach's α of 0.95. I am confident these four subscales belong together, because removing any one of the subscales resulted in a lower Cronbach's α, as did the addition of any of the other scales not included in the overall computer self-efficacy scale. This result gives further evidence that computer self-efficacy can reliably vary in its level of task specificity, since both general and specific computer self-efficacy scales are reliable. For the remainder of this chapter, when I refer to the computer self-efficacy scale, I am referring to the overall scale. When

referring to a specific computer self-efficacy scale, I will note this in parentheses, such as, "CSE (advanced skills/learning)."

Although I expected the scale "hesitancy to use a computer" to be a part of the computer self-efficacy scale, the "hesitancy to use a computer" scale lowered the overall reliability of the computer self-efficacy scale when I added it in. Thus, hesitancy to use a computer is shown as a separate scale in Table 3.

Overall, the results from the factor analysis and reliability analysis were encouraging, since these analyses confirmed the scales I had hypothesized. Additionally, the relatively high Cronbach's α's mean my measurement instruments are reliable ones, which will help me to detect differences in the data. A less reliable instrument would not detect differences so well.

The final scale used on Questionnaire 1 was a computer experience scale. I didn't perform any reliability analyses on this scale for two reasons. First, these items were more factual types of items, as opposed to beliefs or expectations. Second, these items measured different aspects of computer experience, which may or may not correlate highly with one another. So even if I performed a reliability test and found these items didn't correlate highly with one another, I'd still want to use them together since they each tap on different types of computer experience. To compensate for the fact that some kinds of computer experience may be rarer than others (e.g., playing computer games vs. using a database management system), I standardized the items in these scales so I could add the scales meaningfully.

Table 4 shows the descriptive statistics for the scales I use in Questionnaire 1.

Table 4: Descriptive Statistics for Questionnaire 1 Scales

Questionnaire 1 Scale	N	Mean	Std. Dev.
CSE (overall)	194	6.10	1.63
CSE (advanced skills/learning)	194	5.01	1.96
CSE (class)	194	7.41	1.80
CSE (knowledge)	193	6.79	2.09
CSE (grades)	194	5.16	1.55
Instrumentality	194	7.85	1.80
Hesitancy to Use a Computer	194	4.37	3.05
Commitment to do well	194	8.97	1.17
Procrastination	194	5.04	1.93
Computer Experience	184	0	3.04
Computer Ownership	193	36%	
Computer Related Academic Major	189	7%	

Questionnaire 4

A factor analysis wasn't performed on the Questionnaire 4 items. Since many items on Questionnaire 4 were the same as the items on Questionnaire 1, it made the most sense to use the same scales as on Questionnaire 1 (where possible) rather than to form new ones from a separate factor analysis. A reliability analysis, however, was performed on the factors in Questionnaire 4. Table 5 shows the scales used along with the Cronbach's α for each scale. The primary dependent variable in this study is the scale intentions to use a computer when given the opportunity.

Table 5: The Questionnaire 4 Scales I Use

Questionnaire 4 Scale	Questionnaire 4 Items	Cronbach's α
CSE (overall)	1-11, 25-31, 33-36, 52	0.95
CSE (advanced skills/learning)	1, 10, 25, 26, 27, 31, 33, 34, 35, 36	0.93
CSE (class)	2, 3, 4, 5, 6, 7, 8, 9	0.94
CSE (knowledge)	28, 29, 30	0.93
CSE (grades)	11, 52	0.93
Instrumentality	14, 15, 16, 17, 18	0.88
Plans to own or use a computer	19, 20	0.79
Plans to use specific applications	21, 22, 23, 24	0.91
Intentions to use a computer when given the opportunity	53, 54, 55, 56, 57	0.79

Another scale I used was performance, which measured the subjects' grades in the class. Specifically, I asked the subjects their test grades, project grades, homework grades, and their best estimation of their overall grades in the class. I didn't test these for reliability since I wanted these items to go together whether they formed a reliable scale or not. I averaged the two test grades to form the test subscale, and I averaged the two project grades (if they had two project grades in the class) to form the project subscale. The homework grade and overall grade were each represented by only one item and represented the single-item subscales homework and overall grade (subject's estimate), respectively. I formed the scale mean grade which was simply an average of the subscales test, project, and homework. I used the scale mean grade in addition to the subjects' estimation of their overall grade because the class instructors informed me that many of the students neither keep up with their grades in the class nor accurately compute their average for the class.

Table 6 shows the descriptive statistics for the Questionnaire 4 scales I use.

Table 6: Descriptive Statistics for Questionnaire 4 Scales

Scale	N	Mean	Std. Dev.
CSE (overall)	138	6.53	1.61
CSE (advanced skills/learning)	138	5.86	1.87
CSE (class)	138	7.48	1.74
CSE (knowledge)	137	7.21	2.06
CSE (grades)	138	5.12	2.16
Instrumentality	138	7.55	1.81
Mean Grade	136	84.5	11.6
Intentions to Use a Computer	134	36.7	8.82

Hypothesis Testing

This section is broken into three subsections. The first subsection, "Original Tests of Hypotheses," describes the results of the analyses I said I would perform in the earlier chapter, "Research Approach." The final two subsections, "The Effect of the Strategy," and, "Predicting Intentions to Use a Computer," include analyses that were not mentioned in the "Research Approach" chapter, but that still address the original hypotheses and research questions.

Original Tests of Hypotheses

My hypothesis testing was severely hampered by the low power and bias due to the small numbers of subjects that used the strategy I gave them. Because only 28 of the 193 initial subjects reported using the strategy they received, I was unable to run either of the two path analyses I had intended, since the numbers of subjects participating was too low to yield a reliable analyses.

However, I was able to run a multivariate analysis of variance (MANOVA) as planned, testing my hypothesis that the strategy received would have a differential effect on the

three dependent variables: computer self-efficacy, intentions to use a computer, and performance. (See Figure 12.) For these dependent variables, I used the scales computer self-efficacy, intentions to use a computer when given the opportunity, and mean grade. These scales all came from Questionnaire 4, which was administered after the subjects had eight weeks to use the strategy. Unless I indicate otherwise, my dependent variables in all my analyses are from Questionnaire 4. This is important to remember since several scales appear on both Questionnaire 1 and 4. I tested the model setting $\alpha = 0.05$.

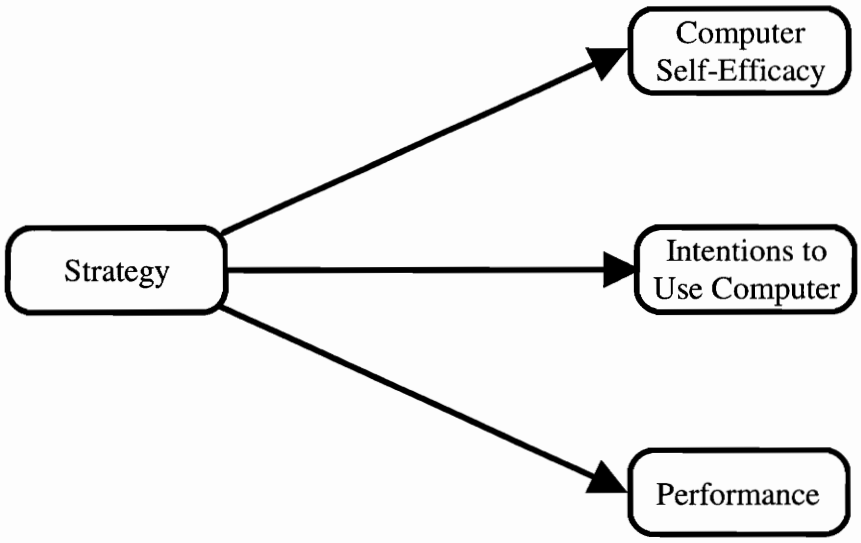

Figure 12: The arrows show the relationships I test using a MANOVA.

My hypothesis wasn't supported, as the MANOVA yielded a Wilks' λ of 0.872 (p = 0.3596). Since this statistic is a "gatekeeper" that tests the significance of the whole model, if this statistic is not significant, then none of the individual variables in the model should be considered significant. Thus, I did not find the results I expected.

The Effect of the Strategy

To make the results of these analyses easier to follow, I have used subheadings within each subsection that ask questions. The question I pose in each subheading is addressed by the test or tests described in that subsection. This format should help you more easily follow what I was trying to accomplish with each test I ran.

Did the strategy have an effect for those using it at least two weeks?

Since the strategy had no significant effect in testing my hypothesis above, I decided to probe further. In the original test of my hypothesis, I included anyone who indicated they used the strategy for at least one week. Since the strategy should probably only have an effect to the extent that the subjects used it, I decided to run another MANOVA including only those subjects who used the strategy during at least *two* of the eight possible weeks. This decision was a statistical trade off. My sample size was reduced from 28 to 17, but the remaining subjects were more likely to have been affected by the strategy if the strategy did have an effect, since they used the strategy more, on average. With this reduced sample, I ran the same MANOVA as above. (See Figure 12.) Ten of these 17 subjects used the self-efficacy strategy, and seven used the placebo strategy. This MANOVA yielded a Wilks' λ of 0.501 ($p = 0.0255$). The only dependent variable that was significantly predicted was intentions to use a computer ($p = 0.0156$). However, the effect of the strategy was the *opposite* of what I expected. That is, the subjects using the placebo strategy had greater intentions to use a computer that those using the self-efficacy strategy. See Table 7 for a summary of the means of this test. Computer self-efficacy and performance were not significantly predicted by the strategy used.

Table 7: Means of Mean Grade, Computer Self-Efficacy, and Intentions to Use a Computer Across Strategies (for 2 or more weeks of use)

Scale	Placebo strategy	Self-efficacy strategy
n = 17	*n = 7*	*n = 10*
Mean grade	92.0/100	82.5/100
Computer self-efficacy	7.92/10	7.17/10
Intentions to use a computer	44.7/50 *	34.3/50 *

*$p < 0.05$

Did the strategy have an effect for those using it at least three weeks?

Probing further, I performed a third MANOVA, this time limiting the sample to those subjects who indicated they had used the strategy during at least *three* of the eight weeks. Again, limiting the sample was a trade off, since my sample was reduced to 13 subjects, 8 using the self-efficacy strategy and 5 using the placebo strategy. Only big differences between the strategies would achieve significance. This MANOVA yielded a Wilks' λ of 0.408 ($p = 0.0373$). This time, two dependent variables were significantly predicted: intentions to use a computer ($p = 0.0040$) and computer self-efficacy ($p = 0.0388$). In both of these cases, the effect of the strategy was the opposite of what I expected. That is, those using the placebo strategy had higher computer self-efficacy and intentions to use a computer than those using the self-efficacy strategy. See Table 8 for a summary of the means of this test.

Table 8: Means of Mean Grade, Computer Self-Efficacy, and Intentions to Use a Computer Across Strategies (for 3 or more weeks of use)

Scale	Placebo strategy	Self-efficacy strategy
n = 13	*n = 5*	*n = 8*
Mean grade	90.8/100	79.9/100
Computer self-efficacy	8.44/10 *	6.86/10 *
Intentions to use a computer	46.2/50 **	32.1/50 **

*$p < 0.05$, **$p < 0.01$

Did the strategy have an effect on instrumentality?

Because the placebo strategy was an instrumentality strategy, I ran two more MANOVAs with the same design as the above two (See Figure 12.) except that instrumentality was included as a fourth dependent variable. Although the placebo strategy addressed instrumentality beliefs about computers, it was questionable if this strategy would positively affect instrumentality, since it was not created to be a powerful strategy. However, since the placebo strategy significantly influenced intentions to use a computer and computer self-efficacy relative to the self-efficacy strategy, this strategy may have also influenced subjects' instrumentality beliefs. Thus, MANOVAs were run to see if the placebo strategy did have such an effect on instrumentality. Figure 13 shows the model tested.

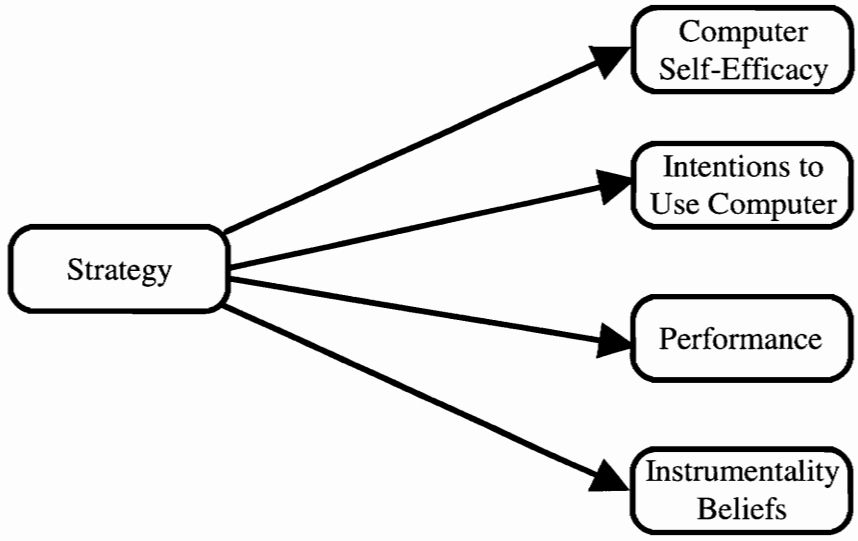

Figure 13: The arrows show the relationships I test in my exploratory MANOVA.

The first MANOVA I ran included only subjects using the strategy for two or more of the eight weeks (n = 17). This MANOVA yielded a Wilks' λ of 0.486 ($p = 0.0540$). Thus, the model wasn't significant. However, since it was close to significance, I looked at the individual p-value for instrumentality ($p = 0.0399$). The placebo strategy yielding higher means than the treatment strategy for each of these two variables ($M = 9.26/10$ and $M = 7.56/10$, respectively).

The second MANOVA I ran included only subjects using the strategy for three or more of the eight weeks (n = 13). This MANOVA yielded a Wilks' λ of 0.383 ($p = 0.0748$). Again, the model wasn't significant, but since it was close to significance, I looked at the p-value for instrumentality ($p = 0.0616$).

Did the strategy have an effect on the changes in computer self-efficacy or instrumentality?

Because the results showed differences I did not expect, I decided to repeat the MANOVA using "difference" variables where possible. That is, instead of using the computer self-efficacy scale from Questionnaire 4, I computed the *change* in computer self-efficacy from Questionnaire 1 to Questionnaire 4 by simply subtracting the earlier measure from the later one. The new dependent variable was the difference in computer self-efficacy. The difference variable for instrumentality was done in the same way. However, since no other variables appeared on both questionnaires, computer self-efficacy and instrumentality were the only two variables with which I could test changes across the questionnaires. The model I tested in this MANOVA is shown in Figure 14.

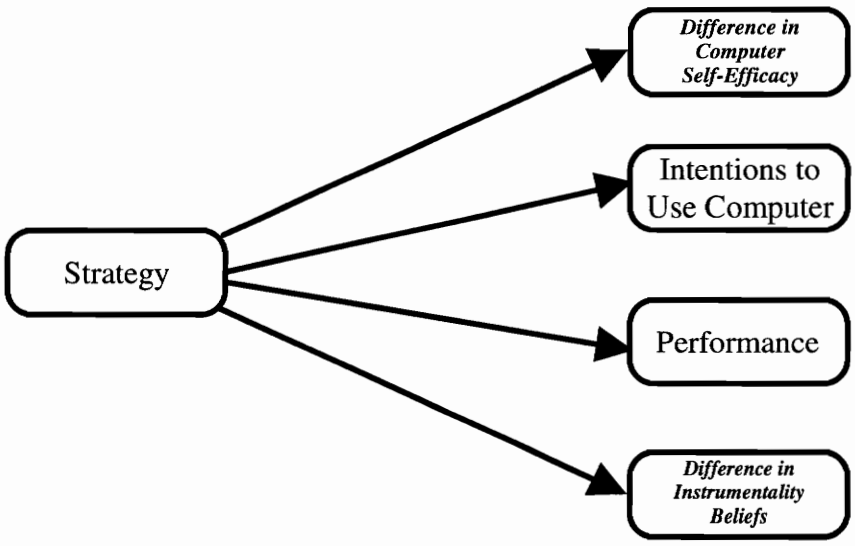

Figure 14: The arrows show the relationships I test in my exploratory MANOVA using the "difference" variables.

The MANOVA that included only subjects using the strategy for two or more of the eight weeks (n = 17) yielded a Wilks' λ of 0.630 ($p = 0.2013$). Thus, the model wasn't

significant. The individual p-values for the difference variables were 0.6039 for computer self-efficacy and 0.1886 for instrumentality.

The same pattern was found for the sample including only subjects using the strategy for three or more of the eight weeks (n = 17). This MANOVA yielded a Wilks' λ of 0.381 (p = .0730). The individual p-values for the difference variables were 0.4052 for computer self-efficacy and 0.2398 for instrumentality. (The lower p-value for the model was apparently a result of the intentions to use a computer variable, $p = 0.0040$.)

Were the two groups different at the outset?

It is interesting that the strategy yielded significant differences in computer self-efficacy and instrumentality, but it did not yield significant differences in the *changes* of these two variables. These results lead to the important question, "Were these two groups significantly different before they received the strategy?" To help answer this question, I ran two one-way ANOVAs to find out if those who used the two strategies were significantly different on either computer self-efficacy or instrumentality. An ANOVA was performed first for the sample that included those who used the strategy for at least two of the eight weeks (n = 17). The ANOVA for computer self-efficacy yielded a p-value of 0.4097, with $R^2 = 0.05$. The ANOVA for instrumentality yielded a p-value of 0.0966, with $R^2 = 0.17$. Thus, in neither case was a significant difference achieved.

The same design was used to run two one-way ANOVAs for the sample that included only those who used the strategy for at least three of the eight weeks (n = 13). The ANOVA for computer self-efficacy yielded a p-value of 0.0980, with $R^2 = 0.23$. The ANOVA for instrumentality yielded a p-value of 0.1675, with $R^2 = 0.17$. Thus, in neither case was a significant difference detected.

Predicting Intentions to Use a Computer

In this subsection, I perform analyses relating to my original hypotheses. Because I could not perform the path analyses I intended, I performed these analyses to address the relationship between computer self-efficacy and intentions to use a computer.

What correlates highly with intentions to use a computer?

One of the primary aims of this study was to increase subjects' intentions to use a computer by increasing their computer self-efficacy. Although I was not able to successfully increase the subjects' computer self-efficacy due to low numbers of subjects using the strategy, I can still look at what items and scales best predict a person's intentions to use a computer. To get an initial idea of what predicted their intentions to use a computer, I ran a correlation analysis including the variable intentions to use a computer along with many other variables from Questionnaire 1. These variables from Questionnaire 1 included computer self-efficacy, CSE (advanced skills/learning), CSE (class), CSE (knowledge), CSE (grades), instrumentality, commitment to do well, procrastination, hesitancy to use a computer, computer experience, computer ownership, amount of education, gender, age, and major (computer-related vs. not computer-related). I also included two variables in this correlation not from Questionnaire 1: level of use of a strategy (number of weeks used), and which strategy the subjects received (treatment or placebo). One-hundred subjects were included in this correlation analysis. Several of the variables in this analysis correlated highly with intentions to use a computer and had p-values less than 0.0001. These variables included computer self-efficacy ($r = 0.60$, $p < 0.0001$), CSE (advanced skills/learning) ($r = 0.56$, $p < 0.0001$), CSE (class) ($r = 0.54$, $p < 0.0001$), CSE (knowledge) ($r = 0.38$, $p < 0.0001$), CSE (grades) ($r = 0.42$, $p = 0.0001$),

hesitancy to use a computer ($r = -0.39$, $p < 0.0001$), and computer experience ($r = 0.42$, $p < 0.0001$).

What variables significantly and independently predicted intentions to use a computer?

To find out what variables significantly and independently predicted intentions to use a computer, I had to run several regressions that helped me "zero in" on the right variables. The following six paragraphs describe the six regressions (or series of regressions) that helped me zero in on these variables. In all of the regressions, intentions to use a computer was the dependent variable.

In the first regression, I ran a regression with all of the same 17 variables in the above correlation (in the previous subsection) as the independent variables ($n = 88$). Although the model came out significant ($p < 0.0001$, $R^2 = 0.46$), none of the independent variables did (all p's > 0.05). This result probably occurred because two or more of the independent variables were highly correlated with one another, and thus none of them had an independent effect.

Since computer self-efficacy (from Questionnaire 1) was a combination of the four computer self-efficacy subscales and therefore highly correlated with these, I took out these four subscales and ran another regression. This time the model was again significant ($p < 0.0001$, $R^2 = 0.45$), and the variable computer self-efficacy had an independent significant effect ($p = 0.0038$). None of the other variables did (all p's $>$ 0.05). The only other veriable that came close was the level of use of the strategy ($p =$ 0.0647), a variable that by itself did not correlate highly with intentions to use a computer ($r = -0.07$, $p = 0.5298$).

Next, I ran a regression with a model that included just two independent variables: computer self-efficacy and level of use of the strategy ($n = 95$). The model was significant ($p < 0.0001$, $R^2 = 0.41$), and each variable had an independent significant effect ($p < 0.0001$ for computer self-efficacy, $p = 0.0207$ for level of use of the strategy).

To make sure computer self-efficacy and level of use were the only two variables that had significant independent prediction of intentions to use a computer, I ran a series of 15 regressions. Each of these regressions included these two variables along with a third variable from the original model. These third variables for the 15 different models were: CSE (advanced skills/learning), CSE (class), CSE (knowledge), CSE (grades), instrumentality, commitment to do well, procrastination, hesitancy to use a computer, computer experience, computer ownership, amount of education, gender, age, major (computer-related vs. not computer-related), and which strategy they received. In no case did a third variable have an independent significant effect (all p's > 0.10). Thus, I have confidence that computer self-efficacy and level of use are the only two variables that make a significant independent contribution in predicting intentions to use a computer.

Because level of use of the strategy did not by itself correlate highly with intentions to use a computer, but did prove significant when in the model with computer self-efficacy, I ran a series of regressions to test a second-degree model that included interaction and squared terms. The only second-degree term to prove significant was the squared term of level of use. The model with computer self-efficacy, level of use, and the level of use squared term was significant ($p < 0.0001$, $R^2 = 0.47$), with each of these three terms significant ($p < 0.0001$, $p = 0.0411$, and $p = 0.0026$, respectively). Thus, level of use has a curvilinear relationship with intentions to use a computer, which is why its linear correlation with intentions to use a computer was not high.

To demonstrate the significance of the level of use term when this term is considered a quadratic rather than a simple linear function, I created a single variable, "quadratic use," that included both the level of use and its squared term along with the coefficients recommended by the regression that included these two terms. The formula is as follows:

$$\text{quadratic use} = -0.543\ (\text{level of use})^2 + 2.29\ (\text{level of use})$$

I then ran a regression with computer self-efficacy and quadratic use as the two independent variables and intentions to use a computer as the independent variable. As expected, the model was significant ($p < 0.0001$, $R^2 = 0.47$), and each of the two variables had an independent significant effect ($p < 0.0001$ for each). The purpose of this regression was to show that the quadratic use term was significant at the 0.0001 level, even when computer self-efficacy was accounted for. Thus, when level of use is considered to have a quadratic effect on intentions to use a computer, it becomes highly significant.

To help visualize how computer self-efficacy and level of use predict intentions to use a computer, see the contour graph in Figure 15. Note that this is not a plot of the data, but a graph of the model that best fits the data. (Note also that the variable intentions to use a computer can only range from 0 to 50, even though in this graph values at slightly above 50 are predicted by the model.) This graph shows that the level of use is almost flat at less than four weeks, but begins to sharply decline after four weeks. This finding that the greatest levels of use predict a drop in intentions to use a computer is surprising. Once again, this finding is the opposite of what I would expect.

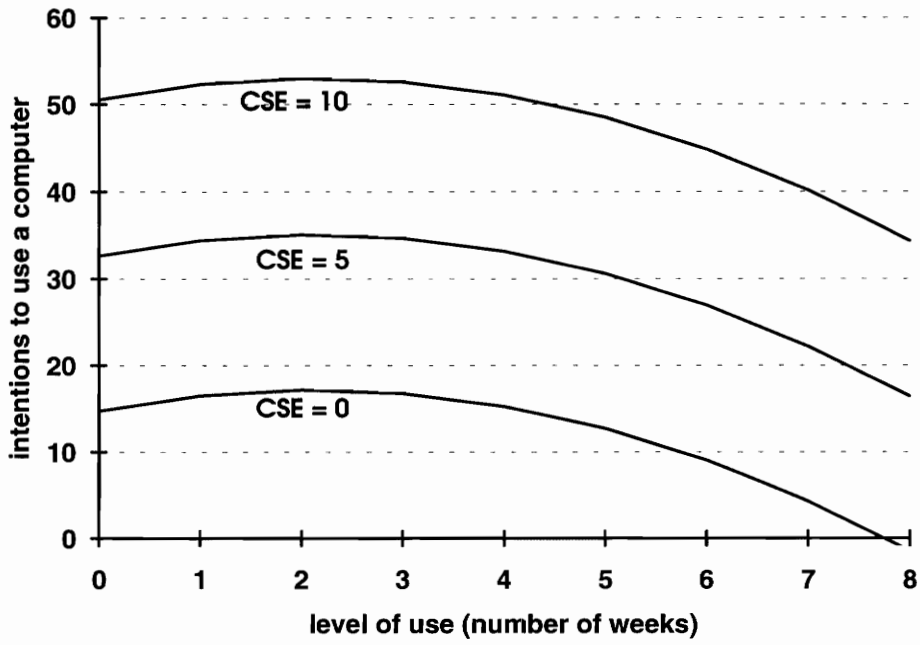

Figure 15: This contour graph shows the prediction of intentions to use a computer by level of use of the strategy for different values of computer self-efficacy.

Exploratory Analyses

A large part of my data analyses will be exploratory in nature. The results of these exploratory analyses should be interpreted with caution, since I did not have any up-front, formal hypotheses for these analyses. I also ran large numbers of tests, which greatly increased the chance of a Type I error. For these analyses, when I say a variable is or isn't significant, an α level of 0.05 is assumed.

Differences Between Strategy Users and Non-Users

What did level of strategy use predict?

Having compared the users of the two different strategies, I wanted to compare strategy users and strategy non-users. The first test I performed was to run a regression for each Questionnaire 4 scale to see if the scale was significantly predicted by level of strategy use. The level of strategy use refers to the number of weeks the subjects used the strategy. For these analyses, I only used subjects who had the opportunity to use the strategy; thus, subjects who never received strategies due to absences were not included in the sample. The sample sizes for these regressions ranged from 91 to 132, depending on how many people responded to each item. (The regression with only 91 subjects, which had project grades as its dependent variable, was due to the fact that two of the eight classes did not receive project grades.) For these analyses, I ran 14 regressions, which greatly increased the chance of a Type I error, so these results must be interpreted with caution. The dependent variables in each of the 14 regression models were: computer self-efficacy, CSE (advanced skills/learning), CSE (class), CSE (knowledge), CSE (grades), instrumentality, intentions to use a computer when given the opportunity, plans to own or use a computer, plans to use specific applications, mean grade, test grade, project grade, homework grade, and overall grade (subject's estimate). Of these, only two were significantly predicted by strategy use: CSE (advanced skills/learning) ($p = 0.0423$, $R^2 = 0.03$) and overall grade (subject's estimate) ($p = 0.0102$, $R^2 = 0.07$). In both cases, the parameter estimate was positive, indicating that the more weeks the strategy was used, the higher the CSE (advanced skills/learning) or overall grade (subject's estimate). Because of the inflated alpha incurred by running 14 tests, the significant CSE (advanced skills/learning) result should not be considered significant, since its p-value was barely

under 0.05. For the overall grade (subject's estimate), the probability of finding a p-value as small as 0.0102 in 14 tests is $p = 0.1337$, and thus, this result too, should not be considered significant. Level of use of the strategy did not significantly predict any of the 14 variables tested.

What predicted strategy use or non-use?

To find out what predicted strategy use or non-use, I ran 10 one-way ANOVAs, one for each of the scales from Questionnaire 1: computer self-efficacy, CSE (advanced skills/learning), CSE (class), CSE (knowledge), CSE (grades), instrumentality, hesitancy, commitment, procrastination, and computer experience. Four of those ten were significant: computer self-efficacy ($p = 0.0099$, $R^2 = 0.04$), CSE (advanced skills/learning) ($p = 0.0057$, $R^2 = 0.04$), CSE (knowledge) ($p = 0.0348$, $R^2 = 0.02$), and procrastination ($p = 0.0015$, $R^2 = 0.05$). In each case, except for procrastination, those with the higher scores were more likely to use the strategy they received. Those with lower procrastination scores were more likely to use the strategy they received. The means of users and non-users on these scales is shown in Table 9. Again, because 10 tests were run, these p-values should be interpreted with caution.

Table 9: Means of Selected Questionnaire 1 Scales for Strategy Users and Non-Users

Scale	Users	Non-users
	n = 28	*n = 157*
Computer self-efficacy	6.82/10 **	5.96/10 **
CSE (advanced skills/learning)	5.93/10 **	4.82/10 **
CSE (knowledge)	7.53/10 *	6.62/10 *
Procrastination	3.94/10 **	5.19/10 **

*$p < 0.05$, **$p < 0.01$

Subjects' Reasons for Not Using the Strategy

What reasons did the subjects give for not using the strategy?

The main problem with this study is that only a small percentage of the subjects used the strategy. Thus, I wanted to investigate the reasons the subjects did not use the strategy so this problem can be avoided in future research or practice. Before I administered Questionnaire 4, I wanted to act on the fact that I had low strategy use as reflected in Questionnaires 2 and 3. Thus, I added questions to Questionnaire 4 to find out why the subjects did not use the strategy. Based on a content analysis of subjects' responses to open-ended questions on Questionnaires 2 and 3 asking why they didn't use the strategy, I created 9 possible reasons why subjects may have chosen not to use the strategy. Each subject who indicated he or she had read about but did not use the strategy was asked to indicate whether each of these possible reasons was or was not a reason they did not use the strategy. Subjects who indicated they did not read about the strategy were not asked why they did not use the strategy, since they did not know anything about it. Table 10 shows a summary of the subjects' responses to these items, sorted by which strategy they received. The subjects could check as many of the nine reasons as they wanted. The reasons the subjects chose most are listed first. Forty subjects responded to these items, 15 who received the treatment strategy and 25 who received the placebo strategy.

Table 10: Summary of Reasons Subjects Didn't Use the Strategy

Reason for not using the strategy:	Treatment (n = 15)	Placebo (n = 25)	Overall (n = 40)
I am satisfied with my current study habits.	80%	77%	78%
I am satisfied with my current grade in the class.	67%	58%	63%
I didn't have enough time to use the strategy.	53%	54%	53%
I forgot.	53%	48%	50%
The strategy appeared to take too much time.	33%	48%	43%
I didn't think the strategy would have been beneficial.	27%	48%	40%
Using the strategy wasn't worth the effort.	27%	28%	28%
I didn't understand the strategy.	7%	16%	13%
I was already using the components of the strategy.	0%	12%	8%

Did the "satisfied non-users" differ from the "dissatisfied non-users"?

The top two reasons given for not using the strategy were a satisfaction with current study habits or current grade in the class. To find out if subjects who listed one of these two reasons were performing better, I ran a one-way ANOVA. For this ANOVA, one group consisted of those non-users who indicated they were satisfied with either their current study habits or their current grades or both. The other group consisted of the non-users who did not indicate they were satisfied with either their current study habits or their grades. I'll call these two groups the "satisfied non-users" and the "dissatisfied non-users." I tested the satisfied non-users and the dissatisfied non-users for differences in their mean grade, to see if the subjects' satisfaction or dissatisfaction was evident in their grade. This test was significant ($p < 0.0001$, $R^2 = 0.32$). The satisfied non-users had the higher mean grade ($M = 89.4$ as compared with $M = 78.4$). Thus, subjects who indicated satisfaction in their study habits or grades did have a higher mean grade.

I ran a second ANOVA to compare these two groups (the satisfied non-users and the dissatisfied non-users) on computer self-efficacy. This test was also significant ($p =$

0.0058, $R^2 = 0.15$). The dissatisfied non-users had lower computer self-efficacy (M = 5.10 as compared with M = 6.75).

Under what circumstances would the subjects have used the strategy?

As another attempt at finding out why the subjects didn't use the strategy, Questionnaire 4 included the item, "Under what circumstances would you have used a strategy given to you?" The subjects could either respond by circling "None," or by completing the sentence, "I would have used a strategy if..." Most of the subjects' responses were just rewordings of one of the nine reasons listed in Table 10 above, which made it easy for me to group their responses into categories. In a few cases new categories were formed. A summary of the subjects' responses to this question are listed in Table 11 below. Note that I have grouped subjects who circled "None" as "...under no circumstances" in the table below. Forty subjects responded to this item.

Table 11: Circumstances under Which Subjects Would Have Used the Strategy

I would have used the strategy...	Treatment (n = 18)	Placebo (n = 22)	Overall (n = 40)
...under no circumstances.	39%	36%	38%
...if I had more time.	28%	23%	25%
...if the strategy was required.	6%	18%	13%
...if my study habits weren't working.	11%	0%	5%
...if I remembered to use it.	6%	5%	5%
...if I understood the strategy.	6%	5%	5%
...if I didn't have a computer class.	6%	0%	3%
...if I was flunking.	0%	5%	3%
...if I wasn't already using it.	0%	5%	3%
...if I learned about it more.	0%	5%	3%

Does expectancy theory help explain why the subjects didn't use the strategy?

As a final attempt to understand why the subjects did not use the strategy, items were included on Questionnaire 4 that related to the three parts of the expectancy theory of motivation. As briefly described in the "Literature Review" chapter, the three components of expectancy theory are the effort-performance expectancy ("Will my effort lead to successful performance?"), the performance-outcome expectancy ("Will a successful performance lead to a certain outcome?"), and valence ("Do I value the outcome?"). The items relating to these components, along with their means, are shown in Table 12 below. The significance of these data will be discussed in the "Discussion" chapter.

Table 12: Expectancy Theory Items Relating to Using the Strategy

Expectancy theory component addressed:	Item	Treatment Mean (n = 16)	Placebo Mean (n = 26)	Overall Mean (n = 42)
Effort-performance	"I could have used the strategy if I wanted to."	7.69/10	6.77/10	7.12/10
Performance-outcome	"Using the strategy would have improved my grade in the course."	3.06/10	3.35/10	3.24/10
Performance-outcome	"Using the strategy would have helped me better learn the material covered in this course."	3.44/10	3.31/10	3.36/10
Valence	"How important to you is your grade in this class?"	9.13/10	9.28/10	9.22/10
Valence	"How important to you is learning the material covered in this class?"	8.56/10	8.56/10	8.56/10

Note: The anchors on the first three items were 0 = Strongly Disagree, 10 = Strongly Agree.
The anchors on the last three items were 0 = Not at all Important, 10 = Very Important.

Could low self-efficacy explain why the subjects didn't use the strategy?

There are two types of self-efficacy which could possibly have had an influence on the subjects' use or non-use of the strategy: computer self-efficacy and strategy self-efficacy. Strategy self-efficacy refers to the subjects' belief that he or she can successfully use the

strategy. The item on Questionnaire 4 that corresponded most closely to strategy self-efficacy was the effort-performance expectancy item, shown in Table 12 above, which reads, "I could have used the strategy if I wanted to." Because only strategy non-users responded to this item, I cannot test whether this strategy self-efficacy item differed between users and non-users.

However, to see if strategy self-efficacy and computer self-efficacy were related to each other, I ran a simple correlation of these two variables. They did not significantly correlate ($r = 0.10$, $p = 0.4946$). A further discussion of how these two types of self-efficacy may have influenced strategy use is presented in the "Discussion" chapter.

Predicting Computer Self-Efficacy

Which variables significantly and independently predicted computer self-efficacy?

Since computer self-efficacy did significantly predict intentions to use a computer, I looked next at what predicted computer self-efficacy. To find out what predicted computer self-efficacy, I ran a regression with computer self-efficacy (from Questionnaire 4) as the dependent variable, and with the following independent variables: instrumentality, commitment to do well, procrastination, hesitancy to use a computer, computer experience, computer ownership, amount of education, gender, age, major (computer-related vs. not computer-related), level of use, and which strategy the subjects received (treatment or placebo). All of these independent variables except the last two were from Questionnaire 1. This model was significant ($p < 0.0001$, $R^2 = 0.40$). Instrumentality and hesitancy to use a computer were the only two variables to have a significant independent effect ($p = 0.0034$ and $p = 0.0064$, respectively). Perhaps a more interesting finding is the variables that did *not* have a significant independent effect on

computer self-efficacy: computer experience ($p = 0.5898$), computer ownership ($p = 0.4535$), major (computer-related vs. not computer related) ($p = 0.6606$), and amount of education ($p = 0.3351$).

Predicting Level of Use

Did any variables from Questionnaire 1 correlate highly with level of use?

Since level of use was the other variable that significantly predicted intentions to use a computer, I looked at what Questionnaire 1 variables correlated highly with level of use. The variables included in this correlation along with level of use were: computer self-efficacy, CSE (advanced skills/learning), CSE (class), CSE (knowledge), CSE (grades), instrumentality, commitment to do well, procrastination, hesitancy to use a computer, computer experience, computer ownership, amount of education, gender, age, major (computer-related vs. not computer-related), and which strategy the subjects received. None of these variables correlated highly with level of use (all r's < 0.20). The variable that correlated the most highly with level of use was computer self-efficacy ($r = 0.19$), but even this correlation only accounted for 4% of the variance in level of use.

The Effect of the Class

Because this study was carried out in eight different classes taught by three different instructors at two different schools, it is possible that the different classes had an effect. Thus, I tested to see if there were effects from the two schools or from the three instructors.

Did the school have a significant effect?

The first test I ran was a MANOVA to test the effect of the two schools on the following five dependent variables: difference in computer self-efficacy, difference in instrumentality, intentions to use a computer, plans to own or use a computer, and plans to use specific applications. The difference variables are the differences on the scales between Questionnaires 1 and 4. The model I am testing is shown in Figure 16. This MANOVA yielded a Wilks' λ of 0.976 ($p = 0.8090$). Thus, I didn't detect that the school had a significant effect on these variables.

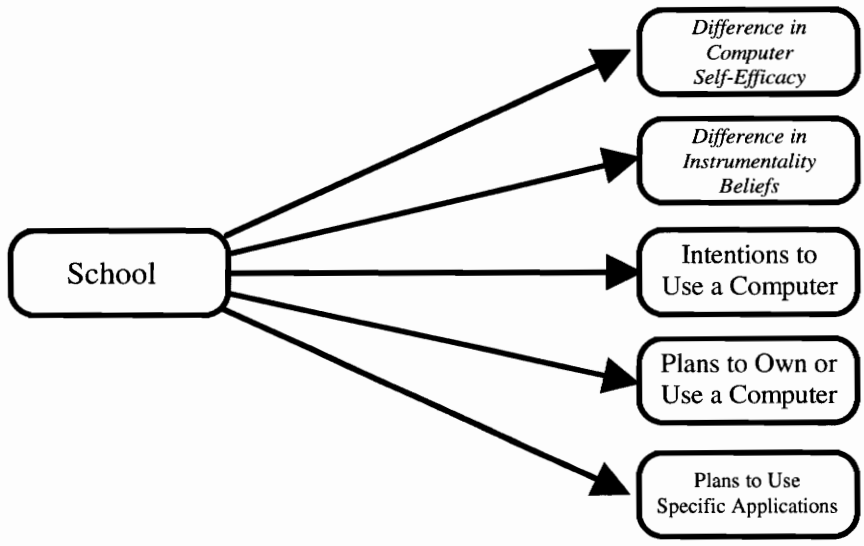

Figure 16: The arrows show the relationships I test using a MANOVA.

Did the instructors have a significant effect?

The next test I ran was the same as the one shown in Figure 16 except that the independent variable was instructor and not school, which had three levels instead of two. This MANOVA yielded a Wilks' λ of 0.967 ($p = 0.9784$). Thus, I didn't detect that the instructors had a significant effect.

The Effect of Required Interaction with a Computer

Because the two computer classes taught at one school did not have any interaction with computers during the class (as opposed to the six classes at the other school that did), I decided to test the difference between those having computer interaction and those not. As I have already shown in the test above (See Figure 16.), there was no significant effect of the school. However, even though the two classes at one school did not require computer interaction, some students in those classes were taking or had already taken an associated computer lab course that did require computer interaction. So a better test would be to compare those who had never had any required computer interaction in any computer class with those who did have required computer interaction in a computer class. Unfortunately, only three subjects had never had a class with required interaction. Having only three subjects in this condition was not enough, and therefore this test was not performed.

DISCUSSION

This chapter is divided into four sections. In the first section, I interpret the results from this study. In the second section, I discuss who can benefit from this research on computer self-efficacy. In the third section, I discuss practical suggestions on how to increase someone's low computer self-efficacy. In the fourth section, I suggest future directions to extend this line of research.

Interpreting the Results

The headings in this section closely parallel those in the "Hypothesis Testing" and "Exploratory Analyses" sections of the "Results" chapter. However, I do not discuss results where I found no significant effect unless the fact that there was no effect is particularly noteworthy.

The Effect of the Strategy

Although I didn't find any effect of the strategy in the test including those who used the strategy for at least one week, I did find significant results when I limited the sample to those who used the strategy for at least two weeks and also when I further limited the sample to those who used the strategy for at least three weeks. I found significance in the opposite direction from what I expected; that is, the placebo strategy groups scored higher than the self-efficacy strategy groups on computer self-efficacy, instrumentality beliefs, and intentions to use a computer. However, when I ran a MANOVA to test the effect of the strategy on the *change* in computer self-efficacy and instrumentality from

Questionnaire 1 to Questionnaire 4, no significance was found (nor were the results close to significance). The fact that the final measures of these variables were significant while the difference measures of these same variables were not significant indicated that the two groups may have been different at the outset. However, the two one-way ANOVAs I ran did not detect such significant initial differences. Thus, these results are inconclusive and therefore difficult to interpret.

Even though my results were hampered by the fact that relatively few subjects used the strategy, among the few that did use it, I didn't find even tentative support for the effectiveness of the self-efficacy strategy. This strategy was shown to be effective in increasing both self-efficacy and attendance of low-attendance employees in Frayne & Latham's 1987 study. The obvious difference between the strategy as it was used in this study and how it was used in Frayne & Latham's study involves the amount of time devoted to teaching and discussing the strategy. In Frayne & Latham's study, the subjects attended a training program which consisted of eight weekly one-hour group sessions followed by eight 30 minute one-on-one sessions to learn the strategy. These subjects were given time during normal working hours to attend these sessions. In my study, subjects were given four pages of information about the strategy and were encouraged to use it, since the strategy would help them improve their performance in the class. There were no group discussion sessions or one-on-one sessions as in the Frayne & Latham study. Apparently, taking the time necessary to support the subjects in learning the proper use of such a self-efficacy changing strategy is of critical importance.

Predicting Intentions to Use a Computer

Although several variables correlate highly with intentions to use a computer, I'm most interested in those that have an independent predictive effect. Not surprisingly, of all the items and scales on Questionnaire 1, computer self-efficacy was the best predictor of intentions to use a computer. The only other variable that was significant with computer self-efficacy in the model was level of use of the strategy. It is noteworthy that computer experience didn't have an independent effect on intentions to use a computer. Many people believe computer experience makes a person more likely to use a computer. However, research has continually shown that computer experience only influences intentions to use a computer when computer self-efficacy is affected (Merritt & Koball, 1993; Rosen & Maguire, 1990). Experience that does not increase computer self-efficacy has no effect on intentions to use a computer. This research gives more evidence for this finding.

The surprising finding was the strange curvilinear relationship of level of use of the strategy and intentions to use a computer. The relationship between the curve and intentions to use a computer was too strong to dismiss as a chance occurrence ($p < 0.0001$). The particularly surprising part was the direction of that relationship. From zero to four weeks of use, the curve was about flat, and at greater than four weeks of use, the curve began to drop sharply. Thus, this model predicts that the more someone uses the strategy (after about four weeks), the less likely he or she is to use a computer! Although I can think of no solid explanation for this trend in the data, I will offer some possibilities for consideration. One possible explanation of this trend is that the subjects who used the strategy more than four weeks may have been ones who initially started out very low on their intentions to use a computer, and thus they were the ones who were in most need of

such a strategy. This possibility, however, goes against some earlier findings, namely, that users were significantly higher in initial computer self-efficacy than non-users. Since computer self-efficacy is the strongest predictor of intentions to use a computer, it would not make sense that strategy users would start out initially higher than non-users in computer self-efficacy, but lower in intentions to use a computer. Another possibility is that using the strategy too much causes a decrease in intentions to use a computer. However, there is nothing in either strategy that would seem to cause such a decrease. A final possibility is that this curve was primarily fitting the slight *increase* in intentions to use a computer from zero weeks of use to two or three weeks of use, since that's where 176 of the 185 data points would have fallen (only 9 of the 185 used the strategy for four weeks or more). However, this possibility doesn't explain why the right side of the curve had such a dramatic dip down. Whatever the reason, any possibilities offered here are only conjectures. Future research will have to determine the relationship between level of use of a strategy and intentions to use a computer.

Even with the surprising relationship between level of use and intentions to use a computer, there was nothing surprising about the computer self-efficacy having the greatest predictive effect on intentions to use a computer, accounting for 36% of the explained variance. The level of use curve accounted for an additional 11% explained variance, yielding a high 47% explained variance for these two variables on intentions to use a computer.

Differences between Strategy Users and Non-Users

The question of primary interest here is, "Who is more likely to use a strategy given them?" And the results suggest the answer is, at least to some degree, "Those who have

higher computer self-efficacy and those who are less likely to procrastinate." Unfortunately, this means the group most in need of a self-efficacy strategy is also the group least likely to use it. Again, this problem could probably be avoided if more time and attention were given to helping the subjects learn to use the strategy.

Sims & Lorenzi say, "Self-efficacy is an essential predecessor to self-management, while successful self-management experiences can further enhance self-efficacy" (1992, p. 176). So there seems to be a reciprocal relationship between self-efficacy and self-management. Self-efficacy needs to be present for a person to choose to use the principles of self-management.

Under the conditions of this study, it is not surprising that those with lower computer self-efficacy were less likely to use the strategy. The strategies the subjects received required the subjects to come into closer contact with computers. However, subjects with low computer self-efficacy are less likely to want to have closer contact with computers. Thus, low CSEs (i.e., people with low computer self-efficacy) may not have used the strategy because it brought them closer to the very thing they are uncomfortable with: computers.

To make an extreme analogy, the strategy implementation I used is like giving snake phobics a self-help book and a pet snake and telling them to read the book and follow the instructions over the next month to cure them of their phobia. By definition, the snake phobic will be the last ones able to cure themselves without outside help and encouragement. They will avoid the self-help strategy because the strategy brings them closer to snakes.

Subjects' Reasons for Not Using the Strategy

The top two reasons subjects gave for not using the strategy were: "I am satisfied with my current study habits," (78%), and, "I am satisfied with my current grade in the class," (63%). Non-users who responded in either of these two ways had significantly higher grades and computer self-efficacy than non-users who did not. Thus, these subjects apparently did not use the strategy because they did not need it; they were doing fine without it.

The next three reasons subjects gave for not using the strategy were: "I didn't have enough time to use the strategy," (53%), "I forgot," (50%), and, "The strategy appeared to take too much time," (43%). These three reasons seem to support my claim that more time for learning and practicing the strategy would have helped. Had the subjects been given the time and continued encouragement to learn and practice the strategy, these reasons may not have been a deciding factor.

On one item, subjects responded to an open-ended question asking them under what conditions they would have used the strategy. The responses to this item did not provide much new information, with the following two exceptions. First, 41% indicated they would not use a strategy under any condition. (This was a standardized response that they could simply circle; any other responses had to be written in.) The other interesting response was the 11% who indicated they would have used the strategy if it was required. Probably almost all of the subjects would have used the strategy if it was required, because that's what students normally do in a classroom setting. The fact that only 11% responded this way is probably just an artifact of this being an open-ended question. These two responses lead to me the conclusion that even if I had the "perfect strategy," many would not have used it unless it was required.

Finally, I use expectancy theory as a framework for why the subjects didn't use the strategy. From the subjects' responses to the expectancy theory items on the questionnaire, it is clear that the weak link among the expectancy theory components was the performance-outcome expectancy. That is, the subjects did not believe that using the strategy would lead to the outcomes of improving their grades in the course or learning more. They did indicate that they could have used the strategy (effort-performance expectancy) and that they value the outcomes of getting good grades and learning the material in the course (valence).

It is possible that the subjects' low self-efficacy was a reason the subjects didn't use the strategy. If this is the case, the question is, was it their low *computer* self-efficacy or low *strategy* self-efficacy that was the problem? Although having low self-efficacy for the strategy could potentially have influenced the subjects not to use the strategy, this did not appear to be the main reason they didn't use the strategy. Based on the results shown in Table 12 (on p. 83), I believe the subjects' doubts about the strategy were more about the effectiveness of the strategy that about their ability to use the strategy. Thus, having low self-efficacy for the strategy didn't appear to be the main reason the subjects didn't use the strategy. However, as I mentioned in the previous section ("Differences between Strategy Users and Non-Users"), low *computer* self-efficacy may very well have been a reason the subjects didn't use the strategy. The fact that computer self-efficacy and strategy self-efficacy were not significantly correlated isn't surprising; people can believe in their ability to use the strategy and at the same time not believe in their ability to use computers successfully.

In summary, I believe there are several potential reasons the subjects didn't use the strategy: 1) some subjects didn't need a strategy to help them, 2) not enough time or

encouragement was devoted to learning or practicing the strategy, 3) there was no strong incentive or requirement to use the strategy 4) the subjects weren't convinced the strategy would help them, and 5) subjects with low computer self-efficacy aren't predisposed to choose to use a strategy that brings them closer to computers. These potential reasons aren't necessarily mutually exclusive.

Predicting Computer Self-Efficacy

Subjects' initial instrumentality beliefs and their hesitancy to use a computer (from Questionnaire 1) predicted computer self-efficacy (on Questionnaire 4) more than anything else. This finding shows that although computer self-efficacy and instrumentality are conceptually different, they tend to go together. Why they're related isn't addressed in this study, nor is it of particular interest here. The predictive nature of hesitancy to use a computer is not a surprising finding, since a person's hesitancy to use a computer is closely related to the construct of computer self-efficacy.

The surprising finding, however, was the variables that *didn't* have an independent significant effect on computer self-efficacy, namely, computer experience, computer ownership, and major (computer-related vs. not computer-related). Again, this finding underscores the fact that not all computer experience increases computer self-efficacy. The challenge we are left with is to determine what kinds of computer experience increase computer self-efficacy and what kinds don't. Unfortunately, this study didn't successfully address this question.

Who Can Benefit from this Research?

There are three general groups of people who should consider the impact of a person's computer self-efficacy: 1) those who design computer tools, 2) those who choose which computer tools to use, and 3) those who are involved in the training of the potential users of the computer tools. The following three sections briefly describe how a knowledge of computer self-efficacy should influence each of these three areas.

Design

Obviously, designers of computer tools should consider the needs of the users of the tool. One of the things the designers should consider is the computer self-efficacy of the users. First, the designer should try to determine the general level of computer self-efficacy of the users of the tool. For example, if the computer tool is to be used primarily by computer programmers, this means the users probably have high computer self-efficacy. However, if the computer tool is to be used by managers of all kinds, there is probably a wide range of computer self-efficacy for this group of users, ranging from very low to very high computer self-efficacy.

The designer should know the general range of computer self-efficacy of the users because this will affect the design of the tool. When the users of the tool may be low CSEs (people having low computer self-efficacy), it is particularly important for the designer to take the low CSE into consideration. Because the low CSE's initial mindset is that he or she can't use the tool, the designer has to work at proving him or her wrong, that the low CSE *can* use this tool. *The designer should pay special attention to the user's initial interaction with the tool.* For example, if the low CSE runs into problems early on, like in setting up the software or trying to do something seemingly simple after

setting up the software, these problems can only hurt this low CSE's self-efficacy for the tool. An early unsuccessful interaction like this reinforces the low CSE's already low computer self-efficacy and also makes him or her less likely to use the tool to its potential, or less likely to use the tool at all. However, if the tool is carefully designed to give the low CSE the best chance of having personal mastery experiences early on, this can increase this user's self-efficacy by making this user believe that he or she can, in fact, use the tool. This increase of the user's self-efficacy for the tool will make it more likely he or she will use the tool and use it to its potential. Thus, designers can benefit most from this research by focusing on how to ensure early personal mastery experiences for users that may have low computer self-efficacy.

Designers may also consider new designs that can incorporate the needs of both high and low CSEs; that is, a design that is easy to use initially, but also has the power, speed, and advanced capabilities that a high CSE is more likely to want to use right away. One design possibility is to design in two or three different interfaces for different levels of users (e.g., novice, intermediate, and expert). This way, each user can choose the interface best suited to him or her.

Matching the Tool to the User

When selecting a computer tool for a particular user or set of users, it is important to consider the level of computer self-efficacy of the users. Low CSEs and high CSEs will probably have different needs and wants in a computer tool, even if they are both performing the same task. For example, a low CSE will probably put initial simplicity at a higher priority than power, speed, or the presence of advanced features. The opposite would probably be true for high CSEs. Thus, when choosing a specific tool for a user or

group of users, the characteristics of the tool should be best matched to the level of computer self-efficacy of the user.

Training

The method of training a user on a new computer tool should be matched to the level of computer self-efficacy of the user. Different methods of training will have different effects on a person's computer self-efficacy. For example, Gist, Schwoerer, & Rosen (1989) found that low CSEs had their computer self-efficacy increased in a video tape training condition relative to a computer tutorial training condition. In this study, the authors concluded that the video tape training was superior due to the modeling component in the video training that was absent in the computer tutorial training. Thus, when training low CSEs, it is important to model appropriate behaviors in addition to telling the trainees what to do, rather than just telling the trainees what to do without modeling appropriate behaviors.

In addition to including modeling in training, trainees should be given the best opportunity for personal mastery experiences during training. The more the trainee successfully does during the training, the more these personal mastery experiences will influence the trainee's self-efficacy for the new tool. However, the trainee must attribute his or her success to his or her ability or skills for these successes to translate into self-efficacy for the tool. For example, suppose the training is loaded with personal mastery experiences, but the trainee can't successfully do any of these things once the training is over. In this case, the trainee may attribute the successes during training to the hand-holding nature of the training rather than to any real personal mastery. To avoid this problem, the training should include the opportunity for the trainee to demonstrate real

personal mastery that should be distinct from the hand-holding instruction that may have preceded it.

There is a balance at work here. On the one hand, the training should be easy enough to almost ensure the success of the trainee, but not so easy or remedial that it is interpreted as merely a hand-holding experience with no real personal mastery. The key to this balance is to determine just where the trainee is in terms of ability, skills, and computer self-efficacy, and to tailor the training to advance slowly but surely from that point. Achieving this balance means that you can't effectively train people with varying levels of computer self-efficacy at the same time, because what is remedial to one trainee may be too challenging to another. Thus, if people are trained in groups, the trainees' levels of computer self-efficacy should be considered when selecting the training groups, so trainees with similar levels of computer self-efficacy can be grouped together.

In summary, to best influence computer self-efficacy, training should incorporate the following: 1) modeling of the appropriate behavior and 2) opportunities for personal mastery experiences (that will be attributed as personal mastery). Additionally, the level and pace of the training should be adapted to the level of computer self-efficacy of the trainees.

Practical Suggestions for Increasing Self-Efficacy

Although this study deals with the specific problem of increasing a person's computer self-efficacy, the suggestions here apply to increasing self-efficacy in general. There is nothing in the literature to suggest that increasing computer self-efficacy should be fundamentally any different than increasing any other form of self-efficacy. Thus, I prefer to address the larger issue of increasing self-efficacy in general, which has implications

beyond the domain of computers. However, some of the examples I use are given in the context of increasing a person's computer self-efficacy. These suggestions are aimed particularly at increasing low self-efficacy, but the concepts underlying these suggestions should prove useful for increasing anyone's self efficacy for anything, even if the person's self-efficacy is initially high. Most of the suggestions given here are based on my review of the literature. The first suggestion, however, is based on the results from this study.

Do Not Attempt or Expect a "Quick Fix"

Self-efficacy can be changed, but such a change will require time and continued encouragement to reverse the direction of the self-reinforcing pattern of low self-efficacy. When you're attempting to increase someone's self-efficacy, remember that low SEs (those with low self-efficacy) are likely to avoid opportunities to increase his or her self-efficacy. This is the nature of low self-efficacy; it is self-reinforcing, not self-curing. This is why outside encouragement is so important, especially in the early stages of helping a low SE. The assumption that changing a person's self-efficacy can be done with a "quick fix" without much outside encouragement ignores this advice and sets the low SE up for failure. The "quick fix" approach was the main problem with the strategy implementation used in this study. Although the strategy was based on sound self management principles, the implementation of that strategy relied upon those with low self-efficacy to "cure themselves." As I said before, my implementation is analogous to giving a snake phobic a self-help book and a pet snake and telling him or her to to go cure himself or herself.

Understand and Address the Potential Causes of Low Self-Efficacy

Low self-efficacy will change most when you address the reason why it's low (Gist & Mitchell, 1992). Figure 17 shows the factors influencing self-efficacy. (This figure is the same as the conceptual model used for this study except that this model is not limited to computer self-efficacy.) This model may be used as a diagnostic tool to help you assess why a person has low self-efficacy. This model may also be used as a prescriptive tool to help you see how to best counteract the problem. For example, you may notice someone with low computer self-efficacy who actively avoids using computers. Using this model, you can see that a major contributing factor to this person's low computer self-efficacy is the fact that this person has had little or no personal mastery experiences with computers because he or she avoids using them. Whether low computer self-efficacy originally caused the avoidance or the other way around isn't the issue; what is important is that now both are reinforcing each other, and the cycle needs to be stopped. Thus, your first step in helping this person is to encourage him or her to use a computer in certain situations and not avoid computers, since this avoidance is initially where the problem lies. However, in keeping with the model, you should encourage him or her to use a computer where this will lead to personal mastery experiences and not in situations that are initially too difficult that will lead to failure. The suggestions that follow all relate to the components of this model.

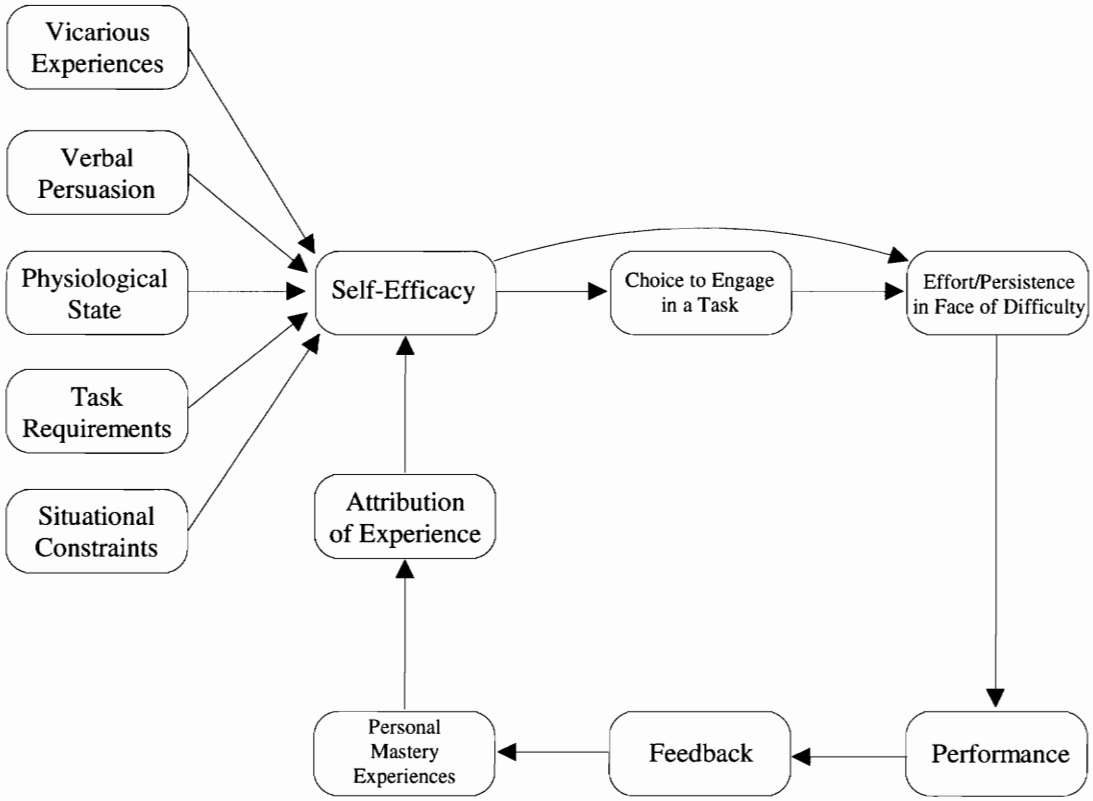

Figure 17: The factors influencing self-efficacy.

Encourage Opportunities for Personal Mastery Experiences

Personal mastery experiences are the most powerful form of self-efficacy information (Bandura, 1986). In providing someone with opportunities for personal mastery experiences, it is important to make the opportunity small and manageable enough for the person to experience personal success at the task. Personal mastery experiences are akin to Weick's concept of "small wins" (1984). The motivational effect a "small win" can have is often more significant than the win itself. This is especially true for the low SE. A low SE needs to see that he or she really *can* perform successfully at a certain task, even if that task is initially small. The motivation from this "small win" will help the low SE to attempt progressively more challenging tasks over time. This process is analogous

to systematic desensitization, in which a phobic is brought into progressively closer contact with the object of fear until eventually the phobic has come to the point of dealing directly with it, such as in the case of a snake phobic handling a snake.

The techniques used in the self-efficacy strategy in this study all support creating personal mastery experiences. Each of the techniques is discussed briefly below. Note that although these techniques were intended to be self-administered in this study, they do not need to be restricted to self-administration.

Proximal goal-setting

Setting proximal or short-term goals, has been shown to be effective in increasing a person's self-efficacy (Bandura & Schunk, 1981; Frayne & Latham, 1987). The most effective goals are ones that are highly specific, challenging but achievable, and immediate (Muchinsky, 1990). Setting such goals leads to personal mastery experiences, which in turn increases self-efficacy.

Feedback

Feedback is necessary for someone to make accurate self-efficacy judgments (Bandura, 1986; Gist & Mitchell, 1992). The more explicit the feedback is, the better the person can see the cause and effect between his or her action and the outcome on a certain activity. This is important, because in absence of clear feedback, low SEs often make systematic attributional errors leading them to underestimate their abilities.

Feedback also works together with goal setting. When a person has no feedback on how he or she is doing in relation to the goals set, the motivational component of goal setting is lost (Bandura & Cervone, 1983).

Reinforcement

Reinforcement can be used to provide the motivation to persevere and succeed at tasks that lead to personal mastery experiences (Frayne & Latham, 1987; Gist & Mitchell, 1992). If you're trying to increase someone else's self-efficacy, note that reinforcement does not necessarily mean a tangible reward; it may be as simple as verbal encouragement or a pat on the back. The reinforcement used should be tailored to the situation and person. Reinforcement works particularly well when combined with goal-setting and feedback (Frayne & Latham, 1987).

Make Use of Vicarious Experiences

Vicarious experiences should either be used together with personal mastery experiences or when personal mastery experiences aren't possible. For example, if you're training someone on a task, you may want to demonstrate what to do before letting him or her try. In one study where soldiers were being recruited to a special forces unit, a soldier who had been in the special forces unit for a few years told personal stories about experiences he had in the special forces unit (Eden & Kinnar, 1991). In this case, it was not possible for the new soldiers to have personal mastery experiences about being in the special forces unit, but the next best thing was having vicarious experiences provided for them from a veteran.

Use Verbal Persuasion

Verbal persuasion is not likely in itself to have much of a lasting impact on self-efficacy; its effect is short lived. However, it is especially useful in persuading people to take part

in opportunities that will lead to personal mastery experiences, which will have a more lasting effect (Bandura, 1986).

Clarify Task Requirements

Since self-efficacy has to do with a person's belief about his or her ability to successfully perform a task, an accurate self-efficacy judgment obviously depends on an accurate understanding of the task. In cases where low self-efficacy stems from a poor understanding of the task, clarifying the task requirements can increase self-efficacy for that task (Gist & Mitchell, 1992).

Provide Training

In cases where a person's low self-efficacy is an accurate assessment of his or her ability to perform a task, self-efficacy can be indirectly increased by providing training to impart the requisite skills for the task (Gist & Mitchell, 1992). Organizations wanting to increase the self-efficacy of its employees can't only train them in specific job skills, but also in general skills that will help them deal more effectively with their working environment, such as communication skills (Geddes, 1993), self-management skills (Frayne & Latham, 1987), and skills in making accurate causal attributions (Seligman, 1991). After a person has been trained in a new skill, it is important to provide him or her adequate opportunity to practice that skill in a non-threatening environment to build self-efficacy with regard to that skill (Bandura, 1986). If training is provided and the trainee is expected to immediately have mastery of the new skill, more harm may result than good, particularly for those with low self-efficacy.

Future Research

In this section I give suggestions for future research that would extend the line of research addressed in this study. First, I suggest ways this study can be improved. Second, I suggest possible research directions for computer self-efficacy. Finally, I suggest possible research directions for increasing self-efficacy.

Improving on this Study

Require or provide incentive for the subjects to use the strategy.

As discussed earlier in this chapter, low SEs, who stand to benefit most from the self-efficacy strategy, are the least likely to use it on their own initiative. Thus, this study would be improved if the subjects were either required or given some incentive to use the strategy. If the study were carried out in a classroom setting, perhaps the instructor could make use of the strategy a requirement of the course, where the students would have to hand in periodic progress sheets indicating the goals, reinforcement, and feedback they had used. However, where possible, care should be taken to make sure students are really using the strategy and not just making up information to fulfill a requirement.

Take more time to train subjects in the use of the strategy.

Sims & Lorenzi say, "If employees are to be effective self-managers, their managers must provide the environment and training for them to develop these skills" (1992, p. 193). Similarly, if I want future subjects to be effective in using the self-management skills involved in this strategy, they will need to be given adequate time to be trained in these skills. As in the Frayne & Latham (1987) study, there should be discussion time to talk about the strategy both before the subjects use it and after they begin using the strategy.

The subjects should be encouraged to ask questions about the strategy or discuss problems they run into using the strategy. If possible, time should be made available for the subjects to talk one-on-one with the trainer about the strategy. Having an open classroom discussion about the strategy would be beneficial; however, this open discussion would mean that you couldn't have both treatment and control strategies within the same class. If this study were carried out in a classroom setting where several sections of the same class were being taught, I would suggest eliminating the control strategy altogether and instead using a multiple baseline design, introducing the strategy at different points in time in the different classes. In this case, as long as the majority of students in one class were not in close contact with the students in the other classes, the chance of having the Hawthorne effect would be eliminated, since most students would not be aware of the difference between the two classes.

Investigate the effect of the level of use of the strategy on intentions to use a computer.

The effect of the level of use of the strategy on intentions to use a computer should be tested. The results of test should be compared with the results found in this study, particularly the significant curvilinear relationship between level of use of the strategy and intentions to use a computer. If the same results are found, subjects should be interviewed to find out more about why such an unusual relationship exists.

Future Research on Computer Self-Efficacy

Develop and test training methods that increase computer self-efficacy.

The area of training is perhaps the most obvious practical application of research on computer self-efficacy. Whether training takes place in a classroom, in a one-on-one

setting, using a training video, or using a computer-based tutorial, research should address what training methods effectively increase computer self-efficacy. Future research should especially focus on training methods for low CSEs, since many forms of training may be overwhelming for them, and therefore discouraging rather than helpful.

Develop methods for reaching and helping those with low computer self-efficacy.

As I have said several times, those with low computer self-efficacy are also among those least likely to choose to participate in a program designed to increase computer self-efficacy. Future research should find out what methods are most effective for reaching and helping those with low computer self-efficacy.

Study the differences between those with high and low computer self-efficacy.

Those with high and low computer self-efficacy may respond best to two totally different kinds of training. They may also respond best to two totally different types of software or hardware. Future research should study these differences.

Future Research on Increasing Self-Efficacy

As Gist & Mitchell state, "...the extent to which self-efficacy and performance can be raised and the overall malleability of self-efficacy still are unresolved issues. Little attempt has been made to understand systematically which determinants might be altered to yield the greatest change in self-efficacy and which change strategies should be used" (p. 198). Below, I list specific questions that future research in this area should address.

What strategies work best for raising someone's self-efficacy?

Those wanting to increase self-efficacy in others need to know the best strategies for doing so. Although personal mastery experiences are the most powerful form of self-efficacy information, a personal mastery experience is not a strategy. Gist & Mitchell (1992) state, "Different types of task performance strategies may facilitate performance. These may include behavioral strategies (such as feedback seeking or interpersonal negotiations), analytical strategies (such as breaking the task into subparts for ease of cognitive processing or identifying a simpler way of solving a problem than is typically considered), and psychological strategies (such as persisting despite difficulty, coping with boredom, or managing anxiety)" (p. 195). Research should focus on the effectiveness of these and other kinds of strategies in increasing self-efficacy.

How can the vicious cycle be broken or reversed?

As I said earlier, the reason self-efficacy isn't easily or quickly changed is that self-efficacy is part of a self-reinforcing process that has a "snowballing" effect. Research should address how to most effectively break out of this vicious cycle, or, better yet, how to reverse the cycle so increased self-efficacy begins to reinforce itself. Gist & Mitchell (1992) state, "Operant conditioning suggests that positive feedback (praise) on process components that may have been performed successfully, coupled with the establishment of incremental subgoals on weaker process components might be ideal for breaking exacerbation cycles among individuals with low self-efficacy" (p. 206,7). The strategy suggested here closely corresponds to the self-efficacy strategy I used in this study. Further research is needed on this and other similar strategies to test their effectiveness in breaking the vicious cycle of low self-efficacy.

How do self-efficacy increasing strategies fare in the real world?

Field studies should be conducted to test the effectiveness of self-efficacy increasing strategies in the real world. Studies by Frayne & Latham (1987) , Gist et al. (1989), Eden & Kinnar (1991), and Eden & Ravid (1982) are good examples of this, but more are needed.

CONCLUSIONS

In this chapter I briefly review the main findings of this study and discuss the implications of these findings.

Although my experimental manipulation didn't yield the results I expected due to the subjects' low participation in using the strategies I gave them, I was able to gain important information about why the subjects didn't use the strategies they received. It appears that the main problem in my implementation of the self-efficacy strategy was in not providing the subjects the proper amount of time, encouragement, and incentive for learning and practicing the strategy. I believe if my implementation had included these things, the self-efficacy strategy would have worked. Frayne & Latham (1987) provided such a supportive environment for learning the strategy and successfully increased the self-efficacy as well as attendance of low-attendance government employees. My results also showed that those who used the strategy had higher computer self-efficacy than those who didn't use the strategy; that is, those who could benefit most from the self-efficacy strategy (low CSEs) were less likely to use it. This finding underscores the importance of providing a supportive environment for people to learn and practice the strategy, so low SEs will be able to use the strategy successfully, rather than avoid the strategy before they even get a chance to learn or use it.

Although I was not able to increase computer self-efficacy, my results still showed that computer self-efficacy was the strongest predictor of a person's intentions to use a computer. This result implies that influencing a person's computer self-efficacy is a viable route to increasing that person's likelihood of using a computer tool. The practical

implications of this finding can be applied to three primary groups of people: those who design computer tools, those who choose which computer tools to use, and those who train others on computer tools. Designers should determine if the users of the tool may have low computer self-efficacy. If there may be low CSE users, the designer should make sure that the tool will be simple to use early on, providing the low CSE user with personal mastery experiences during his or her initial interactions with the computer. Those who choose which computer tool will be used should make sure the computer tool chosen matches the level of computer self-efficacy of the users of the tool. Finally, those who train others on new computer tools should make use of both modeling and personal mastery experiences during training. Including these two components during training is especially important when the trainees have low computer self-efficacy.

The last main finding of this study is what did and didn't independently predict the subject's computer self-efficacy. Only instrumentality and hesitancy to use a computer independently predicted computer self-efficacy. Variables that didn't independently predict computer self-efficacy included computer experience, computer ownership, and academic major (computer-related vs. not computer-related). This finding emphasizes the fact that not all computer experience increases computer self-efficacy. The challenge we are left with is to determine what kinds of computer experience increase computer self-efficacy and what kinds don't.

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APPENDICES

Appendix A: Consent Form

Appendix B: Questionnaire 1

New River Community College

Radford University

Appendix C: Strategy Packet

Computer Performance Improvement Strategy (CPIS)

Computer Instrumentality Strategy (CIS)

Appendix D: Questionnaire 2

Appendix E: Questionnaire 3

Appendix F: Questionnaire 4

New River Community College

Radford University

Appendix G: Scripts I Used in Administering Materials

Appendix H: Pilot Tests of Materials

Identification Code

Questionnaire 1

Computer Performance Improvement Strategy (CPIS)

Computer Instrumentality Strategy (CIS)

Questionnaire 2 & 3

Questionnaire 4

Appendix A: Consent Form

Dear Student,

You are invited to participate in a study about computer attitudes. This study is for the purpose of understanding how people's computer attitudes and behaviors affect one another. If you choose to participate in this study, you are asked to respond to the 62 items on the survey. This should take you about 5 minutes. There may also be other surveys in the future that you will be asked to fill out.

Your responses in this study will be kept confidential. In order to match your responses to other related surveys, I ask you to identify yourself by a special code that no one will know but you. Please note that no one will know if you are participating in this study except you. Your participation in this study is voluntary. Although the instructions on the survey ask you to fill out every question (to help make this research complete), if there are any items you wish not to answer, you are free to leave them blank.

Should you have any questions about this research or its conduct, please contact:

John Merritt, Investigator 231-3512
Elizabeth Koball, Ph.D. 231-3349

I have read and understood this information.

Signed_____ Date_____

Appendix B: Questionnaire 1

New River Community College (NRCC)

Radford University

COMPUTER ATTITUDES QUESTIONNAIRE (NRCC)

Please take about 5 minutes to fill out this questionnaire. Your responses are confidential. Please fill out ***EVERY*** item on the questionnaire. If you are unsure of a response, make your best guess.

To insure the confidentiality of your responses in this questionnaire, the following eight digit code is used. This code may be used to match your current responses with any future responses you may be asked to give, but it will not be used to match you to your responses. In the first four spaces, please put your mother's birthday (*month & day only, not year*). In the following four spaces, please put your father's birthday. If you are unsure of any information, please fill in those blanks with X's.

Example: If your mother's birthday is January 4, and your father's birthday is either October 24 or 25 (you can't remember), then your code would be: ***01 04 10 2X***

__ __	__ __	__ __	__ __
month	day	month	day
MOTHER		**FATHER**	

****

Section 1: *Please circle the appropriate response along the continuum indicating how much you agree or disagree with each statement.*

		Strongly Disagree										Strongly Agree
1.	I am confident in my ability to use a computer.	0	1	2	3	4	5	6	7	8	9	10
2.	After this class, I will be able to use a word processor.	0	1	2	3	4	5	6	7	8	9	10
3.	After this class, I will be able to use a spreadsheet.	0	1	2	3	4	5	6	7	8	9	10
4.	After this class, I will be able to perform several operations in DOS.	0	1	2	3	4	5	6	7	8	9	10
5.	After this class, I will be able to use a database management system.	0	1	2	3	4	5	6	7	8	9	10
6.	After this class, I will be able to use a desktop publishing program.	0	1	2	3	4	5	6	7	8	9	10
7.	After this class, I will be able to learn new kinds of software on my own.	0	1	2	3	4	5	6	7	8	9	10
8.	If given a new word processing package to learn on my own, I could learn it fairly easily.	0	1	2	3	4	5	6	7	8	9	10
9.	If I was using a software package and had to do something I'd never learned before, I could learn it from a manual.	0	1	2	3	4	5	6	7	8	9	10
10.	If I needed to, I could learn a new computer language on my own.	0	1	2	3	4	5	6	7	8	9	10
11.	I will be able to make an "A" in this class.	0	1	2	3	4	5	6	7	8	9	10
12.	I am hesitant to try something new on a computer.	0	1	2	3	4	5	6	7	8	9	10
13.	I am afraid I might mess something up if I try to do something new on a computer.	0	1	2	3	4	5	6	7	8	9	10

	Strongly Disagree										Strongly Agree
14. Knowing how to use computers is important to my future success.	0	1	2	3	4	5	6	7	8	9	10
15. If I know about computers I can get a higher status job.	0	1	2	3	4	5	6	7	8	9	10
16. I will not get as high a starting salary if I don't know how to use a computer.	0	1	2	3	4	5	6	7	8	9	10
17. Expertise in computers is of utmost importance if I want to get a good job.	0	1	2	3	4	5	6	7	8	9	10
18. If I don't learn how to use computers it will be difficult to succeed in any professional career.	0	1	2	3	4	5	6	7	8	9	10
19. I plan to own a personal computer within the next two years.	0	1	2	3	4	5	6	7	8	9	10
20. I plan to use a computer in the future only if I have to.	0	1	2	3	4	5	6	7	8	9	10
21. I am committed to doing well in this course.	0	1	2	3	4	5	6	7	8	9	10
22. I am willing to take advantage of opportunities to improve my grade in this course.	0	1	2	3	4	5	6	7	8	9	10
23. I usually do well at something when I set my mind to it.	0	1	2	3	4	5	6	7	8	9	10
24. When I'm given assignments in a class, I tend to put them off until the last minute.	0	1	2	3	4	5	6	7	8	9	10
25. I can usually persevere at a difficult task if I know that it will help me in the long run.	0	1	2	3	4	5	6	7	8	9	10
26. When taking tests and quizzes, my mind often goes blank.	0	1	2	3	4	5	6	7	8	9	10
27. I am a well-disciplined person.	0	1	2	3	4	5	6	7	8	9	10
28. I often get behind in my classes.	0	1	2	3	4	5	6	7	8	9	10
29. If I am behind in a class, I find it difficult to catch up.	0	1	2	3	4	5	6	7	8	9	10
30. I can think of at least one bad habit I have that hurts my performance in my classes.	0	1	2	3	4	5	6	7	8	9	10
31. I am willing to try new ways of doing things.	0	1	2	3	4	5	6	7	8	9	10

****

<u>Section 2:</u> *Please circle the appropriate response along the continuum indicating your level of confidence in doing the following:*

	Very Low Confidence										Very High Confidence
32. Explaining why a program (software) will or will not run on a given computer.	0	1	2	3	4	5	6	7	8	9	10

	Very Low Confidence										Very High Confidence
33. Troubleshooting computer problems.	0	1	2	3	4	5	6	7	8	9	10
34. Writing simple programs for the computer.	0	1	2	3	4	5	6	7	8	9	10
35. Describing the function of computer hardware (keyboard, monitor, disk drives, CPU).	0	1	2	3	4	5	6	7	8	9	10
36. Understanding terms/words related to computer hardware .	0	1	2	3	4	5	6	7	8	9	10
37. Understanding terms/words related to computer software .	0	1	2	3	4	5	6	7	8	9	10
38. Learning to use a variety of programs (software).	0	1	2	3	4	5	6	7	8	9	10
39. Getting help for problems on the computer.	0	1	2	3	4	5	6	7	8	9	10
40. Learning advanced skills within a specific program (software).	0	1	2	3	4	5	6	7	8	9	10
41. Learning a new software package by jumping right in and trying it out.	0	1	2	3	4	5	6	7	8	9	10
42. Figuring out how to do things in a new software package by trial and error.	0	1	2	3	4	5	6	7	8	9	10
43. Solving problems you run into on the computer.	0	1	2	3	4	5	6	7	8	9	10

****

Section 3

44. What grade do you want to try to get in this class? A B C D F

45. What grade do you expect to get in this class? A B C D F

46. Do you own a personal computer? Yes No

47. Do you have access to a personal computer? Yes No

48. Have you ever used a personal computer? Yes No

49. How many years of experience have you had with personal computers (to the nearest year)? _____ years

50. During the past year, how many days per week did you use a computer, on average? (circle one)

0 1 2 3 4 5 6 7

51. Do you have any personal computer experience with the following: (if you are unsure, circle "No")

word processing?	Yes	No
using spreadsheets?	Yes	No
using electronic mail?	Yes	No
using DOS?	Yes	No
using Microsoft Windows?	Yes	No
playing computer games?	Yes	No
using database management systems?	Yes	No

using drawing or graphics programs? Yes No

writing computer programs? Yes No

using a mainframe? Yes No

52. Are you a computer science major? Yes No

53. Are you taking a computer lab class this semester? Yes No

54. Have you taken a computer lab class before this semester? Yes No

55. Is this course a requirement? Yes No

56. Why are you taking this course? (check all that apply)

- as part of a 2 year degree ☐
- plan to transfer to 4 year college ☐
- for a certificate program ☐
- for job-related reasons ☐
- personal satisfaction ☐
- other (please specify in blank below) ☐

_____

_____

57. How many credit hours have you taken at New River Community College before this semester?

0-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80-89 90-99 100 or more

58. How many credit hours have you taken at other colleges?

0-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80-89 90-99 100 or more

59. Gender: M F

60. Age: _____

61. Circle what day of the week it is today: Mon Tue Wed Thu Fri

COMPUTER ATTITUDES QUESTIONNAIRE (Radford)

Please take about 5 minutes to fill out this questionnaire. Your responses are confidential. Please fill out ***EVERY*** item on the questionnaire. If you are unsure of a response, make your best guess.

To insure the confidentiality of your responses in this questionnaire, the following eight digit code is used. This code may be used to match your current responses with any future responses you may be asked to give, but it will not be used to match you to your responses. In the first four spaces, please put your mother's birthday (*month & day only, not year*). In the following four spaces, please put your father's birthday. If you are unsure of any information, please fill in those blanks with X's.

Example: If your mother's birthday is January 4, and your father's birthday is either October 24 or 25 (you can't remember), then your code would be: ***0 1 0 4 1 0 2 X***

__ __	__ __	__ __	__ __
month	day	month	day
MOTHER		**FATHER**	

****

Section 1: *Please circle the appropriate response along the continuum indicating how much you agree or disagree with each statement.*

		Strongly Disagree										Strongly Agree
1.	I am confident in my ability to use a computer.	0	1	2	3	4	5	6	7	8	9	10
2.	After this class, I will be able to use a word processor.	0	1	2	3	4	5	6	7	8	9	10
3.	After this class, I will be able to use a spreadsheet.	0	1	2	3	4	5	6	7	8	9	10
4.	After this class, I will be able to perform several operations in Windows.	0	1	2	3	4	5	6	7	8	9	10
5.	After this class, I will be able to use a database management system.	0	1	2	3	4	5	6	7	8	9	10
6.	After this class, I will be able to use a graphics program.	0	1	2	3	4	5	6	7	8	9	10
7.	After this class, I will be able to learn new kinds of software on my own.	0	1	2	3	4	5	6	7	8	9	10
8.	If given a new word processing package to learn on my own, I could learn it fairly easily.	0	1	2	3	4	5	6	7	8	9	10
9.	If I was using a software package and had to do something I'd never learned before, I could learn it from a manual.	0	1	2	3	4	5	6	7	8	9	10
10.	If I needed to, I could learn a new computer language on my own.	0	1	2	3	4	5	6	7	8	9	10
11.	I will be able to make an "A" in this class.	0	1	2	3	4	5	6	7	8	9	10
12.	I am hesitant to try something new on a computer.	0	1	2	3	4	5	6	7	8	9	10
13.	I am afraid I might mess something up if I try to do something new on a computer.	0	1	2	3	4	5	6	7	8	9	10

	Strongly Disagree										Strongly Agree
14. Knowing how to use computers is important to my future success.	0	1	2	3	4	5	6	7	8	9	10
15. If I know about computers I can get a higher status job.	0	1	2	3	4	5	6	7	8	9	10
16. I will not get as high a starting salary if I don't know how to use a computer.	0	1	2	3	4	5	6	7	8	9	10
17. Expertise in computers is of utmost importance if I want to get a good job.	0	1	2	3	4	5	6	7	8	9	10
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20. I plan to use a computer in the future only if I have to.	0	1	2	3	4	5	6	7	8	9	10
21. I am committed to doing well in this course.	0	1	2	3	4	5	6	7	8	9	10
22. I am willing to take advantage of opportunities to improve my grade in this course.	0	1	2	3	4	5	6	7	8	9	10
23. I usually do well at something when I set my mind to it.	0	1	2	3	4	5	6	7	8	9	10
24. When I'm given assignments in a class, I tend to put them off until the last minute.	0	1	2	3	4	5	6	7	8	9	10
25. I can usually persevere at a difficult task if I know that it will help me in the long run.	0	1	2	3	4	5	6	7	8	9	10
26. When taking tests and quizzes, my mind often goes blank.	0	1	2	3	4	5	6	7	8	9	10
27. I am a well-disciplined person.	0	1	2	3	4	5	6	7	8	9	10
28. I often get behind in my classes.	0	1	2	3	4	5	6	7	8	9	10
29. If I am behind in a class, I find it difficult to catch up.	0	1	2	3	4	5	6	7	8	9	10
30. I can think of at least one bad habit I have that hurts my performance in my classes.	0	1	2	3	4	5	6	7	8	9	10
31. I am willing to try new ways of doing things.	0	1	2	3	4	5	6	7	8	9	10

****

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	Very Low Confidence										Very High Confidence
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34. Writing simple programs for the computer.	0	1	2	3	4	5	6	7	8	9	10
35. Describing the function of computer hardware (keyboard, monitor, disk drives, CPU).	0	1	2	3	4	5	6	7	8	9	10
36. Understanding terms/words related to computer hardware .	0	1	2	3	4	5	6	7	8	9	10
37. Understanding terms/words related to computer software .	0	1	2	3	4	5	6	7	8	9	10
38. Learning to use a variety of programs (software).	0	1	2	3	4	5	6	7	8	9	10
39. Getting help for problems on the computer.	0	1	2	3	4	5	6	7	8	9	10
40. Learning advanced skills within a specific program (software).	0	1	2	3	4	5	6	7	8	9	10
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42. Figuring out how to do things in a new software package by trial and error.	0	1	2	3	4	5	6	7	8	9	10
43. Solving problems you run into on the computer.	0	1	2	3	4	5	6	7	8	9	10

****

Section 3

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45. What grade do you expect to get in this class? A B C D F

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47. Do you have access to a personal computer? Yes No

48. Have you ever used a personal computer? Yes No

49. How many years of experience have you had with personal computers (to the nearest year)? _____ years

50. During the past year, how many days per week did you use a computer, on average? (circle one)

0 1 2 3 4 5 6 7

51. Do you have any personal computer experience with the following: (if you are unsure, circle "No")

word processing?	Yes	No
using spreadsheets?	Yes	No
using electronic mail?	Yes	No
using DOS?	Yes	No
using Microsoft Windows?	Yes	No
playing computer games?	Yes	No
using database management systems?	Yes	No

using drawing or graphics programs? Yes No

writing computer programs? Yes No

using a mainframe? Yes No

52. Are you or do you plan to be an information systems major? Yes No

53. Are there enough personal computers in this classroom for each of you to use one without sharing? Yes No

54. Have you taken a computer lab class before this semester? Yes No

55. Is this course a requirement? Yes No

56. Why are you taking this course? (check all that apply)

strictly as an elective ☐

to fulfill a general education requirement ☐

to meet a minor requirement ☐

to meet a major requirement ☐

other (please specify in blank below) ☐

_____

_____

57. How many credit hours have you taken at Radford before this semester?

0-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80-89 90-99 100 or more

58. How many credit hours have you taken at other colleges?

0-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80-89 90-99 100 or more

59. Gender: M F

60. Age: _____

61. Circle what day of the week it is today: Mon Tue Wed Thu Fri

62. Circle what time of day this class meets: 8:00 9:30 10:00 11:00 12:00

Appendix C: Strategy Packet

Cover Letter

Computer Performance Improvement Strategy (CPIS)

Computer Instrumentality Strategy (CIS)

Dear _____ (ID number printed here),

Thank you for taking the time to fill out the questionnaire last week. Based on an analysis of your responses from this questionnaire, a research-tested strategy has been selected for you that can help you significantly improve your performance in this class. I encourage you to try it out during the next week and decide for yourself if it is beneficial for you.

Attached is a description of how you can use this strategy, should you choose to do so. Please read this today. Next week you will receive a short 2-minute questionnaire asking you if you have used this strategy and how beneficial you have found it. Although I highly encourage you to try this strategy, please remember that your participation is voluntary and that no one will know whether or not you are participating.

Thank you,

John Merritt, Investigator

Computer Performance Improvement Strategy

Introduction

Many students like yourself have improved their class performance when they've used the Computer Performance Improvement Strategy (CPIS). The CPIS has three parts: goal setting, self-reinforcement, and regular feedback. These need to be used together for the CPIS to be effective. Each part is discussed below, giving you examples of how each one can be applied in this class.

Part 1: Goal Setting

Goals can be either long term goals or short term goals. They are both useful, but for different reasons. Long term goals are important because they give people a direction that they can work toward. Short term goals, however, are much more effective for motivating people. For this class, use both.

Long term goals

Think first about your long term goals for this class. Perhaps your long term goal is to perform well in this class and learn to be more proficient with computers. If you choose to boil this down to a more specific goal, you might say that your goal is to make an "A" in this course. Think about whatever your long term goal is for this class, and when you've decided, write it in the space below.

Long Term Goal:

Short term goals

The next part probably requires a little more thought and is also more crucial to the success of the CPIS. You need to think about what short term goals will help you achieve the long term goal. Begin by asking yourself, "What is it that I can do that will help me do well in this course (or achieve whatever your long term goal may be)?" For many students, the answer would be to keep up with your work regularly and not put it off. You can turn this into an effective short term goal by keeping in mind three basic rules about short term goals:

1. *Short term goals work best the more specific and "measurable" they are.* Don't choose vague goals, like "I will work hard this week", but rather a specific goal, such as "I will begin this assignment by 8:00".
2. *Short term goals work best when they are somewhat challenging.* If they are too easy or too hard, this can backfire. Make sure your goal is challenging, but not so hard that you'll fail and then give up.
3. *Short term goals work best the more immediate they are.* You'll probably want to set short term goals for each day. If your short term goals are for a longer period than this,

they won't work as well. For example, suppose you have a project due next Wednesday. The immediate goal "I will work on this project for two hours today," is a better goal than "I will finish this project by next Monday evening." Sometimes, however, it may be helpful to use both of these goals together.

As an example of setting a short term goal, consider the following: Joe has an assignment due in two days, and he thinks it will take a couple of hours to complete. Since he knows he has a test in another class the same day this assignment is due, he wants to get this assignment done early so he can study. So Joe sets a goal that he will finish this assignment before he goes to bed tonight. Notice that this goal is specific. Joe knows exactly what he has to do to achieve the goal. And because the goal is making him work ahead of time, something he is not very good at doing, it is also challenging for him. And finally, because the goal is for today, it is relatively immediate.

Is there a specific short term goal you can set for today or tomorrow that will help you achieve your long term goal? Write it down below.

Short term goal:

Part 2: Self-Reinforcement

This is a crucial step in the CPIS. If this is done well, everything else will work much better. If this isn't done well, it will be difficult for the CPIS to help you achieve your goals. Self-reinforcement is essentially giving yourself rewards or punishments based on whether or not you reach the short term goals (not long term goals) you set for yourself. Examples of rewards may be buying yourself a small gift, going to the gym, or watching a particular TV program— essentially, anything you enjoy doing. Punishments may include cleaning the kitchen, doing pushups, or eating brussel sprouts— anything you dislike doing. You probably will only need to use either a reward or a punishment for each short term goal, but you can use both if you want to. Find out what works best for you, and stick to that.

The tricky part about self-reinforcements is that it can be tempting to give yourself the reward or skip the punishment even if you didn't achieve your goal. Self-reinforcements work very well if you can avoid this temptation, and they work very poorly if you give in to it. If you think you are likely to "break" the rules you set for yourself, you may consider writing up a "contract" for yourself, signing it, and putting it on your mirror. Or you may tell a friend the conditions you have set up for yourself and ask him or her to help you stick to them.

Think of some small rewards and punishments you can offer yourself. Write them down, along with a plan for "keeping yourself honest" if you think you need one.

Reinforcement:

Part 3: Feedback

Feedback is also important for goals to be useful. Imagine if you were a runner and your personal goal was to get your 2-mile time below 13 minutes. If you never carried a watch with you when you ran, it would be hard to stay motivated in trying to achieve that goal, wouldn't it? But if you did carry a watch and wrote down every day how long your run took you, you would perform much better as you tried to reach your goal. You need feedback to see how you're doing on the way to your goal.

To start you off, we have provided you with the "CPIS Work Sheet" (attached). This will help you keep track of your short term goals, the reinforcements you're using, and how well you are doing at achieving your goals. Columns for dates are included to help you see when your goals were assigned and when they're due. As mentioned earlier, you'll probably want to update this work sheet fairly often— every day or every few days. To help you remember to do this, you'll want to put it in a place where you'll be likely to see it regularly, perhaps on your bedroom mirror or in your class notebook. The "CPIS Work Sheet" is just a place to begin. If you think of a method of feedback that works better for you, use it!

Conclusion

Research has shown that for students like yourself, the CPIS significantly increases students' performance, particularly when they use all three parts together. We encourage you to see for yourself the benefits the CPIS can have for you this semester.

CPIS Work Sheet

This work sheet is designed to help you keep track of the goals and reinforcements you use, as well as provide you with an effective source of feedback showing you how well you are doing on your goals for this course. Put this in a place where you will see it regularly.

Instructions: Simply fill in the appropriate spaces below, adding new entries each time you set new goals. The "Date Assigned" and "Date Due" columns are to record when you set the short term goal and when it will be due. The last two columns help you keep track of whether you've achieved the goal and whether or not you've given or withheld the reward or punishment appropriately.

Long Term Goal:

Short Term Goal:	**Reward or Punishment:**	Date Assigned:	Date Due:	Goal Achieved?	Rew./Pun. Followed?
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No
				Yes No	Yes No

Computer Instrumentality Strategy

Introduction

Many students like yourself have improved their class performance when they've used the Computer Instrumentality Strategy (CIS). The CIS focuses on identifying the different reasons why computers are or can be useful in your life and reminding yourself of these on a regular basis. The CIS is discussed below, giving you examples of how it can be applied to this class.

Part 1: Identifying Reasons Why Computers Are Useful for You

There are many possible reasons why computers are useful in your life. For example, if you use a computer to type up a paper for class, this is a very specific reason why computers are useful for you now. There also may be reasons why computers will be useful to you in the future. For example, knowing how to use computers may be useful in finding the right kind of job for you. Whether short term or long term, identify the reasons why computers are useful in your life. Write five reasons in the space below.

Reasons Why Computers Are Useful for Me

Part 2: Reviewing the Instrumentality List

Writing down the five reasons above was the beginning of your "instrumentality list", a list showing why computers are instrumental, or useful, in your life. For the CIS to be effective, it is important for you to review your instrumentality list regularly. Attached is a blank work sheet entitled, "Instrumentality List". Write your five reasons on this sheet and keep this list in your class notebook. Then, each time before you go to class and also before you work on an assignment for this class, read each item on this list.

Part 3: Adding to the Instrumentality List

Each time you review your instrumentality list before class or your homework, add a new reason why computers are or can be useful in your life. You should find that as the class progresses, you will think of more and more reasons over time. If you get stuck, try listing possible ways that

you can use what you're learning in class in a "real life" situation, either now or in the future. For example you may write, "I can use a spreadsheet to keep track of my personal finances". Make it a goal to add a new reason each time you review the list.

Conclusion

Research has shown that for students like yourself, the CIS significantly increases students' performance, particularly when they both review and add to the instrumentality list regularly. We encourage you to see for yourself the benefits the CIS can have for you this semester.

Instrumentality List

This list will help you remember to add a new reason each time you review this list before class or an assignment. Each time you review this list, write the date in the first column, and then write a new reason in the second column. There should be at least one reason for each date. Also, the date column will show you how frequently you are reviewing this list. Remember that for the CIS to be effective, you must review this list frequently!

Date Reviewed:	Why computers are or can be useful in your life:

Instrumentality List (cont.)

Date Reviewed:	Why computers are or can be useful in your life:

Appendix D: Questionnaire 2

COMPUTER ATTITUDES QUESTIONNAIRE: PART 2

Please take about 1 minute to fill out this questionnaire. It is important that you answer these items as honestly as possible. Remember that since you are identified only by a secret code, your responses are confidential. Please fill out every item on the questionnaire that applies to you. If you are unsure of a response, make your best guess.

To insure the confidentiality of your responses in this questionnaire, the following eight digit code is used. This code may be used to match your current responses with other responses in this study, but it will not be used to match you to your responses. In the first four spaces, please put your mother's birthday (*month & day only, not year*). In the following four spaces, please put your father's birthday. If you are unsure of any information, please fill in those blanks with X's.

Example: If your mother's birthday is January 4, and your father's birthday is either October 24 or 25 (you can't remember), then your code would be: ***0 1 0 4 1 0 2 X***

__ __	__ __	__ __	__ __
month	day	month	day
MOTHER		**FATHER**	

****

1. Have you been using the strategy during the last week? (circle the letter of the response that applies the most)
   A. I have used the strategy.
   B. I have only used the strategy partially (i.e. for only a part of the week, or using only certain parts of the strategy).
   C. I read about the strategy, but did not use it.
   D. I received information about the strategy, but did not read it.
   E. I did not receive any information about the strategy.

If you circled "A" in question 1, please answer questions 2 & 3 only:

2. Has the strategy been beneficial? Yes No
3. Briefly explain why or why not:

If you circled "B" in question 1, please answer questions 4 - 9 only:

4. Briefly explain how much of the strategy you've used:
5. Has your partial involvement with the strategy been beneficial? Yes No
6. Briefly explain why or why not:
7. Briefly explain why you're not using the strategy more fully:
8. Do you believe the strategy would be beneficial if you used it more fully? Yes No
9. Briefly explain why or why not:

If you circled "C" in question 1, please answer questions 10 - 12 only:

10. Briefly explain why you're not using the strategy:
11. Do you believe the strategy would be beneficial if you used it? Yes No
12. Briefly explain why or why not:

If you circled "D" or "E" in question 1, you do not need to answer any questions.

Next week, you will receive another brief questionnaire asking if you've been using the strategy during the week. Whether you've used it fully, partially, or not at all, I encourage you to make use of the strategy during this next week.

Appendix E: Questionnaire 3

COMPUTER ATTITUDES QUESTIONNAIRE: PART 3

Please take about 1 minute to fill out this questionnaire. It is important that you answer these items as honestly as possible. Remember that since you are identified only by a secret code, your responses are confidential. Please fill out every item on the questionnaire that applies to you. If you are unsure of a response, make your best guess.

To insure the confidentiality of your responses in this questionnaire, the following eight digit code is used. This code may be used to match your current responses with other responses in this study, but it will not be used to match you to your responses. In the first four spaces, please put your mother's birthday (*month & day only, not year*). In the following four spaces, please put your father's birthday. If you are unsure of any information, please fill in those blanks with X's.

Example: If your mother's birthday is January 4, and your father's birthday is either October 24 or 25 (you can't remember), then your code would be: ***0 1 0 4 1 0 2 X***

__ __	__ __	__ __	__ __
month	day	month	day
MOTHER		**FATHER**	

****

1. Have you been using the strategy during the last week? (circle the letter of the response that applies the most)
   A. I have used the strategy.
   B. I have only used the strategy partially (i.e. for only a part of the week, or using only certain parts of the strategy).
   C. I read about the strategy, but did not use it.
   D. I received information about the strategy, but did not read it.
   E. I did not receive any information about the strategy.

If you circled "A" in question 1, please answer questions 2 & 3 only:

2. Has the strategy been beneficial? Yes No
3. Briefly explain why or why not:

If you circled "B" in question 1, please answer questions 4 - 9 only:

4. Briefly explain how much of the strategy you've used:
5. Has your partial involvement with the strategy been beneficial? Yes No
6. Briefly explain why or why not:
7. Briefly explain why you're not using the strategy more fully:
8. Do you believe the strategy would be beneficial if you used it more fully? Yes No
9. Briefly explain why or why not:

If you circled "C" in question 1, please answer questions 10 - 12 only:

10. Briefly explain why you're not using the strategy:
11. Do you believe the strategy would be beneficial if you used it? Yes No
12. Briefly explain why or why not:

If you circled "D" or "E" in question 1, you do not need to answer any questions.

Later in the course, you will receive a questionnaire asking if you've been using the strategy. If you've found the strategy beneficial, I encourage you to continue to use it during this course.

Appendix F: Questionnaire 4

New River Community College (NRCC)

Radford University

Computer Attitudes Questionnaire: Part 4 (NRCC)

Please take about 10 minutes to fill out this questionnaire. Your responses are confidential. Please fill out ***EVERY*** item on the questionnaire. If you are unsure of a response, make your best guess.

To insure the confidentiality of your responses in this questionnaire, the following eight digit code is used. This code may be used to match your current responses with any future responses you may be asked to give, but it will not be used to match you to your responses. In the first four spaces, please put your mother's birthday (*month & day only, not year*). In the following four spaces, please put your father's birthday. If you are unsure of any information, please fill in those blanks with X's.

Example: If your mother's birthday is January 4, and your father's birthday is either October 24 or 25 (you can't remember), then your code would be: ***0 1 0 4 1 0 2 X***

— —	— —	— —	— —
month	day	month	day
MOTHER		**FATHER**	

****

Section 1: *Please circle the appropriate response along the continuum indicating how much you agree or disagree with each statement.*

		Strongly Disagree										Strongly Agree
1.	I am confident in my ability to use a computer.	0	1	2	3	4	5	6	7	8	9	10
2.	After this class, I will be able to use a word processor.	0	1	2	3	4	5	6	7	8	9	10
3.	After this class, I will be able to use a spreadsheet.	0	1	2	3	4	5	6	7	8	9	10
4.	After this class, I will be able to perform several operations in DOS.	0	1	2	3	4	5	6	7	8	9	10
5.	After this class, I will be able to use a database management system.	0	1	2	3	4	5	6	7	8	9	10
6.	After this class, I will be able to use a desktop publishing program.	0	1	2	3	4	5	6	7	8	9	10
7.	After this class, I will be able to learn new kinds of software on my own.	0	1	2	3	4	5	6	7	8	9	10
8.	If given a new word processing package to learn on my own, I could learn it fairly easily.	0	1	2	3	4	5	6	7	8	9	10
9.	If I was using a software package and had to do something I'd never learned before, I could learn it from a manual.	0	1	2	3	4	5	6	7	8	9	10
10.	If I needed to, I could learn a new computer language on my own.	0	1	2	3	4	5	6	7	8	9	10
11.	I will be able to make an "A" in this class.	0	1	2	3	4	5	6	7	8	9	10
12.	I am hesitant to try something new on a computer.	0	1	2	3	4	5	6	7	8	9	10
13.	I am afraid I might mess something up if I try to do something new on a computer.	0	1	2	3	4	5	6	7	8	9	10
14.	Knowing how to use computers is important to my future success.	0	1	2	3	4	5	6	7	8	9	10
15.	If I know about computers I can get a higher status job.	0	1	2	3	4	5	6	7	8	9	10

	Strongly Disagree										Strongly Agree
16. I will not get as high a starting salary if I don't know how to use a computer.	0	1	2	3	4	5	6	7	8	9	10
17. Expertise in computers is of utmost importance if I want to get a good job.	0	1	2	3	4	5	6	7	8	9	10
18. If I don't learn how to use computers it will be difficult to succeed in any professional career.	0	1	2	3	4	5	6	7	8	9	10
19. I plan to own a personal computer within the next two years.	0	1	2	3	4	5	6	7	8	9	10
20. I plan to use a computer during this summer.	0	1	2	3	4	5	6	7	8	9	10
21. The only reason I will use a computer in the future is if I'm required to.	0	1	2	3	4	5	6	7	8	9	10
22. The only reason I will use a word processor in the future is if I'm required to.	0	1	2	3	4	5	6	7	8	9	10
23. The only reason I will use a spreadsheet in the future is if I'm required to.	0	1	2	3	4	5	6	7	8	9	10
24. The only reason I will use a database management system in the future is if I'm required to.	0	1	2	3	4	5	6	7	8	9	10

****

Section 2: *Please circle the appropriate response along the continuum indicating your level of confidence in doing the following:*

	Very Low Confidence										Very High Confidence
25. Explaining why a program (software) will or will not run on a given computer.	0	1	2	3	4	5	6	7	8	9	10
26. Troubleshooting computer problems.	0	1	2	3	4	5	6	7	8	9	10
27. Writing simple programs for the computer.	0	1	2	3	4	5	6	7	8	9	10
28. Describing the function of computer hardware (keyboard, monitor, disk drives, CPU).	0	1	2	3	4	5	6	7	8	9	10
29. Understanding terms/words related to computer hardware .	0	1	2	3	4	5	6	7	8	9	10
30. Understanding terms/words related to computer software .	0	1	2	3	4	5	6	7	8	9	10
31. Learning to use a variety of programs (software).	0	1	2	3	4	5	6	7	8	9	10
32. Getting help for problems on the computer.	0	1	2	3	4	5	6	7	8	9	10
33. Learning advanced skills within a specific program (software).	0	1	2	3	4	5	6	7	8	9	10
34. Learning a new software package by jumping right in and trying it out.	0	1	2	3	4	5	6	7	8	9	10
35. Figuring out how to do things in a new software package by trial and error.	0	1	2	3	4	5	6	7	8	9	10
36. Solving problems you run into on the computer.	0	1	2	3	4	5	6	7	8	9	10

Section 3

For items 37 to 40, ***enter a number grade from 0 - 100****. If you are not sure of a grade, make your best guess.*

37. What grades did you get on your *two tests* in this class? *1st test:* _____ *2nd test:* _____

38. What grade did you get on your *project* in this class? _____

39. To the best of your knowledge, what is your *quiz grade* in this class? _____

40. To the best of your knowledge, what is your *current overall grade* in this class? _____

41. Have you been using the strategy during the last six school weeks (since the last time I handed out a questionnaire)? (Circle the letter of the response that applies the most. If you never received a strategy, circle "E".)

    A. I have used the strategy during the last six weeks.

    B. I have only used the strategy partially (i.e., for only a part of the last six weeks, or using only certain parts of the strategy).

    C. I have read about the strategy, but I have not used it during the last six weeks.

    D. I have received information about the strategy, but I have not read it.

    E. I have not received any information about the strategy.

42. If you circled "A" or "B" above, complete the following sentence with a number from 1 - 6:

    I used the strategy during ____ of the last six school weeks. (If you're not sure, make your best guess.)

If you circled "C" on item 41, please fill out the questions in the shaded region below (items 43 to 49).
If you did not circle "C" on item 41, skip to item 50 (below the shaded region).

43. Indicate whether each statement below *was* or *wasn't* a reason you did not use the strategy. (Check the appropriate column.)

was a reason	*wasn't a reason*	
___	___	The strategy appeared to take too much time.
___	___	I didn't have enough time to use the strategy.
___	___	I am satisfied with my current study habits.
___	___	I am satisfied with my current grade in this class.
___	___	I forgot.
___	___	I didn't think the strategy would have been beneficial.
___	___	I was already using the components of the strategy.
___	___	I didn't understand the strategy.
___	___	Using the strategy wasn't worth the effort.

44. Under what circumstances would you have used a strategy given to you? (Circle one.)

    A. None

    B. I would have used a strategy if: _____

    _____

    _____

	Strongly Disagree										Strongly Agree
45. I could have used the strategy if I wanted to.	0	1	2	3	4	5	6	7	8	9	10
46. Using the strategy would have improved my grade in the class.	0	1	2	3	4	5	6	7	8	9	10
47. Using the strategy would have helped me better learn the material covered in this course.	0	1	2	3	4	5	6	7	8	9	10

	Not at all Important										Very Important
48. How important to you is your grade in this class?	0	1	2	3	4	5	6	7	8	9	10
49. How important to you is learning the material covered in this class?	0	1	2	3	4	5	6	7	8	9	10

50. Do you plan on using the strategy for the remainder of the course? Yes No

51. Do you plan on using the strategy outside this course? Yes No

52. What grade do you expect to get in this class? A B C D F

****

Section 4: *Please read each scenario and circle the number from 0 to 10 indicating your likelihood of taking a certain course of action .*

53. You've promised a friend that while she's out, you'd address and send out 200 newsletters for her before the 5:00 p.m. pickup at the post office, and it's 2:00 p.m. now. The addresses are on a file on her computer, which you've just brought up on the word processor. She's left mailing labels for you to use next to the printer. You've never used a printer to print out labels before, but it looks like you can figure out how to do it. You also realize you may need to make some formatting changes to the file to make the addresses fit correctly on the mailing labels. You're not familiar with all the formatting commands on this word processor, but you think you may be able to figure out what you need to know. You know you can address all of the envelopes by hand and still get them out on time, but you also know that if you can print the labels out using the computer, you will save time. How likely is it that you'll use the computer to try to print the addresses on the mailing labels?

Very Unlikely										Very Likely
0	1	2	3	4	5	6	7	8	9	10

54. You are working at a job that involves some paperwork and record keeping. This consumes about an hour of your time each day. Recently, your supervisor has invited a computer specialist to visit the office to see if some of your work can be made easier using the computer. During her visit, she shows you a new software package she thinks can really help you. She makes the software look really easy when she uses it, but when you try to use the software on your own, you feel lost and somewhat frustrated. She says the software just takes a little time to get used to, and once you do, you'll save a lot of time in your work. Your supervisor realizes this is an important decision for you and has decided to let you choose whatever you feel most comfortable with— either buying the software or continuing to use the manual process you're familiar with. How likely is it that you'll decide to get the new software?

Very Unlikely										Very Likely
0	1	2	3	4	5	6	7	8	9	10

55.	As a part of your job, you sometimes have to call in orders for parts. One day while you're doing this, the operator asks you if you'd like to receive information on how you could make orders from your computer. She says the advantage of computerized ordering is that you can browse through the computerized catalog on your own instead of having to ask an operator over the phone, and you can also make orders 24 hours a day. You only call this company about twice a month, but because they're on the West Coast and three hours earlier, sometimes you have to wait several hours in the morning before anyone's there to answer the phone. Since you're the only one from your company who ever calls this company, it is entirely up to you whether you choose to order by phone or computer. How likely is it that you'll tell the operator to send you the information about making orders from your computer?	Very Unlikely 0 1 2 3 4 5 6 7 8 9 10 Very Likely
56.	There's been some reorganization where you work, and you've been given an option to either keep your current job or take on a new job, which will require you to learn new skills. Both jobs are equal in pay and benefits, and they sound equally interesting, but in the new job, you'd need to become proficient in a new computer language and write computer programs. Your company will give you the time you need to learn the new language. How likely is it that you'd take the new job?	Very Unlikely 0 1 2 3 4 5 6 7 8 9 10 Very Likely
57.	At your job, you have to make a brief presentation, and you're preparing slides to use on an overhead projector. You realize you could improve your presentation with the use of some simple illustrations, and your office just got a new graphics program that should be able to help you do these illustrations on the computer if you want to. You've never used this program before, but you have some time to figure it out before your presentation needs to be ready. However, you also realize you can make your illustrations by hand if you want to. How likely is it that you'll try to use the new graphics program to make your illustrations?	Very Unlikely 0 1 2 3 4 5 6 7 8 9 10 Very Likely

Computer Attitudes Questionnaire: Part 4 (Radford)

Please take about 10 minutes to fill out this questionnaire. Your responses are confidential. Please fill out ***EVERY*** item on the questionnaire. If you are unsure of a response, make your best guess.

To insure the confidentiality of your responses in this questionnaire, the following eight digit code is used. This code may be used to match your current responses with any future responses you may be asked to give, but it will not be used to match you to your responses. In the first four spaces, please put your mother's birthday (*month & day only, not year*). In the following four spaces, please put your father's birthday. If you are unsure of any information, please fill in those blanks with X's.

Example: If your mother's birthday is January 4, and your father's birthday is either October 24 or 25 (you can't remember), then your code would be: ***01 04 10 2X***

__ __	__ __	__ __	__ __
month	day	month	day
MOTHER		**FATHER**	

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Section 1: *Please circle the appropriate response along the continuum indicating how much you agree or disagree with each statement.*

		Strongly Disagree										Strongly Agree
1.	I am confident in my ability to use a computer.	0	1	2	3	4	5	6	7	8	9	10
2.	After this class, I will be able to use a word processor.	0	1	2	3	4	5	6	7	8	9	10
3.	After this class, I will be able to use a spreadsheet.	0	1	2	3	4	5	6	7	8	9	10
4.	After this class, I will be able to perform several operations in Windows.	0	1	2	3	4	5	6	7	8	9	10
5.	After this class, I will be able to use a database management system.	0	1	2	3	4	5	6	7	8	9	10
6.	After this class, I will be able to use a graphics program.	0	1	2	3	4	5	6	7	8	9	10
7.	After this class, I will be able to learn new kinds of software on my own.	0	1	2	3	4	5	6	7	8	9	10
8.	If given a new word processing package to learn on my own, I could learn it fairly easily.	0	1	2	3	4	5	6	7	8	9	10
9.	If I was using a software package and had to do something I'd never learned before, I could learn it from a manual.	0	1	2	3	4	5	6	7	8	9	10
10.	If I needed to, I could learn a new computer language on my own.	0	1	2	3	4	5	6	7	8	9	10
11.	I will be able to make an "A" in this class.	0	1	2	3	4	5	6	7	8	9	10
12.	I am hesitant to try something new on a computer.	0	1	2	3	4	5	6	7	8	9	10
13.	I am afraid I might mess something up if I try to do something new on a computer.	0	1	2	3	4	5	6	7	8	9	10
14.	Knowing how to use computers is important to my future success.	0	1	2	3	4	5	6	7	8	9	10
15.	If I know about computers I can get a higher status job.	0	1	2	3	4	5	6	7	8	9	10

	Strongly Disagree										Strongly Agree
16. I will not get as high a starting salary if I don't know how to use a computer.	0	1	2	3	4	5	6	7	8	9	10
17. Expertise in computers is of utmost importance if I want to get a good job.	0	1	2	3	4	5	6	7	8	9	10
18. If I don't learn how to use computers it will be difficult to succeed in any professional career.	0	1	2	3	4	5	6	7	8	9	10
19. I plan to own a personal computer within the next two years.	0	1	2	3	4	5	6	7	8	9	10
20. I plan to use a computer during this summer.	0	1	2	3	4	5	6	7	8	9	10
21. The only reason I will use a computer in the future is if I'm required to.	0	1	2	3	4	5	6	7	8	9	10
22. The only reason I will use a word processor in the future is if I'm required to.	0	1	2	3	4	5	6	7	8	9	10
23. The only reason I will use a spreadsheet in the future is if I'm required to.	0	1	2	3	4	5	6	7	8	9	10
24. The only reason I will use a database management system in the future is if I'm required to.	0	1	2	3	4	5	6	7	8	9	10

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Section 2: *Please circle the appropriate response along the continuum indicating your level of confidence in doing the following:*

	Very Low Confidence										Very High Confidence
25. Explaining why a program (software) will or will not run on a given computer.	0	1	2	3	4	5	6	7	8	9	10
26. Troubleshooting computer problems.	0	1	2	3	4	5	6	7	8	9	10
27. Writing simple programs for the computer.	0	1	2	3	4	5	6	7	8	9	10
28. Describing the function of computer hardware (keyboard, monitor, disk drives, CPU).	0	1	2	3	4	5	6	7	8	9	10
29. Understanding terms/words related to computer hardware .	0	1	2	3	4	5	6	7	8	9	10
30. Understanding terms/words related to computer software .	0	1	2	3	4	5	6	7	8	9	10
31. Learning to use a variety of programs (software).	0	1	2	3	4	5	6	7	8	9	10
32. Getting help for problems on the computer.	0	1	2	3	4	5	6	7	8	9	10
33. Learning advanced skills within a specific program (software).	0	1	2	3	4	5	6	7	8	9	10
34. Learning a new software package by jumping right in and trying it out.	0	1	2	3	4	5	6	7	8	9	10
35. Figuring out how to do things in a new software package by trial and error.	0	1	2	3	4	5	6	7	8	9	10
36. Solving problems you run into on the computer.	0	1	2	3	4	5	6	7	8	9	10

Section 3

For items 37 to 40, ***enter a number grade from 0 - 100****. If you are not sure of a grade, make your best guess.*

37. What grades did you get on your *two tests* in this class? *1st test:* _____ *2nd test:* _____

38. What grade did you get on your *two projects* in this class? *1st project:* _____ *2nd project:* _____

39. To the best of your knowledge, what is your *homework assignment grade* in this class (dropping your two lowest grades)? _____

40. To the best of your knowledge, what is your *current overall grade* in this class? _____

41. Have you been using the strategy during the last six school weeks (since the last time I handed out a questionnaire)? (Circle the letter of the response that applies the most. If you never received a strategy, circle "E".)
    A. I have used the strategy during the last six weeks.
    B. I have only used the strategy partially (i.e., for only a part of the last six weeks, or using only certain parts of the strategy).
    C. I have read about the strategy, but I have not used it during the last six weeks.
    D. I have received information about the strategy, but I have not read it.
    E. I have not received any information about the strategy.

42. If you circled "A" or "B" above, complete the following sentence with a number from 1 - 6:

    I used the strategy during ____ of the last six school weeks. (If you're not sure, make your best guess.)

If you circled "C" on item 41, please fill out the questions in the shaded region below (items 43 to 49).
If you did not circle "C" on item 41, skip to item 50 (below the shaded region).

43. Indicate whether each statement below *was* or *wasn't* a reason you did not use the strategy. (Check the appropriate column.)

was a reason	*wasn't a reason*	
___	___	The strategy appeared to take too much time.
___	___	I didn't have enough time to use the strategy.
___	___	I am satisfied with my current study habits.
___	___	I am satisfied with my current grade in this class.
___	___	I forgot.
___	___	I didn't think the strategy would have been beneficial.
___	___	I was already using the components of the strategy.
___	___	I didn't understand the strategy.
___	___	Using the strategy wasn't worth the effort.

44. Under what circumstances would you have used a strategy given to you? (Circle one.)
    A. None
    B. I would have used a strategy if: _____

	Strongly Disagree										Strongly Agree
45. I could have used the strategy if I wanted to.	0	1	2	3	4	5	6	7	8	9	10
46. Using the strategy would have improved my grade in the class.	0	1	2	3	4	5	6	7	8	9	10
47. Using the strategy would have helped me better learn the material covered in this course.	0	1	2	3	4	5	6	7	8	9	10

	Not at all Important										Very Important
48. How important to you is your grade in this class?	0	1	2	3	4	5	6	7	8	9	10
49. How important to you is learning the material covered in this class?	0	1	2	3	4	5	6	7	8	9	10

50. Do you plan on using the strategy for the remainder of the course? Yes No

51. Do you plan on using the strategy outside this course? Yes No

52. What grade do you expect to get in this class? A B C D F

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Section 4: *Please read each scenario and circle the number from 0 to 10 indicating your likelihood of taking a certain course of action .*

	Very Unlikely										Very Likely
53. You've promised a friend that while she's out, you'd address and send out 200 newsletters for her before the 5:00 p.m. pickup at the post office, and it's 2:00 p.m. now. The addresses are on a file on her computer, which you've just brought up on the word processor. She's left mailing labels for you to use next to the printer. You've never used a printer to print out labels before, but it looks like you can figure out how to do it. You also realize you may need to make some formatting changes to the file to make the addresses fit correctly on the mailing labels. You're not familiar with all the formatting commands on this word processor, but you think you may be able to figure out what you need to know. You know you can address all of the envelopes by hand and still get them out on time, but you also know that if you can print the labels out using the computer, you will save time. How likely is it that you'll use the computer to try to print the addresses on the mailing labels?	0	1	2	3	4	5	6	7	8	9	10
54. You are working at a job that involves some paperwork and record keeping. This consumes about an hour of your time each day. Recently, your supervisor has invited a computer specialist to visit the office to see if some of your work can be made easier using the computer. During her visit, she shows you a new software package she thinks can really help you. She makes the software look really easy when she uses it, but when you try to use the software on your own, you feel lost and somewhat frustrated. She says the software just takes a little time to get used to, and once you do, you'll save a lot of time in your work. Your supervisor realizes this is an important decision for you and has decided to let you choose whatever you feel most comfortable with— either buying the software or continuing to use the manual process you're familiar with. How likely is it that you'll decide to get the new software?	0	1	2	3	4	5	6	7	8	9	10

55.	As a part of your job, you sometimes have to call in orders for parts. One day while you're doing this, the operator asks you if you'd like to receive information on how you could make orders from your computer. She says the advantage of computerized ordering is that you can browse through the computerized catalog on your own instead of having to ask an operator over the phone, and you can also make orders 24 hours a day. You only call this company about twice a month, but because they're on the West Coast and three hours earlier, sometimes you have to wait several hours in the morning before anyone's there to answer the phone. Since you're the only one from your company who ever calls this company, it is entirely up to you whether you choose to order by phone or computer. How likely is it that you'll tell the operator to send you the information about making orders from your computer?	Very Unlikely 0 1 2 3 4 5 6 7 8 9 10 Very Likely
56.	There's been some reorganization where you work, and you've been given an option to either keep your current job or take on a new job, which will require you to learn new skills. Both jobs are equal in pay and benefits, and they sound equally interesting, but in the new job, you'd need to become proficient in a new computer language and write computer programs. Your company will give you the time you need to learn the new language. How likely is it that you'd take the new job?	Very Unlikely 0 1 2 3 4 5 6 7 8 9 10 Very Likely
57.	At your job, you have to make a brief presentation, and you're preparing slides to use on an overhead projector. You realize you could improve your presentation with the use of some simple illustrations, and your office just got a new graphics program that should be able to help you do these illustrations on the computer if you want to. You've never used this program before, but you have some time to figure it out before your presentation needs to be ready. However, you also realize you can make your illustrations by hand if you want to. How likely is it that you'll try to use the new graphics program to make your illustrations?	Very Unlikely 0 1 2 3 4 5 6 7 8 9 10 Very Likely

Appendix G: Scripts I Used in Administering Materials

Questionnaire 1: Procedure

For the initial questionnaire, I will hand out the consent forms to all the students in the class and tell them the following:

Hi. My name is John Merritt, and I'm doing research on people's attitudes about computers. I'd like for you to fill out a survey today, but first I need to have you read and sign the consent form I'm passing out to you now. Basically, this says that your participation in this study totally voluntary and that no one will know if you are participating in this study except you. Also, your responses on this questionnaire will be confidential, since you will be identifying yourself with a code that only you will know. So read this over, and when you're done, sign it and turn it face down on your desk, and I'll collect them when you're all done.

After I collect the forms, I will hand out the questionnaires to all the students in the class and tell them the following:

Please wait to begin until I've read the instructions along with you.

I'll then read the instructions out loud. When done, I'll say:

So, you may go ahead and begin, and when you're done, please turn the form over, face down, on your desk, and when everyone's done, I'll collect them.

Once they've finished, I will collect the forms, place them in an envelope, and then leave the class.

Treatment: Procedure

Last week most of you filled out questionnaires for me. Those have been analyzed, and based on your responses, I have some information for you this week that I believe you'll find both interesting and helpful.

Because the information you're getting is specific to you, based on your questionnaire responses, and because you are only identified by your code, I'll need to have you pick out your own packet with your code on it. But before you do that, let me explain what I want you to do.

Remind them 1) of code, 2) how I've ordered them, and 3) exceptions

Once you pick up the information packet that belongs to you, make sure you read the cover letter as soon as you get it, since this explains what the information is all about. You don't have to read the information packet right now, since I don't want to take up too much class time, but do read the cover letter. I'll give you a minute to read that over, and then I'll go get your instructor so you can begin class.

Like I said, I think you'll find this information both interesting and helpful. So come and get it!

Allow them to get their packets and read the cover letter.

Thanks again, and I'll see you next week!

Questionnaire 2: Procedure

Hi. I have a short, one page questionnaire for you today. I'll pass these out now, but please don't begin filling them out until I've read the instructions along with you.

Pass out questionnaire, then read instructions together.

And the next paragraph explains how to fill out your code, which most of you are already familiar with.

I do want to emphasize that it is very important that you answer these questions as honestly as possible and that no one will know your responses except you.

So go ahead and fill them out, and when you're finished, fold the questionnaire in half like this (show them), and I'll collect them when everyone's done.

Wait until they are finished.

OK. You'll notice on the bottom of the questionnaire, it says:

Read the bottom of the questionnaire.

For anyone who wasn't here last week when I gave out these information packets, you can come up here and get the one that has your code on it after you pass these in. So fold these in half, and pass them toward the center, and if you need to pick up an information packet, go ahead and do that now.

Collect the questionnaire.

Thank you, and I'll see you next week.

Questionnaire 3: Procedure

Hi. I have a short questionnaire for you today, similar to the one I gave you last week. You can go ahead and enter your code and begin filling them out as soon as you get them. When you're finished, fold the questionnaire in half like this (show them), and I'll collect them when everyone's done.

I do want to emphasize again that it's very important for you to answer these questions as honestly as possible and that no one will know your responses except you.

Pass out questionnaire and wait until they are finished.

OK. You'll notice on the bottom of the questionnaire, it says:

Read the bottom of the questionnaire.

So go ahead and fold these in half, and pass them toward the center.

Collect the questionnaire.

Thank you, and I'll see you later in the semester.

Questionnaire 4: Procedure

Hi. I have one last questionnaire for you today. It should take you about 10 minutes to fill out. You can go ahead and enter your code and fill this out as soon as you get it. I do want to remind you it's important for you to answer these items as honestly as possible and no one will know your responses except you. When you're finished, turn the questionnaire face down on your desk, and when everyone's done, I'll collect them.

Wait until everyone's done, then collect the questionnaire.

Thank you for helping me with my research this semester. I hope you've found your participation beneficial. Thanks again.

Appendix H: Pilot Tests of Materials

Identification Code

Questionnaire 1

Computer Performance Improvement Strategy (CPIS)

Computer Instrumentality Strategy (CIS)

Questionnaire 2 & 3

Questionnaire 4

Pilot Test of the Identification Code

To test the clarity of the instructions for the "Mother-Father" identification code I planned to use, I pilot tested this code on 26 officemates. On two people's responses, they put the year of birth where the day of birth was supposed to be. Thus, I added more emphasis in the directions that I wanted the day and not the year of birth. Otherwise, the instructions proved to be clear, and I made no other changes.

Pilot Test of Questionnaire 1

I administered Questionnaire 1 to three people to test it for clarity. Two of those people said the questionnaire was fine and had no suggestions for changing it. The third said that the 5 minutes I suggested that they take to fill it out was too optimistic. I decided to leave it in, not feeling this would hamper the subjects and at the same time encouraging them to work rapidly. He also said that many of the items seemed repetitive, which is fine because I purposefully included repetition in the questionnaire. His last comment was on the "mother/father" method of identification. He wondered if he was supposed to remember in the future if he put "X's" in any of the blanks or not. I told him no, and decided not to address this problem, since adding instructions about this would lengthen the instructions, perhaps making them too complicated.

All the above comments apply to the Questionnaire 1 for New River Community College (NRCC), since it was created first. Since some questions were specific to NRCC, I modified some items on the questionnaire to be used at Radford. These modifications were primarily based on the input from the two Radford instructors. The items that changed were 4, 6, 52, 53, 54, 56, 57, and 62. Since these changes were minor (e.g., changing "I will be able to use DOS" to "I will be able to use Windows"), I only tested this questionnaire on one person, who said I should reword item 53. This suggestion was reflected in the final questionnaire.

Questionnaire 1 was pilot tested on four people (although more than this reviewed it during its construction). However, the items on this questionnaire were largely adapted from a questionnaire I constructed for another study (which never took place). That questionnaire was pilot tested on ten people, and no suggestions were made to change any items on the questionnaire. Three of those ten people were specifically asked to look for unclear items, and the other seven received the questionnaire as a part of a pilot study.

Pilot Test of the Computer Performance Improvement Strategy

I distributed the Computer Performance Improvement Strategy (CPIS) to five people who agreed to use it for two days. After two days, I asked for both positive and negative feedback on the CPIS. I obtained feedback both in written form and through short interviews. A summary of the comments I received is as follows:

- Well written
- Looks like a good idea
- Helps me to think
- Well organized
- Very good, especially stressing the importance of following through on the reward/punishment
- I'm chomping at the bit to use this for other courses!
- Very short
- Why is it called "Computer"?
- How much time percentage should go to rewards/punishments as opposed to work time?
- I was already doing something like this.
- Are you going to collect these forms?
- May add that smaller goals are better.

Overall, from these responses, I concluded that the document was clear, since no one expressed difficulty understanding the document even when I specifically asked for constructively critical comments. However, I did make one change based on the last comment above, "May add that smaller goals are better." As a result of this, I added a third "basic rule" about short-term goals: "Short-term goals work best the more immediate they are."

Pilot Test of the Computer Instrumentality Strategy

I distributed the Computer Instrumentality Strategy (CIS) to five people to read and fill out. I asked them to provide written feedback on the CIS including positive comments, constructively critical comments, and an evaluation of the clarity of the strategy. Primarily I was interested in the subjects' evaluation of the clarity of the document. All five said the document was clear, although one person included, "the concept was kind of abstract or unclear... put the conclusion first?" When I talked to him about what he meant, I discovered that he was more confused about the underlying purpose of the document and how such a strategy could be beneficial, which I did not attempt to explain in the document. Thus, he agreed the document was clear, but the strategy apparently didn't have much face validity to him. The other comments are summarized below:

- This would be interesting if you didn't know about computers.
- This emphasizes the advantages of computers too much, rather than just seeing them as tools.
- This strategy can help people appreciate computers more and can develop the habit of constantly thinking more about how computers can help them.
- This seems designed for people who don't know much about computers.
- Don't know exactly why or how the CIS can benefit students.
- There was a sentence that wasn't easy to understand (marked on document).
- Interesting and innovative idea I have not seen before.
- Some rewriting of the syntax of some paragraphs may be helpful.

- I didn't really understand what the "strategy" was or how I would have used it.
- How would I know initially what it's for, or would that come later?

Generally, it seemed that these five people weren't too excited about the CIS. The few slightly positive remarks may have just been perfunctory, since there was a big box labeled, "Positive Comments" which I suppose they felt somewhat obligated to fill with something. Since my purpose was not to create an exciting strategy, I was not too worried about their comments, except for the fact that this strategy may not have much face validity to the students. However, I made no changes as a result of this pilot test. Although some of the above comments reflected that the document could have been written better, when I talked with the subjects about these comments, they retracted them (e.g., saying that the sentence in question made sense after all). It seemed that their main problem was just the main thrust of the document and its purpose.

Pilot Test of Questionnaire 2 & 3

Questionnaire 2 was initially distributed to five people who had just completed the CPIS. There was some question about what constituted a "partial" use of the strategy, so I drafted a revised version of this questionnaire with a clearer definition of what I meant by a partial use of the strategy. This revised questionnaire was then administered to seven people. No other changes were suggested. Because Questionnaire 3 was nearly identical to Questionnaire 2, no pilot test was run on this questionnaire.

Pilot Test of Questionnaire 4

The pilot testing of Questionnaire 4 is discussed in the "Methodology" section.

Appendix I: Defense Presentation Slides

The Effect of Increasing Computer Self-Efficacy on a Person's Intentions to Use a Computer

A Brief Self-Critique

Presented to

Dr. Harold A. Kurstedt, Jr., Chairman
Dr. Elizabeth H. Koball
Dr. Brian M. Kleiner
Dr. Robert D. Dryden

July 21, 1994

Presented by

John M. Merritt

The Effect of the Strategy

- **Summary:**
  No strategy effect was found.

- **Weakness:**
  The strategy was hardly used.
  - **I had limited experimental control.**
  - **More time and incentive would have helped.**

- **Strength:**
  I avoided a potential pitfall in my analyses.
  - **I included before and after questionnaire items.**
  - **I conducted a thorough data analysis.**

Differences between Strategy Users and Non-Users

- Summary:
  Strategy users have higher computer self-efficacy and lower procrastination scores than non-users.

- Weakness:
  The strategy implementation was not suited to low CSEs.

- Strength:
  I capitalized on the main weakness of this study by focusing my exploratory data analysis on potential root causes for non-use.

Subjects' Reasons for Not Using the Strategy

- Summary:
  Five potential reasons are:
  - Some didn't need a strategy.
  - There was not enough time or encouragement for training on the strategy.
  - There was no strong incentive or requirement to use the strategy.
  - Subjects didn't believe the strategy would help.
  - Subjects with low computer self-efficacy will tend to avoid using the strategy.
- Weakness:
  There was not enough time or incentive to learn the strategy.
- Strength:
  I adjusted my research so I could capture this data.

Predicting Intentions to Use a Computer

- Summary:
  The best predictors were 1) computer self-efficacy and 2) level of use of the strategy.
- Weakness:
  This was a relational study.
- Strength:
  I didn't have all my eggs in one basket.

Predicting Computer Self-Efficacy

- Summary:
  - Instrumentality and hesitancy to use a computer were the best predictors.
  - Computer experience, computer ownership, and academic major (computer related vs. not) did not independently predict computer self-efficacy.
- Weakness:
  This was a relational study.
- Strength:
  I did an extensive exploratory analysis.

Summary of Strengths and Weaknesses

- Strengths
  - Thorough data collection
  - Mid-course adjustment
  - Thorough analyses
- Weakness
  - Strategy implementation

What would I do differently?

- Answer #1: Nothing
- Answer #2: Alter the Strategy Implementation

Summary of Main Findings

- Beware of quick-fix self-help techniques.
- Computer self-efficacy is a strong predictor of intentions to use a computer.
- Much more research is needed to understand the best ways to increase computer self-efficacy.

VITA

John M. Merritt

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Address	604 Sleepy Hollow Road Richmond, VA 23229 (804) 740-7506
EDUCATION	***Virginia Tech***
	M.S., Industrial & Systems Engineering, Management Systems Engineering option, August 1994
	B.S., Industrial & Systems Engineering, May 1991
EXPERIENCE	***Management Systems Laboratories***, Virginia Tech, Blacksburg, Virginia, Graduate Research Assistant, August 1991 to May 1994 • Contributed research to a multi-million dollar grant for the Department of Energy (DOE) to study management tools • Assisted in the writing of a multi-million dollar proposal • Contributed to the developing of test plans for and the testing of software to be used by DOE
	Tennessee Eastman Company, Kingsport, Tennessee, Summer Technical Employee (industrial engineering), May 1989 to July 1989 • Developed plan to increase the overall efficiency of the delivery system for plant maintenance parts • Designed a new layout for truck docks used for in-plant delivery • Developed plan to improve the storage and retrieval of oil and paper products

EXPERIENCE

The Office of Residential Programs, Virginia Tech, Blacksburg, Virginia

Head Resident Advisor, August 1989 to May 1990

- Managed a residence hall of 850 residents
- Supervised a staff of 15 resident advisors

Resident Advisor, December 1987 to May 1989

- Managed a hall of 50 residents
- Served as a university resource to the residents
- Enforced policies

PUBLICATIONS

Merritt, J. M., Kurstedt, H. A., Koball, E. H., & Kleiner, B. M. (in press). The effect of increasing a person's computer self-efficacy on his or her intentions to use a computer. In R. T. Sumichrast (Ed.), *Proceedings of the Thirtieth Annual Meeting of The Institute of Management Sciences, Southeastern Chapter*, Blacksburg, VA: Virginia Tech.

Merritt, J. M., & Koball, E. H. (1993). Computer self-efficacy. In R. T. Barrett (Ed.), *Proceedings of the twenty-ninth Annual Meeting of The Institute of Management Sciences, Southeastern Chapter,* 142-144, Florence, SC: Francis Marion University.

Merritt, J. M., Kleiner, B. M., & Kurstedt, H. A. (1992). Data collection to support managers in continuously learning and improving. In P. B. Barr (Ed.), *Proceedings of the Twenty-eighth Annual Meeting of The Institute of Management Sciences, Southeastern Chapter,* 663-667, Conway, SC: USC Coastal Carolina College.

HONORS

Pratt Fellowship recipient, 3 years

Kodak Scholar: included 3 year industrial engineering scholarship

Material Handling Education Foundation 1 year scholarship

Marshall Hahn 1 year engineering scholarship

Virginia Tech Alumni 1 year scholarship