Chapter 1
INTRODUCTION

In recent years, academians as well as business professionals have placed considerable emphasis on the importance of information systems training in the workplace (Harp, Taylor, and Satzinger, 1998). In today's world of information technology, the successful implementation, acceptance, and, ultimately, usefulness of information systems are directly affected by employees' abilities to use systems to perform their duties. Consequently, these abilities are governed by the quality and appropriateness of the training they receive to perform their systems tasks (Harp, et al., 1998) . Given that an increasing number of professionals are custodians of information, requiring the technical skills to store, retrieve, and analyze data on numerous and varied systems and platforms, adequate computer training is more than a mere luxury; it is a necessity.

According to a recent survey, "60% of computer training decision makers now feel that training is more important for enhancing productivity than 'friendlier' software, more powerful hardware, networks, or even business process redesign. And this opinion is shared by financial, IS, and general managers" ("The Productivity Payoff", 1997). Further, with the increased implementation of client/server technologies in the workplace, training budgets are escalating ("Management- Calculating the Real Benefit of Training", 1995). In 1994, an estimated thirty billion dollars were spent on computer training in the workplace, representing an increase of about seven percent from the previous year (Phillips, 1994). Given this high cost of training, it is imperative that the best training techniques are utilized to achieve maximal gains in productivity.

1.1 COMPUTER TRAINING: A SOCIAL COGNITIVE CONTEXT

The need to develop appropriate computer training techniques has led to an explosion of research in information systems. Integrating the disciplines of psychology and information technology, researchers have begun examining computer training in the context of Social Cognitive Learning Theory (Bandura, 1977). For example, in a recent study by Compeau and Higgins (1995), (hereafter C&H), the effect of behavior modeling on computer training was examined in a model based on Social Cognitive constructs and relationships. C&H posited prior performance, computer self-efficacy, outcome expectations, and behavior modeling as determinants of performance on certain spreadsheet and word processing tasks. Although the C&H study represented one of the first attempts to develop a formal model to identify the relevant causal constructs in effective training methodologies, results obtained in their study revealed only partial support for the hypothesized model.

An experiment conducted by Gist, Schwoerer, and Rosen (1989), (hereafter GSR), served as a basis for the C&H study. It was the first known research to examine the effects of behavior modeling in the context of computer training and Social Cognitive Learning Theory. GSR compared behavior modeling to Computer-Aided Instruction (i.e. an on-line tutorial) and found that behavior modeling significantly outperformed Computer-Aided Instruction on all dimensions examined.

Theoretical justification for the C&H model was provided by Bandura (1977, 1978, 1986). As the founder of Social Cognitive Learning Theory, Bandura introduced constructs that have been examined in studies ranging from smoking cessation and psychological phobias to, most recently, computer training. He proposed causal relationships between various constructs that were purported to facilitate learning: self-efficacy, outcome expectations, prior performance, and vicarious experience.

1.1.1 Social Cognitive Definitions

Prevalent in Social Cognitive vocabulary are terms such as self-efficacy, outcome expectations, prior performance, and vicarious experience--all of which have been shown to exert some influence on a person's ability to learn (Bandura, 1978). In the context of this dissertation, these constructs are operationally defined to reflect their role in information systems training. Hence, as in the C&H study, self-efficacy is "computer self-efficacy"; outcome expectations are "computer outcome expectations"; and vicarious experience is "behavior modeling", a known and tested method of training that is based on the tenants of vicarious experience. The basic tenets of these constructs are presented below, with more in-depth discussions presented in Chapter 2.

1.1.1.1 Self-efficacy

In traditional Social Cognitive Theory, self-efficacy refers to a person's belief in his/her abilities to perform a given task or execute a certain behavior (Bandura, 1978). This "self-referent" process is believed to affect behavior directly through a process of bolstering or undermining one's own attempts at performance and indirectly through interactions with outcome expectations and prior performance.

In the context of Social Cognitive/computer training literature, self-efficacy is further refined to reflect a person's judgment about his/her ability to effectively use a computer to perform a task. In this respect, the entire spectrum of computer self-efficacy encompasses not only a person's belief in his ability to perform a single task, but reflects an individual's broader assessment of overall abilities to use a computer to perform any variety of computer tasks:

> [Computer self-efficacy] is not concerned with what one has done in the past, but rather with judgments of what could be done in the future. Moreover, it does not refer to simple component subskills, like formatting diskettes or entering formulas in a spreadsheet. Rather, it incorporates judgments of the ability to apply those skills to broader tasks... (Compeau

and Higgins, 1995b)

1.1.1.2 Outcome Expectations

Social Cognitive Learning Theory defines outcome expectations as the anticipated consequences of exhibiting some type of behavior. Further, Bandura (1977) portrays outcome expectations as a long-run variable affecting behavior: "Contrary to the common view that behavior is controlled by its immediate consequences, behavior is related to its outcomes at the level of aggregate consequences rather than momentary effects."

In the Social Cognitive/computer training realm, outcome expectations are related to a person's judgment about the likely long-term consequences of using a computer. Such consequences may include, but are not limited to, increased efficiency, enhanced productivity, and improved accuracy (Compeau and Higgins, 1995).

1.1.1.3 Prior Performance

Given the above definitions, it is not surprising that prior performance plays a vital role in the final performance of a given task. Prior performance, as it's name implies, represents a person's previous exposure or experience in executing a specific behavior. In traditional Social Cognitive Theory, prior performance is often cited as one of the most fundamental determinants of behavior as it involves learning from personal past mistakes and successes and also interacts with self-efficacy and outcome expectations to influence final behavior: "By observing the differential effects of their own actions, individuals discern which responses are appropriate in which settings and behave accordingly." (Bandura, 1977)

In Social Cognitive/computer training studies, prior performance refers to a person's previous experiences with a computer and is usually limited to that person's exposure to certain software packages (Compeau and Higgins, 1995; Gist, et al., 1989).

In fact, Harp, et al., (1998) assert that prior computer experience affects not only final performance, but also the type of computer training that should be provided.

1.1.1.4 Vicarious Experience

Vicarious experience functions in a similar manner as prior performance. Vicarious experience, however, involves watching the behavior of another individual and attributing his/her successes and failures to oneself:

> Because acquisition of response information is a major aspect of learning, much human behavior is developed through modeling. From observing others, one forms a conception of how new behavior patterns a performed, and on later occasions, the symbolic construction serves as a guide for action. (Bandura, 1977)

In the C&H study, vicarious experience is referred to as behavior modeling, a training technique in which a model demonstrates the actions to be performed in executing a task (Compeau and Higgins, 1995). Likewise, in this dissertation, behavior modeling represents the vicarious experience construct in the Social Cognitive model.

1.2 THE SOCIAL COGNITIVE MODEL FOR COMPUTER TRAINING

The C&H study examines the effectiveness of behavior modeling (as compared to lecture-based training) on the performance of computer tasks. In the context of Social Cognitive Theory, this training-performance relationship is examined in conjunction with other factors in their model: computer self-efficacy, outcome expectations, and prior performance. Figure 1.1 illustrates the model proposed in the C&H study.

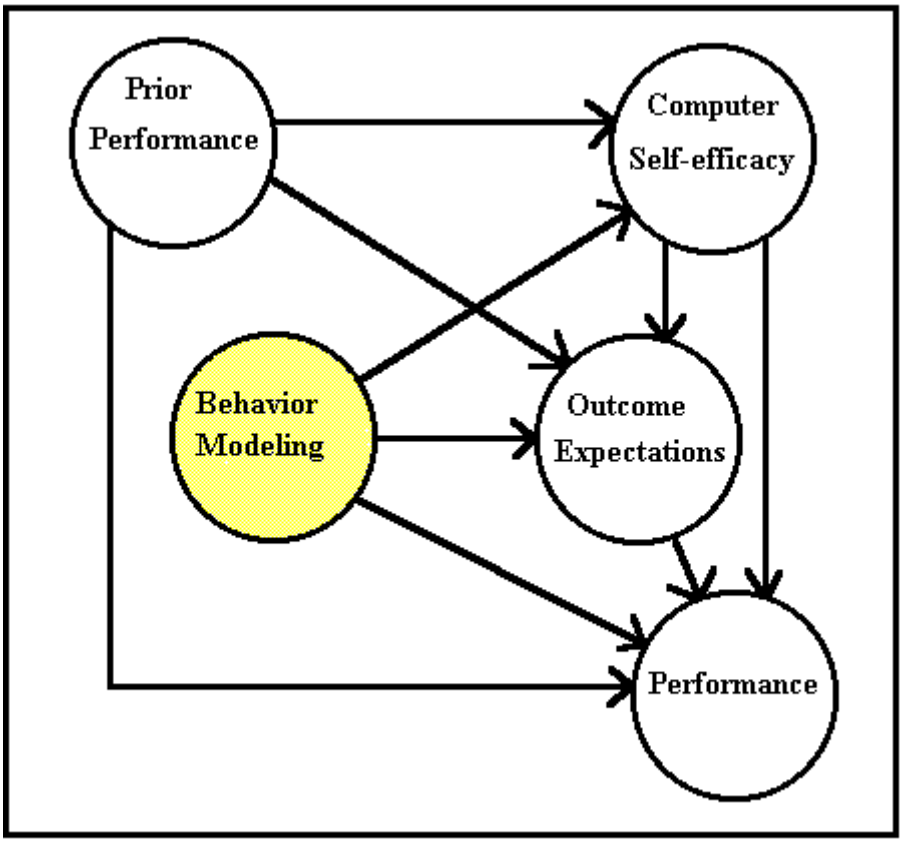

Figure 1.1: Social Cognitive Model for Computer Training

Compeau and Higgins (1995), Information Systems Research, Vol. 6 No. 2, 1995, p.120.

In the figure above, the lines connecting the variables denote hypothesized causal relationships between latent constructs. White circles depict measured exogenous or endogenous variables, and shaded circles symbolize manipulated exogenous variables

As shown in Figure 1.1, C&H expected prior performance and behavior modeling to directly affect final performance and to indirectly affect performance through the mediating constructs, computer self-efficacy and outcome expectations.

1.3 C&H MODEL RESULTS

It should be noted that the C&H model was not supported by the results of their experiment. In lieu of reporting their results in terms of overall model fit, C&H hypothesized the individual relationships between their model's constructs and evaluated their findings based on the significance and directionality of these hypothesized paths.

Further, with respect to the path coefficients, C&H found inconsistent results in the relationships between training methods and tasks used as their final performance measure. Additionally, the relationship between training methods and self-efficacy appeared to be influenced by the type of task to be executed.

1.4 STATEMENT OF THE PROBLEM AND OBJECTIVES

The primary purpose of this dissertation is to introduce a factor to the C&H model that may account for the discrepancies found in their earlier study. Additionally, this paper attempts to identify the best training method for information systems use by examining both modeling and non-modeling techniques in the context of the Social Cognitive model.

1.4.1 Introduction of a Moderating Variable: Task Complexity

This study posits various modifications to the Social Cognitive Model for computer training as developed by C&H by introducing a moderating variable into the model. This moderator, task complexity, is introduced to explain the differences in the training/performance and training/self-efficacy relationships. Figures 1.2, 1.3, 1.4 and 1.5 depict this addition to the C&H model, which is further examined in Chapter 3 and operationally defined in Chapter 5.

In support of this modification to the C&H model, Gist and Mitchell (1992) assert task complexity as a possible moderator of self-efficacy's impact on final performance. Although performance accuracy is certainly a primary concern in the usage and training of information technology, Davis (1989) argues that the moderating affect of complexity on self-efficacy is a key indicator of whether an information system will be initially adopted and subsequently used. He attests to the potential of information technology for enhancing performance on various tasks but cautions that the attainment of these benefits may be hindered by users' "unwillingness to accept and use available systems".

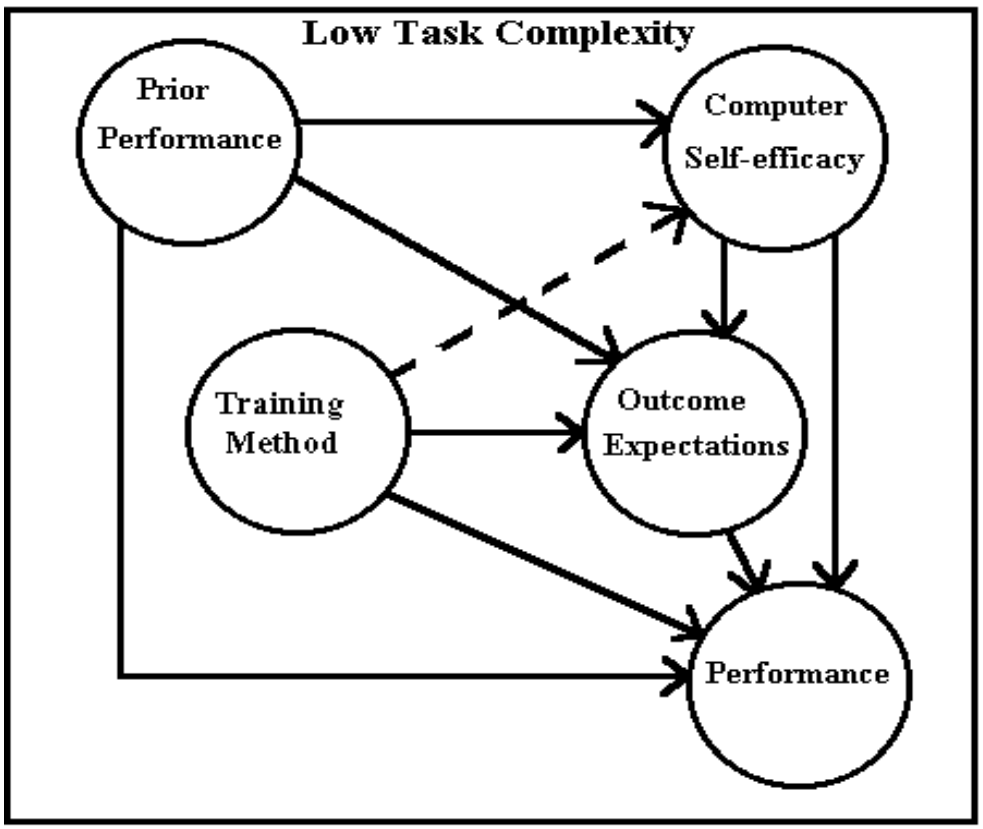

Figure 1.2 Behavior Modeling/Low Complexity Model

In the figure above, solids lines represent hypothesized significant causal relationships between constructs for Behavior Modeling sessions at the low level of task complexity. Broken lines represent non-significant relationships between constructs or path coefficients that are statistically less significant than corresponding relationships in the other models depicted with solid lines.

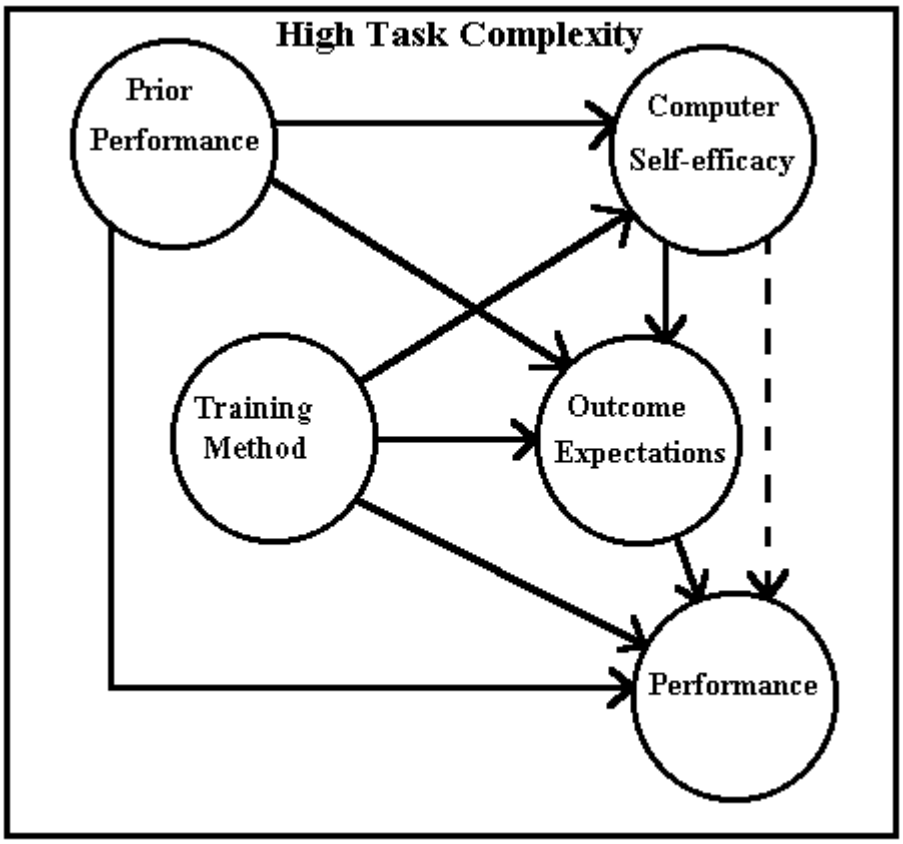

Figure 1.3 Behavior Modeling / High Complexity Model

In the figure above, solids lines represent hypothesized significant causal relationships between constructs for Behavior Modeling sessions at the high level of task complexity. Broken lines represent non-significant relationships between constructs or path coefficients that are statistically less significant than corresponding relationships in the other models depicted with solid lines.

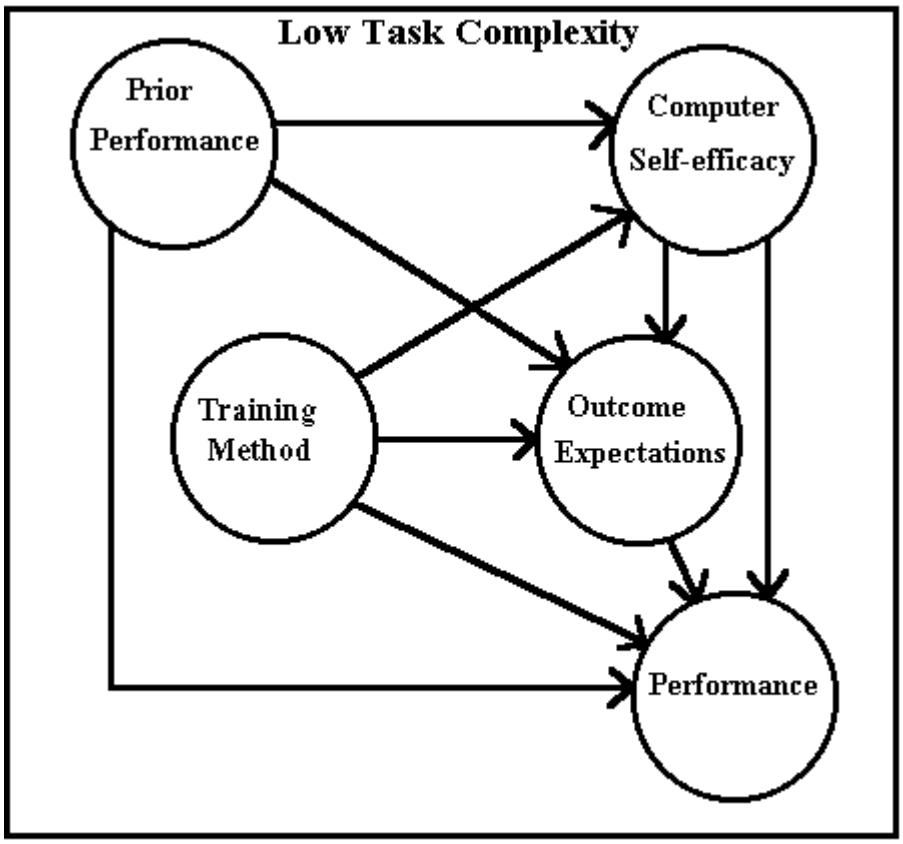

Figure 1.4 Lecture-based Training/ Low Complexity Model

In the figure above, solids lines represent hypothesized significant causal relationships between constructs for Lecture-based training sessions at the low level of task complexity. Broken lines represent non-significant relationships between constructs or path coefficients that are statistically less significant than corresponding relationships in the other models depicted with solid lines.

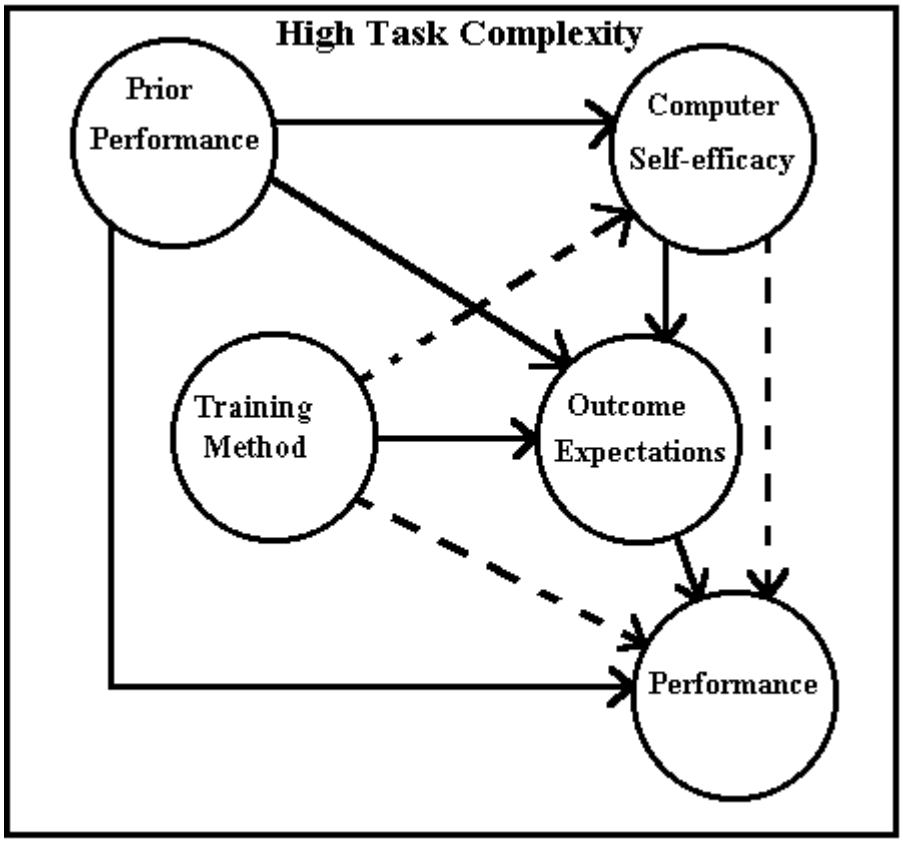

Figure 1.5 Lecture-based Training/ High Complexity Model

In the figure above, solids lines represent hypothesized significant causal relationships between constructs for Lecture-based training sessions at the high level of task complexity. Broken lines represent non-significant relationships between constructs or path coefficients that are statistically less significant than corresponding relationships in the other models depicted with solid lines.

Support for introducing a moderator into the Social Cognitive paradigm lies in the malleability of the self-efficacy construct. Numerous studies have shown self-efficacy to be affected by other Social Cognitive factors such as vicarious experience (modeling) and prior performance (Gist and Mitchell, 1992). It follows, then, if task complexity moderates the effectiveness of these constructs on self-efficacy, and self-efficacy, in turn, affects final performance and subsequent usage of information technology, training methods may require customization to include task dimensions, consequently, enhancing performance and ensuring continued acceptance of information systems.

1.4.2 Evaluation of Non-Modeling Techniques

As stated previously, the C&H model was based on the GSR study, which compared behavior modeling to a non-modeling technique, Computer-Aided Instruction (CAI). Both studies predicted that behavior modeling would outperform the non-modeling techniques examined, CAI and lecture-based instruction. Neither, however, addressed the relative effectiveness of the non-modeling techniques.

Only one other known study, Simon and Werner (1996), has examined the relative effectiveness of modeling and non-modeling techniques on computer training. In their study, Simon and Werner examined three approaches to computer training: behavior modeling, self-paced study, and traditional lecture-based instruction. Like C&H and GSR, they found that behavior modeling resulted in greater performance and satisfaction than the two non-modeling techniques. Additionally, they found the self-paced approach to be the second-most effective technique with lecture-based instruction being the least effective method. This study represents one of the first attempts to rank behavior modeling and various non-modeling techniques in terms of outputs (performance and satisfaction). It does not, however, address the effectiveness of CAI as a self-paced method, nor does it address the relative effectiveness of non-modeling techniques on the processes/constructs that facilitate learning in a Social Cognitive context (i.e. their relationships with self-efficacy, outcome expectations, and prior performance).

Because CAI is a relatively less expensive and increasingly popular method of training employees on new software packages, it is important to determine its effectiveness in relation to other training methods (Harp, et al., 1998). Like the C&H, GSR, and Simon and Werner studies, behavior modeling is still expected to outperform the non-modeling techniques (i.e. CAI and lecture-based training). However, an examination of these non-modeling techniques and their relationships in the Social Cognitive model may provide a more comprehensive hierarchy of effectiveness for

information systems training. Thus, another purpose of this study is to examine Computer-Aided Instruction in addition to behavior modeling and lecture-based training in the context of the Social Cognitive model.

1.4.3 Research Questions

Given the seemingly broad scope of this dissertation, its purpose can be stated succinctly in the following two research questions:

- Does the introduction of task complexity into the Social Cognitive model for computer training moderate the relationships between training types, self-efficacy, and final performance?

- How effective is Computer-Aided Instruction in relation to behavior modeling and lecture-based training in the context of the Social Cognitive model?

1.5 RESEARCH METHODS AND PROCEDURES

An experimental approach was taken to examine the above research questions and to maintain the control necessary to infer causality from the exogenous constructs in the model.

Data for this study were gathered through an experiment consisting of 353 students at Virginia Tech, which resulted in 291 usable observations. Chapter 5 defines the rules used to eliminate observations and describes the sample characteristics.

The experiment involved training subjects on the use of an Excel 5.0 feature, Solver, that is used for solving linear programming problems. A between-subjects design was employed with groups of subjects receiving one of three types of training: behavior modeling, lecture-based training, or computer-aided instruction. Task complexity was

manipulated at two levels (low and high) by varying the number of constraints in a linear programming problem given to subjects to assess final performance.

The experiment consisted of three questionnaires to determine computer self-efficacy, outcome expectations, and general demographic information. The computer self-efficacy and outcome expectations instruments were developed and used by C&H in their study. Further, like the GSR study, the experiment required subjects to complete a set of ten tasks on the computer to determine their level of prior performance. All questionnaires and tasks were administered on a computer with responses and keystrokes automatically recorded by an Excel Visual Basic macro.

1.6 ORGANIZATION OF THE STUDY

The six remaining chapters in this dissertation provide background information to support modifications to the Social Cognitive model for computer training and describe the methodology and resulting analysis of the experiment that was conducted. Chapter 2 provides a review of relevant literature, beginning with the foundations of Social Cognitive research in psychology and ending with its application in information systems research. The C&H model, experiment, and findings also are presented in Chapter 2. Chapter 3 describes the proposed modifications to the C&H model with justification for selecting task complexity as the moderating variable. Chapter 4 provides a development of hypotheses. Chapter 5 discusses the research design, including the sample selection, procedure, and operational definitions of the exogenous and endogenous variables in the model. The method and results of analysis are presented in Chapter 6, followed by a discussion of their implications, limitations, and suggestions for future research in Chapter 7.