AN EMPIRICAL INVESTIGATION OF THE EFFECTIVENESS OF USING
ASSIGNED, EASY GOALS TO STRENGTHEN SELF-EFFICACY
PERCEPTIONS AND PERSONAL GOALS IN COMPLEX
TASK PERFORMANCE

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirement
For the Degree of

DOCTOR OF PHILOSOPHY

By

Megan L. Endres, B.A., M.B.A.
Denton, Texas
December 1998

The perception of self-efficacy is a central cognitive construct in explaining motivation. Assigned goals are established in the literature as affecting self-efficacy, but only a few researchers investigated their effects in complex tasks. One stream of research revealed the positive effects of easy goals on performance in a complex task without regard to self-efficacy perceptions. In the present study, the focus was on the effects of assigned, easy goals on self-efficacy and personal goals in complex task performance. It was expected that easy goals would be superior to moderate or impossible goals because the complexity and uncertainty of the task distorts subjects’ perceptions of goal difficulty.

The Brunswik (1955) Lens Model was used as the framework for studying self-efficacy perceptions because it allows researchers to model the subjective and objective decision making environments. Although this model was rarely used in self-efficacy research, it provides a statistical means for varying uncertainty and for determining the accuracy of self-efficacy judgments. The research model was constructed of a system of influences around self-efficacy, including feedback, past performance, personal goals, performance, effort, and feedback.

One valuable result of this study is that assigned, easy goals led subjects to challenge themselves more than moderate or impossible goals. In addition, task complexity and uncertainty distorted subjects’ perceptions about their performance level and goal
difficulty. Past researchers found that men report stronger self-efficacy perceptions in mathematical/financial tasks than women report. Men reported that they enjoyed the present task more than women, and set more challenging personal goals than women set. Finally, the effects of subjects’ self-efficacy perceptions on effort and persistence appeared to be distorted due to task complexity. It can be concluded that the overall goals of this study, to add to existing literature and to guide future research, were reached.
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ACKNOWLEDGMENTS

This document was not the result of a single, individual effort, but the culmination of years of study and influence by others. Special acknowledgments are mentioned here.

First, I am grateful for the support and valuable input of my committee members, Drs. Vicki Goodwin, Nancy Boyd, and Robert Pavur. I am especially grateful for the continual encouragement and instruction of my chair and mentor, Dr. Lewis A. Taylor, III. Additionally, I could not mention the completion of my Ph.D. without expressing great appreciation to my cohort and friend, Sanjib Chowdhury.

When I did not believe in myself and in my abilities, two people not only believed in me, but told me that I could be the best in whatever I attempted. I would not be where I am today without my parents and role models, Drs. Vernon A. and Carol H. Lee. I also must acknowledge the importance of the encouragement and advice of my brothers, Vernon, Jr. and Kenneth Lee.

Finally, no accomplishment in my life is meaningful without my best friend, greatest supporter, and husband, Steve, and my inspiration, Ethan Christopher.
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CHAPTER 1

THEORETICAL FOUNDATION

Motivation Theory and the Importance of Social Cognitive Theory

The primary theoretical orientation in motivation research changed over the last sixty years (Kanfer, 1990). In the 1930s and 1940s, researchers were primarily interested in drive-based learning that focuses on inborn motivation and reactions to rewards, but this interest shifted to the development of cognitive-based theories in the 1950s and 1960s. This time period was termed the cognitive revolution, and researchers supporting this perspective encouraged development of theories that focused on the role of cognitions, or human thought, in behavior. In response to concerns about measurement and construct issues related to the study of unobservable behavior, many researchers countered arguments of the cognitive explanation of human motivation with behavioral explanations (Corrigan, 1995). For example, Skinner (1953) originally focused on the study of observed behavior in response to the preponderance of nonempirical work that had emerged concerning cognitions (e.g., Freud's work on the subconscious).

During the cognitive revolution, many researchers developed cognition-based theories, or theories that primarily focused on thought processes as central to human behavior. The ensuing debate between researchers who promoted the key role of cognitions in explaining behavior (cognitivists) and those who focused on the central...
importance of observable behavior (behaviorists) remained active. Bandura's (1986) Social Cognitive Theory (SCT) and its key construct, self-efficacy perceptions, are central subjects in debates about the role of cognitions in human behavior (Hawkins, 1995). Self-efficacy perceptions are defined as judgments of the capability to perform a specific task (Bandura, 1986). These judgments vary in terms of strength of confidence in performance capability, and this is influenced by personal and environmental factors. In SCT, Bandura (1986) proposed that behavior, personal traits/cognitions, and the environment reciprocally influence each other. The environment is an important factor in SCT's explanation of behavior, and the main difference between the social cognitive approach to studying motivation and behavioral approaches is the study of cognitions as independent causes of behavior (Dougher, 1995). In the social cognitive view, cognitions such as self-efficacy perceptions are not simply reflections of external influences, but originate in the person to cause behavior (Bandura, 1997). Bandura stated that this focus on cognitive mechanisms enhances the understanding of motivation and behavior. Two main goals of SCT are predictive efficacy, to explain and predict behavior, and change efficacy, to cause change in individuals (Bandura, 1986).

Researchers who focus on the role of cognitions in motivation propose that, although cognitions are not directly observable, they are necessary to fully describe human psychology (Corrigan, 1995). The study of cognitions helps researchers understand how and why external factors influence action, and this increases knowledge about why these factors may or may not be effective. External factors influence cognitions, but people also influence their own behavior, thought, and emotions with their cognitions (Bandura,
1984). This is referred to as the generative capacity of cognitions (Bandura, 1997).

Humans have the ability to organize and integrate their cognitive, social, emotional, and behavioral subskills. Using different types of self-referent thought, they are able to translate this knowledge into action. People vary in their ability to regulate behavior through cognitions, but self-regulation skills can be improved and self-efficacy perceptions can be strengthened through vicarious, enactive, persuasory, and emotional influences.

Bandura (1982) stated that the generative capacity of cognitions is evidenced by the fact that an equal external influence does not result in the same level of self-efficacy perceptions across individuals. Behavioral researchers counter this argument and state that different personal histories of experiences explain why an immediately prior external influence does not result in the same behavior across individuals (Dougher, 1995). Due to the difficulties of measuring a person’s history of experience, and due to the requirement that cognitions are measured indirectly, these arguments persist. The arguments center on researchers’ perspectives of how human motivation should be studied. The view in the current study is that cognitions have generative capabilities and may account for variance in human motivation and behavior. Thus, they should be investigated.

In order to establish the theoretical background for the present study, it is helpful to discuss Bandura’s (1986) Social Cognitive Theory (SCT) and the central construct, self-efficacy perceptions, relative to other perspectives on motivation. Motivation theories can be classified into three categories – need-motive-value theories, cognitive choice theories, and self-regulation theories (Kanfer, 1990). Using need-motive-value theories,
researchers seek to explain motivation based on internal drives, needs, or instincts. An example of these theories is Alderfer's (1972) existence-relatedness-growth theory, which explains human motivation as resulting from three classes of needs, existence needs, relatedness needs, and growth needs. Researchers explain motivation in cognitive choice theories through the calculated maximization of outcomes. Examples of these theories are Vroom's (1964) and Campbell, Dunnett, Lawler, and Weick's (1970) expectancy theories. In these theories, motivation is explained by the interaction of expectancies about the probability of outcomes, correlations between first and second level outcomes, and value of the outcomes. SCT is often referred to as a type of expectancy theory, but SCT does not explain behavior as the result of the desire to maximize outcomes. In SCT, self-efficacy perceptions are people's judgments of their capabilities, and outcomes influence behavior after self-efficacy perceptions are considered. SCT is more accurately categorized as a self-regulation theory, due to its focus on how people motivate themselves through their own cognitions (Gist & Mitchell, 1992).

In summary, SCT is a self-regulation theory that seeks to explain human motivation based on the generative capabilities of cognitions and their interactive relationships with external influences and behavior. The goals of SCT are explanation, prediction, and positive change in individuals. In the present study, self-efficacy perceptions are discussed as key mechanisms in human motivation. The measurement of cognitions is inherently indirect and, therefore, imperfect. An alternative view is that they are helpful in order to understand how people motivate themselves as well as how external influences affect outcomes.
Managerial decision making is often characterized by more incomplete information, complexity, novelty, iterativeness, and judgment than other decision making situations (Taylor, 1984). Despite this conclusion, little attention focused on complex decision making situations relative to research on simpler decision situations (Schweiger, Anderson, & Locke, 1985). More research is needed that examines the role of complexity in managerial decision making to understand how factors such as assigned goals differently affect outcomes as compared to these processes in simple tasks (Wood, Mento, & Locke, 1987). Therefore, the research question in this study asks, what is relationship between goals, feedback, self-efficacy perceptions, effort, persistence, and performance over repeated trials?

Self-efficacy perceptions provide explanations for human motivation across diverse types of behaviors and situations (Bandura, 1997), but much remains to be learned about the construct (Gist & Mitchell, 1992). As in decision-making research, most motivation research is conducted using simple tasks (Wood & Bandura, 1989b). Therefore, conclusions from this research may not apply to the operation of self-efficacy perceptions in complex environments because the relationships between cognitive mechanisms and outcomes are altered. Therefore, more knowledge is needed about how self-efficacy perceptions operate in complex environments (Stone, 1994).

The relationships between other cognitive mechanisms, such as personal goals, analytic strategies, and self-evaluations, also are affected and may behave differently in complex environments. For example, negative self-evaluations appear to negatively affect
performance in complex environments, but positively affect performance in simple task environments (Cervone & Wood, 1995). This type of disparity in outcomes based on environmental complexity illustrates the need for more research in this area because conclusions about self-evaluations in simple task performance cannot be extended to performance in complex tasks.

Complex task research on self-efficacy perceptions is also needed as it relates to external influences such as assigned goals, feedback, and their interactive effects. The importance of external influences to self-efficacy perceptions and other cognitive mechanisms is well-established in clinical research and simple task research (Bandura, 1997), but these effects are not well understood in complex task environments. According to SCT, personal/cognitive factors, behavior, and environmental factors reciprocally affect each other (Cervone & Wood, 1995). Therefore, goals and feedback are necessary environmental influences for effective functioning of cognitive mechanisms.

A final issue is that different types of tasks and settings are needed in complex task self-efficacy research (Cervone & Wood, 1995; Stone, 1994). Exclusive focus on one complex task and decision-making environment limits the ability to draw broader conclusions that can be extrapolated to more types of situations, thereby enhancing external validity.

To summarize, little attention was given to managerial concerns in decision making because these environments are characterized by complex factors that are not used in simple task research. Self-efficacy perceptions are important in understanding managerial behavior, and, therefore, complex task self-efficacy research is valuable. Goals and
feedback are integral to explanations of self-efficacy perceptions, and their effects in complex environments are not well understood, either. These research limitations call for complex task self-efficacy research involving the effects of assigned goals and feedback to further the understanding of managerial decision making.

In this chapter, the theoretical foundation for a study of this type is discussed. Self-efficacy theory, goal theory, feedback theory, and issues related to the study of complex tasks are presented. Last, a statement of the purpose of the study is presented.

Self-Efficacy Theory

The Role of Self-Efficacy Perceptions in Social Cognitive Theory

Self-efficacy perceptions (also referred to as self-efficacy) are defined as judgments of capabilities to organize and execute action necessary to perform specific tasks (Bandura, 1986). Self-efficacy perceptions are formed through a judgment process that people engage in when deciding whether they can execute an action based on the influence of situational and personal factors. When people develop self-efficacy perceptions about performance in a specific area, these perceptions are incorporated into their belief systems.

Self-efficacy perceptions are central to human motivation, but operate as one of a group of cognitive subskills that operate together to govern human motivation and thought. These subskills are referred to as forms of self-referent thought. Other important forms of self-referent thought that self-efficacy perceptions influence are analytic strategies, personal goals, and self-evaluative reactions (Jourden, 1992). These cognitive
mechanisms are governed by higher-level, self-regulatory skills. Self-regulation is a comprehensive, cognitive process that influences behavior (Gist & Mitchell, 1992). Self-regulatory skills are more generalized than the subskills, and allow people to influence their performance across different activities (Bandura, 1997). Self-efficacy perceptions can be described by three aspects (Bandura, 1982; Gist & Mitchell, 1992).

First, perceived self-efficacy is a comprehensive judgment of the capability of performing a specific task, including the organization and integration of cognitive, social, and behavioral skills for task execution.

Second, self-efficacy perceptions are dynamic, changing when new information becomes available, with self-efficacy influencing thought and emotional reactions to tasks in anticipation of behavior and during actual task execution.

Third, perceived self-efficacy has a generative capacity, causing effort to be mobilized to fit performance in different situations. It is not an inert estimate of future action and is not sufficient for a person to act. Given appropriate and adequate skills, though, efficacy expectations are a major determinant of activity choice, effort, and persistence (Bandura, 1977).

Self-efficacy perceptions are judgments of the capability to use skills, not simply a reflection of skill level. The perception of individuals is key, versus the objective reality of the task, ability, and environmental forces. Self-efficacy perceptions are pertinent to a specific task area, and this specificity allows greater predictive power of actions. Using self-efficacy perceptions, one can predict performance, effort, persistence, lower stress
and anxiety, choice of activities, commitment, quality of decision-making strategy, choice of goal level, affective reactions, intrinsic interest, and coping skills (Bandura, 1997).

Self-efficacy perceptions can be measured on three main dimensions: magnitude, generality, and strength (Bandura, 1977). Self-efficacy magnitude refers to the degree of difficulty people believe they can perform at when given a specific task. Generality is the degree that self-efficacy perceptions can be extended to other tasks. When self-efficacy perceptions become more generalized, they improve capabilities for self-regulation. Strength is the level of confidence in performance expectations. Using strength measures of self-efficacy, people are asked what degree of confidence they have in their ability to perform a specific task, on a scale of one to 100. Higher perceived degrees of confidence are termed strong self-efficacy perceptions, and lower perceived degrees of confidence are termed weak self-efficacy perceptions. People with weak self-efficacy perceptions, or low confidence in performance expectations, may be more adversely affected by failure or performance difficulty as compared to those with stronger self-efficacy perceptions. People with strong self-efficacy perceptions, or high confidence in performance expectations, display more perseverance, effort, and better performance than those with weaker perceptions.

Social Cognitive Theory Model of Human Behavior

SCT was originally termed Social Learning Theory (as was the title of Bandura’s 1977 book), but Bandura (1986) changed the name because his new additions to the theory encompassed motivation and self-regulation in addition to learning. In SCT, self-efficacy
perceptions, personal goals, analytic strategies, and affective self-evaluations are central cognitive mediators (i.e., intervening variables) between environmental events and behavior (Jourden, 1992).

Distal motivation theories center on the external influences on motivation, while proximal motivation theories are concerned with the internal factors in the motivation process (Kanfer, 1990). Bandura's (1986) SCT offers a combined approach of distal and proximal aspects through its interactive focus on environmental, personal/cognitive, and behavioral factors that regulate human functioning. Using SCT, the relationships between self-generated and external events are viewed as being dynamic, with each having more or less influence depending on the situation (Figure 1). Bandura (1984) stated that, contrary to some criticisms of cognitive approaches to motivation, the environment plays an important role in SCT.

Figure 1. The triadic model of human behavior in Social Cognitive Theory (Bandura, 1986).

In SCT, Bandura proposed a model of triadic determinism in which the three interacting, reciprocal influences in Figure 1 are all needed to explain human functioning. Central to the SCT model of human behavior are two related principles, interactive
personal agency and reciprocal determinism (Bandura, 1986). First, personal agency is part of the cognitive and personal factors in Figure 1, and is a mediator between external stimuli and action. According to a model of interactive agency like the one in Figure 1, personal agency is high. A person affects and is affected by elements in the model. Second, determinism refers to those factors believed to cause behavior, which are external factors and cognitive/personal factors in Figure 1. The reciprocal influence occurs because behavior is affected by and affects these factors.

Cognitive mechanisms of SCT. According to SCT, external events are cognitively processed and synthesized before action takes place (Bandura, 1986). Knowledge and skills are necessary, but not sufficient, for performance because the effect of knowledge on behavior is mediated by self-referent thought that is exhibited in self-efficacy perceptions, personal goal setting, affective self-evaluations, and analytic strategies (Bandura, 1982). An important assumption of SCT is that people possess certain cognitive capabilities that allow them to be active processors of information (Bandura, 1986). These capabilities include the capability to symbolize, the capability for forethought, vicarious capability, and self-reflective capability.

First, people use their capability to symbolize by using symbols to translate external events into models that serve as behavioral guides (Decker, 1980). This capability helps them to predict future occurrences by testing outcomes of behavior symbolically before actually acting. Symbolization also helps to interpret others' behavior by translating viewed behaviors into meaningful codes that guide actions. Second, people have the capability for forethought, and can predict future outcomes based on past experience
People plan their behaviors through goal setting and anticipation of expected outcomes. Those with strong self-efficacy perceptions have more positive expectations of outcomes, and this encourages their action. Third, people have the capability to learn vicariously by observing models, versus learning by actually acting out the behavior (Bandura, 1986). According to SCT, the cognitive influence occurs when people apply codes to observed behaviors, and then use these codes when performing future behaviors. Finally, people have self-reflective capabilities that allow them to analyze their own cognitive processes and experiences. Self-efficacy perceptions are developed through a reflective self-appraisal process in which actions are compared to expected or desired outcomes.

Belief systems. People rely on their belief systems to process information and anticipate consequences. This processing can cause the distortion of information biased toward the person's beliefs. In this way, a person's belief system affects perceptions of ability and perceived self-efficacy (Bandura, 1991). For example, whether a person believes ability is an acquirable skill or a stable trait affects what tasks a person attempts (Wood & Bandura, 1989a). People who view ability as an acquirable skill take on more challenging tasks, and those who view ability as an inherent capacity take on tasks that require low effort and minimize any threat of errors. A person's belief in the controllability of the environment also affects self-perceptions of efficacy (Bandura, 1991). When the environment is perceived as uncontrollable, a person will not try to make changes or will act timidly, which may cause failure. If people believe their environments are controllable, their self-efficacy perceptions will be stronger (Bandura,
13

1986). This will encourage them to act out in a more confident manner, and more confident action increases the likelihood of successful performance. A person’s self-efficacy also affects the belief system. People with strong self-efficacy perceptions tend to believe that insufficient effort caused their failure, as compared to people with weak self-efficacy perceptions, who tend to believe insufficient ability caused their failure.

**Summary:** The role of self-efficacy perceptions in Social Cognitive Theory. Self-efficacy perceptions, beliefs in the ability to perform a specific task, serve as a central cognitive mediator in SCT and subskill of cognitive self-regulation. Personal goals, analytic strategies, and affective self-evaluations also are cognitive mediators that contribute to self-regulation. SCT explains human behavior through the interaction of both distal and proximal elements of motivation—the environment, personal/cognitive traits, and behavior. The mechanisms governing these interactions are founded on the principles of interactive personal agency and reciprocal determinism. People possess certain cognitive capabilities that help them to process information from the environment, and these cognitive capabilities are central to the explanation of motivation. Belief systems influence self-referent thought and behavior due to the bias or distortion of information, and also are influenced by self-referent thought.

**The Formation and Effects of Self-Efficacy: Theoretical Model**

In order to study self-efficacy perceptions, a researcher must understand the causes and effects of the construct. Gist and Mitchell (1992) provided a model of self-efficacy formation that was developed primarily from Bandura’s (1977; 1982; 1986)
specifications and research (see Figure 2). This model is the theoretical model for the present study. Gist and Mitchell stated that prior to their model, the process of self-efficacy formation was unclear. They added to previous self-efficacy literature by more clearly specifying the mediating processes through which external influences affect the formation of self-efficacy perceptions.

In Gist and Mitchell's model, the four major factors that affect self-efficacy perceptions include: enactive mastery, vicarious experience, verbal persuasion, and physiological arousal. These influencing factors do not directly affect self-efficacy perceptions, but do so through cognitive appraisal by the individual. Specifically, a person will analyze task requirements, past experience, and personal/situational resources and constraints before forming self-efficacy judgments (Gist & Mitchell, 1992). Self-efficacy perceptions affect the formation of personal goals, analytic strategies used, affective self-evaluations, persistence, and task choice. These factors then influence performance. Performance feedback affects future self-efficacy perceptions through its persuasive influence on the mediating cognitive processes. Figure 2 illustrates the dynamic nature of self-efficacy perceptions as they continually change based on past performance, changing task characteristics, and situational/personal influences.

Influences on the formation of self-efficacy perceptions. Bandura (1982; 1986) specified four factors that affect self-efficacy perceptions: enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological arousal. Bandura (1982) combined data from a series of experiments on snake phobics (e.g., Bandura & Adams, 1977) and found that all four methods strengthened self-efficacy perceptions. By using
these four factors, people communicate important information to an individual such as task complexity, task attributes, or characteristics of the task environment (Gist & Mitchell, 1992).

**Figure 2.** Theoretical model of the antecedents and effects of self-efficacy perceptions (Gist & Mitchell, 1992).

First, personal mastery experiences are the most influential way to strengthen self-efficacy perceptions because they are based on personal enactment of behavior (Bandura, 1982). Mastery experiences also predict stronger self-efficacy at a higher degree of accuracy than do the other three methods (Bandura & Adams, 1977). Personal enactment and vicarious experiences both provide a person with information about their ability and the quality of their performance strategies (Gist & Mitchell, 1992).

Second, vicarious influence occurs when models communicate information about the task and its difficulties (Bandura, 1986). An observer does not simply mimic a model, but
extracts information from the model in the form of rules. Models can effectively be used to demonstrate novel behaviors, inhibit or uninhibit observers' behaviors, encourage desired behaviors, focus attention on an action or object, or stimulate emotions. Modeling can be more valuable than enactive mastery in some conditions because the observer can focus attention on learning rules rather than worrying about performing. The goal of modeling is to convey maximum information to the observer. Modeling strengthens self-efficacy perceptions by providing observers with information about predictability and controllability of the task, thereby reducing stress and enhancing coping skills (Bandura, Reese, & Adams, 1982).

Third, verbal persuasion strengthens self-efficacy perceptions (Bandura, 1982). Verbal persuasion is less effective in strengthening self-efficacy than enactive mastery and modeling. It will not cause lasting effects in self-efficacy if it is used alone, but it can augment enactive mastery or modeling techniques if the content of the persuasion is realistic. Exaggerated feedback can mislead a person and cause inevitable failure. From these failure experiences, the persuader's credibility is damaged. Therefore, verbal persuasion is most effective in strengthening self-efficacy perceptions when the content of the persuasion is slightly beyond the person's perceived capability. In addition to credibility, persuaders will be more effective if they are perceived as prestigious, trustworthy, or as an expert (Bandura, 1977). Verbal persuasion may be communicated in the form of standards for behavior (goals), discrepancies between standards and performance, or feedback.
Last, physiological arousal can strengthen self-efficacy beliefs because of labels that social environments provide for bodily states (Bandura, 1986). When people experience physiological arousal, they label it with a cause. For example, people perceive they have physical inefficacy when they feel tired and achy, and in negative moods judge their self-efficacy as being weaker. People interpret physiological states like these as signs that they are not capable when they face stressful or challenging situations.

Cognitive mediators affecting the formation of self-efficacy perceptions. Through experiences with enactive mastery, modeling, verbal persuasion, and physiological arousal, people form rules that they use to judge future input and form self-efficacy judgments (Bandura, 1986). External and internal cues do not directly affect self-efficacy judgments because a person's cognitive appraisal and integration of the cues mediate their effectiveness (Bandura, 1982; Gist & Mitchell, 1992). This explains why people with the same skill level may have different levels of confidence in their self-efficacy. The three mediators include analysis of the task, attributional analysis of experience, and analysis of situational resources and constraints. They are independent, but people may process them iteratively. Little is known about how people integrate cues to form self-efficacy perceptions (Bandura, 1997). The integration process may vary from a quick and simple evaluation, called automatic, to an in-depth and complex one, called controlled (Gist & Mitchell, 1992). Each person's cognitive appraisal process is influenced by the types of cues people learned to associate with self-efficacy perceptions and by the processes people use to integrate efficacy information from varied sources.
The first form of cognitive appraisal that affects self-efficacy perceptions is the analysis of task requirements. People decide what inputs are necessary to perform different tasks. Perceived task requirements can be manipulated to affect self-efficacy perceptions. People may be alerted to the need for a more overt analysis of self-efficacy perceptions due to several task factors, including novelty, unexpected failure experiences, task complexity, task salience, task importance, major changes in the task, and/or major changes in the self (Bandura, 1982; Gist & Mitchell, 1992).

Second, cognitive evaluation of external cues involves the analysis of experience. People decide why they performed at certain levels in the past based on judgments or attributions about their past performance. Self-efficacy perceptions mediate the relationship between attributions about past performance and future performance, affect, and thought (Bandura & Adams, 1977). Therefore, a person's self-efficacy can be strengthened not only by increasing skill level, but also by changing attributions about the variability (stable or unstable) and locus (external or internal) of self-efficacy determinants.

Third, people determine whether personal (e.g., skill level, anxiety, desire, effort) and/or situational (e.g., competing demands, distractions) factors will positively or negatively affect performance (Bandura, 1986; Mitchell, Hopper, Daniels, George-Falvy, & James, 1994). A perceived constraint may be unfounded. For example, women typically perceive that they have lower mathematical and analytical skills as compared to men (Betz & Hackett, 1986). This perceived constraint affects their self-efficacy
perceptions and can affect their choices of activities and careers, even though it has been found that their objective ability and performance in these areas are equal to men's.

Coping and the formation of inefficacy perceptions. Self-efficacy perceptions may be undermined because of several reasons, and those who perceive they cannot perform a specific task (weak self-efficacy perceptions) can be referred to as inefficacious (Bandura, 1982). Factors that can undermine self-efficacy perceptions include situational factors that are often present when poor performance occurs, the presence of a very confident person who undermines performance, selective attention focused on new parts of a task, or the use of labels that classify people as inefficacious (e.g., beginner group). Because of low self-efficacy perceptions, people with high ability may perform poorly (Bandura, 1986).

Due to the dynamic nature of self-efficacy perceptions, the initial level of self-efficacy can cause a behavioral trend called an exacerbation cycle (Storms & McCaul, 1976). People with weak self-efficacy perceptions tend to see challenges as insurmountable, and this shifts their focus to personal shortcomings in performing the task, which causes stress and lower performance (Bandura, 1982). When personal standards are dysfunctional (for example, unreasonably high, as are the standards of clinically depressed patients), people detect large discrepancies between feedback about actual performance and personal standards (Bandura, 1986). This negatively affects their perceptions of efficacy and motivation. An upward spiral of self-efficacy and performance can cause overconfidence and complacency, however (Lindsley, Brass, & Thomas, 1995). The most beneficial
cycle, which causes the highest levels of resilient self-efficacy perceptions and performance, is continued success with periodic failure (Bandura, 1986).

Task attributes can affect self-efficacy perceptions negatively. Task novelty may cause upward or downward cycles of self-efficacy perceptions that affect effort, persistence, and performance (Lindsley, et al., 1995). This is also expected to be true of tasks that are dependent on probabilistic information with much uncertainty. Self-efficacy perceptions moderate the relationship between performance and future attributions about the causes for the past performance, so this effect is perpetuated (Silver, Mitchell, & Gist, 1995). People with strong self-efficacy perceptions attribute the causes of performance favorably, and those with weak self-efficacy perceptions attribute the causes of performance negatively. Continued failures despite high effort expenditure can cause learned helplessness (Maier & Seligman, 1976) when a person decides a task is impossible (Brown & Inouye, 1978).

In order to stop downwardly spiraling self-efficacy, interventions correct false attributions about performance. These include frequent and detailed feedback about performance, improved ability, motivational techniques such as goal setting, or new task designs (Gist & Mitchell, 1992). If tasks are complex, information about cause-and-effect relationships are helpful (Lindsley, et al., 1995). Mastery experiences, modeling, verbal persuasion, and physiological arousal build individual skills and beliefs in self-regulatory ability (Bandura, 1986).

**Summary:** The formation and effects of self-efficacy perceptions. Enactive mastery, vicarious experience, verbal persuasion, and physiological arousal are all effective means
for influencing self-efficacy perceptions. These methods allow people to gather information about tasks, their own abilities, past performances, and desired future performances. Although they are all effective in raising self-efficacy, enactive mastery is the most influential and vicarious experience is the second most influential. Verbal persuasion and physiological arousal are less salient, but can be used in combination with the other means.

These four influencing methods are suggested to affect self-efficacy through mediating cognitions. A person analyzes task requirements, past experiences, and situational/personal resources and constraints to form self-efficacy judgments. Bandura (1982) stated that this is evidenced by the fact that an equal external influence does not result in the same level of self-efficacy perceptions across individuals. Behavioral researchers counter this argument and state that differential personal histories of experience explain why an immediately prior external influence does not result in the same behavior across individuals (Dougher, 1995). In the current study, cognitions are proposed to account for these differences.

Inefficacy is perpetuated by a lack of perceived control over the environment or undermined performance (Bandura, 1986). This can lead to a downward spiral of self-efficacy and learned helplessness. Feedback and goal setting are two methods that strengthen self-efficacy perceptions. The most resilient self-efficacy perceptions are formed through successes with periodic failures so that a person does not become complacent with easy achievements.
Constructs Related to Self-Efficacy

Self-efficacy perceptions are frequently compared to other constructs in management literature. Those most frequently compared are self-esteem, expectancy-related constructs, and the Pygmalion Effect.

Self-concept. The self-concept is formed through direct experiences and evaluations by significant others (Bandura, 1986). Self-esteem is one part of the self-concept and refers to a person's perceived self-worth relative to the values held as important in that person's culture. Self-efficacy perceptions and self-worth are not always related because people may consider themselves capable of performing a task that does not affect how they value themselves. Similarly, people may consider themselves incapable of performing a task that has no bearing on their self-worth. Self-efficacy is a judgment of capability, while self-esteem is an evaluative reaction about the self (Gist & Mitchell, 1992). Factor analysis results confirm that self-efficacy is a separate construct from personality constructs. Hollenbeck and Brief (1987) found that self-efficacy loaded on one factor with ability, while locus of control, self-esteem, and need for achievement loaded on a separate factor.

Personality psychologists view the perception of self-efficacy as a general trait (Eden & Aviram, 1993). The term general self-efficacy (GSE) is defined as "beliefs about self-competence in achievement situations in general" (Eden & Kinnar, 1991, p. 771). Researchers who investigate the GSE construct state that self-efficacy, self-confidence, self-esteem, and self-assurance are all similar constructs. The controversy between studying task-specific self-efficacy perceptions (as defined by Bandura) or GSE
perceptions centers on whether these constructs should focus on specific situations or on
general traits that affect behavior across situations (Eden & Aviram, 1993). Bandura
(1997) maintains that the predictive power of self-efficacy perceptions is due to its
microanalysis in specific task areas. Predictive power is lost when more general self-
efficacy measures are used, so researchers should instead focus on the usefulness of
aggregating task specific-measures to test the generalizability of self-efficacy perceptions
(Gist, 1987).

GSE moderates the relationship between task-specific self-efficacy and performance.
Eden and his colleagues (e.g., Eden & Kinnar, 1991) termed this the behavioral plasticity
effect. Although GSE exerts a main effect on actions, performance, and effort, it only
accounts for a small portion of variance in criterion measures (Tipton & Worthington,
1984).

In summary, although GSE exerts some influence on performance, the construct is
distinct from self-efficacy perceptions that have independent, stronger effects on
outcomes. In several studies, researchers found a behavioral plasticity effect, that GSE
moderates the relationship between task-specific self-efficacy and performance.

Outcome and expectancy theories. The question of whether self-efficacy perceptions
are the same as expectancy constructs has caused considerable debate (e.g., Bandura,
1984; Eastman & Marzillier, 1984). The constructs from Vroom’s (1964) expectancy
theory are the focus of much research related to organizational phenomena, and,
therefore, are the focus here. Expectancy is a belief in the likelihood that action will result
in an outcome, and is expressed as a subjective probability between zero and one
Researchers often refer to outcome expectancy as a singular construct. Campbell, et al. (1970) distinguished between two types of expectancy, \( E_1 \) and \( E_2 \), that together make up overall outcome expectancy. \( E_1 \) is the expectancy that effort will lead to accomplishment of a task goal, and \( E_2 \) is the expectancy that the accomplishment of this task goal will lead to certain outcomes. Outcomes vary in how instrumental they are in achieving other outcomes that flow from them. This aspect of Vroom's (1964) theory distinguishes between first-level (e.g., pay) and second-level (e.g., food) outcomes. The instrumentality of first-level outcomes is expressed in a correlation between +1 and -1, referring to the correlation between the first-level and second-level outcomes. The valence, or value, of a first-level outcome is expressed as the sum of the instrumentalities for all possible second-level outcomes. Vroom (1964) stated in his theory that expectancy, instrumentality, and valence influence motivational force, or effort.

Theoretical debate centers on the nature of the relationships between the constructs and whether self-efficacy perceptions can be distinguished from expectancy constructs. Bandura (1977; 1986; 1997) proposed that self-efficacy perceptions are more comprehensive than expectancy constructs, but that the constructs are related. He stated that outcome value influences the relationship between self-efficacy perceptions and outcomes in encouraging action, but that self-efficacy perceptions encompass the consideration of a more broad range of outcomes that are often neglected in expectancy analyses, such as affective and cognitive outcomes. Outcome value is rarely addressed in self-efficacy research, but it is an important component of self-efficacy perceptions.
(Maddux, Norton, & Stoltenberg, 1986). People act on their self-efficacy perceptions when they perceive the outcomes will be valuable (Bandura, 1982). Maddux, et al. (1986) suggested that researchers ensure that outcomes are valuable to subjects.

The expectancy that behavior will lead to an outcome, E2, is not the same construct as self-efficacy perception (Bandura, 1977). Self-efficacy perceptions represent the belief that the person can bring about a behavior, and outcome expectancies refer to the belief that behaviors will lead to outcomes. Outcome expectancies alone do not result in self-regulation, though, because low self-efficacy perceptions negate the motivating potential of attractive outcomes (e.g., Frayne & Latham, 1987). Researchers challenged the proposal that self-efficacy and outcome expectancies are independent because many expectancies about outcomes are interrelated with expectancies about task performance capabilities (e.g., Eastman & Marzillier, 1984). Most of these criticisms center on phobic subjects' abilities to separate their perceived ability to perform from feared outcomes. Bandura (1984), however, maintains that outcome expectancies and self-efficacy are not interrelated, and that how people judge their capability to perform influences what outcomes they expect.

Researchers also questioned the relationship between self-efficacy perceptions and E1, or the expectancy that effort will lead to accomplishment of a task goal. Self-efficacy perceptions are formed from a wide range of situational and personal factors that influence beliefs about a person's ability to perform a behavior. Self-efficacy perceptions are influenced by adaptability, creativity, resourcefulness, and perceived capability to act in complex situations (Bandura, 1997; Locke & Latham, 1990). E1 refers to the belief
that effort will lead to performance, not including other situational and personal
influences (Bandura, 1997). E1 is expressed as a prediction of behavior, while self-
efficacy perceptions also include a generative capability that influences cognitions and
motivation to act (Gist & Mitchell, 1992). Therefore, E1 should be related to self-efficacy
perceptions, but self-efficacy perceptions should be a better predictor of outcomes.
Kanfer (1987) hypothesized that self-efficacy is related to E1, but is more narrowly
defined, and this may account for its superior predictive ability. Self-efficacy perceptions
are measured over a wide range of performance levels, and E1 is measured as one
question of how effort generally affects performance. For example, a weight lifting self-
efficacy questionnaire may include items such as, "I can lift 10 pounds," and identical
statements for 20, 30, 40, and 50 pounds. The confidence ratings each individual reports,
usually between one and 100, are summed over the questionnaire for a measure of self-
efficacy perceptions. An effort item may ask the subject whether effort will lead to lifting
weight. This is referred to as a microanalytic method of measurement because each level
of perceived performance capability is assessed.

In summary, E1 and E2 are separate constructs from self-efficacy perceptions
according to SCT. Self-efficacy perceptions refer to a person’s perceived capability to
perform behaviors, but E2 is the subjective belief that performance will lead to outcomes.
E1 is more narrowly defined than self-efficacy perceptions, and does not include the
broader influences of situational and personal factors on perceived capability to perform.
Outcome value is necessary for performance, but is independent of self-efficacy
perceptions.
The Pygmalion and Galatea Effects. Although the issues concerning expectancy constructs and self-efficacy perceptions are related to disagreements among researchers, the issues concerning the Pygmalion and Galatea Effects are related to a need to distinguish the role self-efficacy perceptions play in the phenomena. The Pygmalion Effect occurs when expectations induced in instructors about their trainees enhances the trainees' performance (Eden & Ravid, 1982). The Pygmalion Effect operates through the mediation of a construct that Eden and Ravid termed self-expectancy. Although the authors did not cite Bandura in their research, the self-expectancy measure is very similar to a self-efficacy measure. Subjects are asked to specify their confidence in their ability to perform specific behaviors at progressive levels of difficulty, as specified in Bandura’s (1995) guidelines for constructing self-efficacy scales. Performance can either be induced directly by raising self-expectancies or by inducing higher performance expectations in instructors. Eden and other authors of training literature since referred to the Galatea Effect as the raised performance resulting from enhanced self-efficacy perceptions (e.g., Eden & Aviram, 1993; Eden & Kinnar, 1991; Quiñones, 1995). The Galatea Effect should not be confused as being synonymous with self-efficacy perceptions.

Summary: Constructs related to self-efficacy perceptions. In summary, three constructs are conceptually and empirically compared to self-efficacy perceptions most often in the literature—self-esteem, expectancy (E1 and E2), and the Pygmalion Effect. Although these constructs are related to self-efficacy perceptions, they can conceptually be distinguished. Compared to expectancy constructs, self-efficacy perceptions are measured in terms of more specific behaviors at a microanalytic level and encompasses
more personal and situational factors that people consider in task performance. Self-efficacy perceptions are not equal to the Pygmalion Effect, but explain its operation. The Galatea Effect is a term researchers used to describe the increase in performance that results from raising self-efficacy perceptions.

Theory of Task Complexity

Researchers often do not describe what qualifies tasks to be called complex (Wood, 1986). In order to judge the complexity of a task in the present study, it is necessary to describe theoretically-defined attributes of complex tasks. In addition, it is important to discuss how task complexity is related to self-efficacy perceptions because perceived task attributes are an input into the formation of self-efficacy perceptions, as specified in the theoretical model for this study (see Figure 2).

Attributes of Complex Tasks

In order to determine that a task is complex, its attributes must be analyzed (Wood, 1986). Tasks have three main dimensions: outputs, required acts, and information cues. Attributes relating to these three dimensions make a task complex. Tasks may be complex due to: (1) component complexity, the number of distinct acts used in performance and the number of information cues a person must process for performance, (2) coordinative complexity, the nature of relationships between task inputs and products, and (3) dynamic complexity, changes in the task over time. This definition of task complexity reveals that uncertainty is a dimension of coordinative task complexity so that the stronger the objective relationship between cue and a criterion, the less complex the task. One
research framework in which task complexity can be varied is the Brunswik (1955) lens model.

In simple tasks, effort and performance may be linearly related (Kanfer, 1987), and are perceived as such. People can achieve success by applying themselves and persisting. For many tasks, effort and performance are not linearly related, and this effect may be due to task attributes such as complexity. People perceive that their effort does not result in equal influences in performance. Complex task performance such as this requires the use of effective strategies to determine what level of effort and types of skills that are most effective.

**Effects of Task Complexity on Self-Efficacy Perceptions**

Much of the published research in motivation was conducted using simple tasks (Wood & Bandura, 1989b). Task complexity is important, however, because it can affect self-efficacy as an input to personal task experience, vicarious task experience, and persuasion when the task is described to the task performer. As people gain task experience, they adjust their self-efficacy perceptions to reflect their increases in skills and improved task strategies. In addition, perceived task complexity may strengthen initial self-efficacy perceptions (Stone, 1994). People also may express initial overconfidence in self-efficacy perceptions when they are unaware of the task complexity.

People may believe that their actions will not lead to effective performance due to an unresponsive or punishing environment (Bandura, 1982). Although people with strong
self-efficacy perceptions act out to change an unresponsive environment, learned
helplessness (Maier & Seligman, 1976) can occur if they neither believe the environment
is responsive or that they are capable of affecting it. This is because effort and ability are
perceived as being negatively correlated (Bandura, 1986). To reduce the desire to give up,
incentives may be necessary.

Summary: Task Complexity Theory

In summary, task complexity has three important dimensions: component complexity,
coordinative complexity, and dynamic complexity. Task uncertainty is a part of
coordinative complexity. Perceived task complexity can affect judgments of self-efficacy
because people may believe the environment is unresponsive to their actions.

Feedback Theory

Feedback can be defined as “the process by which an environment returns to
individuals a portion of the information in their response output necessary to compare
their present strategy with a representation of an ideal strategy” (Balzer, Doherty, &
O'Connor, 1989, p. 412). This type of feedback informs people that their actions are
adequate and/or correct (Earley, Northcraft, Lee, & Lituchy, 1990). Through its effects on
self-efficacy perceptions and on the strategies adopted, feedback is an important source of
motivation because it tells people how they are performing as compared to standards, why
a task is important, and/or how to more effectively perform in the future (Bandura, 1986;
Earley, 1985).
The Role of Feedback in Self-Efficacy Theory

Feedback is an important influence on self-efficacy perceptions as a form of verbal persuasion. This is illustrated in the theoretical model for this study (see Figure 2). Effective feedback is realistic and comes from a source that is perceived to have credibility, expertise, prestige, and trustworthiness (Bandura, 1997). Feedback is not an effective influence on self-efficacy perceptions when used alone, but is effective in conjunction with enactive mastery or modeling.

Feedback increases knowledge about performance. Knowledge of performance encourages people to engage in more self-directed behavior because they know how they are proceeding with respect to assigned goals or internal standards (Bandura, 1986). People who have more self-direction set higher goals, assess situations better, create self-incentives and punishments, and monitor their progress better when working toward goals (Frayne & Latham, 1987). Self-efficacy perceptions mediate this effect and are a major cognitive influence on self-direction. Feedback also provides self-knowledge that helps people set more realistic personal goals (Bandura & Jourden, 1991).

Feedback is effective in influencing self-efficacy perceptions and, therefore, performance because of two motivating processes, discrepancy reduction and discrepancy production. When people perceive a difference exists between desired and actual performance, they proactively attempt to reduce the discrepancy. Goals create discrepancies between current performance and future desired performance. Through a conception-matching process (Bandura, 1986, p. 67), people use feedback to match their performance to the conception of what they want the performance to be. Self-efficacy
perceptions guide the choice of a desired performance level. Feedback motivates people by informing them of discrepancies they reduced or of discrepancies they can choose to create in the future through personal goal setting. This cyclic process of discrepancy reduction and production requires both knowledge of past performance and the input of information for future performance.

Although the effects of feedback on self-efficacy perceptions appear to operate according to Control Theory, they are different in attributing cause to behavior (Cervone & Wood, 1995). According to Control Theory, reactions to feedback are determined only by the desire to minimize discrepancies (Carver & Scheier, 1981), but the focus in SCT is on self-reactions (personal goals, self-efficacy, analytic strategies and affective self-evaluations) as central mediators between performance information and action. In contrast, Control Theory does not specify that self-reactions are necessary to understand self-regulation.

Attributes of Feedback

Augmented feedback is created externally to the person performing a task (Taylor, 1984). This is distinguished from intrinsic feedback, or the natural result of a movement or action. Outcome feedback (OFB) is the most frequently studied type of augmented feedback (hereafter also referred to as feedback) and provides people with knowledge of their past performance attainments (Hammond, Summers, & Deane, 1973). A learner is normally given the correct response after each attempt at a task. OFB is most effective in enhancing performance when it is specific and timely (Johnson, Perlow, & Pieper, 1993).
Feedback can help a person reflect on past performance or it can aid in preparing for future performance. Feedback provides knowledge of past success, but becomes *feedforward* information when this knowledge is applied to future task performance (Naylor, Pritchard, & Ilgen, 1980). This use of feedback and feedforward information contributes to the ongoing motivational process of discrepancy reduction and production (Bandura, 1988b).

Feedback can be positive or negative. Negative feedback communicates that performance was below a standard, and positive feedback communicates that performance met or exceeded a standard (Bandura, 1991). Therefore, negative feedback informs a person that a deficit exists between current and desired performance. Negative feedback results in strategic cognitive processing, or the formation of new strategies for performance to reduce the discrepancy (Wofford & Goodwin, 1990). A person who receives negative feedback may, for example, set future goals that are lower and more attainable than past goals. After goals are reached, this feedback is motivating through its positive influence on self-efficacy perceptions (Bandura, 1997). Compared to negative feedback, positive feedback encourages current behavior and results in less overt, more controlled cognitive processing that is based on past performance strategies (Wofford & Goodwin, 1990). Strengthened self-efficacy perceptions encourage higher personal goal setting. Task complexity also may moderate the relationship between feedback and self-evaluations, so that negative feedback leads to dissatisfaction with prior performance and causes poorer future performance (Bandura & Jourden, 1991; Cervone & Wood, 1995). These conclusions are recent additions to self-efficacy theory. Bandura (1997) stated that,
because of the complex relationships between cognitive and affective factors, negative feedback may have diverse effects on different individuals.

Feedback may be evaluative or nonevaluative (Naylor, et al., 1980). Evaluative feedback is a reflection of the quality of performance as compared to a standard. Nonevaluative feedback simply provides knowledge of how one performed, and is necessary for people to learn the relationship between actions and outcomes in task performance.

Feedback also can vary according to the amount of information it provides to the person performing the task. OFB provides task performers with information about correct results and their performance, allowing them to compare desired to achieved performance. Feedback also may provide additional information concerning suggested strategies and more complex past performance analyses. Although researchers use different terms to refer to this type of feedback, authors who reviewed Brunswik (1955) lens model studies referred to it as cognitive feedback (CFB) (Balzer, et al., 1989).

Balzer, et al. discussed the benefits of CFB, defined as feedback that provides a person with objective information about relations between variables. Three types of cognitive feedback are task information, cognitive information, and functional validity information. Task information provides statistics concerning the objective relationships between cues and predicted criteria measures (e.g., correlations) and affects performance most. Cognitive information provides data about perceived relationships between cues and criteria. Functional validity information provides knowledge of how perceived relationships compare to actual relationships. CFB may be helpful as a feedforward
method because it gives a person information on how to control future performance (Hammond, et al., 1973), and this may help a person learn more quickly than OFB (Slovic & Lichtenstein, 1971). For CFB to be beneficial, however, it must provide information that is helpful in affecting future actions.

**Summary: Feedback Theory**

Feedback affects personal goals and future performance through its effects on self-efficacy perceptions. Feedback informs people of discrepancies between their current and desired performance, they adjust their self-efficacy perceptions based on this information, and this then affects the future personal standards they set for themselves. The direction of the feedback determines whether people will have to strategize in their cognitive processing to perform in the future, or whether they will use controlled cognitive processing. Negative feedback is motivating because people desire to reduce the discrepancy between desired and actual performance. When people attain a standard, however, this positive feedback strengthens their self-efficacy and they set higher personal goals. Some researchers suggested that negative feedback may have a harmful effect on self-evaluations and performance in complex task environments. This point has not been solidified in theory, though, because of the complexities of the relationships between individual cognitive and affective factors.

Feedback may vary in terms of its purpose, evaluative or nonevaluative. It may also vary in terms of the amount of information a person is provided. CFB provides additional information about variable relationships over OFB information, which only provides
information about the differences between actual performance and desired/correct outcomes.

Goal Theory

Goals are standards for performance, and can be imposed externally on an individual (assigned goals) or internally by an individual (personal goals). According to goal setting theory, goals positively affect performance through their influence on increased effort and persistence, directed attention, and better strategies (Locke, Shaw, Saari, & Latham, 1981). Assigned goals and personal goals both play an important role in self-efficacy theory. Assigned goals are external influences on self-efficacy and personal goals are cognitive mediators of the relationship between external influences and performance. Specific, difficult goals positively affect performance in simple tasks, but they do not appear to be as effective in complex tasks.

The Role of Goals in Self-Efficacy Theory

Two forms of goals are important in self-efficacy theory, personal goals and assigned goals. In the theoretical model (see Figure 2), personal goals are important cognitive mediators between external influences and outcomes, and assigned goals are influential sources of verbal persuasion (Bandura, 1986). Goals serve three main purposes in SCT: (1) provide motivation, a sense of purpose, and direction that affects effort and persistence, (2) build beliefs in capabilities by providing standards for judging performance, and (3) create satisfaction with attainments, thereby increasing task interest (Wood & Bandura, 1989b). Feedback affects the formation of personal goals through its
effect on self-efficacy perceptions because knowledge of performance helps in setting more realistic future goals. By setting more realistic goals, a person will be more self-directed and perform better.

People have the ability to set personal goals through what Bandura (1986) termed the judgmental cognitive subfunction. Personal goals may be different depending on the task, and can be developed through social comparisons (e.g., assigned goals), collective comparisons (to collective principles in social systems), or self-comparisons in the form of personal goals (Bandura, 1991). Both assigned and personal goals produce discrepancies between desired and actual performance, and the desire to reduce the discrepancy is motivating. Assigned goals and self-efficacy perceptions both influence personal goal setting. If people strengthen their perceptions of the capability to perform a task, they will set higher personal goals as a result.

Assigned Goals

The fact that specific, difficult goals enhance persistence, effort, attention, and the effective use of strategies in simple tasks is well-established in the goal setting literature (Locke & Latham, 1990). Specific goals establish a performance standard versus the assignment to “do your best.” Difficult goals require more effort, knowledge, and/or skill than easy goals (Locke, et al., 1981). Goal setting theory proposes that a nonlinear relationship exists between goal difficulty and performance so that impossible goals are rejected. Goal acceptance is a necessary condition for goals to be effective, so goal rejection would nullify the goal—performance relationship. In 90% of goal setting
studies, however, a linear relationship has been found (Locke, et al., 1981), and few researchers found a nonlinear relationship (Taylor, 1987). This may be due to the fact that simple tasks were used in these studies or because impossible goal conditions were not tested.

The dimension of task complexity must be distinguished from that of goal difficulty (Taylor, 1987). Task complexity refers to the nature of the work, while goal difficulty is a performance standard. Task complexity is a moderator of the relationship between goal difficulty and performance, so that difficult goals lead to better performance in easy tasks, but easy goals lead to better performance in complex tasks. This effect may occur due to uncertainty in complex tasks and the fact that people cannot find an optimal strategy easily (Earley, Connolly, & Ekegren, 1989; Huber, 1985; Taylor, 1987). Subjects' perceptions become distorted and easy goals appear difficult. Suboptimal cognitive processing results, impairing performance (Huber, 1985).

**Personal Goals**

Personal goals are an important mediator between assigned goals and performance (Locke & Latham, 1990). While assigned goals are key external tools that can be used to influence performance, personal goals are cognitive mediators of this effect. Like self-efficacy perceptions, personal goals are self-regulatory mechanisms people use to motivate themselves (Bandura, 1986). The effects of personal goals may be weaker in more uncertain, complex environments because people initially are unable to diagnose the best strategies for performance (Bandura & Jourden, 1991). Assigned goals positively
affect personal goals because they set an initial standard task performance. Self-efficacy perceptions also mediate the relationship between assigned goals and personal goals because people set their own goals based on their perceived self-competence.

Summary: Goal Theory

In summary, self-efficacy perceptions and personal goals are two cognitive mediators of the relationship between the external influence of assigned goals on performance. Self-efficacy perceptions mediate the effect of assigned goals on performance and the effect of assigned goals on personal goals. Personal goals also mediate the relationship of assigned goals on performance. Assigned and personal goals create motivating discrepancies between actual and desired performance.

Although goal setting theory proposes that difficult, specific goals lead to higher performance, this relationship may be moderated by task complexity. Specifically, easy goals facilitate performance in complex, uncertain tasks better than difficult goals. This effect may occur due to the distortion of perceived goal difficulty that occurs in the performance of complex tasks.

Time Theory

Saks (1995) stated that very few longitudinal self-efficacy studies exist, only two measuring variables over more than eight weeks' time. Several self-efficacy studies were conducted over repeated experimental trials, so Saks' criticism should be qualified by a definition of time effects research.
Time effects (longitudinal) research is defined as "the analysis of relationships over selected time periods or intervals" (Bergh, 1993, p. 684). Research that measures time effects must measure each variable at two or more points in time and use statistics that examine causality between variables (Williams & Podsakoff, 1989). The ability to draw conclusions about causality is a major benefit of time effects research. The length of each observation period should be the same, and the subjects providing the data at each point in time should be comparable (Bergh, 1993). In time effects research, intervals of data collection are not necessarily days, weeks, or months, but any equal measurement intervals.

When considering this description of time effects research, self-efficacy perceptions have been studied longitudinally more often than is acknowledged by Saks’ (1995) criticism. For example, all of the complex task studies using a simulated organization management task measured the variable over at least two trials (e.g., Bandura & Wood, 1989). Researchers used multiple trials to examine reciprocal effects of performance on self-efficacy perceptions and to study causality.

Time effects research can be found in five major forms: (1) prediction of data in a later period based on prior data, (2) investigation of time as a moderator variable, (3) pooling variables over time, (4) using time as a dependent variable, and (5) focusing on the change in variables over time (Bergh, 1993). All of these are legitimate for discovering the changes in variables over time.

The change in self-efficacy over time is a central issue due to the proposed dynamic nature of the construct and its ongoing effects on outcome variables over time. Self-
efficacy is both an antecedent to performance and an outcome of past performance. The effect of time as a moderator is also important due to the proposed dynamic nature of inputs, based on the reciprocal integration of environmental, personal/cognitive, and behavioral factors in SCT (see Figure 1). According to SCT, self-efficacy influences outcomes more in later stages than in early stages of task performance (Bandura, 1986). In early stages, people form their efficacy beliefs that may be weaker due to the novelty of the task and situation. In later stages of task performance, people may have stronger self-efficacy perceptions that are likely to have more influence on performance. Self-efficacy perceptions reflect the acquisition of skills and knowledge. Because little is known about the dynamic nature of these inputs in forming self-efficacy perceptions (Bandura, 1997), time theory should play an important role in this research in the future.

In summary, time effects research is not restricted to any one type of time interval, but to the restriction that variables are examined at least two points in time over intervals of consistent length, and that appropriate statistics that examine causality are used. Therefore, the criticism that little longitudinal research has been done on self-efficacy is only partially true. Little self-efficacy research has been conducted in which the observation period length was days, weeks, or months. Many researchers conducted self-efficacy studies and used repeated trials over a few hours, and these studies have been critical for drawing conclusions about the construct’s formation and dynamic effects over time.
Brunswik Lens Model and the Multiple Cue Probability Learning Paradigm

Researchers used various settings and tasks when studying self-efficacy perceptions. When choosing a research setting, the researcher should consider construct validity issues, rival hypotheses, and the best setting for construct falsifiability (Ellsworth, 1977). When studying a complex task in a controlled setting, the Brunswik (1955) lens model and the Multiple Cue Probability Learning Paradigm (MCPLP) are ideal.

Theoretical Foundations for Choosing a Setting in Self-Efficacy Studies

The majority of self-efficacy studies take place in controlled settings. Some researchers expressed concern about the overuse of classroom settings, simulated tasks, and student samples, and suggested that studies in organizations are needed (e.g., Saks, 1995). Bandura (1977) provided a salient reason for experimental control when studying self-efficacy perceptions. “Because people have met different types and amounts of self-efficacy-altering experiences, providing one new source of efficacy information would not be expected to affect everyone uniformly” (p. 212). Therefore, control is a necessary element in studying the effects and outcomes of self-efficacy perceptions. People have different past experiences, and the multiple determinants of self-efficacy perceptions cause difficulty in drawing conclusions about its causes without control. Based on these same arguments, novel tasks are useful when studying self-efficacy perceptions so that subjects’ reactions are not confounded by incomparable past experiences with the task.

This is not to say that studies in less controlled settings (i.e., in organizations) are not valuable. The research question should guide the setting chosen (Campbell, 1986), and
external validity may not be the primary goal of research (Mook, 1983). The researcher should consider, however, that external validity is not entirely dependent on the setting. External validity refers to the ability to extend conclusions of a study to other settings, time, operations, and functional relationships, as well (Taylor, 1997). Self-efficacy is a cognitive construct common to all humans, which allows for broad population validity. Control is also an important element of a study when rival hypotheses are possible (Ellsworth, 1977). For the theoretically-driven researcher, internal validity is most important, followed by construct validity, statistical conclusion validity, and, finally, external validity (Cook & Campbell, 1977). The theoretical study of a complex cognitive construct such as self-efficacy requires control for rival hypotheses and to minimize threats to internal validity.

Most studies of self-efficacy perceptions in complex tasks used the same simulated organizational decision-making task (e.g., Bandura & Jourden, 1991), with some exceptions (e.g., Johnson, et al., 1993). There is a need to study different tasks and settings for more robust evidence (Cervone & Wood, 1995; Stone, 1994). Researchers still have much to learn about the self-efficacy construct (Gist & Mitchell, 1992).

The Brunswik (1955) Lens Model

Humans use points of reference, or cues, to make judgments (Hogarth, 1987). For example, when judging a person's suitability for a job, a decision maker considers cues such as past experience, likeableness, or educational experience. The Brunswik (1955)
lens model reflects this judgment process and affords researchers the opportunity to analyze decision situations that have varied attributes.

The lens model was developed based on the principles of *representative design* and *probabilistic functionalism* (Brunswik, 1955). First, Brunswik stated that representative design is necessary to create an experimental situation in which experimental cues are comparable to those found in the environment. These cues cannot be replicated exactly, but can have high *ecological validity*, or be valid representatives from the environment that is studied. Second, probabilistic functionalism is based on the inherently limited, or probabilistic, nature of psychological functioning. *Functional validity*, or the correlation between objective variables and a subject’s response, is based on probability estimates because of human limitations. This reflects the uncertainty that is a fundamental characteristic of the relationships of people with their environments. Although Brunswik proposed the lens model as a framework for understanding all human behavior, researchers since applied a more restricted version of the model to social judgment situations (Hammond & Wascoe, 1980). It is this type of model of the human judgment that is used in the present study.

The lens model is applied to best represent a probabilistic, or uncertain, environment (Brunswik, 1947). In this way, lens model research provides a valuable way to model human judgment (Slovic & Lichtenstein, 1971). In effect, “the lens model offers a unique opportunity for laboratory control while maintaining environmental uncertainty” (Cosier, 1983, p. 80).
Using the lens model, human judgment is depicted by correlations between criteria and probabilistically-related cues. An experimenter can vary the coordinative, component, or dynamic complexity of a task by varying the number of cues, the relationships of the cues to the criterion (or criteria), or by changing these relationships over time (Wood, 1986). The basic lens model and component parts are illustrated in Figure 3.

Figure 3. The Brunswik (1955) lens model framework of analysis adapted from Taylor (1984).

Using the framework in Figure 3, researchers can determine the relative contribution of the environmental cues to the subject’s judgment accuracy. The right side of the model demonstrates the way an individual combines and weights information (Naylor, et al., 1980). The left side includes the features that objectively influence the criterion most. The
lens model is applied in experiments in a method such as the one described by Taylor, Cosier, and Ganster (1992, p. 881):

In effect, individuals repeatedly predict outcomes by (1) deciding the worth of information cues, (2) selecting a policy for weighting cues, (3) acting upon their chosen strategies for prediction, (4) receiving and evaluating feedback after every decision, and (5) learning to cope as best they can in an uncertain probabilistic environment.

The Multiple Cue Probability Learning Paradigm (MCPLP)

Research using the lens model may use single-cue or multiple-cue tasks (Slovic & Lichtenstein, 1971). When investigating judgments using the lens model, the Multiple Cue Probability Learning Paradigm (MCPLP) is often used to model the probabilistic relationships (Castellan, 1973). Multiple cue probability learning tasks are judgment tasks in which the criterion to be judged and the cues upon which the judgment is made are related probabilistically, creating uncertainty. Uncertainty is created in MCPLP tasks by varying the relationships between cues and the criterion (or criteria), by the dynamic relationships of cues to the criterion, and/or by the amount of variance left unexplained in the criterion. Feedback studies are well-suited to MCPLP tasks because feedback affects human judgment. MCPLP tasks also are inherently complex and, therefore, are sometimes used in studying the effects of task complexity (Wood, 1986).
Summary: Application of the Brunswik (1955) Lens Model and MCPLP

The choice of a research setting should depend on the research question asked (Campbell, 1986). Theoretically-driven empirical researchers are most concerned with internal validity, and, thus, a controlled study is appropriate. The Brunswik (1955) lens model allows for control, while still modeling a complex, uncertain environment. Using this model, rival hypotheses can be effectively handled and precise measurements can be made, reducing the effects due to extraneous variance. In addition, the MCPLP is a valuable paradigm for creating complex tasks when using the lens model.

Purpose of This Study

The theoretical synthesis presented established the importance of self-efficacy perceptions as a central cognitive construct in explaining motivation. Feedback and goals (personal and assigned) are integral constructs to include when studying self-efficacy perceptions.

The purpose of this study is to investigate these variables in a probabilistic environment during the performance of a complex task. Specifically, one goal of this research is focused on the attempt to determine what combination of feedback and goal level best enhances the effect of self-efficacy perceptions on performance, effort, and persistence. A second goal is to model the relationships between external influences and cognitive mechanisms, self-efficacy perceptions and personal goals, to better understand human behavior in complex tasks.
The Brunswik (1955) lens model and Multiple Cue Probability Learning Paradigm are appropriate frameworks for studying self-efficacy perceptions when seeking to draw conclusions about complex, uncertain tasks while maintaining a controlled research situation. The use of repeated trials is appropriate for drawing conclusions about causality in self-efficacy research and in studying the effects of time on the construct.
CHAPTER 2

LITERATURE REVIEW

Management Research on Self-Efficacy Perceptions

Researchers conducted self-efficacy perception research on diverse types of tasks in diverse research areas (Bandura, 1997). In this research, authors concluded that self-efficacy perceptions predict outcomes across time, settings, domains, and different performance measures for both within-subject changes and within-treatment group changes. Research results revealed that self-efficacy perceptions positively predict performance, effort, persistence, lower stress and emotional arousal, choice of activities, commitment, quality of decision-making strategy, choice of goal level, behavioral intentions, affective reactions, intrinsic interest, and coping skills.

The first studies of self-efficacy perceptions investigated phobic subjects (e.g., Bandura & Adams, 1977), and these studies instigated the subsequent application of the construct to other treatments in clinical psychology. Self-efficacy perceptions influence behavioral and affective outcomes in many other areas, such as athletic performance, career aspirations and pursuits, and academic performance (Bandura, 1997).

Researchers more recently addressed the topic of self-efficacy perceptions as they relate to organizations. Gist (1987) stated that possible organizational applications of self-efficacy include training, leadership, counseling, goal setting, selection, legal issues, and performance appraisal. Bandura (1988a) also described ways that self-efficacy
perceptions could be applied to organizational research, including goal setting and training. Self-efficacy perceptions were investigated in these and other areas of research such as training (e.g., Martocchio & Dulebohn, 1994), commitment (e.g., Tannenbaum, Mathieu, Salas, & Cannon-Bowers, 1991), negotiation skills (e.g., Gist, Stevens, & Bavetta, 1991), risk taking (e.g., Krueger & Dickson, 1994), goal setting (e.g., Locke & Latham, 1990), performance appraisal (e.g., London & Smither, 1995), business ethics (e.g., Jenson & Wygant, 1990), decision-making (e.g., Bandura & Jourden, 1991), groups and cultural differences (e.g., Earley, 1994), equity (Eden & Ravid, 1982), entrepreneurial behaviors (Boyd & Vozikis, 1994), socialization (e.g., Saks, 1995), and absenteeism (e.g., Latham & Frayne, 1989).

To summarize, although clinical psychology researchers originally studied self-efficacy, recent researchers investigated its importance to diverse areas of study related to behavior in organizations. Despite this initial research, many issues remain to be addressed concerning the application of self-efficacy perceptions to the study of organizations.

Expectancy Versus Self-Efficacy

Theoretical debate centered on the comparison of self-efficacy perceptions and expectancy constructs (e.g., Bandura, 1984; Eastman & Marzillier, 1984). Expectancy theory received much empirical support and is one of the most researched theories of work motivation (Tubbs, Boehne, & Dahl, 1993). Regardless, conflict exists concerning the differentiation between self-efficacy perceptions and expectancy constructs.
Expectancy is a belief in the likelihood that an action will result in an outcome, and is expressed as a subjective probability between zero and one (Campbell, et al., 1970). Campbell, et al. (1970) distinguished between two types of expectancy, E1 and E2, that together make up overall outcome expectancy. E1 is the general expectancy that effort will lead to accomplishment of a task goal, and E2 is the expectancy that the accomplishment of this task goal will lead to certain outcomes. Outcomes vary in their value to the individual performing the behavior, and this value is defined as how instrumental the outcome is in reaching other outcomes (expressed as a correlation between valued outcomes). Expectancy, instrumentality, and valence together influence motivation (Vroom, 1964).

Researchers debated whether expectancy constructs and self-efficacy perceptions represent the same phenomena. Self-efficacy perceptions are more broad, encompassing more than effort as in E1, and are formed prior to E2 considerations of what outcomes will result (Bandura, 1977; Bandura, 1986; Bandura, 1997). Outcome value is an important input into self-efficacy perceptions, but expectancy theories traditionally restrict the type of outcomes that are considered and ignore many important affective and cognitive outcomes. Several researchers investigated the relationship between E2 and self-efficacy perceptions, and between outcome value and self-efficacy perceptions. The majority of this research supports that the constructs are distinct, and that self-efficacy perceptions are superior predictors of outcomes. Fewer researchers focused on the empirical differences between E1 and self-efficacy perceptions, although they have been conceptually distinguished.
Outcome expectancies, E2, were empirically distinguished from self-efficacy perceptions in several studies. Researchers found that the two are independent predictors of outcomes in diverse tasks such as athletic performance (Barling & Abel, 1983), sales performance (Barling & Beattie, 1983), and smoking behavior (Godding & Glasgow, 1985). A representative sample of studies investigating these relationships is detailed here.

E2 is usually measured as a question of what outcomes are expected in a given situation, and self-efficacy perceptions are measured in statements relating to perceived capabilities to perform a behavior. Outcome valence is stated in terms of a person's value for an outcome. For example, Maddux, Norton, and Leary (1988) measured outcome expectancy (E2), self-efficacy perceptions, and outcome valence to investigate their relationship with social anxiety. Outcome expectancy (E2) was measured in responses to statements such as, “By confronting the professor I will obtain a better grade.” Self-efficacy perceptions were measured in responses to statements such as, “I feel confident that I will be able to confront the professor.” The outcome valence measure used statements such as, “I place a lot of value on getting the grade I think I deserve in this course.” Maddux, et al. (1988) found that self-efficacy perceptions and outcome expectancies were both significantly correlated with social anxiety and anticipated anxiety, but that only self-efficacy was a significant predictor of the two constructs. Outcome expectancy and self-efficacy perceptions were significantly correlated, also.

Other researchers found that outcome expectancies, E2, alone do not result in performance and that self-efficacy perceptions exert a stronger direct effect on behavior.
Bandura (1977) stated that low self-efficacy perceptions can negate the influence of high E2 on behavior, and this was supported in research. Lee (1984) investigated the accuracy of self-efficacy perceptions and outcome expectancies in predicting assertiveness. She found that self-efficacy perceptions better predicted assertiveness than outcome expectancy, but that the two were significantly correlated. When outcome expectancies were added to a multiple regression equation predicting assertiveness, they did not add to the predictability of self-efficacy perceptions.

Davis and Yates (1982) studied the relationships of outcome expectancy and self-efficacy perceptions as predictors of solution time in solving anagrams. Self-efficacy perceptions were significantly correlated with solution time across all trials, and the relationship between the two became stronger over trials. The relationship between solution time and outcome expectancy was nonsignificant in early trials, and became significant in later trials.

In two studies, researchers compared the relationship between self-efficacy perceptions and outcome expectancies using objective performance measures versus self-report measures alone. Godding and Glasgow (1985) studied the usefulness of using outcome expectancy, E2, and self-efficacy perceptions for predicting smoking behavior. They found that self-efficacy perceptions predicted six dependent measures of smoking behavior after five to seven weeks of training and at a six-month follow-up. Five of the dependent measures were self-reported, and one was physiological. Outcome expectancies did not predict dependent variables at either measurement time, and did not significantly increment variance explained in the dependent measures when combined
with self-efficacy perceptions. Barling and Abel (1983) investigated the relationship between self-efficacy perceptions, outcome expectancies, and outcome valence with tennis performance. Tennis performance measures included judges' performance measures and self-reported measures. Self-efficacy perceptions were significantly related to performance over time, but outcome expectancy and outcome valence were not related to performance significantly.

Researchers also found self-efficacy perceptions to be equal or inferior predictors of outcomes versus E2. These researchers support, however, that self-efficacy perceptions and E2 are independent predictors of outcomes. Maddux, Sherer, and Rogers (1982) found that self-efficacy perceptions and outcome expectancies were independent predictors of behavioral intentions for interpersonal effectiveness. Outcome expectancies predicted behavioral intentions, but self-efficacy perceptions did not. Outcome expectancies predicted changes in self-efficacy perceptions. This empirical finding contrasts with Bandura's (1977) conclusion that self-efficacy perceptions influence the outcomes a person expects from the performance behavior. Maddux, Norton, and Stoltenberg (1986) also did not find self-efficacy perceptions to be superior in predicting behavioral intentions. They concluded that E2, outcome value, and self-efficacy perceptions were equivalent, independent predictors of intentions (Maddux, et al., 1986). Each construct added significantly to the variance explained in intentions. Finally, Manning and Wright (1983) found that E2 and self-efficacy perceptions were equal predictors of persistence of pain in childbirth. Similarly to Maddux, et al. (1986), they concluded that self-efficacy perceptions and E2 were redundant predictors of outcomes.
Researchers focused more on the comparison of self-efficacy perceptions with E2 than with E1, or generalized beliefs that effort leads to performance. Danehower (1988) compared the influences of E1 and self-efficacy perceptions on performance, and found that self-efficacy perceptions influenced performance, while E1 did not.

Outcome value is important to encourage action based on self-efficacy perceptions, but researchers found mixed support for its independent impact on outcomes. Researchers found both that outcome value is an independent predictor of outcomes (e.g., Maddux, et al., 1986) and that, although significantly related to self-efficacy perceptions, it does not predict outcomes (e.g., Manning & Wright, 1983). Bandura (1982) suggested that outcome value, as it is usually measured in expectancy theories, does not encompass many types of outcomes that are important to individuals, such as affective and cognitive outcomes. Outcome value is important to encourage action, but without strong self-efficacy perceptions, it is not sufficient.

In summary, the majority of researchers investigating the relationship between self-efficacy perceptions, E2, and outcome value found that the constructs were empirically distinct, regardless of their relative predictability of outcomes. Most of these researchers found self-efficacy perceptions to be superior predictors of outcomes versus E2 and outcome value. This is consistent with the theory that a person must have strong self-efficacy perceptions in order for outcome expectancies and outcome value to be considered as important to outcomes. Less empirical attention focused on the comparison of E1 and self-efficacy perceptions, although some support exists for the distinction of the constructs and the superior predictive ability of self-efficacy perceptions. Therefore, the
inclusion of an EI measure in the present study would be valuable to compare the relative predictive ability of the two constructs.

Complex Task Studies

Despite the large amount of research on self-efficacy perceptions, only 14 of these studies included complex tasks. These studies are listed in Table 1, along with information on the task, subject used, and focus of the study. In addition, one conceptual piece focused specifically on self-efficacy perceptions in complex tasks (Wood & Bandura, 1989b). In this study, Wood and Bandura integrated the findings of three of the complex task studies in Table 1 (Bandura & Wood, 1989; Wood & Bandura, 1989a; Wood, Bandura, & Bailey, 1990).

Of the 14 complex task studies on self-efficacy perceptions, the same computer simulation was used in seven of them (e.g., Wood, et al., 1990). In this simulation, student subjects managed a fictitious manufacturing organization and matched employees to job requirements for the purpose of completing production orders. Task complexity was varied by the number of employees supervised and degree of match required between employee and job. In addition, subjects used goals, feedback, and incentives to encourage the performance of employees. This task used component complexity, because subjects processed a number of cues relating to the employee-job matches, and coordinative complexity, because subjects determined the relationships between tasks and outcomes for successful performance.
Table 1

**Complex Task Studies of Self-Efficacy Perceptions**

<table>
<thead>
<tr>
<th>Study</th>
<th>Task</th>
<th>Subjects</th>
<th>N</th>
<th>Focus of study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandura &amp; Jourden (1991)</td>
<td>Organizational decision simulation</td>
<td>Graduate students</td>
<td>60</td>
<td>Social comparison</td>
</tr>
<tr>
<td>Bandura &amp; Wood (1989)</td>
<td>Organizational decision simulation</td>
<td>Graduate students</td>
<td>60</td>
<td>Perceived controllability and norms</td>
</tr>
<tr>
<td>Cervone, Jiwani, &amp; Wood (1991)</td>
<td>Organizational decision simulation</td>
<td>Undergraduate students</td>
<td>48</td>
<td>Goal effects</td>
</tr>
<tr>
<td>Cervone &amp; Wood (1995)</td>
<td>Organizational decision simulation</td>
<td>Undergraduate students</td>
<td>20</td>
<td>Goal and feedback effects</td>
</tr>
<tr>
<td>Johnson, Perlow, &amp; Pieper (1993)</td>
<td>Space Shuttle simulation</td>
<td>Undergraduate students</td>
<td>54</td>
<td>Learning versus performance feedback</td>
</tr>
<tr>
<td>Jourden (1992)</td>
<td>Organizational decision simulation</td>
<td>Undergraduate students</td>
<td>62</td>
<td>Framing effects in feedback</td>
</tr>
<tr>
<td>Latham, Winters, &amp; Locke (1994)</td>
<td>Class scheduling task</td>
<td>Undergraduate students</td>
<td>53</td>
<td>Participation in goal setting</td>
</tr>
<tr>
<td>Mitchell, Hopper, Daniels, George-Falvy, &amp; James (1994)</td>
<td>Computer air traffic control simulation</td>
<td>Undergraduate students</td>
<td>110</td>
<td>Determinants of self-efficacy over trials</td>
</tr>
<tr>
<td>Quiñones (1995)</td>
<td>Computer air traffic control simulation</td>
<td>Undergraduate students</td>
<td>69</td>
<td>Training assignment and attributions</td>
</tr>
<tr>
<td>Stock &amp; Cervone (1990)</td>
<td>Complex cognitive problem</td>
<td>Undergraduate students</td>
<td>61</td>
<td>Proximal goals</td>
</tr>
<tr>
<td>Stone (1994)</td>
<td>Computer decision making</td>
<td>Undergraduate students</td>
<td>139</td>
<td>Overconfidence in self-efficacy</td>
</tr>
<tr>
<td>Winters &amp; Latham (1996)</td>
<td>Class scheduling</td>
<td>Undergraduate students</td>
<td>114</td>
<td>Goals in complex and simple tasks</td>
</tr>
<tr>
<td>Wood &amp; Bandura (1989)</td>
<td>Organizational decision simulation</td>
<td>Undergraduate students</td>
<td>24</td>
<td>Ability conceptions</td>
</tr>
<tr>
<td>Wood, Bandura, &amp; Bailey (1990)</td>
<td>Organizational decision simulation</td>
<td>Undergraduate students</td>
<td>60</td>
<td>Goals in high and low complexity tasks</td>
</tr>
</tbody>
</table>
The seven studies that used the computer simulation are discussed here. In five of the seven studies, researchers investigated the effects of verbal persuasion on self-regulatory factors and performance in the computer simulation task. Researchers manipulated task complexity in one study, and assigned goals and feedback in another.

First, Bandura and Jourden (1991) investigated the effects of social comparison on self-efficacy perceptions, analytic strategies, personal goals, self-evaluations, and performance in the simulated organization task. These researchers also found that self-regulatory factors (self-efficacy perceptions, analytic strategies, personal goals, and self-satisfaction) and past performance mediated the effects of verbal persuasion on performance. Verbal persuasion in this study consisted of feedback that communicated how subjects performed compared to their fellow subjects. Those who perceived they were progressively mastering the task strengthened their self-efficacy perceptions, efficient analytic thinking, personal goals, helpful self-evaluations, and performance over experimental trials. Perceived progressive decline relative to others led to negative effects on these variables. Perceived similarity and perceived superiority conditions led subjects to strengthen their self-efficacy perceptions, but not to increase their personal goals.

Second, Bandura and Wood (1989) investigated the effects of perceived controllability and difficulty of assigned goals on self-regulatory factors (self-efficacy perceptions, personal goals, analytic strategies) and performance. They found that the self-regulatory factors and past performance mediated the effects of verbal persuasion on performance. Subjects who were led to believe that organizations are easily controlled performed better, set higher goals, used more efficient analytic strategies, and reported
stronger perceived self-efficacy. Subjects who were led to believe that organizations are difficult to control reported negative effects on these measures. For subjects who perceived organizations are readily controllable, assigned, easy goals led to stronger self-efficacy perceptions, and assigned, difficult goals led to weaker self-efficacy perceptions. Self-efficacy perceptions did not vary based on difficulty of assigned goals for subjects who perceived organizations were difficult to control.

Cervone, Jiwani, and Wood (1991) used the computer simulation task to investigate the effects of assigned goals on self-regulatory factors (self-efficacy perceptions, self-evaluations, and personal goals) in a third study. They found that the specificity of assigned goals moderated the effect of the self-regulatory factors on performance so that self-efficacy perceptions and self-evaluations influenced performance more when subjects had an assigned specific goal versus a "do your best" goal.

Fourth, Cervone and Wood (1995) extended from goal setting research to self-efficacy perception research the idea that interactive goal and feedback effects may influence performance. They found that the combination of specific goals and specific outcome feedback moderated the relationship between self-regulatory factors (self-efficacy perceptions, self-evaluations, and personal goals) and performance, so that specific goals and feedback used together led to highest performance. Subjects who received less specific feedback and no goals did not perform as well as those who received specific goals and feedback.

Fifth, Jourden (1992) investigated the effects of feedback framing on self-regulatory factors and performance in the computer simulation task. He found that self-regulatory
factors (self-efficacy perceptions, self-evaluations, and analytic strategies) and past performance mediated the effects of feedback on performance. Feedback framing differentially influenced these factors. Subjects who received gain-framed feedback phrased in terms of their progress, reported more stable self-efficacy perceptions, higher self-evaluations, higher personal goals, better analytic strategies, and higher performance than subjects who received deficit-framed feedback phrased in terms of their distance from the desired standard.

Wood and Bandura (1989a) conducted a sixth study using the computer simulation task, and sought to understand how subjects’ conceptions of ability, induced using verbal persuasion, influenced self-regulatory factors and performance. They found that self-regulatory factors (efficacy perceptions, analytic strategies, and personal goals) and past performance mediated the effects of this verbal persuasion on performance. Subjects who perceived that ability in performing the task was an acquirable skill maintained their strength of self-efficacy perceptions, set higher personal goals, used effective analytic strategies, and performed better than those who perceived that ability was a stable entity. These subjects reported negative effects on these variables.

Seventh, Wood, Bandura, and Bailey (1990) investigated the effects of task complexity on the effects of assigned goals on self-regulatory factors (self-efficacy perceptions, personal goals, and analytic strategies) and performance of the computer simulation task. Component and coordinative task complexity were lowered in the low complexity condition by reducing the number of employees supervised and the degree of match required between employees and jobs. Self-regulatory factors (self-efficacy
perceptions, personal goals, and analytic strategies) and past performance mediated the effects of assigned goals on performance. Task complexity moderated the relationship between assigned goals and performance, so that assigned goals did not influence performance in the high complexity condition.

In three studies, researchers used problem solving tasks in which subjects considered multiple cues and uncertain relationships between cues and criteria. Due to these attributes, the tasks were high in coordinative and component complexity. First, Stock and Cervone (1990) used two problem-solving tasks in order to examine the effects of proximal goal setting on self-regulatory factors (self-efficacy perceptions and self-evaluations) and task persistence. In the first task, subjects pretended to transfer fictitious characters (missionaries and cannibals) across a river given certain constraints. In the second task, subjects matched fictitious students and residences given a list of clues. The authors found that self-efficacy perceptions mediated the effects of proximal goals on persistence, and that attainable proximal goals led to stronger self-efficacy perceptions, more helpful self-evaluations, and higher levels of persistence than in the no proximal goal or unattainable proximal goal conditions.

Researchers in two other studies used a problem-solving task in which students prepare a number of class schedules while avoiding scheduling conflicts (Latham, Winters, & Locke, 1994; Winters & Latham, 1996). Latham, et al. (1994) investigated the effects of participation in goal setting and strategy formation on self-regulatory factors (self-efficacy perceptions and analytic strategies) on performance. They found that self-regulatory factors mediated the effects of participation in strategy formation on
performance. Participation in goal setting did not influence performance over assigned goals. Assigned, difficult goals did not directly impact performance because self-efficacy perceptions completely mediated the effect. Winters and Latham (1996) used the same class scheduling task to examined the relative effectiveness of learning goals, outcome goals, and "do your best" goals on self-regulatory factors (self-efficacy perceptions and analytic strategies) and performance. Learning goals included outcome measures to strive for and shortcuts to use during task performance, and outcome goals included only a numeric performance goal. The authors found that difficult learning goals more positively affected performance than outcome goals. Difficult learning goals and outcome goals similarly and positively influenced self-efficacy perceptions, and self-efficacy perceptions were significantly stronger in the learning goal group than in the "do your best" group. In the same study, Winters and Latham used a simplified version of the scheduling task and found outcome goals to be superior to "do your best" goals in influencing performance. They defined a simple task as one in which subjects did not need to learn a task strategy or strategies to perform, and in which performance was increased directly through effort and persistence.

Stone (1994) used a computer decision-making task in order to determine how overconfidence in initial measures of self-efficacy perceptions influence performance. In this task, subjects made optimal choices of colleges based on cues (e.g., student quality) and criteria given to them before the task. Component and coordinative complexity resulted from the need to match multiple cues with a choice for which the decision rules were not clear. Stone found that initial self-efficacy perception estimates in complex tasks
tend to be overestimated and did not influence future performance, effort, and analytic strategy formation. When subjects received induced, mildly negative expectations for performance, more positive outcomes resulted versus when they received strongly negative or positive expectations. Johnson, et al. (1993) also used a computer simulation in their study, in which they examined the effects of learning-oriented and performance-oriented feedback. Subjects used the Space Shuttle Remote Manipulation System (RMS) to simulate the retrieval and storage of the shuttle’s payload. Component complexity was high because subjects dealt with 27 manipulation rules. Learning-oriented feedback informed subjects of the types of errors they made and the correct method for avoiding the error in the future, and led to better performance than subjects who received performance-oriented feedback that only informed them of the types of errors they made. Johnson, et al. also found that self-efficacy perception strength moderated the effects of the feedback on performance, so that individuals with strong self-efficacy perceptions performed best with performance-oriented feedback and those with weak self-efficacy perceptions performed best with learning-oriented feedback. These results are consistent with research on behavioral plasticity effects, in which people with weak self-efficacy perceptions are more easily influenced with verbal persuasion.

An exhaustive search of psychological and organizational literature revealed two studies in which the MCPLP and/or the Brunswik (1955) lens model were used. Quiñones (1995) used a Naval Air Defense simulation that required subjects to make decisions after being assigned randomly to training groups labeled remedial or advanced. The task was a computer Naval Air Defense simulation in which subjects decided how to react given a
number of situational cues (e.g., speed, altitude, identification as friend or foe), and this caused component complexity. The task included possible nonlinear relationships of cues to the criterion, and this added coordinative complexity. Quinones found that subject attributions about past performance moderated the relationship between the training assignment and self-efficacy perceptions so that subjects who attributed their performance to ability reported the strongest self-efficacy perceptions in the advanced training group and those who attributed their performance to external causes reported the strongest self-efficacy perceptions in the remedial training group. Expected training assignment moderated the relationship between training assignment and fairness perceptions so that subjects who expected to be assigned to advanced training perceived highest fairness when assigned to the advanced group, and those who expected a remedial assignment perceived highest fairness when assigned to the remedial group.

Mitchell, Hopper, Daniels, George-Falvy, and James (1994) used the same task as Quinones (1995) to examine the individual process of determining self-efficacy perceptions while acquiring skills, but they did not mention using the MCPLP or lens model. Mitchell, et al. found that subjects reported they used a more effortful, comprehensive cognitive process to estimate self-efficacy perceptions for initial task performance, but shifted to a less effortful, quick cognitive process in later stages of performance.

No study was found that included the lens model and/or the MCPLP to study self-efficacy perceptions with goals or feedback. In addition, Stone (1994) stated that a paper by Switzer and Sniezek (1991) is an example of a complex task self-efficacy study. The
focus of this study was an act-to-product contingency, which is described as a subjective probability function relating to the level of time and effort spent on a task to produce a given level of outcomes. Self-efficacy is a broader construct that depends on much more than estimations of effort and time inputs (Bandura, 1997), so this was not a self-efficacy perception study. Therefore, the Switzer and Sniezek (1991) study was not included in this literature review.

In summary, half of the complex task studies of self-efficacy included the same computer simulation decision task. Other authors used different computer simulations, problem-solving tasks, or an MCPLP task. The majority of these tasks were complex due to component complexity, based on the number of cues subjects must deal with, and coordinative complexity, based on the uncertainty of the relationships between cues and criteria. Task complexity played an important role as a moderator in two of the studies in which the effectiveness of goals were altered for complex tasks versus less complex tasks (Winters & Latham, 1996; Wood, et al., 1990). It is important to specifically research the role of self-efficacy perceptions in complex task environments because task complexity can influence the relationship between external factors, self-regulatory factors, and performance.

The manipulated variables in all of these studies were similar in that some external influence was used to affect outcome variables through the influence of self-regulatory variables. In eight of the studies, researchers used feedback or task instructions to determine how self-efficacy perceptions and task performance were strengthened. Assigned goals were manipulated in six of the studies (one study used both a goal and
feedback manipulation). In one study, the researchers investigated the process of forming self-efficacy perceptions, a topic that received little research attention (Bandura, 1997). All of the researchers found that forms of external influence changed self-efficacy perceptions and other self-regulatory variables such as self-evaluations, analytic strategies, and personal goals. In six of these studies, researchers used path analysis to show that self-regulatory factors mediated the effects of external influences on performance and/or effort. These results reaffirm Bandura’s (1997) conclusion based on self-efficacy perception research that self-regulatory factors mediate the relationship between external influences and outcomes.

Researchers used the Brunswik (1955) lens model and/or MCPLP in two of these studies. More knowledge is needed of how self-efficacy perceptions operate in complex task environments (Stone, 1994), and the lens model and MCPLP appear to be valuable frameworks for increasing this knowledge. Extending self-efficacy research to different complex tasks and analysis frameworks will be valuable to both check the effects of past studies and to provide different types of data that can be used to understand the construct.

Self-Efficacy Perceptions

Self-efficacy perceptions influence both behavioral and affective outcomes (Bandura, 1997). In this study, self-efficacy is proposed to affect performance, effort, and persistence in the performance of a complex task. Table 2 displays a list of researchers who investigated these effects.
The Effect of Self-Efficacy Perceptions on Complex Task Performance

Self-efficacy perceptions positively predict performance in a wide variety of tasks and with a wide variety of subject types (Bandura, 1997). Locke and Latham (Locke & Latham, 1990) combined the correlation coefficients between self-efficacy perceptions and performance for 13 studies (n = 2285). The resulting correlation was r = .42. This aggregated correlation provides information about the relationship between self-efficacy and performance, but only includes one complex task study. In addition, several researchers did not define self-efficacy perceptions as Bandura intended. Therefore, this information indicates that a strong relationship between self-efficacy perceptions and performance exists, but the strength of this relationship should be reanalyzed to confirm it for the complex task self-efficacy studies reviewed here.

In all of the studies in Table 2, researchers reported positive relationships between self-efficacy perceptions and performance, and that this relationship was present for specific experimental conditions, measures, and stages in the experiment. Self-efficacy perceptions were positively related to performance when subjects were given specific goals versus "do your best" goals (Bandura & Jourden, 1991), performance-oriented feedback versus learning-oriented feedback (Johnson, et al., 1993), mildly negative performance expectations versus positive or strongly negative expectations (Stone, 1994), and with difficult goals and specific feedback versus no goals and non-specific feedback (Cervone & Wood, 1995). Quiñones (1995) used both a qualitative and quantitative performance measure in his study, but only found a positive relationship between self-efficacy and performance for the qualitative measure.
Table 2

Effects of Self-Efficacy Perceptions on Performance, Effort, and Persistence

<table>
<thead>
<tr>
<th>Study</th>
<th>SE—P</th>
<th>SE—E, Pers.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandura &amp; Jourden (1991)</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandura &amp; Wood (1989)</td>
<td>+*</td>
<td></td>
<td>*in later trial only</td>
</tr>
<tr>
<td>Cervone, Jiwani, &amp; Wood (1991)</td>
<td>+*</td>
<td></td>
<td>*only with specific goal</td>
</tr>
<tr>
<td>Cervone &amp; Wood (1995)</td>
<td>+*</td>
<td></td>
<td>*only with challenging goals and highly specific feedback</td>
</tr>
<tr>
<td>Johnson, Perlow, &amp; Pieper (1993)</td>
<td>+*</td>
<td></td>
<td>*for performance-oriented feedback; negative effects for learning-oriented feedback</td>
</tr>
<tr>
<td>Jourden (1992)</td>
<td>+*</td>
<td></td>
<td>*in later trial only</td>
</tr>
<tr>
<td>Latham, Winters, &amp; Locke (1994)</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitchell, Hopper, Daniels, George-Falvy, &amp; James (1994)</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quiñones (1995)</td>
<td>+*</td>
<td></td>
<td>*for qualitative measure</td>
</tr>
<tr>
<td>Stock &amp; Cervone (1990)</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stone (1995)</td>
<td>+*</td>
<td>+*</td>
<td>*strongest when subjects received mildly negative performance expectations</td>
</tr>
<tr>
<td>Winters &amp; Latham (1996)</td>
<td>+</td>
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<td></td>
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<tr>
<td>Wood &amp; Bandura (1989)</td>
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<td></td>
</tr>
<tr>
<td>Wood, Bandura, &amp; Bailey (1990)</td>
<td>+</td>
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</tbody>
</table>

*Note. SE = Self-efficacy perceptions; P = Performance; E = Effort; Pers. = Persistence.*
Finally, Wood, et al. (1990) found that the influence of self-efficacy perceptions on performance increased over the experimental trials. This is consistent with the conclusion by Wood and Bandura's (1989b) conclusion that the influence of self-efficacy increases over time as more knowledge about the task and skills affect perceptions of performance ability.

The findings for all the studies in Table 2 indicate causation because the researchers always measured performance after self-efficacy and used statistical methods that allow for causal inference (ANOVA, regression, path analysis). Numerous authors confirmed that self-efficacy perceptions positively predict performance (Bandura, 1997). Self-efficacy perceptions exert independent and powerful effects on performance, even with past performance controlled (Locke, Frederick, Lee, & Bobko, 1984).

**Conceptual and Measurement Issues About Self-Efficacy Perceptions and Performance**

Although researchers found positive relationships between self-efficacy and performance in all of the complex task studies, researchers of some simple task studies failed to find a relationship (Thomas & Mathieu, 1994). In these studies, self-efficacy perceptions often still played an important role in their influence on personal goals. In some studies, distortions or misinformation are purposely given to the subjects, and this also lessens the relationship between self-efficacy perceptions and performance (e.g., Quiñones, 1995; Stone, 1994). People with strong self-efficacy perceptions may choose not to perform due to such reasons as anticipated social reactions, modesty, lack of
incentives, or ambiguous tasks that are difficult to assess (Bandura, 1986). Ceiling effects may also occur when people initially report strong self-efficacy perceptions.

Methodological problems can be the reason that self-efficacy perceptions do not positively predict performance. These include a time lag between the measurement of self-efficacy and the performance predicted, and self-efficacy measures that are too global (Bandura, 1986; Bandura, et al., 1982). Self-efficacy perceptions are concerned with the performance of specific tasks, and the key to the predictability of the construct is its microanalysis of behavior. This microanalysis includes asking subjects whether they can perform specific behaviors at several levels of the behavior (Bandura, 1995). For example, subjects in an experiment may be asked to respond with their confidence level in the statement, “I can lift 20 pounds.” The subjects respond in terms of their confidence (zero to 100), and are asked the same question for 40 pounds, 60 pounds, and 80 pounds. The sum of the reported confidence levels for each subject is the self-efficacy strength measure. Kirsch (1980) argued that this method artificially inflates the correlation between self-efficacy and performance because it is not compared to the relationship that would be expected by chance. If people report strong confidence in their ability to lift 80 pounds, then they must also be able to lift 40 and 60 pounds, and the levels of performance are not independent. In response to Kirsch’s (1980) criticism, Cervone (1984) developed a statistical procedure to estimate chance congruence between self-efficacy and behavior. Cervone’s application of the procedure demonstrated that self-efficacy was significantly related to behavior when considering chance occurrence. Bandura (1980) stated, though, that not all studies with positive results have measures
that assess progressive levels of attainment, such as those measuring self-efficacy perceptions of social capabilities (e.g., "I can approach my professor."). He also stressed that the goal of self-efficacy studies is not to show their predictive ability as compared to chance, but simply the prediction of behavior.

**Self-Efficacy Effects on Effort and Persistence**

Effort is a critical component of motivation (Kanfer, 1987). Researchers often use performance measures as proxies for motivation, which is dependent on the effort a person applies to performance. When researchers use performance as a proxy measure of motivation, they implicitly assume that the relationship between effort and performance is linear. In some studies, this linear relationship is clear. For example, Bandura and Cervone (1983; 1986) conducted studies in which subjects peddled a stationary cycle, and effort was directly related to performance. In contrast to a study such as this, however, effort is often not linearly related to performance in complex and cognitive tasks (Kanfer, 1987). The implication of this is that researchers may need to measure both effort and performance if they are concluding that motivation was affected. Therefore, researchers can avoid erroneously reporting that motivation increased when performance increased without a change in effort, or that motivation did not increase when effort increased without changing performance significantly. Stone (1994) demonstrated in his study how measuring effort and performance helps to conclude that motivation was affected. He found that, even though his task was complex, effort and information search mediated the effect of self-efficacy perceptions on performance. By conducting a mediator analysis
using ANCOVA, he concluded that increases in performance were due to increased effort.

Persistence is another important measure of motivation, and is defined as effort maintained over time (Locke & Latham, 1990). Persistence is usually defined in self-efficacy studies as time spent in an activity or the number of tasks attempted over time. Researchers who used simple tasks found that self-efficacy affects effort and persistence (Bandura, 1997). In two complex task studies in Table 2, researchers investigated the effect of self-efficacy on effort and persistence (Stock & Cervone, 1990; Stone, 1994). Stock and Cervone (1990) found that subjects who attained proximal goals increased their persistence. The authors also used regression analysis to determine that self-efficacy perceptions mediated the effect of proximal goals on persistence. Stone (1994) found that subjects given mildly negative performance expectations were most persistent versus those who received positive or strongly negative expectations. Therefore, the conclusion thus far in self-efficacy research is that persistence is affected by external influences in complex task performance, and that self-efficacy perceptions mediate these effects. Authors investigated these relationships in two studies, and more research is needed to explore the relationship between self-efficacy perceptions, effort, and persistence in complex tasks.

Past Performance

Past performance is an important input into the formation of self-efficacy perceptions. This is illustrated by research results indicating that personal mastery experiences are the
most influential sources of information in forming self-efficacy judgments (Bandura, 1982). The measurement of past performance includes the influence on self-efficacy perceptions and other self-regulatory factors (personal goals, analytic strategies, and self-evaluations) before the performance took place (Wood & Bandura, 1989a). If the effects of past self-efficacy perceptions and other self-regulatory factors were removed from past performance before it was used to predict future self-efficacy perceptions, past performance would not be perfectly correlated with future self-efficacy perceptions. This is because self-efficacy perceptions are influenced by many other environmental and personal resources and constraints in addition to past performance (Bandura, 1997). The influence of past performance on self-efficacy perceptions is also affected by the fact that perceived performance may not be equal to objective performance. Despite this, past performance is one important input into the formation of self-efficacy perceptions, and consistently influenced them in complex task self-efficacy studies (see Table 3).

Past performance also affects personal standards. Enactive mastery experiences provide important information regarding discrepancies between desired and actual performance. These discrepancies affect perceived self-efficacy because people gain knowledge about the difficulty of reaching goals in a given situation. These perceptions affect the level of personal goals people then set for themselves. People use personal goals to motivate themselves (Bandura, 1997). In four complex task self-efficacy studies, researchers investigated the effect of past performance on personal goals and found positive relationships (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone, et al., 1991; Wood & Bandura, 1989a).
Table 3

<table>
<thead>
<tr>
<th>Study</th>
<th>PP—SE</th>
<th>PP—PG</th>
<th>PP—FP</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandura &amp; Jourden (1991)</td>
<td>+</td>
<td>*+</td>
<td>+</td>
<td>*in later trial only</td>
</tr>
<tr>
<td>Bandura &amp; Wood (1989)</td>
<td>+</td>
<td>*+</td>
<td>+</td>
<td>*in early trial only</td>
</tr>
<tr>
<td>Cervone, Jiwani, &amp; Wood (1991)</td>
<td>*+</td>
<td>*+</td>
<td>NS</td>
<td>*when subjects had specific goals</td>
</tr>
<tr>
<td>Cervone &amp; Wood (1995)</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Mitchell, Hopper, Daniels, George-Falvy, &amp; James (1994)</td>
<td>+</td>
<td></td>
<td>+</td>
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<tr>
<td>Stock &amp; Cervone (1990)</td>
<td>+</td>
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<tr>
<td>Wood &amp; Bandura (1989a)</td>
<td>+</td>
<td>*+</td>
<td>NS</td>
<td>*in early trial only</td>
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<tr>
<td>Wood, Bandura, &amp; Bailey (1990)</td>
<td>+</td>
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</tbody>
</table>

*Note. PP = Past Performance; SE = Self-Efficacy; PG = Personal Goals; FP = Future Performance.*

First, Cervone, et al. (1991) examined the influence of assigned goals on the relationship between self-regulatory factors (personal goals, self-efficacy perceptions, and personal goals) and performance. Past performance influenced personal goals only with
an assigned specific goal versus a "do your best" goal. In the three other studies, however, the positive relationship was not consistent for every trial (see Table 3). Bandura and Jourden (1991) investigated the effects of feedback containing social comparison information that suggested progressive mastery, progressive decline, consistently similar, or consistently superior performance. Past performance influenced personal goals in the later experimental trial, but not in the early trial. Bandura and Wood (1989) manipulated task instructions to study the effects of induced perceived controllability of the task. In contrast to Bandura and Jourden's (1991) results, they found in their path analysis that past performance influenced personal goals in the early trial only. Wood and Bandura (1989a) also investigated the effects of manipulating task instructions, but to induce conceptions of ability as a stable entity or as an acquirable skill. They also found that past performance influenced personal goals in the early trial only.

In these three studies, the authors suggested reasons for different effects of past performance on personal goals over the experimental trials. Bandura and Wood (1989) and Wood and Bandura (1989a) found that past performance influenced personal goals only in an early trial, while Bandura and Jourden (1991) found that past performance influenced personal goals only in a later trial. The mediating effects of personal goals on future performance differed, however. Bandura and Wood (1989) and Bandura and Jourden (1991) both found that personal goals mediated past performance effects on future performance only in the later trial because subjects had gained more information about their knowledge and skills that enabled them to set personal goals. Wood and Bandura (1989a), however, found that the mediating influence of personal goals was only
present in the first trial. According to Wood and Bandura, these overall weak effects of personal goals may be expected in complex task performance because subjects are not able to assess their skills and knowledge in terms of desired performance as easily as in simple tasks. These different results and conclusions suggest that more research is needed to understand how personal goals are formed over experimental trials.

Finally, past performance is a strong predictor of future performance. Self-efficacy may be a better predictor of future performance when self-efficacy perceptions are altered to reflect changed skills, knowledge, resources, or constraints (Bandura, 1997). The self-efficacy perception measure reflects an updated appraisal of future performance that is more accurate than the past performance, especially as the gap in time between past performance and future performance increases and the self-efficacy assessment takes place close in time to the future performance. As indicated in Table 3, researchers who measured performance over trials in two studies did not find a direct relationship between past performance and future performance (Cervone, et al., 1991; Wood & Bandura, 1989a). In these studies, past performance affected future performance through self-regulatory factors.

Cervone, et al. (1991) used hierarchical regression and found that past performance influenced future performance through self-efficacy perceptions, personal goals, and self-evaluations. Wood and Bandura (1989a) found in a path analysis that self-efficacy perceptions, personal goals, and analytic strategies mediated the relationship between past performance and future performance. Researchers who found a direct influence of past performance on future performance stated that self-regulatory factors became more
influential and past performance became less influential as subjects gained information about the knowledge, skills, resources, and constraints that were needed for performance (e.g., Bandura & Jourden, 1991). The conclusion from the majority of these studies is that past performance is a significant predictor of future performance. According to theory (Bandura, 1997), self-regulatory factors should become more influential than past performance in later trials, but most researchers found that past performance continued to exert a direct, significant influence on future performance throughout experimental trials.

Feedback

People gain information about task performance through feedback, which they use to evaluate past performance, and feedforward, which they use to predict future performance (both referred to as feedback here). Feedback is important because people use it to evaluate their past behavior based on internal standards they formed (Bandura, 1986). Information people gain from performance feedback is also used as a basis for forming self-efficacy perceptions concerning future performance (Karl, O'Leary-Kelly, & Martocchio, 1993). By affecting feedback, researchers can influence self-efficacy perceptions and personal goals, which then affect future performance (see Figure 2). Without feedback, self-efficacy perceptions in cognitively complex tasks will be overestimated (Stone, 1994).

The Effects of Feedback in Complex Task Self-Efficacy Studies

Feedback reinforces or causes reevaluation of currently held efficacy perceptions. Research on the relationship between feedback and self-efficacy perceptions is varied
with regard to the type and direction of feedback. The results of research on simple tasks clearly indicates that outcome feedback (OFB, or knowledge of results) affects self-efficacy perceptions (e.g., Krueger & Dickson, 1994). Specific characteristics of OFB that affect self-efficacy perceptions include information about progressive improvement or decline, performance relative to others (e.g., Bandura & Jourden, 1991), controllability of a situation (e.g., Martocchio & Dulebohn, 1994), and credibility of the feedback (e.g., Podsakoff & Farh, 1989).

In four complex task studies listed in Table 4, researchers investigated the effects of feedback on self-efficacy perceptions (Bandura & Jourden, 1991; Cervone & Wood, 1995; Jourden, 1992; Quiñones, 1995). In three of these studies, evaluative feedback was used. Evaluative feedback is a reflection of the quality of performance as compared to a standard, versus nonevaluative feedback that simply provides knowledge of how one performed (Naylor, et al., 1980). Bandura and Jourden (1991) examined the effects of framing feedback relative to others' performance. Feedback positively affected self-efficacy perceptions and personal goals so that those who perceived they were progressively mastering the task reported strengthened self-efficacy perceptions and higher personal goals, and those who perceived progressive decline reported weakened self-efficacy perceptions and lower personal goals. Subjects who perceived they were performing similarly to other subjects, or superiorly to other subjects also strengthened their self-efficacy perceptions, but did not increase their personal goals. Although the focus of this experiment was on comparative social information, the findings suggest that feedback communicating positive information strengthens self-efficacy perceptions, and
that feedback communicating progressive mastery causes higher personal goal setting.

Continual negative feedback can negatively affect self-efficacy perceptions and personal goal setting.

Cervone and Wood (1995) found that highly specific feedback negatively affected self-efficacy perceptions and personal goals, while less specific feedback did not. The authors stated that this occurred because subjects overestimated their initial self-efficacy perceptions on the novel task, and highly specific feedback sharply pointed out the negative discrepancies. Low specificity feedback contained partial outcome information from which subjects computed their overall performance level. Highly specific feedback contained additional information that made this computation unnecessary. The authors stated that this overestimation was not surprising because subjects estimated their self-efficacy initially without any task performance experience.

Table 4

Effects of Feedback on Self-Efficacy and Personal Goals

<table>
<thead>
<tr>
<th>Authors</th>
<th>F—SE</th>
<th>F—PG</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandura &amp; Jourden (1991)</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Cervone &amp; Wood (1995)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jourden (1992)</td>
<td>+*</td>
<td>+*</td>
<td>*negatively-framed (deficit) feedback negatively affected; positively-framed (gain) feedback positively affected</td>
</tr>
<tr>
<td>Quiñones (1995)</td>
<td>+*</td>
<td></td>
<td>*moderated by ability conceptions</td>
</tr>
</tbody>
</table>

*Note. F = Feedback; SE = Self-Efficacy; PG = Personal Goals.*
Feedback framing was further investigated by Jourden (1992), who gave subjects feedback using positive or negative phrasing. Subjects who received positively-framed feedback (in terms of performance gains) reported strengthened self-efficacy perceptions and higher personal goals, and those who received negatively-framed feedback (in terms of performance deficits) reported weakened self-efficacy perceptions and lower personal goals. Subjects in the negative condition reported feelings of frustration, depression, and lack of confidence due to the continual focus on performance deficiencies. This caused increased feelings of inefficacy, which affected personal goal setting and performance. Subjects in the positive condition reported feelings of increasing capability over trials because their focus was on performance gains. This strengthened their self-efficacy perceptions, increased their personal goal setting, and heightened their performance. Jourden concluded that, regardless of subjects' actual ability, the way feedback is framed is an important factor in affecting self-efficacy perceptions, personal goals, and performance. These findings suggest that positive information about performance strengthens self-efficacy and raises personal goal setting, and that negative information weakens self-efficacy and lowers personal goal setting.

Finally, Quiñones (1995) randomly assigned subjects to either an advanced or remedial condition, although subjects were told their assignments were based on their trial performances. He found that subject attributions about past performance moderated the relationship between the training assignment and self-efficacy perceptions so that subjects who attributed their performance to ability had the strongest self-efficacy perceptions in the advanced training group and those who reported low attribution of
performance to ability had the strongest self-efficacy perceptions in the remedial training group. Overall, subjects in the advanced training group reported the strongest self-efficacy perceptions. Quiñones concluded that the framing of training assignments can affect self-efficacy perceptions and performance, independent of ability. As in other studies, positive feedback strengthened self-efficacy perceptions and raised personal goal setting, and negative feedback weakened self-efficacy perceptions and lowered personal goal setting.

In summary, researchers of simple tasks found that OFB, whether it is correct or incorrect, influences self-efficacy and personal goals (Bandura, 1997). Positive feedback positively influenced self-efficacy and personal goals, and negative feedback negatively influenced self-efficacy and personal goals. Subjects who form initial self-efficacy estimations without task experience tend to overestimate their capability, however, and highly specific feedback (versus less specific) communicating this discrepancy negatively affects future self-efficacy and personal goals (e.g., Cervone & Wood, 1995). Researchers in three studies found that different forms of positive feedback strengthened self-efficacy perceptions and personal goals (Bandura & Jourden, 1991; Jourden, 1992; Quiñones, 1995). In these studies, feedback was manipulated to appear positive, regardless of the objective information conveyed. Because researchers investigated the effects of feedback in only four complex task studies, and because these studies focused on evaluative feedback, these results need further exploration as they relate to nonevaluative feedback.
Effects of Outcome Feedback on Performance in MCPLP Studies

Because little research has been done on the effects of feedback in complex task self-efficacy studies, the effects of OFB on self-efficacy perceptions and performance remains undetermined. Investigation of lens model research provides some insight into the mixed effects of OFB on performance. In a recent literature review of the effects of OFB, Balzer, et al. (1989) proposed that OFB effects on performance may be moderated by task complexity so that OFB has lesser, or even damaging, effects in complex tasks. The authors found positive findings for OFB in general, but cognitive feedback (CFB) was found to be superior in many studies. CFB provides knowledge about relationships between the person, the environment, and the person’s perceptions. Researchers of some lens model studies found that OFB was detrimental to performance of complex tasks (e.g., Hammond, et al., 1973). Others found that OFB produces positive outcomes in lens model studies (e.g., Taylor, Hall, Cosier, & Goodwin, 1996).

Summary: The Effects of Outcome Feedback

Lens model researchers conducted a significant amount of research on the effects of OFB in complex tasks. These researchers suggested that OFB effects may be lessened in complex tasks, although mixed results exist. Researchers established that OFB influences self-efficacy perceptions and personal goals in simple tasks. Few researchers of self-efficacy studies investigated nonevaluative OFB in complex tasks, so its effects are yet to be established conclusively. In the research that exists, however, positively-framed feedback appears to increase personal goals and strengthen self-efficacy perceptions,
while negatively-framed feedback appears to decrease personal goals and weaken self-efficacy perceptions. For novel tasks, subjects may need task experience before making self-efficacy estimations so that feedback is not highly discrepant from overestimates of ability.

Goals

Goals both affect and are affected by self-efficacy perceptions. In the theoretical model for this study (Figure 2), assigned goals can be viewed as a form of verbal persuasion that influence self-efficacy perceptions and personal goals (Bandura, 1997). Earley and Liturchy (1991) compared three models that depicted different relationships between self-efficacy perceptions, assigned goals, personal goals, ability, and performance, developed by Locke and Latham (1990), Garland (1985), and Eden (1988). Earley and Liturchy found the best fit for Locke and Latham's (1990) model (Figure 4). Locke and Latham aggregated data from 13 studies in order to test the relationships in this model (n = 2285). The computed correlations are largely from studies using simple tasks (correlations were not available for ability effects on self-efficacy and personal goals).

Figure 4. Locke and Latham's (1990) model (with first-order correlations).
The Relationships Between Personal Goals, Self-Efficacy, and Performance

In Figure 4, personal goals are an important mediator between self-efficacy perceptions and performance, and between assigned goals and performance (Locke & Latham, 1990). Personal goals motivate people in the same way that assigned goals do, through increased effort and persistence, directed attention, and better strategies (Locke, et al., 1981), but people adjust their personal goals to reflect past performance and changing perceived competency (Bandura, 1997). Although researchers studying the effect of personal goals on performance in simple tasks consistently found positive and significant effects, the effects in complex, uncertain environments were questioned by Bandura and Jourden (1991) based on their study (see Table 5). They attributed weaker effects of personal goals on performance to the complex task that required more coordination than simple tasks.

Bandura and Jourden stated that task complexity may cause difficulty for subjects attempting to estimate their self-efficacy, and this may impede their personal goal setting. Wood and Bandura (1989a) also attributed weak effects to task complexity, and cited research that supported weaker personal goal effects in complex tasks (Wood, et al., 1987). Jourden (1992) attributed his nonsignificant findings to the fact that feedback contained some goal information that may have overridden personal goal setting. The feedback in Jourden’s study was phrased in comparison with a preset assigned standard, so subjects were constantly reminded of this externally-imposed standard. The effect of personal goals on effort and persistence in complex tasks has not been studied.
Table 5

Self-Efficacy Effects on Personal Goals

<table>
<thead>
<tr>
<th>Authors</th>
<th>PG—P</th>
<th>SE—PG</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandura &amp; Jourden (1991)</td>
<td>+*</td>
<td>*</td>
<td>in later trial</td>
</tr>
<tr>
<td>Bandura &amp; Wood (1989)</td>
<td>+*</td>
<td>+</td>
<td>* in later trial</td>
</tr>
<tr>
<td>Cervone, Jiwani, &amp; Wood (1991)</td>
<td>+*</td>
<td></td>
<td>* in later trial</td>
</tr>
<tr>
<td>Cervone &amp; Wood (1995)</td>
<td>+*</td>
<td>+</td>
<td>*only with assigned, challenging goals and highly specific feedback</td>
</tr>
<tr>
<td>Jourden (1992)</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitchell, Hopper, Daniels, George-Falvy, &amp; James (1994)</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood &amp; Bandura (1989a)</td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Wood, Bandura, &amp; Bailey (1990)</td>
<td>+*</td>
<td>+</td>
<td>* in later trial</td>
</tr>
</tbody>
</table>

Note. PG = Personal Goals; P = Performance; SE = Self-Efficacy Perceptions.

Self-efficacy perceptions positively affect personal goal setting because people with stronger perceptions of their capability to perform raise their personal standards (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone & Wood, 1995; Wood, et al., 1990). Wood and Bandura (1989a) did not find this effect and stated that this may be attributed
to the longer intervals in which they measured personal goals as compared to previous studies. Distal personal goals for an entire block of performance trials may have been less motivating to subjects than proximal goals set for each trial.

**Assigned Goal Effects on Self-Efficacy Perceptions and Personal Goals**

Self-efficacy perceptions and personal goals mediate the relationship between assigned goals and performance (Bandura, 1986). Although Locke and Latham found positive effects in their aggregated analysis (Figure 4), researchers of complex tasks reported mixed results. In Table 6, findings of these studies and the goal manipulations that were used are listed.

Authors of two studies in Table 6 reported nonsignificant effects of assigned, difficult goals on self-efficacy perceptions and personal goals (Cervone, et al., 1991; Wood, et al., 1990). Cervone et al. (1991) compared the effects of assigned, difficult goals, assigned moderate goals, and no goals on self-efficacy perceptions and personal goals, and found that assigned goals did not significantly affect either construct. Goal manipulation tests revealed that subjects did not perceive the difficult and moderate goal conditions to be different, so they were combined. Wood, et al. (1990) compared the effects of difficult goals with “do your best” goals and found nonsignificant effects of assigned goals. They concluded that subjects did not base their personal goal setting on assigned goals, but on other factors such as self-efficacy perceptions.
### Table 6

**Assigned, Difficult Goal Effects on Personal Goals and Self-Efficacy Perceptions**

<table>
<thead>
<tr>
<th>Authors</th>
<th>ADG—SE</th>
<th>ADG—PG</th>
<th>ADG—P</th>
<th>Goal Manipulations</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandura &amp; Wood (1989)</td>
<td>—*</td>
<td>+**</td>
<td></td>
<td>1. Easy</td>
<td>*positive effect for easy goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Difficult</td>
<td>**in first trial</td>
</tr>
<tr>
<td>Cervone, Jiwani, &amp; Wood (1991)</td>
<td>NS</td>
<td>NS</td>
<td>+*</td>
<td>1. No goal</td>
<td>*with specific, moderately difficult or difficult goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Moderate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Difficult</td>
<td></td>
</tr>
<tr>
<td>Cervone &amp; Wood (1995)</td>
<td>−</td>
<td>−*</td>
<td>+*</td>
<td>1. No goal</td>
<td>*with challenging goals &amp; specific feedback</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Difficult</td>
<td></td>
</tr>
<tr>
<td>Latham, Winters, &amp; Locke (1994)</td>
<td>+</td>
<td>NS</td>
<td></td>
<td>1. Participative, difficult</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Assigned, difficult</td>
<td></td>
</tr>
<tr>
<td>Winters &amp; Latham (1996)</td>
<td>+</td>
<td>+</td>
<td></td>
<td>1. Difficult, outcome</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Difficult, learning</td>
<td></td>
</tr>
<tr>
<td>Wood, Bandura, &amp; Bailey (1990)</td>
<td>NS</td>
<td>NS</td>
<td>+*</td>
<td>1. Do your best</td>
<td>*in low complexity condition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Difficult</td>
<td></td>
</tr>
</tbody>
</table>

**Note.** ADG = Assigned, Difficult Goals; SE = Self-Efficacy Perceptions; PG = Personal Goals; P = Performance.

In two studies, researchers found that assigned, difficult goals influenced self-efficacy perceptions positively (Latham, et al., 1994; Winters & Latham, 1996). Latham, et al. (1994) studied the effects of participatively-set difficult goals versus assigned, difficult
goals on self-efficacy perceptions, and found that, although degree of participativeness did not significantly affect self-efficacy perceptions, goal difficulty strengthened them. Assigned, difficult goals did not directly impact performance because self-efficacy perceptions completely mediated the effect.

Winters and Latham (1996) also found that assigned, difficult goals strengthened self-efficacy perceptions when they compared the effects of difficult outcome goals, difficult learning goals, and "do your best" goals. Learning goals included outcome measures to strive for and shortcuts to use during task performance, and outcome goals included only a numeric performance goal. The authors found that difficult learning goals more positively affected performance than outcome goals. Difficult learning goals and outcome goals similarly and positively influenced self-efficacy perceptions, and self-efficacy perceptions were significantly stronger in the learning goal group than in the "do your best" group. Bandura and Wood (1989) found a more positive effect of assigned, difficult goals on personal goals versus easy goals, but this effect was only present in the first trial.

Assigned, difficult goals affected self-efficacy perceptions negatively in two studies (Bandura & Wood, 1989; Cervone & Wood, 1995). In Bandura and Wood's (1989) study, subjects with induced perceptions that task performance was controllable (versus uncontrollable) were detrimentally affected by difficult goals, but positively affected by easy goals. Cervone and Wood (1995) found that assigned, difficult goals negatively affected self-efficacy perceptions and personal goals, and that no goal nonsignificantly affected these constructs. They stated that the negative effect was unusual and was due to the initial overestimation of self-efficacy perceptions and personal goals in a novel task.
Assigned goals affect performance directly and through their influence on cognitive mediators. In three complex task self-efficacy studies, researchers reported a direct, positive influence of assigned, difficult goals on performance, but with moderating influences. These findings were positive only for specific, moderately difficult, or difficult goals (Cervone, et al., 1991), for challenging goals combined with specific feedback (Cervone & Wood, 1995), and in a low task complexity condition (Wood, et al., 1990). Winters and Latham (1996) found that assigned goals affected performance positively without moderating influences, and Latham, et al. (1994) reported nonsignificant effects because self-efficacy acted as a complete mediator.

The effects of assigned, specific, and difficult goals on self-efficacy, personal goals, and performance are mixed in complex task self-efficacy studies. Due to the evidence presented in Table 6 and the small number of studies available, it is difficult to conclude that assigned, difficult goals led to higher self-efficacy perceptions and performance in complex tasks. It may be that task complexity somehow affected the influence of assigned, difficult goals on self-efficacy perceptions, personal goals, and performance. In addition, it appears that difficult goals may not be the most effective means for positively influencing these variables. A review of the research on easy goals in complex tasks is necessary to draw further conclusions.

**Easy Goal Effects in Complex Tasks**

All of the complex task self-efficacy studies in Table 6 included a difficult goal manipulation, but the other goal manipulations they used varied. Bandura and Wood
(1989) included an easy goal manipulation in their study, but they did not hypothesize higher performance for easy goals than for difficult goals. Stock and Cervone (1990) included three assigned goal conditions—no proximal goal, achievable proximal goal, and unachievable proximal goal. The achievable proximal goal can be described as an easy goal because it was reached by 95 percent of subjects. The easy proximal goal led to stronger self-efficacy perceptions than the other goal conditions. The purpose of Stock and Cervone's study was to examine the effects of proximal goals, but not to compare easy goals to moderate or difficult goals. Therefore, no conclusions can be drawn about the effectiveness of easy goals relative to more difficult goals. This is an important point because evidence exists that the effects of assigned goals may vary according to task complexity and that easy goals can be superior to difficult goals in complex task performance. This evidence may help explain the mixed results reported in Table 6.

In a series of studies, Taylor and his colleagues revealed that easy goals facilitated performance better than moderately difficult or impossible goals in complex MCPLP tasks (Taylor, 1987; Taylor, 1988; Taylor, et al., 1992; Taylor, et al., 1996; Taylor, 1984). Results indicated that task complexity may moderate the effect of goal difficulty on performance so that easy goals led to higher performance than moderate or impossible goals. This effect occurred because goal levels were distorted due to task complexity, making easy goals seem more difficult, and this facilitated higher performance. Moderate goals were distorted so that they seemed impossible. These findings are displayed in Table 7.
Table 7

MCPLP Effects of Assigned, Easy Goals on Complex Task Performance

<table>
<thead>
<tr>
<th>Study</th>
<th>EG—P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taylor (1984)</td>
<td>+</td>
</tr>
<tr>
<td>Taylor (1987)</td>
<td>+</td>
</tr>
<tr>
<td>Taylor (1988)</td>
<td>+</td>
</tr>
<tr>
<td>Taylor, Cosier, &amp; Ganster (1992)</td>
<td>+</td>
</tr>
<tr>
<td>Taylor, Hall, Cosier, &amp; Goodwin (1996)</td>
<td>+</td>
</tr>
</tbody>
</table>

Note. EG = Easy Goals; P = Performance.

The distortion of difficult goals in complex tasks is illustrated in Figure 5 (Taylor, et al., 1992). The subjects in the Taylor et al. (1992) study had different rates of goal achievement in the easy goal (98%), moderate goal (55%), and impossible goal (0%) conditions. Although these reflect the actual achievement rates, subjects' perceptions of task difficulty and performance are more important to explain their motivation. According to Taylor et al. (1992), achievement motivation (Atkinson, 1958) should be highest when people perceive they have a 50% chance of success. Actual perceptions by the participants in this study reveal that the easy goals were perceived to be closest to the 50% perceived probability of success (63.65%). Subjects with moderate goals perceived they had a low probability of success (37.31%), and those with impossible goals perceived their probability of success as higher than actual (16.28%). These subjects' perceptions illustrate the distortion created by uncertainty in a complex task and the
impact this can have on the impact of assigned goals on performance. If task complexity affects subjects' perceptions of goal difficulty and resultant performance, then it may affect perceptions of self-efficacy as well. Research results in Table 7 indicate that easy goals facilitate performance in complex tasks. Based on findings that the effects of assigned goals on performance are mediated by self-efficacy perceptions, the conclusion appears that easy goals may lead to stronger self-efficacy perceptions and, therefore, higher personal goals, in complex tasks.

Wood et al. (1990) corroborated the proposed moderating effect of task complexity on the relationship between goal difficulty and performance. They found that assigned, challenging goals positively affected performance in a low complexity task, but did not affect performance in a high complexity task. Personal goals did not change due to goal condition or to task complexity. Over 16 trials, the effects of assigned goals on performance strengthened.

Other researchers who investigated goal setting in complex tasks found that difficult goals did not affect performance, although few of these studies were conducted (Cervone & Wood, 1995). According to a meta-analysis of goal setting research, assigned goals have weaker effects in cognitively complex tasks as compared to simple tasks (Wood, et al., 1987). Goal setting researchers reported that effects of difficult goals on performance also are lessened in novel tasks (Earley, et al., 1989). Earley et al. reported that “do your best” goals were more beneficial to performance than specific, difficult goals in a complex, novel task. The authors stated that this was because specific, difficult goals
increased subjects' search for an optimal strategy, which was not effective in a complex task.

Figure 5. Comparison of perceived and actual complex task performance for easy, moderate, and impossible goals (Taylor, et al., 1992).

From the evidence reported in these studies, it can be concluded that the effectiveness of specific, difficult goals is compromised in complex MCPLP tasks. Although Bandura and Wood (1989) and Stock and Cervone (1990) incorporated an easy goal manipulation into their complex task self-efficacy studies, no self-efficacy researchers hypothesized
positive effects of easy goals over difficult goals on self-efficacy perceptions and performance. This omission calls for an analysis of the effects of easy goals on self-efficacy and performance in complex tasks. According to the theoretical model for this study (Figure 2), the analysis of task attributions is an important input into the formation of self-efficacy perceptions. Taylor, et al. (1992) suggested that subjects' perceptions of goal difficulty are important because they alter the effects of goal level on performance. Based on this argument, task complexity should also affect self-efficacy perceptions, and the change in this mediating factor may explain why performance gains are not found according to goal setting theory's propositions. Easy goals appear to positively influence performance in complex tasks, so easy goals may be expected to positively influence self-efficacy perceptions and personal goals as well.

The Effects of Task Experience

Task experience affects cognitive processes, whether they are antecedents or outcomes of performance. When self-efficacy perceptions are measured over more than one trial, it is expected that people will adjust their perceptions based on the most recent task experience and informational inputs. Researchers who investigate self-efficacy perceptions over more than one trial must consider the changing influences of self-efficacy and its inputs.

Task Experience Effects on the Relationship Between Self-Efficacy and Performance

People gain task experience when they perform a task repeatedly. The number of experimental trials can serve as a proxy for task experience, indicating that the more trials
subjects participated in, the more task experience they have. The amount of task experience moderates the relationship between self-efficacy and performance so that self-efficacy perceptions influence performance more in later stages than early stages. This effect is due to the increasing resilience of self-perceptions with experience. As people gain more knowledge about their skills, the task, resources, and constraints, they are able to form more accurate self-efficacy perceptions that influence performance. Past performance may even be a better predictor of future performance than self-efficacy perceptions during earlier stages of task performance because people are not able to accurately perceive their self-efficacy.

For example, Wood and Bandura (1989b) found that managers who attempted new, complex tasks relied on past performance to judge their self-efficacy and to set goals for themselves. As they gained more task experience, they formed self-efficacy perceptions that more strongly influenced performance than past performance (when prior self-regulatory influences are removed). Mastery experiences allowed the managers to develop discrepancy beliefs concerning their desired versus actual performance, and they more accurately perceived their self-efficacy. Other researchers (Bandura & Jourden, 1991; Bandura & Wood, 1989; Wood, et al., 1990) reported that self-efficacy became more influential over time in affecting complex task performance, while past performance became less influential over time. These researchers also concluded that subjects formed more accurate self-efficacy perceptions as they gained experience with a task. Past performance became less influential on future performance as compared to self-efficacy perceptions because self-efficacy perceptions became more accurate and resilient. It is
important to note, however, that past performance was adjusted in these analyses so that cognitive self-influences (e.g., self-efficacy perceptions) were partialled out of the measure. This may result in an unfair comparison between self-efficacy perceptions and past performance because all of the influences on past performance are not included in the analysis.

In contrast, Mitchell, et al. (1994) found that self-efficacy perceptions predicted complex task performance in early trials better than in later trials. In later trials, expected score and goal score predicted performance better. The authors concluded that what subjects thought they could do (self-efficacy perceptions) was a better predictor of performance in early stages, what they thought they would do (expected score) and wanted to do (goals) were better predictors when they learned the task. They stated that this may be because concrete data about performance was unavailable in early stages, and subjects relied more on perceptions. These results were qualified by the fact that the personal goal measure was problematic because subjects were asked to report their personal goals for the previous trial after they knew their performance level for that trial.

In summary, researchers who investigated the relative influence of self-efficacy perceptions and past performance over trials in complex tasks found some contradicting evidence. The majority of research findings are consistent with theory, though, in that self-efficacy perceptions exert a stronger influence in later trials than in earlier trials because these perceptions are more accurately formed with increased knowledge about skills, the task, resources, and constraints. In one study, self-efficacy perceptions exerted more influence in early trials than later ones, but some measurement problems existed.
Task Experience Effects on Personal Goals

Personal goals appear to have weakened effects in the performance of a complex task. Wood and Bandura (1989a) attributed this effect to the fact that, in complex tasks, people may not have the knowledge and skills to control their performance. The effect of personal goals on performance is lessened. This may also explain why researchers found that personal goals affected performance in later task performance, but not in early task performance in four complex task self-efficacy studies (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone, et al., 1991; Wood, et al., 1990). These authors suggested that the novelty of the task decreased with task experience, so the effect of personal goals increased. This is because self-efficacy perceptions became increasingly accurate in predicting performance and influenced personal goals as well.

Research Model and Hypotheses

This literature review presented the variables and relationships that will be investigated in this study. These relationships are illustrated in the research model (see Figure 6), and the proposed relationships are expressed in Hypotheses 1 through 12.

Hypothesis 1

Self-efficacy perceptions predict performance consistently in complex task self-efficacy studies. Researchers investigated the effects of self-efficacy on effort and persistence in two complex task self-efficacy studies (Stock & Cervone, 1990; Stone, 1994). The positive findings from these studies, combined with the similar findings in simple task self-efficacy studies, indicate that self-efficacy perceptions should affect
effort and persistence. Self-efficacy perceptions reflect people's beliefs in their ability to perform a task, and stronger perceptions encourage them to apply themselves. When people increase their effort and persist, their performance should increase also (Bandura, 1997).

**H1:** Stronger self-efficacy perceptions will result in higher levels of performance, effort, and persistence.

Figure 6. Research model for the present study showing predictive effects in a complex task.

Hypothesis 2

As illustrated in the theoretical model for this study (see Figure 2), people consider their past experience, task attributes, resources, and constraints when forming their perceptions of self-efficacy. Past performance is an important input into the formation of self-efficacy perceptions when the effects of previous self-regulatory influences are
removed, because it gives people information about their capabilities to perform a task. Past performance is not perfectly predictive of self-efficacy perceptions because other situational and personal factors may affect self-efficacy as well. Researchers of complex task self-efficacy studies found that past performance positively influences self-efficacy perceptions (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone, et al., 1991; Cervone & Wood, 1995; Mitchell, et al., 1994; Stock & Cervone, 1990; Wood & Bandura, 1989a; Wood, et al., 1990). Based on theory and evidence, it is expected that past performance will positively predict subsequent self-efficacy perceptions so that past performance increases will result in stronger self-efficacy perceptions.

\textit{H2: Higher levels of past performance will result in subjects reporting stronger subsequent self-efficacy perceptions.}

\textbf{Hypothesis 3}

Past performance is also an important predictor of personal goals. This is because task experience affords people knowledge about their performance levels, and they are more willing and able to set personal goals that will be motivating. Researchers of complex task self-efficacy studies supported this theoretical explanation (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone, et al., 1991; Wood & Bandura, 1989a). They concluded that the influence of past performance on personal goals may be weaker, however, in complex tasks versus in simple tasks. Weaker effects may be due to the fact that subjects have difficulty assessing the task, their skills, and the situational influences, and this makes setting motivating personal goals more difficult. Based on theory and the
predictability of personal goals in the complex task self-efficacy studies, however, past performance is expected to positively influence personal goals so that past performance increases lead to setting more challenging personal goals.

*H3: Higher levels of past performance will result in subjects setting more challenging subsequent personal goals.*

**Hypothesis 4**

Past performance, when effects of past self-regulatory influences are removed, is a positive predictor of future performance. The majority of complex task self-efficacy studies supported this assertion (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone & Wood, 1995; Mitchell, et al., 1994; Wood, et al., 1990). Researchers of two studies found that past performance influenced subsequent performance through self-regulatory factors (Cervone, et al., 1991; Wood & Bandura, 1989a). According to theory, self-regulatory factors should be more influential with task experience because people become more accurate in their estimations of their ability to perform. The majority of empirical findings suggest, however, that past performance exerted a continual, independent effect on subsequent performance, and this is expected for the present study.

*H4: Higher levels of past performance will result in higher levels of subsequent performance.*

**Hypothesis 5**

Feedback is an important input into the formation of self-efficacy perceptions. When people receive specific outcome feedback, they gain information about their progress in
attaining goals. They also are able to more accurately assess their self-efficacy because
they have knowledge about their past performance and what inputs were necessary to
attain it. Although researchers of simple task self-efficacy studies support the positive
effects of feedback on self-efficacy perceptions and personal goals, few investigated the
relationship for complex tasks. In four complex task self-efficacy studies, researchers
found that feedback influenced self-efficacy perceptions (Bandura & Jourden, 1991;
Cervone & Wood, 1995; Jourden, 1992; Quiñones, 1995). In one study, subjects who
initially overestimated their self-efficacy in a novel task were negatively affected by
highly specific feedback, while less specific feedback communicating these discrepancies
had no effect (Cervone & Wood, 1995). Feedback influenced self-efficacy perceptions
positively for positively-framed feedback (Jourden, 1992), for feedback framed in terms
of progressive task mastery (Bandura & Jourden, 1991), and for feedback that labeled
subjects as advanced in skills (Quiñones, 1995). The positive influences on self-efficacy
perceptions resulted from positively-framed feedback in these three studies. Thus,
positive nonevaluative feedback may strengthen self-efficacy perceptions as well.

Evidence from MCPLP studies indicates that feedback should influence performance
in complex tasks. Recently, researchers suggested that cognitive feedback may be more
effective than outcome feedback (Balzer, et al., 1989), but the positive effects of outcome
feedback continue to be found (e.g., Taylor, et al., 1996). Consequently, it is proposed
that positive nonevaluative feedback will influence self-efficacy perceptions so that
improved performance over previous performance will positively predict subsequent self-
efficacy perceptions.
H5: Positive outcome feedback will result in subjects reporting stronger self-efficacy perceptions.

Hypothesis 6

Feedback is also important in the formation of personal goals. Knowledge of past performance influences personal goals by directly guiding a person's future personal goals. Researchers found that feedback positively influences people to set more challenging personal goals when the feedback was framed in terms of progressive mastery as compared to others (Bandura & Jourden, 1991) and when framed in terms of performance gains (Jourden, 1992). Cervone and Wood (1995) found that highly specific feedback negatively influenced personal goals. They explained that subjects set initial personal goals before having any task experience, and the discrepancies between these goals and their subsequent performance could have caused negative reactions in subjects' goal setting.

H6: Positive outcome feedback will result in subjects setting more challenging personal goals.

Hypothesis 7

Self-efficacy perceptions influence personal goal setting because, as people gain knowledge about their performance capabilities, they are better able to set personal standards. Personal goals are the result of a perceived capability assessment. People with stronger self-efficacy perceptions set more challenging personal goals. Researchers in four complex task studies found that self-efficacy perceptions positively influenced
personal goal setting (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone & Wood, 1995; Wood, et al., 1990). Wood and Bandura (1989a) found a nonsignificant effect of self-efficacy perceptions on personal goals, and stated that this may be attributed to the longer intervals in which they measured personal goals versus previous studies. Distal personal goals for an entire block of performance trials may have been less motivating to subjects than proximal goals set for each trial. In some complex task self-efficacy studies, researchers found that personal goal effects were weaker than in simple studies (e.g., Wood & Bandura, 1989a). They attributed this to the difficulty of subjects to set accurate standards in complex tasks with which they did not have much experience. Based on theory and empirical findings in complex task studies, however, self-efficacy perceptions are expected to predict personal goal levels.

**H7: Stronger self-efficacy perceptions will result in subjects setting more challenging personal goals.**

**Hypothesis 8**

Personal goals are important cognitive mediators because of their motivating potential. Personal goals motivate people in the same way that assigned goals do, through increased effort and persistence, directed attention, and better strategy creation (Locke, et al., 1981). People adjust personal goals, though, to reflect changes in their perceived ability to perform. Through these adjustments, personal goals serve as ongoing motivators. Researchers found that personal goals predict performance in complex tasks (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone, et al., 1991; Cervone &
(Jourden, 1992; Wood & Bandura, 1989a) found nonsignificant effects. Jourden (1992)
attributed his nonsignificant findings to the fact that feedback contained some goal
information that may have overridden personal goal setting. The feedback in Jourden’s
study was phrased in comparison with a preset assigned standard, so subjects were
constantly reminded of this externally-imposed standard. Wood and Bandura (1989a)
attributed their nonsignificant findings to task complexity and the difficulty subjects
appeared to have in setting goals with little understanding about the task and their
performance ability. Researchers did not investigate the effects of personal goals on effort
and persistence in complex tasks. Based on theory and evidence, though, more
challenging personal goals are expected to cause higher performance, effort, and
persistence than less challenging personal goals.

\textit{H8: More challenging personal goals will result in higher levels of performance, effort,
and persistence than less challenging personal goals.}

Hypothesis 9

Difficult goals positively influence performance in simple tasks, but easy goals appear
to more positively influence performance in complex tasks (e.g., Taylor, et al., 1992).
This may be because subjects’ perceptions of the difficulty of assigned goals is distorted
in complex tasks and easy goals appear difficult. Researchers found mixed results
concerning the effects of assigned, difficult goals on self-efficacy perceptions. One way
goals influence self-efficacy perceptions is as a form of verbal persuasion (Bandura,
The goal level influences their perception of the level at which they can perform. Researchers found that assigned, difficult goals negatively affected self-efficacy perceptions in two complex task studies (Bandura & Wood, 1989; Cervone & Wood, 1995). Researchers in two studies found nonsignificant effects (Cervone, et al., 1991; Wood & Bandura, 1989a), and in two studies found positive effects (Latham, et al., 1994; Winters & Latham, 1996). Bandura and Wood (1989) did not hypothesize positive effects of easy goals on self-efficacy perceptions, but found this effect. Stock and Cervone (1990) compared the effects of easy goals to no goals and impossible goals, and found that easy goals were most effective in strengthening self-efficacy perceptions. Empirical evidence from complex task goal setting studies (e.g., Taylor, et al., 1992) demonstrates that easy goals may be more effective in facilitating performance in complex tasks versus difficult goals. Mixed evidence in self-efficacy studies concerning the effectiveness of difficult goals, combined with positive evidence of the effects of easy goals in two studies also suggests that easy goals are expected to superior in raising self-efficacy perceptions.

**H9:** Assigned, easy goals will result in stronger self-efficacy perceptions than moderate or impossible goals.

**Hypothesis 10**

Assigned goals affect personal goals because they serve as verbal persuasion about expected performance. The evidence concerning the effects of assigned, difficult goals on personal goals in complex tasks is mixed, however. Researchers found the effect of assigned, difficult goals on personal goals to be positive (Bandura & Wood, 1989),
negative (Cervone & Wood, 1995), and nonsignificant (Cervone, et al., 1991; Wood, et al., 1990). Cervone and Wood attributed the negative effects to the fact that subjects set personal goals before attempting their complex task. The assigned goals appeared to be discrepant from what subjects expected, negatively affecting personal goals. Based on evidence suggesting that easy goals should positively affect self-efficacy perceptions and performance, and on mixed effects of difficult goals on personal goals, it is expected that assigned, easy goals will cause subjects to set more challenging personal goals than difficult or impossible goals.

*H10: Assigned, easy goals will result in subjects setting more challenging personal goals than moderate or impossible goals.*

**Hypothesis 11**

Self-efficacy perceptions change with task experience, so its effects on other variables change as well. Researchers found that self-efficacy perceptions become a better predictor over time for novel, complex tasks (Bandura & Jourden, 1991; Bandura & Wood, 1989; Wood, et al., 1990). As subjects learned more about the necessary inputs for successful task performance, their self-knowledge impacted performance more. This is because self-efficacy perceptions become more accurate in predicting performance, while earlier in task performance subjects lack of knowledge and experience caused their perceptions of performance capability to be less accurate. Mitchell, et al. (1994) found the opposite effect, that self-efficacy perceptions became less influential in predicting performance with task experience. They explained that, without task experience, subjects may rely on
perceptions more, while task experience allowed them to focus on concrete data that was not available in earlier trials. Based on theory and the majority of empirical evidence, however, it is expected that self-efficacy perceptions will become a better predictor as subjects gain experience with a task.

_H11: Self-efficacy perceptions will have a more positive effect on performance in later than in earlier trials._

**Hypothesis 12**

Personal goals should also exert a stronger effect on performance after some task experience because people can more accurately set realistic performance goals with more knowledge about their skills and capabilities to perform. Self-efficacy perceptions influence personal goals, and the increased knowledge about self-efficacy influences the accuracy of personal goal setting in predicting performance. Researchers suggested that personal goals exert weaker overall effects on performance in complex tasks than in simple tasks (Wood & Bandura, 1989a). The effects of personal goals on performance in complex task studies have been positive and significant, but only in later trials (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone, et al., 1991; Wood & Bandura, 1989a). These findings are consistent with theory, and the effects of task experience are expected in the current study.

_H12: Personal goals will have a more positive effect on performance in later trials than in earlier trials._
Importance of This Study

The results of the hypotheses presented in this chapter can potentially contribute important information to the self-efficacy literature. Self-efficacy perceptions were studied extensively in clinical areas, but research concerning management topics is more recent. Few researchers investigated the effects of self-efficacy perceptions in complex tasks, and the same computer simulation task was used in many of these studies. Therefore, differing approaches to the study of self-efficacy in complex tasks are valuable to the understanding of the construct (Stone, 1994). The MCPLP and Brunswik (1955) lens model are well-suited to this area of study, and have been rarely used in past complex task self-efficacy research.

The results of this study will aid in the understanding of the effects of goals in complex tasks. Researchers of recent goal setting studies suggested that task complexity may moderate the relationship between goal level and performance so that easy goals lead to higher performance. The positive effects of easy goals were investigated in several goal setting studies (e.g., Taylor, et al., 1992). Because self-efficacy perceptions mediate the relationship between assigned goal level and performance, the extension to these studies is to investigate the effects of easy goals on self-efficacy perceptions in the performance of a complex task. Researchers of self-efficacy in complex tasks found mixed results of assigned, difficult goals in strengthening self-efficacy perceptions, further suggesting that easy goals may be more effective. Because self-efficacy perceptions mediate the goal level-performance relationship, they may help explain the positive effects of easy goals.
Self-efficacy researchers also did not hypothesize the positive effects of easy goals on personal goal setting. Self-efficacy perceptions and assigned goals influence personal goal setting, which influences performance. Self-efficacy researchers found weak effects of personal goals in complex task studies. Knowledge about the effects of easy goals on the strength of personal goal effects is valuable to determine how easy goals strengthen the effectiveness of personal goal setting. Knowledge of the role personal goals play as cognitive mediators also may help to explain the cognitive mediation of assigned goals on performance.

Feedback plays an important role in affecting self-efficacy as a form of verbal persuasion. It increases knowledge about past performance, and influences the conception of whether one can perform a task in the future. More knowledge is needed concerning the effects of outcome feedback on self-efficacy perceptions in complex tasks because few researchers addressed the topic. Researchers found that OFB framed positively strengthens self-efficacy perceptions and personal goals, and OFB framed negatively weakens self-efficacy perceptions and personal goals. In the present study, truthful OFB will be presented with no attempt to frame the feedback with persuasive or biased language. Self-efficacy researchers have not explicitly studied these effects in past complex task research, although people may often receive numerical feedback without framing in practice. Knowledge of these effects can be valuable to help understand how subjects are affected by their objective increases and decreases in performance without framing.
The effects of task experience were reviewed, and the findings reveal that the determinants of self-efficacy, personal goals, and performance change with task experience. These effects will be studied in the present research because variables will be investigated over trials. The study of how self-efficacy perceptions and personal goals change with experience is important because the impact of external influences on these factors be more effective in certain stages of task performance. Knowledge of these effects may be helpful to more efficiently and effectively influence self-efficacy and personal goals.

In summary, little research was conducted on the effects of self-efficacy perceptions in complex task environments. Researchers of these studies concluded positive effects of self-efficacy and personal goals on performance, but the effects of feedback and goals on the constructs were not solidified. One aim of this study is to extend the present research in an attempt to help understand the mixed effects of assigned, difficult goals on self-efficacy perceptions with the hypothesis that easy goals may be more effective in strengthening self-efficacy perceptions and raising personal goals in complex task environments. The effects of nonevaluative feedback on self-efficacy perceptions and personal goals also were not hypothesized in past studies because past authors manipulated the wording of the feedback in these studies. Therefore, the results of this study may provide insight into the straightforward effects of positive and negative feedback in complex task situations. Finally, because self-efficacy is a dynamic construct, its changing properties with task experience are necessary to increase the effectiveness of goal setting and feedback. In conclusion, self-efficacy perceptions and personal goals can
be influenced by external factors, and then affect performance. The goal of this study is to help increase the understanding of how self-efficacy perceptions can most effectively be strengthened by the external factors of goals and feedback, and how cognitive mediators can help explain the effects of these factors on performance.
CHAPTER 3

METHODS

Overview of Methods

The purpose of this chapter is to present the research framework and complex task for the study, procedures for conducting the experiment, and results of the pilot study. The pilot study was conducted in order to validate these procedures before the main experiment. In light of the pilot study results, changes were made to procedures and measures. First, the research framework and complex task are discussed, and then the subjects, research design, study procedures, operationalizations, and debriefing procedures are presented. Finally, the pilot study results are presented, followed by changes that were made in the main experiment as a result of these findings.

Brunswik (1955) Lens Model

The Brunswik (1955) lens model is the analysis framework in this study (see Figure 7). This framework provides researchers with the ability to create uncertainty under controlled experimental conditions (Cosier, Ruble, & Aplin, 1978). Uncertainty is an important dimension of task complexity (Wood, 1986). The two important parts of the lens model are the objective relationship of information cues with a criterion, and the relationship that subjects perceive exists between the cues and criterion. The right side of the lens model illustrates the way an individual combines and weights information.
(Naylor, et al., 1980). The left side indicates the features that influence the decision most.

When people form a judgment about the criterion value, they subjectively weight cues that are given \( (x_i) \) and their relationship with a criterion to be predicted \( (y_c) \). This relationship is expressed by the correlation, \( r_{xy_c} \). The perceived relationship of the cues with the criterion is called *ecological validity* (Castellan, 1972). Optimal decisions occur when the subjective cue weighting is equal to the objective cue weighting \( (r_{x_iy_c}) \).

Correlations between the cues and the subject’s response are called *utilization coefficients*. Three cues are used in the present study. Subjects were instructed to use these three cues to predict a criterion. The closer the subject’s prediction matched the actual criterion, the higher the subject’s level of success.

*Figure 7.* The Brunswik (1955) lens model used in the present study.

Prediction accuracy can be measured in the lens model as absolute error in predicting a criterion (Cosier, et al., 1978). Subjects made 20 decisions over four trial blocks.
Prediction accuracy was measured at each decision and was averaged over 20 decisions (see Equation 1).

\[
\frac{\sum_{i=1}^{20} (y_i - \bar{y})}{20}
\]

The lens model is a valuable tool for modeling decision task uncertainty in a controlled setting. Using the lens model, researchers can specify the precise amount of variance that will be unexplained by the cues. This reduces the predictability of the cues and increases the uncertainty the subject must deal with when predicting the criterion. The approximate variance that is explained by the cues in this study is expressed in Equation 2.

\[
R^2 \approx \sum_{i=1}^{20} r_{ij}^2 x_i y_c
\]

In Equation 2, the correlation of the cues with the criterion over 20 predictions approximately equals the amount of variance explained by the cues. Equation 3 was used as the model for this study (Cosier, et al., 1978; Taylor, 1984). In this equation, \( r_{ij} = 0 \) indicates that the three cues have near zero multicollinearity. Each of the cues is related to the criterion approximately equally at \( r_{xiyc} = .50 \). Therefore, the variance each cue shares with the criterion is approximately 25\%, leaving approximately 25\% of the variance in
the criterion unexplained \( r^2_{xy_C} \). The total predictability of the cues is illustrated in Equation 3.

\[
R^2 = r^2_{x_1y_C} + r^2_{x_2y_C} + r^2_{x_3y_C}
\]

or

\[
R^2 = .25 + .25 + .25
\]

\[
R^2 = .75
\]

In summary, the Brunswik (1955) lens model is used in this study to create subject perceptions of an uncertain and, therefore, complex task environment. Decision accuracy is measured using the comparison of subjects’ decisions with actual criteria. The amount of variance that is unexplained by the cues is controlled, and this provides knowledge to the researcher of the objective amount of uncertainty that subjects face. The perceptions of uncertainty may not equal the objective amount of uncertainty, though, and may actually be much higher due to the complexity of the task (e.g., Taylor, 1992). The experimental manipulations are expected to further affect the perceived uncertainty and complexity.

**Complex Task**

The complex task used in this study is a Multiple Cue Probability Learning Paradigm (MCPLP) task designed by Taylor (1984) and adapted from Cosier (1980) that has been used in several decision studies (Taylor, 1987; Taylor, 1988; Taylor, et al., 1992; Taylor,
et al., 1996). Subjects were told that they were playing the role of a financial manager for ABCD Electronics, Inc. Subjects were asked to predict price/equity (P/E) ratios based on three financial ratios that were given to them as cues (current ratio, inventory turnover, and debt-to-equity). In four trial blocks, called Profit Centers A, B, C, and D, each subject made 20 predictions, or 80 predictions total. The three financial ratios used as cues have multicollinearity near zero, and the amount of variance explained by the cues in each trial block was determined in previous research (Taylor, 1984). The ecological cue validities, or the correlations between the cues and the criteria in each Profit Center, are listed in Table 8. In accordance with Equation 3, these three cues explain approximately 75% of the variance in each Profit Center.

Table 8

<table>
<thead>
<tr>
<th>Profit Center</th>
<th>( r_{x_1y_c} )</th>
<th>( r_{x_2y_c} )</th>
<th>( r_{x_3y_c} )</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.49</td>
<td>.54</td>
<td>.53</td>
<td>.74</td>
</tr>
<tr>
<td>B</td>
<td>.53</td>
<td>.53</td>
<td>.52</td>
<td>.71</td>
</tr>
<tr>
<td>C</td>
<td>.50</td>
<td>.46</td>
<td>.54</td>
<td>.78</td>
</tr>
<tr>
<td>D</td>
<td>.47</td>
<td>.55</td>
<td>.52</td>
<td>.77</td>
</tr>
</tbody>
</table>
The relationship between the cues and criteria is shown in the linear model:

$$\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 - y_c$$  \hspace{1cm} (4)

In Equation 4, $\beta_0$ is a constant, and $\beta_j x_j$ indicates the first, second, and third cues and their regression weights. The value of the criterion is expressed as $y_c$. When the cue and criterion values are placed in Equation 4, the result is a number that represents the error left unexplained. On average, a person cannot predict the criteria better than this error rate. For example, if the resulting number for Profit Center A is 1.67, subject error averaged over time cannot be minimized to less than 1.67. Therefore, the goal of making an average of one error per trial block is impossible, but the goal of two errors per trial block is possible (although very difficult). The error allowable in each trial block (Profit Center) is displayed in Table 9 (Taylor, 1984).

<table>
<thead>
<tr>
<th>Table 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Allowable Error for Each Profit Center</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Profit Center</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Allowable Error</td>
<td>1.65</td>
<td>1.8</td>
<td>1.85</td>
<td>1.7</td>
</tr>
</tbody>
</table>

To increase the complexity of the task, a risk element was included (e.g., Taylor, et al., 1992). Each subject was assigned to one of three goal level conditions—easy,
moderate, or impossible. Goal level was expressed in the task instructions as the average amount of error they are told to strive for in each Profit Center. An easy goal was expressed as 5 units of error on average per Profit Center, a moderate goal as an average of 3 units of error per Profit Center, and an impossible goal as an average of 1 unit of error per Profit Center. Subjects were allocated 100 points at the beginning of each Profit Center, and were told that points would be translated into extra credit points after the experiment. Although subjects believed they were risking their extra credit points, all were awarded the maximum number of points after the experiment.

During the experiment, subjects were led to believe that they were allowed to risk their 100 points by committing one time during each Profit Center to their assigned goal. This means that they agreed they would reach the assigned goal for that Profit Center in terms of average error over the 20 trials. Subjects could commit at any time during the Profit Center, and risked less as they delayed committing to their goal. Subjects also could decide not to commit at all, and these subjects were told they would retain their original 100 points. Therefore, subjects who decided to risk resources during the first prediction of a Profit Center profited most if the goal was reached, and lost the most if they did not reach their goal.

Subjects were provided with a commitment scale in the task instructions (see Appendix) that lists their total payoff depending on when, if ever, they commit to their goal (see Figure 8). For example, if subjects committed to their goal after decision 9 and before decision 10, those who reached their goal received 155 points for the Profit Center, and those who were unsuccessful received 45 points.
**Figure 8.** Payoff scale for the commitment portion of the task.

PROFIT CENTER A, B, C, or D  
Initial Stake = 100 points per Profit Center

<table>
<thead>
<tr>
<th>Trial</th>
<th>Wager</th>
<th>Reward</th>
<th>Protect</th>
<th>Total Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>100</td>
<td>200</td>
<td></td>
<td>= 200</td>
</tr>
<tr>
<td>2.</td>
<td>95</td>
<td>190</td>
<td>5</td>
<td>= 195</td>
</tr>
<tr>
<td>3.</td>
<td>90</td>
<td>180</td>
<td>10</td>
<td>= 190</td>
</tr>
<tr>
<td>4.</td>
<td>85</td>
<td>170</td>
<td>15</td>
<td>= 185</td>
</tr>
<tr>
<td>5.</td>
<td>80</td>
<td>160</td>
<td>20</td>
<td>= 180</td>
</tr>
<tr>
<td>6.</td>
<td>75</td>
<td>150</td>
<td>25</td>
<td>= 175</td>
</tr>
<tr>
<td>7.</td>
<td>70</td>
<td>140</td>
<td>30</td>
<td>= 170</td>
</tr>
<tr>
<td>8.</td>
<td>65</td>
<td>130</td>
<td>35</td>
<td>= 165</td>
</tr>
<tr>
<td>9.</td>
<td>60</td>
<td>120</td>
<td>40</td>
<td>= 160</td>
</tr>
<tr>
<td>10.</td>
<td>55</td>
<td>110</td>
<td>45</td>
<td>= 155</td>
</tr>
<tr>
<td>11.</td>
<td>50</td>
<td>100</td>
<td>50</td>
<td>= 150</td>
</tr>
<tr>
<td>12.</td>
<td>45</td>
<td>90</td>
<td>55</td>
<td>= 145</td>
</tr>
<tr>
<td>13.</td>
<td>40</td>
<td>80</td>
<td>60</td>
<td>= 140</td>
</tr>
<tr>
<td>14.</td>
<td>35</td>
<td>70</td>
<td>65</td>
<td>= 135</td>
</tr>
<tr>
<td>15.</td>
<td>30</td>
<td>60</td>
<td>70</td>
<td>= 130</td>
</tr>
<tr>
<td>16.</td>
<td>25</td>
<td>50</td>
<td>75</td>
<td>= 125</td>
</tr>
<tr>
<td>17.</td>
<td>20</td>
<td>40</td>
<td>80</td>
<td>= 120</td>
</tr>
<tr>
<td>18.</td>
<td>15</td>
<td>40</td>
<td>85</td>
<td>= 115</td>
</tr>
<tr>
<td>19.</td>
<td>10</td>
<td>20</td>
<td>90</td>
<td>= 110</td>
</tr>
<tr>
<td>20.</td>
<td>5</td>
<td>10</td>
<td>95</td>
<td>= 105</td>
</tr>
</tbody>
</table>

*The longer you delay in committing to your goal, the less you can earn.*

<table>
<thead>
<tr>
<th>Trial</th>
<th>Wager</th>
<th>Reward</th>
<th>Protect</th>
<th>Total Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.</td>
<td>5</td>
<td>10</td>
<td>100</td>
<td>= 100</td>
</tr>
</tbody>
</table>

*If you never commit to your goal, you will still receive 100 points.*

The risk element of the task increased task complexity according to Wood's (1986) definition, versus the same task without the risk element, because uncertainty increased (coordinative complexity). The nature of the task changed as subjects committed resources, also, because subjects were required to consider whether to commit to their assigned goal initially. If they made the decision to commit during the Profit Center, they no longer were required to consider this option until the next Profit Center (dynamic complexity). Finally, the number of elements that composed the task increased, because
subjects not only considered the relationship of cues with a criterion, but their competence in predicting the criterion (component complexity).

**Research Design and Manipulations**

The research design for this study is a $3 \times 3$ factorial, incorporating three levels of goals over repeated-measures trial blocks (see Figure 9). Subjects completed four trial blocks of predictions (Profit Centers A, B, C, and D), but three sets of data were analyzed because only one variable from Profit Center A, the performance measure, was used as an input to Profit Center B analyses.

**Figure 9.** The $3 \times 3$ research design.

Two variables were manipulated in this study—goal level and number of trials. Subjects were randomly assigned to one of three goal conditions (easy, moderate, or impossible). Goal level was operationalized as the average error over a block of 20 decisions (Profit Center) that the subject was assigned as a standard for performance. Goal level was manipulated in the task instructions as the goal that subjects were told to
strive for. Subjects were told that reaching their goal results in obtaining more course extra credit points when they commit to the goal. Goal levels were set based on past research using this task (Taylor, 1987; Taylor, et al., 1992). For example, a subject in the impossible goal condition was told to strive for an average error prediction rate of one unit over each Profit Center (see Equation 1). If the subject predicted a P/E ratio as 10 and the correct answer was 12, the subject’s prediction error was 2, and the subject failed to meet the goal in a single decision.

Subjects

Subjects were given the opportunity to participate in the pilot study and main experiment for extra credit in undergraduate management classes. No prior self-efficacy study could be found that considered effect sizes and statistical power to make sample size decisions. Few simple task self-efficacy studies and no complex task studies conducted post hoc power analyses. Martocchio and his colleagues investigated the effects of feedback on self-efficacy perceptions using simple tasks, and found effect sizes that exceeded Cohen’s (1988) standard for medium effects (Martocchio & Dulebohn, 1994; Martocchio & Webster, 1992). In order to estimate sample size for the main experiment, an effect size estimate (d statistic) was computed for feedback or goal manipulations on self-efficacy perceptions for eight complex task self-efficacy studies. Some studies were not used because they lacked information necessary to compute the effect size statistic. The results revealed medium to large effect sizes (Table 10) by Cohen’s (1988) convention of small (.2), medium (.5), and large (.8) effect sizes. In these
studies, researchers manipulated self-efficacy perceptions through performance standards and information about past performance.

Table 10

**Effect Sizes in Past Complex Task Self-Efficacy Studies**

<table>
<thead>
<tr>
<th>Study</th>
<th>Relationship Investigated</th>
<th>Effect Size*</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandura &amp; Wood (1989)</td>
<td>Feedback (communicating high or low controllability) → Self-Efficacy</td>
<td>.648</td>
<td></td>
</tr>
<tr>
<td>Quiñones (1995)</td>
<td>Feedback (communicating low or high ability) → Self-Efficacy</td>
<td>.648*</td>
<td>*with strong attribution of task success to ability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.212**</td>
<td>**with weak attribution of task success to ability</td>
</tr>
<tr>
<td>Latham, Winters, &amp; Locke (1994)</td>
<td>Goals (participative vs. assigned) → Self-Efficacy</td>
<td>.246</td>
<td></td>
</tr>
<tr>
<td>Stock &amp; Cervone (1990)</td>
<td>Assigned Goals (achievable subgoal vs. unachievable or no subgoal) → Self-Efficacy</td>
<td>.554</td>
<td></td>
</tr>
<tr>
<td>Stone (1994)</td>
<td>Feedback (positive vs. mildly negative) → Self-Efficacy</td>
<td>.415</td>
<td></td>
</tr>
<tr>
<td>Winters &amp; Latham (1996)</td>
<td>Assigned Goals (specific goal vs. do your best) → Self-Efficacy</td>
<td>.434*</td>
<td>*Trial 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.692**</td>
<td>**Trial 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.470***</td>
<td>***Trial 3</td>
</tr>
<tr>
<td>Wood &amp; Bandura (1989)</td>
<td>Feedback (communicating ability attributions) → Self-Efficacy</td>
<td>1.09</td>
<td></td>
</tr>
<tr>
<td>Wood, Bandura, &amp; Bailey (1990)</td>
<td>Assigned Goals (challenging vs. do your best) → Self-Efficacy</td>
<td>.592*</td>
<td>*Trial 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.233**</td>
<td>**Trial 2</td>
</tr>
</tbody>
</table>

*Note. a. Effect sizes were computed as the $d$ statistic.*
Taylor, et al. (1992) served as the model for the present study in terms of the task, lens model framework, and goal manipulations used. The influence of goal manipulation on performance in the Taylor, et al. (1992) study indicate an effect size of .33 for the effect of assigned goals on performance. In similar studies, Taylor and his colleagues found effect sizes of .284 for the effect of assigned goals on performance (Taylor, 1987) and .325 for the effect of assigned goals on effort (Taylor, 1988). Using these results and those from Table 11, the sample size for this study was determined with Cohen’s (1988) power tables. Desired power level was set at .80, suggested by Cohen when researchers do not have a basis for setting it at a different level. An effect size estimate of .60 was determined to be appropriate. Alpha level was set at .05. The resulting sample size was 45 subjects for each group in the main experiment. Three manipulation groups were planned, indicating 135 subjects total were needed.

Approximately 70 percent of subjects who signed up for the main experiment actually arrived and participated. Therefore, more subjects than needed were sought, resulting in an initial sample size of 169. Seven subjects were rejected from the analysis. Five of these subjects did not complete their Profit Center predictions, one subject decided not to participate after reading the task instructions, and one subject’s results could not be assessed because the experimenter did not correctly pre-code the sheet that allowed the Profit Center predictions to be graded. This attrition resulted in a total of 162 subjects.

Of the 162 subjects, 80 were males (49.4%) and 82 were females (50.6%). Because of the nature of the task, subjects were asked how many finance courses they had taken. A majority (n = 114, 72%) reported that they had taken one finance course, while the
remaining stated they had taken either zero ($n = 3$, 2%), two ($n = 14$, 9%), three ($n = 3$, 2%), four ($n = 6$, 4%), or five ($n = 18$, 11%) finance courses. This difference in subjects is significant, $\chi^2 = 274.85, p < .000$. A few subjects were finance majors ($n = 15$, 9%), but a significant majority were not ($n = 143$, 91%), $\chi^2 = 103.7, p < .000$. These results reinforced that the sample was largely homogeneous in its knowledge of financial terminology. Four subjects skipped the page containing these questions in the post-task questionnaire.

Subjects from undergraduate management classes were told they would have the opportunity to earn up to a given number of extra credit points. Although these were different courses, the number of extra credit points offered was approximately 2% of the total course grade in the majority of the classes. Subjects included students from 14 sections of Business Communications, Organizational Behavior, and Complex Organizations management classes. They signed up to participate in one of 25 offered sections of the experiment, which took place during the week at different times of the day. Subjects were randomly assigned to one of three groups, and received either an easy ($n = 54$, 33.3%), moderate ($n = 54$, 33.3%), or impossible ($n = 54$, 33.3%) goal.

Measures

Dependent Variables

Four questionnaires were used in this study, and many of the variable measurements were repeated on each questionnaire. Some of the items were measured on Likert scales in the past, but these were replaced in this study with continuous 100 mm lines with polar
descriptors at either end of the line. Subjects marked an “x” on the line to indicate their answer. This technique captures maximum variability in responses.

**Self-efficacy perceptions.** A construct’s predictive validity is a part of its overall construct validity (Cook & Campbell, 1977), and self-efficacy has demonstrated its strength in this capacity (Gist & Mitchell, 1992). When self-efficacy perceptions significantly predict performance, construct validity is established. If predictions are not significant, the cause can be attributed to the theory, the measure, or construct validity. In order to guard against measurement difficulties, Bandura’s (1995) method for measuring self-efficacy perceptions was used here. Because self-efficacy is a task-specific construct, the self-efficacy questionnaire is unique for each study. This makes the pilot study more important to help establish validity and reliability. Reliability was measured using Cronbach’s (1951) alpha coefficient. Stability also was measured using within-subject correlations between the self-efficacy measures in Profit Centers B, C, and D.

First, self-efficacy must be measured for behaviors that people can control, which was the case in this study (Bandura, 1995). This is because self-efficacy perceptions reflect perceived capability to perform, and people cannot use self-efficacy perceptions as motivational self-regulatory tools if they cannot form these perceptions. Second, the self-efficacy questionnaire measures perceived capability in progressive levels of task challenges. For the present task, self-efficacy perceptions were measured for the ability to predict criteria at progressive levels of difficulty (ability to minimize errors in prediction). Items on the self-efficacy questionnaire were phrased in terms of what people can do
versus what they will do. In addition, subjects were asked of their perceived capabilities as of now, not in terms of future or potential capabilities.

In order to measure self-efficacy strength, a 100-point scale is traditionally used that ranges in 10-point intervals from zero ("cannot do") to intermediate strength, 50 ("moderately certain can do") to complete assurance, 100 ("certain can do"). The subject responses are summed for all self-efficacy questions, and this number represents self-efficacy strength. As a comparison to the traditional self-efficacy measure, a measure was used in the pilot study that labeled a 100 mm line with polar descriptors that reflected low to high confidence. Subjects were assigned to receive one of the two types of scales using a random number table (Scheaffer, Mendenhall, & Ott, 1990). This comparison was done to determine the relative predictability of and coherence between the two types of scales. For each level of achievement, subjects were asked to rate their degree of confidence in their ability to perform. For example, one questionnaire item stated, "I can predict P/E ratios within an average of 6 units of error." Subjects answered to reflect confidence in this statement. In the pilot study, the statement, "I can predict P/E ratios within ___ units of error" included units of error between zero and six. The average error for subjects in past research ranged from 2.89 to 3.2 across the four trial blocks (Taylor, 1984). This indicates that the range of four units of error may be objectively accurate, but the perceived capability of subjects may reflect a wider range, so more levels were used here. A sample item was provided for subjects on the first page of the first questionnaire to illustrate how to use the traditional and/or 100 mm scale.
Researchers often use a two-staged self-efficacy measure in which subjects are asked (1) if they perceive they can perform a task (yes or no), and if yes, (2) what their confidence level is in this perception. Bandura (1995) recommended using a single-judgment format, however, which only uses the zero to 100-point scale measuring certainty. This method is more straightforward and gives the researcher equivalent information to the two-staged measure. Although some self-efficacy researchers use Likert scales or single-item questions of perceived self-efficacy, these methods have been shown to be inferior to Bandura's suggested procedures (Lee & Bobko, 1994). Bandura (1995) stated that self-efficacy measures should be provided privately and with assurance of confidentiality. A title of “Self-Efficacy” was not used on the questionnaire in case subjects were familiar with the construct definition, because this could have affected their responses. Bandura determined in past research that the process of estimating self-efficacy perceptions does not affect subsequent behavior (Bandura, Adams, Hardy, & Howells, 1980).

Recently, however, researchers found that poor performance and negative self-evaluations can result if subjects estimate their self-efficacy before task experience in a novel, complex task (Stone, 1994). This effect is attributed to overconfidence reflected in subjects' self-efficacy perceptions due to the complexity and ambiguity of the novel task. Because overconfidence is not a focus in this study and could distort outcome measures, subjects were allowed to have task experience in Profit Center A before they estimated their self-efficacy perceptions for Profit Center B on Questionnaire I. Eastman and Marzillier (1984) argued that the coherence researchers found between self-efficacy
perceptions and behavior may indicate a construct validity problem with self-efficacy perceptions. They stated that self-efficacy perceptions may be equivalent to performance predictions based on past behavioral enactments. Self-efficacy perceptions are more than predictions of behavior, however, and this is evidenced in researchers' empirical findings that the construct increases based on various influences, vicarious and emotional, that occur after past performances (Bandura, 1977).

**Effort-Performance Expectancy (El).** $E_l$, or the expectancy that effort will lead to performance of a behavior, was measured and compared to self-efficacy perceptions to determine its relative predictability and whether it was perceived as a distinct construct. Like the self-efficacy measure, $E_l$ was measured on the traditional confidence scale for one-half of the questionnaires, and the 100 mm scale for the other half in the pilot study.

**Personal Goal Level.** In accordance with other complex task self-efficacy studies (Bandura & Jourden, 1991; Bandura & Wood, 1989; Cervone, et al., 1991; Cervone & Wood, 1995), personal goal level was operationalized in the pilot study as a question asking subjects for the level of performance they were striving for in the next Profit Center, or block of 20 decisions. A multiple choice question was used that gave subjects the choice of between zero and six units of error as their personal goal. The degree that a personal goal is challenging ranged from 1 to 8, with 1 reflecting the most challenging personal goal (zero units of average error over a Profit Center) and 8 representing "no particular goal."

For the purpose of analyzing hypotheses in the main experiment, personal goal level is operationalized as subjects' stated goal level relative to their assigned goal level, or as
the assigned goal level minus the personal goal level. Subjects' assigned goal level, expressed as the number of units of error they are told to strive for, serves as an anchor value against which their personal goal level is compared. Past self-efficacy research indicates that anchors such as assigned goals powerfully affect subjects' reactions (Cervone & Palmer, 1990). Therefore, it is necessary in this study to define personal goals in terms of their significance relative to the assigned goals subjects are given. For example, subjects who are assigned to minimize prediction error to 3 units of error on average per Profit Center are challenging themselves more relative to their assigned goal if they state that they are striving for a personal goal level of 2 units of error (personal goal level = 3 - 2 = 1). Subjects who are assigned a prediction error rate of 1 unit of error on average per Profit Center are challenging themselves less relative to their assigned goal if they select a personal goal level of 2 units of error (personal goal level = 1 - 2 = -1).

The category of "no particular goal" was included in past studies and in the present experiment because subjects may not have set a goal. The addition of the "no particular goal" option makes the variable categorical, but the hypotheses are worded to reflect the effects of "more challenging" and "less challenging" personal goals. Therefore, those who answered that they had "no particular goal" were removed from hypotheses analyses.

Performance. Performance was measured as the accuracy of the subject's predictions (Equation 1). The lower the average prediction error over a block of 20 decisions, the better the performance.
**Effort.** Effort measures in complex task self-efficacy studies include the total time a person took to make a choice in a decision-making task (Stone, 1994) and as the total time a person spent working on a task (Stock & Cervone, 1990). Two effort measures were used in this study. First, effort was measured as the total amount of time in minutes that a person spent making decisions in each Profit Center. This measure was noted by subjects on their answer sheets when they started and finished each Profit Center. This required that a clock was visible in the experiment room. For a second measure of effort, a questionnaire item asked subjects after each Profit Center how much effort they expended (measured on a continuous 100 mm line). It was decided that the timed measure would be used for the analysis if the two measures significantly correlated. Two separate analyses were planned the two measures were significantly different.

**Persistence.** Persistence is defined as effort expended over time. Persistence was determined in this study from an analysis of subjects’ changes in effort. Persistence was expressed as the within-subject difference in the timed effort measure between the current and most recent Profit Center, expressed as a positive or negative number in minutes. Therefore, persistence measures were used for analysis in Profit Centers B, C, and D. If the two effort measures were significantly different in the t-test analysis, separate analyses would have to be done for persistence using each measure (e.g., Stock & Cervone, 1990).
Independent Variables

Feedback. Feedback is the information subjects receive about their performance. In this task, feedback was presented to subjects as the correct P/E ratio. They could look at the correct answer after each decision by turning over the cue card for each month. Feedback was operationalized here as the difference between subjects’ assigned goal for the experiment and their average error for the prior Profit Center. For example, if a subject was assigned a goal of 1 average unit of error for each Profit Center, and the subject averaged 3 units of error for the last Profit Center, the feedback would be -2 units of error for that Profit Center.

Past Performance. An important point to consider is the measurement of cognitive variables and their impact on past performance (Wood & Bandura, 1989a). Two Profit Centers of the present experiment are illustrated in Figure 10, and serve as an example of this point. Past performance influences future performance both directly and through cognitive factors, self-efficacy perceptions and personal goals. Performance in Profit Center B was influenced by cognitive factors measured before Profit Center B and, thus, includes variance attributed to these non-ability factors. Therefore, entering Profit Center B performance first into the path analysis to predict Profit Center C performance would remove effects that are attributable to Profit Center B cognitive factors. Because cognitive factors are likely to be autocorrelated, controlling for Profit Center B performance also may remove the effects of Profit Center C cognitive factors on Profit Center C performance. To avoid this overcorrection, past performance is adjusted before it is entered into a regression analysis. Profit Center B self-efficacy perceptions and personal
goals are removed from Profit Center B performance before it is used as a predictor of Profit Center C performance. To accomplish this, a regression equation was constructed that used self-efficacy perceptions and personal goals as predictors of performance, and the residual was used as the performance predictor. In the current experiment, subjects did not complete a self-efficacy measure before Profit Center A based on research that stated this could cause overestimation due to the unfamiliarity with the novel, complex task (Stone, 1994). Therefore, the past performance measure based on Profit Center A performance is unadjusted because no self-efficacy measure or personal goal measure is available.

Figure 10. Diagram of measurements over two trial blocks.

![Diagram of measurements over two trial blocks.](image)

Additional Measured Variables

Additional variables were measured to account for possible confounding variance on the hypothesized effects. Self-efficacy researchers found that the variables measured here affected results in complex and simple tasks. The purpose for measuring these variables was to provide additional information for results that were inconsistent with hypotheses.
For example, if self-efficacy perceptions do not predict performance, a possible explanation is that the prediction was significant for males, but not for females.

**Gender.** Subjects indicated their gender in response to one questionnaire item on the post-task questionnaire. Researchers found that self-efficacy perceptions differed on the basis of gender for analytical or mathematical tasks (Betz & Hackett, 1986). Based on the research of Cervone and his colleagues (Cervone & Palmer, 1990; Cervone & Peake, 1986; Stock & Cervone, 1990), these differences should lessen with task experience.

**Mood.** Mood predicts human performance within a complex task significantly and positively over many other variables (Cervone, et al., 1991; Cervone & Wood, 1995). Mood was measured here as it was in past analyses, which included two questionnaire items. The first asked subjects to rate how tired versus energetic they felt, and the second time asked them to rate how disinterested versus enthusiastic they felt. These items were combined in previous studies because they were highly correlated (Cervone & Wood, 1995). Although researchers in past studies used a nine-point scale with the opposite reactions on either end, a continuous 100 mm scale was used in this study. If subject reactions to feedback, goal levels, and past performance are not as hypothesized, the reason may be their mood.

**Affective self-evaluations.** Affective self-evaluations are important cognitive mediators in addition to self-efficacy perceptions and personal goals. Although no hypothesis here related to affective self-evaluations, their measurement may account for variance and help explain results. Past complex task self-efficacy studies' measures of affective self-evaluations were used in this study (Bandura & Jourden, 1991; Cervone, et
al., 1991; Cervone & Wood, 1995). Subjects were asked in one item how self-satisfied or self-dissatisfied they were with their performance in the prior Profit Center (for Profit Centers B, C, and D). Although measured on nine-point scales in past studies, a continuous 100 mm scale was used here.

**Manipulation checks.** A questionnaire item that addressed the subjects' assigned goal levels was analyzed for correspondence with actual experimental conditions. Subjects also were asked whether they accepted their goals. If subjects reported that they did not accept their goals, this may explain results counter to hypotheses because goal acceptance is key for goals to be motivational.

**Post-Task Perception Measures**

Post-task perception measures related to subjects' perceptions of the task, perceptions of the instructions, and their own performances. These included questions about the usefulness of instructions, how carefully subjects read the instructions, whether subjects reported being committed to their goal, enjoyment of the task, how unusual the task was perceived to be, whether subjects understood the task, motivation for participating, preference for type of problem, and time they would like to have to perform the task. If subjects differ across experimental conditions in their answers to these items, this may help explain results. For example, it may be concluded that the positive effects of easy goals on performance over moderate and impossible goals may be partly explained by higher task enjoyment, as was found in a past study using the same post-task questions (Taylor, 1984). The answers to these questions also were important for improving
instructions for the main experiment. Three items assessed subject perceptions of the task and their performance. The answers were important in addition to self-efficacy perceptions to understand the effects of task complexity and uncertainty on outcomes. In past analyses using these same questions, subjects reported distorted perceptions of the goal difficulty (Taylor, et al., 1992). Subjects also were asked how they felt they performed and improved from the beginning to end of the task, and this provided additional information about the effects of task complexity and uncertainty.

Pilot Study

In the following section, pilot study results are presented. The subjects' characteristics and the manipulation checks are discussed first. Then, the construct measures are analyzed. The perception measures are discussed next, with results concerning subjects' reactions to the experiment and to their performances. All ANOVA tests were subjected to the Levene Test for Homogeneity of Variance and Normal PP plots showing that dependent variables used in ANOVAs were distributed normally.

Subjects

A total of 51 subjects agreed to participate in the pilot study. One subject became ill during the experiment and left, and six subjects did not show up for their scheduled time, reducing the sample size to 44. The subjects were randomly assigned so that 15 subjects were assigned an impossible goal, 14 were assigned a moderate goal, and 15 were assigned an easy goal. The sample consisted of 27 males (67.4%) and 17 females (38.6%). Because the task used financial terminology, the college major and number of
finance courses subjects had taken were assessed. The sample was largely homogeneous on these responses, however, so statistical comparisons could not be made. One subject was majoring in finance (2.3%), and the other 43 (97.7%) were not. Most subjects had taken one finance class \( n = 39, 88.6\% \), two had never had a finance class (4.5%), one each had taken two, three, and four finance classes (each 2.3%).

Lack of statistical power may result from small sample size or lack of effects (Cohen, 1988). Because of the small sample size in the pilot study, effect size estimates were not applicable. The expected lack of statistical power was amplified by problems with one self-efficacy measure, which may have compromised these estimates as well. For the main experiment, past research effect sizes were used for sample size estimates (see Table 12).

Procedures

In the pilot study, subjects signed up for one of four time periods conducted in one week on a Tuesday, Wednesday, Thursday, and Friday at 3:30 p.m. each day. Subjects' names were associated with a one-digit code number. This number was noted on the outside of their experiment materials. Subjects signed the outside of their experiment materials packet, but they were ensured of confidentiality in the Informed Consent form they signed before beginning the experiment (see Appendix). Experiment packets were passed out after subjects took their seats. Therefore, subject's code numbers were not assigned to certain individuals prior to the study day. Each of the subject numbers had previously been randomly assigned to one of three experimental conditions using a
random number table (Scheaffer, et al., 1990). The experimental conditions included either an easy goal, moderate goal, or impossible goal. Two types of self-efficacy measures were used in the pilot study to determine the coherence of a new measure \((n = 22)\) with a traditional-style measure \((n = 22)\). Subject numbers were associated with one of the two types of questionnaires using a random number table. Because the pilot study took place on four consecutive days, each subject number also was associated with a certain day. These three variables of assigned goal, self-efficacy measure type, and day of experiment combined to give each subject a three-part code. For example, G1F1D1 meant goal condition 1 (impossible), form 1 (new measure), and day 1 of the experiment. The number of subjects in each cell is in Figure 11.

**Figure 11.** Subject assignment to conditions in the pilot study.

<table>
<thead>
<tr>
<th>Questionnaire Form 1</th>
<th>Questionnaire Form 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy Goal</td>
<td>Moderate Goal</td>
</tr>
<tr>
<td>D1 = 3</td>
<td>D1 = 2</td>
</tr>
<tr>
<td>D2 = 2</td>
<td>D2 = 0</td>
</tr>
<tr>
<td>D3 = 3</td>
<td>D3 = 2</td>
</tr>
<tr>
<td>D4 = 2</td>
<td>D4 = 1</td>
</tr>
<tr>
<td>Moderate Goal</td>
<td></td>
</tr>
<tr>
<td>D1 = 2</td>
<td>D1 = 2</td>
</tr>
<tr>
<td>D2 = 2</td>
<td>D2 = 3</td>
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<tr>
<td>D3 = 2</td>
<td>D3 = 2</td>
</tr>
<tr>
<td>D4 = 0</td>
<td>D4 = 1</td>
</tr>
<tr>
<td>Impossible Goal</td>
<td></td>
</tr>
<tr>
<td>D1 = 2</td>
<td>D1 = 3</td>
</tr>
<tr>
<td>D2 = 2</td>
<td>D2 = 0</td>
</tr>
<tr>
<td>D3 = 2</td>
<td>D3 = 6</td>
</tr>
<tr>
<td>D4 = 0</td>
<td>D4 = 0</td>
</tr>
</tbody>
</table>

*Note. D1 = Day 1 of the pilot study.*
Four pilot study groups were used to allow the experimenter to answer subjects' questions and manage the experimental materials, resulting in 15-20 subjects per experimental group (Day 1 \( n = 14 \), Day 2 \( n = 9 \), Day 3 \( n = 17 \), Day 4 \( n = 4 \)). Based on the number of questions subjects asked and the difficulty in monitoring subjects, it was determined that 10 subjects would be the limit for experimental groups in the main experiment. When subjects arrived, they signed a sheet at the front desk and took any seat in the classroom. When all subjects were seated, the experimenter passed out an experiment packet to each subject. Subjects were told to first sign their name and write their social security number in the blanks provided on the front of the packet. They were then told to open the packet and pull out a smaller packet with the label “Step 1,” to open this packet and pull out the enclosed task instructions. An informed consent form was stapled to the top of the instructions, which subjects were asked to read and sign (see the Appendix). Then, subjects were informed that they could begin reading their instructions and then start the experiment when they were ready. They also were instructed to raise their hands with any questions and the experimenter would come to them.

The task instructions were the same for all subjects except for statements referring to whether the subject should strive for the easy, moderate, or impossible goal (see instructions in the Appendix). The instructions included several main points relating to subject participation:

1. Subjects should not worry if they are not familiar with the terminology used.
2. For the pilot study, subjects were told that past research experience indicated that the entire experiment would take approximately two hours (Taylor, 1984), but time varied for different individuals. Subjects in the pilot study took between 45 minutes and 1 1/2 hours to complete the study, so these instructions were changed to reflect this in the main experiment. Subjects were instructed that the experiment would task not more than 2 hours.

3. Subjects must complete the experiment for full credit.

4. Subjects should note their beginning and finishing time for each Profit Center. They may work at their own pace, but each step of the experiment must be completed in order or they will be disqualified.

5. Subjects work alone and must not talk because this is an individual task. Subjects who talk will be disqualified and will not receive credit for participating.

6. Subjects should raise their hands with any questions about the task, and can leave the task instructions out on their desks for reference during the experiment.

Using the three financial ratio cues, subjects estimated the P/E ratio for each card, and wrote down their prediction on an answer sheet. They were instructed to turn over the card for the correct answer (outcome feedback) only after they recorded their prediction. If they turned over the card for feedback before making predictions, they would be disqualified and asked to leave. No subject was disqualified in the pilot study.

Six packets were contained in the large experiment packet subjects received when the experiment began. The Step 1 packet contained the task instructions. The Step 2 packet contained the Profit Center A answer sheet and cards. The Step 3, Step 4, and Step 5 packets each contained a Profit Center answer sheet, prediction cards, and a questionnaire. The front sheet of each of these questionnaires reminded subjects to fill out the questionnaire before beginning the Profit Center predictions, and to replace it in the packet before beginning their predictions, not making any changes after beginning predictions. The Step 6 packet contained post-task Questionnaire IV. The cover sheet to
this questionnaire stated that subjects should bring all their materials to the front when finished.

After turning in their materials, subjects were given a copy of the Informed Consent form that they could take home, along with a sheet stating not to discuss the experiment and that they would receive a debriefing sheet and their earned extra credit points approximately two weeks later in class (although all subjects were awarded the maximum number of extra credit points). On this debriefing sheet, general purposes of the experiment were stated, along with the information that all participants were awarded the maximum number of points regardless of their performance (see Appendix). The experimental steps are outlined in Table 11. One change is that the affective self-evaluations and perceived effort measures were omitted from Questionnaire I. They are italicized in Table 11, and were added in the main experiment. Two other changes were made to the questionnaires for the main experiment. First, the personal goal item on Questionnaires I, II, and III asked subjects to indicate their personal goal for the next Profit Center. The question was written as, "My personal goal is to predict P/E ratios in the next profit center within an average of __." After this statement, subjects were given numbered choices in terms of units of error. Some subjects filled in their answer in the blank rather than circling their choices, which caused confusion as to their answer, because the numbered choices did not correspond with the units of error. To circumvent this problem in the main experiment, no blank was used in the question. Instead, a colon was added after the statement "within an average of" so that subjects were forced to circle their answers. Second, scale items at the ends of the 100 mm scales and the traditional
self-efficacy scale were bolded for the main experiment to draw attention to the polar opposites.

Table 11

Experimental Steps and Variables Measured

<table>
<thead>
<tr>
<th>Steps in Experiment</th>
<th>Action</th>
<th>Questionnaire Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Instructions</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>Profit Center A</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>Questionnaire I</td>
<td>• self-efficacy perceptions - Profit Center B</td>
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<tr>
<td></td>
<td></td>
<td>• effort-performance expectancies - Profit Center B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• personal goal level - Profit Center B</td>
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<tr>
<td></td>
<td></td>
<td>• affective self-evaluations - Profit Center A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• effort level - Profit Center A</td>
</tr>
<tr>
<td>Step 4</td>
<td>Profit Center B</td>
<td></td>
</tr>
<tr>
<td>Step 5</td>
<td>Questionnaire II</td>
<td>• self-efficacy perceptions - Profit Center C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• effort-performance expectancies - Profit Center C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• personal goal level - Profit Center C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• affective self-evaluations - Profit Center B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• effort level - Profit Center B</td>
</tr>
<tr>
<td>Step 6</td>
<td>Profit Center C</td>
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<tr>
<td>Step 7</td>
<td>Questionnaire III</td>
<td>• self-efficacy perceptions - Profit Center D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• effort-performance expectancies - Profit Center D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• personal goal level - Profit Center D</td>
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<td></td>
<td>• affective self-evaluations - Profit Center C</td>
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<td>Step 8</td>
<td>Profit Center D</td>
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<tr>
<td>Step 9</td>
<td>Questionnaire IV</td>
<td>• affective self-evaluations - Profit Center D</td>
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<tr>
<td></td>
<td></td>
<td>• effort level - Profit Center D</td>
</tr>
<tr>
<td></td>
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<td>• post-task measures</td>
</tr>
<tr>
<td>Step 10</td>
<td>Receive Debriefing Sheet</td>
<td></td>
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</tbody>
</table>
Manipulation Checks

A manipulation check on the post-task questionnaire assessed whether subjects correctly understood their assigned goal level. Subjects were asked to identify their assigned goal level from three choices (1, 3, or 5). The Pearson correlation between these responses and the subjects’ assigned goal conditions indicate that subjects understood their assigned goal, $r = .91, p < .000$. Goal acceptance is a necessary condition in the operation of goal theory, so subjects were asked on the post-task questionnaire if they accepted their goal, given a choice of yes, only part of the time, or no. Most subjects answered that they did accept their goal ($n = 31, 70.5\%$), while eleven responded that they accepted their goal part of the time (25%), and two subjects answered that they did not accept their goal (4.5%). A chi-square test indicated that these proportions were significantly different ($\chi^2 = 30.05, p < .000$).

Construct Measurement Issues

Self-Efficacy Perceptions. Self-efficacy perceptions were measured in two ways, using both a traditional self-efficacy scale, in which confidence in ability to perform was expressed in 10-unit increments from zero (“cannot do at all”) to 100 (“certain can do”), and using a 0 to 100 mm continuous line, on which subjects marked their confidence level between the same polar opposites. The self-efficacy strength score was the sum of the confidence levels on each questionnaire. Subjects were randomly assigned either Form 1, the continuous scale ($n = 22$), or Form 2, the incremental scale ($n = 22$). The scores from the two scale types were compared using a $t$-test for each Profit Center.
Results indicated that a significant difference existed between self-efficacy strength scores on the two scales in Profit Center B (mean difference = 102.86, \( p < .017 \)), Profit Center C (mean difference = 66.69, \( p < .009 \)), and in Profit Center D (mean difference = 62.64, \( p < .001 \)).

The reliability of the scales also was measured using Cronbach’s (1951) alpha. Alpha levels are high for the traditional self-efficacy measure (Form 2) in Profit Centers B (.89), C (.94), and D (.95). Alpha levels for the continuous self-efficacy measure (Form 1) are low for Profit Centers B (.35), C (.51), and D (.57). It was apparent based on the continuous scale measure that the reason for the low reliability was that polar opposites at the ends of the scales were randomly switched so that some scales were arranged low to high from left to right, and others were arranged from high to low from left to right.

Subjects appeared to answer the items without checking to make sure the scale did not change. Subjects’ responses verified this (e.g., three subjects asked if they could go back and fix their past questionnaires because they realized on the last questionnaire that the scales were reversed in some places.)

Test-retest reliability was checked to analyze the stability of the data using correlations between the three self-efficacy strength scores for each form. Self-efficacy strength is the sum of the independent items in the self-efficacy scale. For Form 1 (continuous measure), the correlations are significant between self-efficacy strength scores for Profit Centers B and C (\( r = .50, p < .018, n = 22 \)) and Profit Centers C and D (\( r = .88, p < .000, n = 22 \)). A nonsignificant relationship emerged between scores for Profit Centers B and D (\( r = .34, p < .124, n = 22 \)). Correlations between scores using
Form 2 (traditional measure) are statistically significant between Profit Centers B and C ($r = .77$, $p < .00$, $n = 20$), Profit Centers B and D ($r = .69$, $p < .001$, $n = 20$), and Profit Centers C and D ($r = .93$, $p < .00$, $n = 21$). These results indicate that within-subject self-efficacy scores are stable, with the exception of scores between Profit Centers B and D using the continuous scale. It may be that while subjects may not have paid attention to the polar opposites on the scales in the continuous measure, they were consistent in their answers.

These results led to the question of whether to use Form 1 or Form 2 in the main experiment. Form 1 could be improved by making instructions more explicit about paying attention to the ends of the scales. Calling attention to the scale ends, however, may add variance to the self-efficacy measure relating to the anxiety subjects feel when filling out the form. A related issue is the complexity of the experiment and the number of steps subjects must complete. Subjects' comments after the experiment concerning their desire to go back and fix their responses on the reverse score items indicate that they were paying attention. Because they were required to complete many steps in the experiment, however, they may have been overloaded with stimuli. When this task was used in past experiments (Taylor, 1984), subjects completed all four Profit Centers without breaking to fill out questionnaires, so overloading the subjects with stimuli was not a problem. A problem with Form 2 is that no attempt was made to reverse score items and, therefore, check that subjects were closely reading the questions. A benefit to Form 2 is that its reliability and validity were established in a review comparing different types of self-efficacy scales (Lee & Bobko, 1994). In addition, although each self-efficacy scale is
unique, numerous researchers demonstrated the scale’s reliability and validity as it was adapted for that particular study (Cervone & Wood, 1995; Latham, Winters, & Locke, 1994; Bandura & Jourden, 1991). For these reasons, the traditional self-efficacy scale (Form 2) was used in the main experiment.

**Expectancy 1 (E1).** E1, the belief that effort will lead to performance of a behavior, was compared to self-efficacy strength using Pearson’s correlation coefficient. Using data from the Form 2 self-efficacy scale only, results indicate that E1 is significantly correlated with self-efficacy strength in Profit Centers B ($r = .49, p < .031, n = 20$), C ($r = .45, p < .041, n = 21$), and D ($r = .55, p < .009, n = 22$). Conversely, an analysis using Form 1 responses reveal that E1 is not significantly correlated with self-efficacy strength in Profit Centers B ($r = .29, p < .19, n = 22$), C ($r = .15, p < .50, n = 22$), or D ($r = .19, p < .395, n = 22$). The differences may be due to the differences in the two forms discussed above, and was considered to be an important issue to resolve in the main experiment with a larger sample size.

**Effort and persistence.** Two effort measures were used, a timed measure and a perception measure, and the intention was to combine them for analyses. The correlations between them indicated mixed results, however. One effort measure was a self-reported measure after the Profit Centers that asked subjects how much effort they exerted. The other measure was calculated from the self-reported beginning and ending time of the Profit Centers. To calculate this measure, the beginning time was subtracted from the ending time in a Profit Center, resulting in a number of minutes the person spent making predictions in that Profit Center. In Profit Center B, a marginal significance level
indicates the two measures are related, \( r = .29, p < .063, n = 41 \). In Profit Center D, the two are related significantly, \( r = .38, p < .018, n = 38 \). In Profit Center C, however, the two are not significantly related, \( r = .005, p < .978, n = 38 \). One reason for the lack of a consistent relationship between the two measures may be that some subjects did not record their beginning and ending times on the cover sheet of the answer sheets for the Profit Centers, as indicated by the varied sample sizes in the correlation analyses. Most of these subjects recorded the beginning time, but forgot to record the ending time. To remedy this in the main experiment, the blanks for beginning and ending time were placed on the answer sheet to be more conspicuous (see Appendix). The timed and perceived effort measures are significantly correlated in the main experiment in which subjects reported their beginning and ending times more consistently.

A self-reported effort measure in the post-task questionnaire also asked subjects how much overall effort they exerted in the experiment. Subjects reported that they exerted moderately high levels of effort, where a low score signifies low effort (mean = 59.39, \( SD = 22.22 \)). The responses do not differ across assigned goal conditions, \( F(2, 41) = .06, p < .943 \). The self-reported measure of overall effort also does not vary according to the day of the experiment, \( F(3, 40) = .40, p < .75 \). The overall effort measure is significantly correlated with the self-reported effort measures for Profit Centers B (\( r = .68, p < .000, n = 43 \)), C (\( r = .76, p < .000, n = 43 \)), and D (\( r = .71, p < .000, n = 44 \)). The overall effort measure is not significantly correlated with the timed effort measure in Profit Centers A (\( r = .13, p < .426, n = 42 \)), B (\( r = .11, p < .49, n = 42 \)), C (\( r = -.15, p < .378, n = 39 \)), or
D \ (r = .04, \ p < .834, \ n = 38). This corresponds with the lack of a consistent relationship between the perceived and timed measures in each Profit Center.

The persistence measures were calculated based on the effort results. Because of the lack of consistent convergence between the timed and perceived effort measures, two persistence measures were calculated. The persistence measure was formed by computing the difference between effort measures in two subsequent Profit Centers. A negative number indicates that effort decreased from the former Profit Center to the latter one because the subject spent less time working on the latter Profit Center. A positive number indicates that effort increased. An error was made in the pilot study analysis in that a perceived effort measure was left off the first questionnaire. Therefore, persistence in Profit Center B could only be calculated using the timed measure. For Profit Centers C and D, both types of persistence measures were calculated. Using the timed measure, persistence decreased significantly from Profit Center B to Profit Center C (t = -3.92, \ p < .000), but not from Profit Center C to Profit Center D (t = -.04, \ p < .969). Using the perception measure, persistence did not change significantly from Profit Center C to D (t = -.74, \ p < .466). In the main experiment, a self-reported effort measure was added to Questionnaire I.

**Perception Measures**

In the post-task questionnaire, subjects were asked to respond to questions concerning their participation, the instructions, the task, and their performance. The answers to these
items provided important data about the pilot study, indicating whether changes needed to be made for the main experiment.

On the post-task questionnaire, subjects were asked what most interested them as they participated in the experiment, whether it was to obtain course credit, to reach the assigned goal, both of these options, or neither of these options. Responses reveal that most subjects were interested in both achieving course credit and reaching the assigned goal \((n = 23, 52.3\%)\), twelve reported being interested in reaching the assigned goal \((27.3\%)\), nine reported a primary interest in obtaining course credit \((20.5\%)\), and no subjects answered that they were interested in neither credit or the goal. A chi-square analysis indicates that these differences are significant \((\chi^2 = 24.55, p < .000, n = 44)\). Therefore, subjects were involved in reaching their goals.

Most subjects reported that they preferred a mathematical problem with a "right" answer \((n = 33, 75\%)\), and fewer stated that they preferred a novel problem with no clear "right" answer \((n = 11, 25\%)\). A chi-square test revealed that these proportions are significantly different, \(\chi^2 = 11.00, p < .001\). The task subjects participated in was a novel and complex problem. The subject responses are important because they indicate the general preference people have for problems that are not novel and complex. Complex, novel tasks are prevalent in the work environment, and the importance of their study is amplified by these responses indicating people may avoid or dislike them.

The means and standard deviations of continuous scale questions (0 to 100 mm) in the post-task questionnaire provided insight into subjects' perceptions about the task, the
experiment, and perceived performance. The means, standard deviations, and ANOVA results are presented in Table 12.

Table 12

Perception Questions Using Interval and Ratio Data

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
<th>SD</th>
<th>F-value</th>
<th>p-value</th>
<th>F-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximately how much time (in minutes) would you have liked to complete the predictions in all four Profit Centers? (1 = 15, 2 = 30, 3 = 45, 4 = 60, 5 = 75 or more)</td>
<td>2.64</td>
<td>1.40</td>
<td>1.67</td>
<td>.20</td>
<td>3.29</td>
<td>.03</td>
</tr>
<tr>
<td>How carefully did you read the instructions? (0 = extremely carefully, 100 = not carefully at all)</td>
<td>28.39</td>
<td>22.04</td>
<td>.38</td>
<td>.69</td>
<td>.85</td>
<td>.478</td>
</tr>
<tr>
<td>How useful did you find the instructions? (0 = not useful at all, 100 = extremely useful)</td>
<td>47.27</td>
<td>26.43</td>
<td>2.49</td>
<td>.096</td>
<td>.54</td>
<td>.657</td>
</tr>
<tr>
<td>How well did you understand the task? (0 = not well at all, 100 = extremely well)</td>
<td>48.02</td>
<td>27.21</td>
<td>2.03</td>
<td>.144</td>
<td>.38</td>
<td>.767</td>
</tr>
<tr>
<td>Did you enjoy making the predictions? (0 = yes, a great deal, 100 = no, not at all)</td>
<td>40.91</td>
<td>25.19</td>
<td>.31</td>
<td>.738</td>
<td>.70</td>
<td>.555</td>
</tr>
<tr>
<td>How unusual did you find the task to be? (0 = not unusual at all, 100 = extremely unusual)</td>
<td>68.82</td>
<td>26.87</td>
<td>2.59</td>
<td>.087</td>
<td>.49</td>
<td>.692</td>
</tr>
<tr>
<td>How well did you feel you performed in this study? (0 = extremely good performance, 100 = extremely poor)</td>
<td>60.30</td>
<td>27.30</td>
<td>2.86</td>
<td>.068</td>
<td>.47</td>
<td>.706</td>
</tr>
<tr>
<td>How much did you improve from beginning to end? (0 = no improvement at all, 100 = a great deal of improvement)</td>
<td>49.20</td>
<td>26.10</td>
<td>3.11</td>
<td>.055</td>
<td>.93</td>
<td>.435</td>
</tr>
<tr>
<td>How difficult was it for you to reach your assigned goal? (0 = impossible, 100 = not difficult at all)</td>
<td>29.91</td>
<td>22.85</td>
<td>.9663</td>
<td>.3890</td>
<td>1.4111</td>
<td>.2537</td>
</tr>
<tr>
<td>How committed were you to achieving your goal? (0 = not committed at all, 100 = extremely committed)</td>
<td>59.05</td>
<td>23.77</td>
<td>.2087</td>
<td>.8125</td>
<td>1.0987</td>
<td>.3609</td>
</tr>
</tbody>
</table>
When asked how much total time they preferred to complete the entire task, the majority of subjects answered that they would prefer either 15 minutes \((n = 11, 25\%)\) or 30 minutes \((n = 14, 31.8\%)\). Fewer subjects reported that they would prefer 45 minutes \((n = 5, 11.4\%)\), 60 minutes \((n = 8, 18.2\%)\), or 75 minutes or more \((n = 6, 13.6\%)\). Because this question provided interval data, ANOVA was used to test for group differences. The amount of time desired does not vary according to subjects' goal levels, \(F(2, 41) = 1.67, p < .20\). Desired time does vary according to the day subjects participated in the experiment, though, \(F(3, 40) = 3.29, p < .03\). According to the Newman-Keuls multiple comparison test, subjects who participated on the final day of the experiment stated that they would prefer significantly more time \((mean = 4.25)\) than those who participated on the first day \((mean = 2.00)\). Using the more liberal Duncan's multiple-range test, subjects who participated on the final day of the experiment reported that they would prefer significantly more time than those participating on the first day and those participating on the third day \((mean = 2.65)\). These means can be interpreted according to the scale in which 1 = 15 minutes, 2 = 30 minutes, 3 = 45 minutes, 4 = 60 minutes, and 5 = 75 minutes or more. In the post-experiment interview, subjects stated that they did not rush through the experiment, and they felt that not much time was needed after they learned how to perform the task. Subjects also indicated in the interviews that they did not discuss the experiment or the time required to complete it. Therefore, no explanation could be determined for the group differences based on the day of the experiment.

Three questions related to the instructions of the experiment and whether subjects understood them. When asked how carefully they read the instructions, subjects reported
that they read the instructions somewhat carefully where a low score indicated "extremely carefully," and a high score indicated "not carefully at all" (mean = 28.39, SD = 22.04, n = 44). In ANOVA, these responses do not vary according to subjects' assigned goal level, $F(2, 41) = .38, p < .689$, or according to the day subjects participated in the experiment, $F(3, 40) = .85, p < .478$. Subjects answered the question of whether instructions were "not useful at all" (0) to "extremely useful" (100) with neither positive or negative reactions (mean = 47.27, SD = 26.43, N = 44). ANOVA also revealed here that these responses do not vary according to the subjects' assigned goal level, $F(2, 41) = 2.49, p < .096$, or according to the day of the experiment, $F(3, 40) = .54, p < .657$. When asked whether they understood the task, subjects answered similarly, between understanding it "not well at all" and "extremely well" on the scale from 0 to 100 (mean = 48.02, SD = 27.21, n = 44). Again, these responses do not vary according to the assigned goal level, $F(2, 41) = 2.03, p < .144$, or according to the day of the experiment, $F(3, 40) = .38, p < .768$. In the post-experiment interview, a few subjects stated that the complexity of the task made the instructions inherently difficult to understand. This helped to explain the mediocre results reflecting subjects' reported understanding and perceived usefulness of the instructions.

Two questions probed subjects' perceptions of the task. Subjects reported that they tended to enjoy the task slightly more than not enjoying it, where "0" indicates that subjects did not enjoy the task at all and "100" indicates that they enjoyed it a great deal (mean = 40.91, SD = 25.19, n = 44). ANOVAs revealed that these results do not vary according to the subjects' assigned goal level, $F(2, 41) = .31, p < .738$, or according to the
day of the experiment, $F(3, 40) = .70, p < .555$. Subjects were asked how unusual they found the task to be, between “not unusual at all” (0) and extremely unusual (100), and they reported that they perceived the task as somewhat unusual (mean = 68.82, $SD = 26.87, n = 44$). In ANOVA results, responses do not vary according to the subjects’ assigned goal, $F(2, 41) = 2.59, p < .087$, or according to the day of the experiment, $F(3, 40) = .4884, p < .6923$. This response verified that the task was not perceived as an everyday task, when, in fact, it was designed to be complex and novel.

Related to their assigned goal, subjects were asked to indicate whether they were “not committed at all” to their goals (0) to “extremely committed” (100), and the answers indicate that subjects tended to be somewhat committed (mean = 59.05, $SD = 23.77, n = 44$). A check on this self-report commitment measure was done using a correlation between the self-report measure and subjects’ actual commitment in each Profit Center, expressed as the number of the decision in which subjects decided to commit to their goal. This comparison reveals that the self-report measure does not correlate significantly with commitment decisions in Profit Centers A ($r = .24, p < .119, n = 43$), B ($r = .20, p < .194, n = 43$), C ($r = .14, p < .119, n = 44$), or D ($r = .09, p < .564, n = 44$). This suggests that subjects may not have equated their actual commitment decision in the Profit Centers to their perception that they were committed to their goal. The goal commitment self-report measure does not vary according to subjects’ assigned goals, $F(2, 41) = .21, p < .813$, or according to the day the experiment was conducted, $F(3, 40) = 1.10, p < .36$. 
Two questions concerned subjects' perceptions about their own performances. Subjects reported that their performance was slightly poor on a scale from 0 to 100 labeled "extremely good performance" to "extremely poor performance" (mean = 60.30, $SD = 27.30$, $n = 44$). Subjects' perceptions of their performance correlates significantly with an average of subjects' performance, measured as the average number of errors subjects made for all 80 decisions, 20 in each Profit Center ($r = .33$, $p < .03$, $n = 42$). Perceived performance does not differ according to the day subjects participated in the experiment, $F(3, 40) = .47$, $p < .706$. If a marginal significance level is accepted, perceived performance differs according to subjects' assigned goal level, $F(2, 41) = 2.86$, $p < .069$. Although the Newman-Keuls multiple comparison test showed no significant differences between groups, the Duncan test indicated that the subjects assigned an impossible goal (mean = 73.40) perceived that their performance was significantly poorer than subjects assigned an easy goal (mean = 52.73). Subjects' perceptions in the moderate goal condition are not significantly different from subjects' perceptions in the other two goal conditions (mean = 54.36). The difference between perceived performance across goal conditions is an important finding that was followed closely in the main experiment. The expectations of this experiment are that subjects' perceptions will be altered based on the goal level they are assigned, specifically in terms of self-efficacy perceptions. The post-task assessment of perceived performance indicates that this effect occurred.
Related to subjects' perceived performance was their perceived improvement throughout the task, from "no improvement at all" (0) to "a great deal of improvement" (100). Subjects responded between these two opposites (mean = 49.20, SD = 26.10, n = 44). Like perceived performance, perceived improvement differs significantly across goal conditions with a marginal significance criterion, $F(2, 41) = 3.11, p < .055$. Both Duncan's and Newman-Keuls' multiple comparison tests revealed that the subjects in the easy goal condition (mean = 60.60) perceived their improvement to be significantly greater than subjects in the impossible goal condition (mean = 37.93). Perceived improvement in the moderate goal condition (mean = 49.07) does not differ significantly from the other conditions. Again, the easy goal was influential in subjects' perceptions of their performance. Perceived improvement in performance does not differ according to the day of the experiment, $F(3, 40) = .93, p < .435$.

Subjects' perceptions of goal difficulty do not correlate significantly with goal level ($r = .21, p < .177, n = 44$). Perceived goal difficulty also does not differ by goal level, $F(2, 41) = .97, p < .389$. In order to investigate the relationship between perceived and actual goal difficulty, descriptive statistics were calculated for each goal level. Means are in the expected direction using the scale from "impossible" (0) to "not difficult at all" (100). The mean perceived goal difficulty for the impossible goal subjects is 23.53, for moderate goal subjects is 31.43, and for easy goal subjects is 34.87. Perceived goal difficulty does not differ according to the day subjects participated in the experiment, $F(3, 40) = 1.41, p < .254$. 
Additional Measured Variables

Additional variables were measured that may account for variance in the dependent measures. Analysis of these variables using the pilot study data provides an indication of how valuable these variables may be in the main experiment analysis. In past self-efficacy studies involving analytical or mathematical tasks (Betz & Hackett, 1986), self-efficacy perceptions varied by gender, and these effects decreased over time. ANOVA reveals that self-efficacy perceptions in the pilot study do not vary by gender, $F(1, 40) = .12, p < .726$. A repeated measures ANOVA indicated that males' and females' self-efficacy strength scores do not change differently over the four Profit Centers, $F(2, 2, 80) = .01, p < .991$.

Mood correlates significantly with complex task performance in past studies (Cervone & Wood, 1995). The mood measures used in this study were the same as in the Cervone and Wood (1995) study, and, as in that study, were combined into one averaged measure because they were significantly correlated ($r = .67, p < .000, n = 44$). Using a scale of 0 to 100, the mean value and standard deviation indicate that subjects were neither in an alert, energetic, and enthusiastic mood or in a tired, disinterested mood (mean = 51.23, $SD = 21.94, n = 44$). Subjects’ mood does not vary according to their assigned goal level, $F(2, 41) = 2.08, p < .138$, or according to the day they participated in the experiment, $F(3, 40) = 1.07, p < .374$. Mood is not significantly correlated with performance in Profit Centers A ($r = .16, p < .319, n = 43$), B ($r = .22, p < .164, n = 43$), C ($r = .08, p < .623, n = 44$), or D ($r = .12, p < .45, n = 44$).

Affective self-evaluations were measured after Profit Centers B, C, and D to evaluate how subjects felt about their performance in the prior Profit Center. The scale varied from
“dissatisfied” (0) to “satisfied” (100). Affective self-evaluations that subjects reported after a Profit Center correlate significantly with subjects’ prior performance in Profit Center B ($r = -0.38, p < .014, n = 42$), in Profit Center C ($r = -0.42, p < .005, n = 43$), and in Profit Center D ($r = -0.53, p < .000, n = 44$). Affective self-evaluations also correlate significantly with subjects’ future performance in Profit Center C ($r = -0.34, p < .024, n = 43$) and in Profit Center D ($r = -0.37, p < .014, n = 43$). As the performance variable increases, the subject made a greater number of errors. A higher level of affective self-evaluations indicates higher self-satisfaction with performance. Therefore, a negative correlation between these variables indicates that subjects were more satisfied with a lower number of errors. An error was made in construction of the questionnaires in that the affective self-evaluation measure was omitted from Questionnaire I, which would reflect self-evaluations as a result of Profit Center A performance. This was added for the main experiment. The available data from the pilot study reveals that affective self-evaluations may be important in explaining performance.

Post-Experiment Interviews

Approximately ten students were interviewed after the experiment to address issues about the task, procedures, or instructions that may improve the main experiment. Most stated that they enjoyed the task and felt that it was challenging. Most subjects also stated that they were concerned about risking their extra credit points, and that they waited until the end of the Profit Centers to commit, if they committed at all. Only one subject stated that she decided to “go for it” and commit at the first of each Profit Center. Some concern
existed because subjects took considerably less time than expected to complete the experiment. These times ranged from approximately 40 minutes to one hour and 20 minutes. In the post-experiment interviews, however, subjects reported that they did not feel that they rushed through the task. Several subjects stated that after they “got the hang of” the task and procedures, they worked faster. During the experiment and after, a few subjects expressed frustration that their extra credit points would be based on such a difficult task. This was expected, especially for subjects with impossible goals who were faced with little chance of reaching their assigned goals.

Summary of Pilot Study Changes

Several changes were made to the main experiment based on pilot study results. First, each group in the experiment was limited to 10 subjects. One group in the pilot study had 17, and this caused a problem with too many subject questions and difficulty in monitoring subjects. Second, the instructions were modified to reflect the amount of time subjects took to complete the pilot study. For the pilot study, subjects were told in the informed consent form that the experiment would most likely take approximately 2 hours. In the main experiment, subjects were told that the experiment would not take more than 2 hours to complete.

Three changes were made to questionnaires. First, perceived level of effort and affective self-evaluations were added to Questionnaire I because they were omitted from the questionnaire in the pilot study. Second, one question before Profit Centers B, C, and D asks subjects to identify their personal goal level for the next Profit Center. The layout
of this question encouraged some students to fill in their answer in a blank, rather than circling their response as they were instructed. This blank was removed to avoid this problem. Second, the ends of scales on the questionnaires were bolded to call attention to the polar opposites.

One change was made to the answer sheets for each Profit Center. In the pilot study, a cover sheet provided blanks for subjects to record their starting and finishing times for the Profit Center. Some subjects did not record their finishing times, so these blanks were added to the answer sheets themselves to make them more conspicuous.

Finally, two forms of self-efficacy measures were used in the pilot study, a measure with continuous 100 mm scales, and one with an incremental scale from 10 to 100. The traditional self-efficacy measure which uses 10-point increments was used in the main experiment. This decision was based on the scale’s reliability and validity in past studies, as well as its reliability and stability in the pilot study. In addition, it was determined from subject interviews and by viewing subjects’ questionnaires that the continuous scale measures may have added to information overload the subjects experienced in this multi-staged task.

Chapter Summary

One purpose of this chapter was to detail the experimental design, task, procedures, and subjects in the main experiment. Effect size and statistical power estimates were calculated to determine the appropriate sample size for the main experiment. The Brunswik (1955) lens model and MCPLP task were used in the pilot study and allowed
for specific knowledge of the amount of objective uncertainty subjects faced. Post-task measures indicate that the subjective uncertainty of the task affected subjects' perceptions of the task and of their performance, as expected. In addition, subjects' answers to post-task measures reveal that experimental manipulations were successful and that subjects reacted to goal assignments consistently with expectations. Based on the pilot study results, changes were made to construct measures and procedures.
CHAPTER 4

RESULTS

Analysis Methods

The purpose of this chapter is to present the results of the main experiment, including an analysis of each hypothesis. First, the post-task manipulation checks are discussed. Then, the hypotheses are analyzed using the methods listed in Table 13. ANOVA and regression analyses were done with SPSS 6.1 (1995), and path analyses were conducted with SAS (1987). ANOVA and path analysis were used in the same manner in all of the complex task studies conducted by Bandura and his colleagues (Bandura & Jourden, 1991; Bandura & Wood, 1989; Jourden, 1992; Wood & Bandura, 1989a; Wood, et al., 1990). In all of the analyses, statistical assumptions were tested. Unless otherwise indicated, data passed all of these tests.

Table 13

Statistical Method for Each Hypothesis

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Analytic Method</th>
<th>Purpose of Hypotheses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 8</td>
<td>Path analysis</td>
<td>Prediction</td>
</tr>
<tr>
<td>9 - 10</td>
<td>ANOVA</td>
<td>Group differences</td>
</tr>
<tr>
<td>11 - 12</td>
<td>Regression</td>
<td>Interaction effects</td>
</tr>
</tbody>
</table>
Manipulation Checks and Construct Measures

Manipulation Checks

Subjects were asked in the post-task questionnaire to indicate their assigned goal level. The Pearson product-moment correlation between the actual and reported assigned goal is significant ($r = .695, p < .000, n = 162$), indicating that subjects understood their assignment. Subjects also were asked whether they accepted their goals. Most subjects answered that they did ($n = 104, 65\%$), and fewer reported that they accepted their goal part of the time ($n = 41, 25\%$) or that they did not accept their goal ($n = 16, 10\%$). A chi-square analysis reveals that this difference is significant, $\chi^2 = 76.63, p < .000$. Goal acceptance is a critical component for goal theory to operate, making these positive results important to establishing that subjects were involved in the task. One subject did not answer this question.

Three post-task questions were used to establish that subjects understood the task and used the instructions. Subjects were asked how carefully they read the instructions, and the mean value indicates that they read them carefully ($mean = 29.61, SD = 21.73$; $0 =$ extremely carefully, $100 = $ not carefully at all). Subjects responded that the instructions were moderately useful on a scale where $0 = $ not useful at all and $100 = $ extremely useful ($mean = 45.41$). Subjects responded that they understood the task moderately well ($mean = 48.28, SD = 24.53$ was reported, where $0 = $ not well at all and $100 = $ extremely well). The moderate responses reflecting perceived usefulness and understanding of instructions were expected because of the complex nature of the task.
Last, subjects stated that the task was unusual, verifying that the task was perceived as novel and different \((\text{mean} = 65.85, SD = 20.25; 0 = \text{not unusual at all}, 100 = \text{very unusual})\). The responses to each of these task-related questions do not differ across goal assignment, course section, or experimental group. Perceived usefulness of the instructions differs significantly according to gender, however, with women reporting the instructions to be less useful \((\text{mean} = 41.93)\) than men did \((\text{mean} = 49.03, t = 2.04, p < .043)\).

The mean performance in the Profit Centers should not be different because the average allowable error was specified in past studies to be approximately equal (see Table 9). As expected, the means are not significantly different between Profit Centers A \((\text{mean} = 3.656)\), B \((\text{mean} = 3.337)\), C \((\text{mean} = 3.203)\), and D \((\text{mean} = 3.18)\).

**Investigation of Measurement Scales**

**Self-efficacy perceptions.** Cronbach’s alpha calculations reveal that the self-efficacy scale displays high internal consistency in Profit Centers B \((\alpha = .924, n = 159)\), C \((\alpha = .935, n = 158)\), and D \((\alpha = .939, n = 159)\). Correlations between the three self-efficacy measures also indicate high test-retest reliability. Self-efficacy perceptions are correlated significantly for Profit Centers B and C \((r = .662, p < .000, n = 158)\), B and D \((r = .585, p < .000, n = 159)\), and C and D \((r = .874, p < .000, n = 158)\). Based on these measures, the self-efficacy scale was deemed reliable.

The validity of self-efficacy measures is confirmed through the ability of the construct to predict performance (Gist & Mitchell, 1992). Self-efficacy, by its theoretical definition,
is a person's perception of his or her ability to perform a specific task. The construct validity of self-efficacy in this study is confirmed because of its ability to predict performance. Self-efficacy is a significant predictor of performance in Profit Centers B ($T = -2.745, p < .007, R^2 = .046$), C ($T = -3.208, p < .002, R^2 = .062$), and D ($T = -4.474, p < .000, R^2 = .114$). The negative $T$-values indicate that as self-efficacy strength increases, the number of errors decrease (performance increases). The $T$-value represents the regression coefficient used in the SPSS analysis.

The effort–performance measure, $E_l$, is significantly correlated with self-efficacy perceptions in Profit Centers B ($r = .359, p < .000, n = 159$), C ($r = .453, p < .000, n = 156$), and D ($r = .442, p < .000, n = 156$). The conceptual definition of self-efficacy distinguishes the construct from $E_l$, or the expectancy that effort will lead to performance. Few researchers investigated the relationship between $E_l$ and self-efficacy, and the results of these studies varied. Danehower (1988) found that $E_l$ was a distinct construct from self-efficacy and not a valid predictor of outcomes, but Maddux, et al. (1986) discovered that $E_l$ was a distinct construct from self-efficacy and a valid predictor of outcomes. Manning and Wright (1983) found that, although $E_l$ and self-efficacy were significantly correlated, $E_l$ did not predict outcomes. Data in the present study indicate that, although self-efficacy and $E_l$ are significantly related (see above correlations), self-efficacy is a superior predictor of performance in Profit Centers B, C, and D. $E_l$ is not a significant predictor of performance in Profit Center B ($T = -1.344, p < .181, R^2 = .011$) or Profit Center C ($T = -1.328, p < .186, R^2 = .011$). $E_l$ is a significant predictor of performance in Profit Center D ($T = -1.939, p < .054, R^2 = .024$). The negative $T$-value
indicates that as subjects' expectations that effort led to performance increased, their prediction errors decreased. Therefore, the construct validity of self-efficacy is verified by its discriminant validity from E1, and by its predictability of performance.

**Effort.** Two effort measures were used in the present study. In one effort measure, subjects were asked to report the level of effort they exerted in the prior Profit Center. The second effort measure was expressed in the number of minutes a subject worked in a Profit Center. Subjects recorded their beginning and ending times in Profit Center A, B, C, and D. The perception and timed effort measures are significantly correlated in each of the Profit Centers: A ($r = .342, p < .000, n = 157$), B ($r = .274, p < .001, n = 155$), C ($r = .223, p < .005, n = 156$), and D ($r = .229, p < .005, n = 150$). A few subjects did not record their beginning or ending times in a Profit Center, lowering the sample size slightly. The percentage of unrecorded times was decreased from the Pilot Study, however, because the blanks where subjects recorded the times were moved to a more conspicuous location on the answer sheets. Because the two effort measures are significantly related, the timed effort measure was used in the hypotheses' analyses.

A post-task question asked subjects to report their overall effort during the study, and the responses further confirmed the coherence of the perceived and timed effort measures. Subjects reported that they expended somewhat high effort levels ($\text{mean} = 57.21$, $\text{SD} = 19.36$; 0 = no effort at all and 100 = a great deal of effort). Reported overall effort did not vary according to goal level, course section, experimental group, or gender. This overall effort measure correlates significantly with the individual effort measures that subjects reported for Profit Centers A ($r = .505, p < .000, n = 160$), B ($r = .625, p < .000$,
This overall effort measure also significantly correlates with the timed effort measure in Profit Centers A ($r = .16, p < .045, n = 157$), B ($r = .217, p < .007, n = 155$), C ($r = .236, p < .003, n = 156$), and D ($r = .295, p < .00, n = 150$).

**Mood.** Two questions were used to measure mood, as in past self-efficacy studies. Subjects were asked to respond to questions of how they felt, on a scale of tired and disinterested versus enthusiastic, alert, and energetic. The responses to these two questions are significantly related, $r = .667, p < .000$, so they were combined to form one mood measure for post-task analysis.

**Personal goals.** Subjects were asked before Profit Centers B, C, and D to indicate their personal goal levels. Subjects reported that they would minimize their prediction errors to zero, 1, 2, 3, 4, 5, or 6 units of error, or that they had “no particular goal.” Because inclusion of the “no particular goal” option makes this variable non-continuous, those who answered in this manner were removed from the analyses of hypotheses concerning personal goals. Twenty subjects answered “no particular goal” and were removed from Profit Centers B and C analyses, and 21 subjects were removed from Profit Center D analyses. The number of subjects required in the power analysis was 135, so the remaining number of 141 to 142 subjects was deemed sufficient. A similar number of subjects in the impossible, moderate, and easy goal groups indicated “no personal goal,” so the number of subjects per goal assignment was approximately equal after removing subjects.
Analyses of Hypotheses 1-8

Path Analysis Model

A path analysis was conducted in order to study proposed effects in Hypotheses 1-8. Path analysis is appropriate for studying causation in a model that is based on theory (Pedhazur & Schmelkin, 1991). In this study, the direction of causality was established from theory and prior research in which the same variables were measured in temporal sequence (e.g., Wood & Bandura, 1989a). This past research provided the foundation for the path diagram in this study (see Figure 12). All variables in a path analytic model must be continuous, so assigned goal level was not included.

Figure 12. Path analytic model for Profit Centers B, C, and D.
In Figure 12, the proposed relationships among the variables are specified. The exogenous variables, or the variables that are determined by causes outside the model, are feedback and past performance. The endogenous variables, or the variables determined by exogenous or endogenous variables in the model, are self-efficacy perceptions, personal goals, effort, performance, and persistence. The relationships between exogenous variables are not analyzed in path models (r67) because the researcher does not specify that these cause each other. Paths between exogenous and endogenous variables, and between endogenous and endogenous variables are designated by arrows in the model. For example, the notation, p57, designates the effect of variable 7 (feedback) on variable 5 (self-efficacy perceptions). The error terms also are specified for endogenous variables (e.g., e5 for self-efficacy perceptions). Error terms are included in the model because it is rarely possible to account for the total variance of a variable.

The path model in Figure 12 is a recursive model, meaning that the causal flow is unidirectional and no variable is both a cause and effect of another variable (Pedhazur & Schmelkin, 1991). The model is also overidentified, meaning that all possible paths in the model are not specified. In a just identified model, all paths are specified and the correlation or covariance matrix is exactly reproduced because perfect information is available about the relationships between variables in the model. Therefore, statistics that reflect the fit of the model to the data are not useful. In an overidentified model, however, fit indices are used to determine how well the model fits the data. To analyze the fit of the model to the data, the $\chi^2$ statistic was computed. It is desirable to fail to reject the chi-square statistic, which indicates that the proposed and actual matrices are not statistically
different (Hair, et al., 1992). The goodness of fit index indicates the fit of the data to the model and should be above .9 (on a scale between 0 and 1.0), but is not adjusted for degrees of freedom. Adjusted goodness of fit provides the corrected form of this measure and should be above .9. Two other fit statistics were important to assess the model. The Bentler and Bonett non-normed index and the Bentler and Bonett normed fit index are both provided by SAS and should be greater than .9.

In a path analysis, the goal is to model the covariance or correlation matrix as closely as possible (Pedhazur & Schmelkin, 1991). Modeling the covariance matrix results in unstandardized path regression coefficients \((b)\), and modeling the correlation matrix results in standardized path coefficients \(\beta\). Standardized coefficients were calculated in the present study because they can be compared across populations. Coefficients were tested for significance for direct-effects Hypotheses 1-8. Correlation coefficients are commonly reported with path coefficients to specify the first-order, or bivariate, relationship between two variables. These are presented on the path models here and are further explored in post hoc analyses.

A separate path analysis was conducted for Profit Centers B, C, and D. No path analysis was conducted for Profit Center A because there is no past performance, feedback, personal goal, or self-efficacy information as inputs to outcome measures. A series of \(t\)-tests were conducted to determine if the data from Profit Centers B, C, and D could be combined into one overall analysis. Significant differences between variable means indicated that the data could not be combined. Persistence is significantly different between Profit Centers B and C \((t = -6.9, p < .000)\), Profit Centers C and D
(t = -3.4, \( p < .001 \)), and Profit Centers B and D (t = -10.03, \( p < .000 \)). Effort is significantly different between Profit Centers B and C (t = 7.02, \( p < .000 \)), Profit Centers C and D (t = 3.97, \( p < .000 \)), and Profit Centers B and D (t = 8.75, \( p < .000 \)). Performance is significantly different between Profit Centers B and D (t = 2.16, \( p < .032 \)). Personal goals are significantly different between Profit Centers B and C (t = -2.81, \( p < .006 \)), Profit Centers C and D (t = -3.53, \( p < .001 \)), and Profit Centers B and D (t = -4.63, \( p < .000 \)). Finally, past performance is different between Profit Centers B and C (t = 40.08, \( p < .000 \)) and Profit Centers B and D (t = 37.86, \( p < .000 \)). Based on these variable mean differences, three separate path analyses were conducted.

The data for the Profit Centers was deleted listwise for missing cases so that the only cases used in the analyses were those in which every variable was provided by a subject. This resulted in a somewhat smaller sample size for Profit Centers B (n = 133), C (n = 127), and D (n = 122) versus other hypotheses. These sample sizes are still close to the desired sample size specified in Chapter 3 (n = 135).

Data assumptions for path analyses were tested in SAS, or were specified by the researcher. The assumptions are as follows (Pedhazur & Schmelkin, 1991), all of which were adhered to:

1. Variable relationships are linear, additive, and causal.
2. Residuals are not correlated with variables that precede them in the model. This assures that all relevant variables are tested in the model, or that unmeasured systematic variance does not exist.
3. A one-way causal flow exists among variables.
4. Interval data is used.
5. Variables are measured without error.

First, the fit statistics and the path models for Profit Centers B, C, and D are presented. Next, the path models are discussed in terms of Hypotheses 1 - 8. A synthesis of the results is presented, followed by post hoc analyses.

**Profit Centers B, C, and D Path Analyses**

**Profit Center B.** Fit statistics indicate a good fit of Profit Center B data to the proposed model. The goodness of fit index (.9812) and adjusted goodness of fit index (.9340) are both greater than .9, which is considered a criterion for good fit. The chi-square statistic ($\chi^2 = 9.8194, df = 8, p < .2779$) was not rejected. Therefore, the statement that the data fits the model is not rejected. Finally, the Bentler and Bonett non-normed fit index (.9848) and normed fit index (.9707) both adhere the criteria of being greater than .9. The overall model with standardized path coefficients and first-order correlations is presented in Figure 13. First-order correlations indicate the strength of relationships between two individual variables only, and do not include the influence of the other variables in the model. The results of the individual Hypotheses 1-8 are based on the standardized path coefficients in Figure 13 and the significance of their $t$-tests.
Figure 13. Results fitting Profit Center B data to the path analytic model.

Profit Center C. Fit statistics indicate a good fit of Profit Center C data to the proposed model. The goodness of fit index (.9761) and adjusted goodness of fit index (.9163) are both greater than .9. The chi-square statistic ($\chi^2 = 10.9387$, $df = 8$, $p < .2052$) was not rejected. Therefore, the statement that the data fits the model is not rejected. The Bentler and Bonett non-normed fit index (.9732) and normed fit index (.9646) both adhere the criteria of being greater than .9. The overall model with standardized path coefficients and first-order correlations is presented in Figure 14.
Figure 14. Results fitting Profit Center C data to the path analytic model.

Note. Initial numbers on the paths are standardized path coefficients; numbers in parentheses are first-order correlations.
* Correlations are significant at the .05 level.
** Correlations are significant at the .01 level.
a. Significant at the .05 level in t-test (1-tailed).
b. Significant at the .0025 level in t-test (1-tailed).
c. Significant at the .0005 level in t-test (1-tailed).

Profit Center D. Fit statistics indicate a poor fit of Profit Center D data to the proposed model. The goodness of fit index (.9114) is above .9, but the adjusted goodness of fit index (.6965) is not, indicating that the data do not fit the model well. The chi-square statistic ($\chi^2 = 51.1081, df = 8, p < .0001$) was rejected, and this means that the data do not fit the model. Finally, the Bentler and Bonett non-normed fit index (.6688) and normed fit index (.8591) do not adhere to the criteria of being greater than .9. The overall
model with standardized path coefficients and first-order correlations is presented in Figure 15.

Figure 15. Results fitting Profit Center D data to the path analytic model.

```
    e5
   /   \
  /     \
/        \ Self-Efficacy Perceptions 5

Feedback 7  1.38 (.121)
             .6484*. (528**)
             .040 (0.81)
Past Performance 6  .649* (-0.88)

Personal Goals 4
   .4901* (527**)
   .2138* (288**)
   .0652 (-0.054)
   .0693 (-0.035)

Performance 3  .1189 (0.99)
                   .0388 (0.20)
Effort 2
Persistence 1

\     /   e2
  /     \   e1
/        \      e3
```

Note. Initial numbers on the paths are standardized path coefficients; numbers in parentheses are first-order correlations.
*Correlations are significant at the .05 level.
**Correlations are significant at the .01 level.
a. Significant at the .05 level in z-test (1-tailed).
b. Significant at the .0005 level in z-test (1-tailed).

Hypotheses 1–8 Results

**Hypothesis 1.** In Hypothesis 1, it was proposed that stronger self-efficacy perceptions would result in higher levels of performance, effort, and persistence. The standardized path coefficients do not support this hypothesis for performance in Profit Center B
Self-efficacy does affect performance in Profit Center D significantly ($\beta = -.3095$, $t = -4.2529$, $p < .0005$). The negative coefficient indicates that as self-efficacy perceptions strengthened, subjects minimized their errors (attained higher performance).

Stronger self-efficacy perceptions did not result in significantly higher levels of effort in Profit Centers B ($\beta = -.1083$, $t = -1.2178$, $p < .1128$), C ($\beta = -.1727$, $t = -1.8888$, $p < .05$), or D ($\beta = .0388$, $t = .4093$, $p < .3415$). A positive, significant path coefficient would indicate that as self-efficacy perceptions strengthened, effort also increased (amount of time subjects work in the Profit Center increased). The path coefficient in Profit Center C is significant, but negative, and this shows that stronger self-efficacy perceptions resulted in less effort, contrary to the hypothesis. Reasons for this result are explored in the post hoc analysis. Self-efficacy did not result in higher levels of persistence in Profit Centers B ($\beta = .0547$, $t = .6121$, $p < .2703$), C ($\beta = -.0355$, $t = -.3833$, $p < .3511$), or D ($\beta = .1189$, $t = 1.262$, $p < .1047$).

Overall, support is found for the positive effects of self-efficacy on performance (Profit Center D). No support is found for positive effects of self-efficacy on effort or persistence.

**Hypothesis 2.** According to Hypothesis 2, higher levels of past performance should result in subjects reporting stronger self-efficacy perceptions. Past performance is defined as Profit Center A performance in the Profit Center B analysis. In past self-efficacy research, it was recommended that the influences of prior cognitive variables (personal
goals, self-efficacy) be removed from past performance measures before they are entered into analyses as predictors. This was done for Profit Centers C and D, but could not be done for Profit Center B because no prior self-influences were measured. The past performance measure used in the analysis of Profit Centers C and D is described in Chapter 3 (see Figure 10). For Profit Center C, the influences of Profit Center B personal goals and self-efficacy were removed from Profit Center B performance before it was used in the Profit Center C analysis as past performance. The result is a standardized residual from the regression equation: Profit Center B Self-Efficacy + Profit Center B Personal Goal = Profit Center B Performance. Past performance for Profit Center D is computed similarly, using Profit Center C self-efficacy and personal goal level.

Hypothesis 2 is supported by a significant, negative path coefficient in Profit Center B ($\beta = -0.4887$, $t = -3.3796$, $p < .0005$), but is not supported in Profit Centers C ($\beta = -0.1212$, $t = -1.0283$, $p < .1529$) and D ($\beta = 0.0040$, $t = 0.0324$, $p < .4871$). As the number of errors decreased in Profit Center B, self-efficacy perceptions strengthened, accounting for the negative coefficient.

Hypothesis 3. It was expected that higher levels of past performance would result in subjects setting more challenging personal goals. This is confirmed by a significant, positive path coefficient in Profit Centers B ($\beta = 0.6318$, $t = 5.4228$, $p < .0005$), C ($\beta = 0.6993$, $t = 9.3167$, $p < .0005$), and D ($\beta = 0.6495$, $t = 8.9408$, $p < .0005$). The positive coefficient indicates that as subjects minimized their prediction error (past performance),
they set personal goals reflecting their desire to strive for less error in their future predictions (assigned goal level - personal goal level). In sum, Hypothesis 3 is supported.

**Hypothesis 4.** In Hypothesis 4, it was proposed that higher levels of past performance would result in higher levels of subsequent performance. This hypothesis is confirmed because of a significant, positive path coefficient in Profit Centers B ($\beta = .5891$, $t = 7.6055$, $p < .0005$), C ($\beta = .5434$, $t = 7.4405$, $p < .0005$), and D ($\beta = .4901$, $t = 7.0048$, $p < .0005$). Therefore, the data support Hypothesis 4.

**Hypothesis 5.** Positive outcome feedback was expected to result in subjects reporting stronger self-efficacy perceptions. The data do not support this hypothesis in Profit Centers B ($\beta = -.1466$, $t = -1.0139$, $p < .1563$), C ($\beta = .0759$, $t = .6439$, $p < .2604$), or D ($\beta = .1238$, $t = .9966$, $p < .1605$).

**Hypothesis 6.** It was expected that positive outcome feedback would result in subjects setting more challenging personal goals. This hypothesis is supported for Profit Centers B ($\beta = 1.081$, $t = 9.6335$, $p < .0005$), C ($\beta = .9825$, $t = 13.1287$, $p < .0005$), and D ($\beta = 1.0484$, $t = 14.3717$, $p < .0005$). A significant, positive path coefficient indicates that positive outcome feedback resulted in subjects setting more challenging personal goals relative to their assigned goals. In sum, Hypothesis 6 is supported.

**Hypothesis 7.** Stronger self-efficacy perceptions were expected to result in subjects setting more challenging personal goals. This hypothesis is supported by a significant, positive path coefficient in Profit Centers B ($\beta = .1869$, $t = 2.7778$, $p < .005$), C
(β = .2440, \( t = 4.3201, p < .0005 \)) and D (β = .2138, \( t = 4.0194, p < .0005 \)). The positive coefficient indicates that as subjects' reported self-efficacy strengthened, they set more challenging personal goals relative to their assigned goals. Therefore, the data support Hypothesis 7.

**Hypothesis 8.** Hypothesis 8 states that more challenging personal goals should result in higher levels of performance, effort, and persistence versus less challenging personal goals. More challenging personal goals did not result in higher performance in Profit Center B (β = -.1099, \( t = -1.4823, p < .704 \)). The data support Hypothesis 8 for the effect of personal goals on performance in Profit Centers C (β = -.2219, \( t = -2.9622, p < .0025 \)) and D (β = -.1347, \( t = -1.8503, p < .05 \)).

More challenging personal goals did not result in higher levels of effort in Profit Centers B (β = -.0155, \( t = -.1146, p < .4308 \)), C (β = .0530, \( t = .5798, p < .2816 \)), or D (β = -.0652, \( t = -.6879, p < .2464 \)). More challenging personal goals also did not result in higher levels of persistence in Profit Centers B (β = .0312, \( t = .3487, p < .364 \)), C (β = .0629, \( t = .6792, p < .2492 \)), or D (β = -.0693, \( t = -.7348, p < .2319 \)).

In sum, the data support Hypothesis 8 for the positive effects of personal goals on performance. The data do not support the positive effects of personal goals on effort and persistence.
Summary of Path Analyses

A summary of the path analyses results is presented in Table 14. Overall support for Hypothesis 1 is mixed. Stronger self-efficacy perceptions resulted in higher performance (Profit Center D), but did not result in higher levels of effort or persistence. Self-efficacy significantly and negatively influenced effort in Profit Center C, and this is discussed further in the post hoc analyses. In support of Hypothesis 2, higher past performance resulted in stronger self-efficacy perceptions (Profit Center B). Hypothesis 3, that past performance should result in subjects setting more challenging personal goals, is supported in Profit Centers B, C, and D. Hypothesis 4 is supported in Profit Centers B, C, and D, confirming that higher past performance resulted in higher levels of subsequent performance.

Positive outcome feedback was expected to result in subjects' stronger self-efficacy perceptions, but Hypothesis 5 receives no support in the analyses. Hypothesis 6 effects are significant and positive in Profit Centers B, C, and D, supporting the statement that more positive feedback resulted in subjects setting more challenging personal goals.

In support of Hypothesis 7, stronger self-efficacy perceptions resulted in subjects setting more challenging personal goals in Profit Centers B, C, and D. Finally, support for Hypothesis 8 is mixed. More challenging personal goals resulted in higher performance (Profit Centers C and D). More challenging personal goals did not result in higher levels of effort or persistence in any Profit Center.

An overall analysis of these results indicates that the effects of feedback on self-efficacy perceptions are nonsignificant (Hypothesis 5), but the positive effect of past
performance on self-efficacy perceptions is significant in Profit Center B (Hypothesis 2). The effects of feedback, past performance, and self-efficacy perceptions on personal goals are significant and positive (Hypotheses 3, 6, and 7). Self-efficacy and personal goals positively influenced performance, but did not positively affect effort and persistence (Hypotheses 1 and 8). Finally, the effect of past performance on future performance is significant and positive (Hypothesis 4). In sum, effort and persistence are of questionable value in the path models, although performance is a valuable variable. The effects of feedback are mixed, but past performance effects are positive and significant.

Post Hoc Analyses of Hypotheses 1–8

Power analyses. A post hoc analysis was performed to determine effect sizes and statistical power. This information was compared to the effect sizes computed in Chapter 3. According to Cohen’s (1988) suggestions, alpha was set at .05, and desired power was .80.

Effect sizes for Hypotheses 1-8 were computed based on the $R^2$ explained in each variable in the path analyses. Each variable’s $R^2$ reflects the amount of variance explained by its predictors in the model, and is reported by SAS. Table 15 displays the sample size, $R^2$ for the variable, effect size, and power level for each variable. Effect size and power were calculated in a computer program that uses an $F^2$ statistic for effect size (Borenstein & Cohen, 1988). Using this statistic, the thresholds for effect sizes are approximately: small (.025), medium (.175), and large (.375).
Table 14

**Summary of Results of Path Analyses for Profit Centers B, C, and D**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Overall Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Stronger self-efficacy perceptions will result in higher levels of performance, effort, and persistence.</td>
<td>MS</td>
</tr>
<tr>
<td>H2: Higher past performance will result in subjects reporting stronger subsequent self-efficacy perceptions.</td>
<td>S</td>
</tr>
<tr>
<td>H3: Higher past performance will result in subjects setting more challenging subsequent personal goals.</td>
<td>S</td>
</tr>
<tr>
<td>H4: Higher past performance will result in higher levels of subsequent performance.</td>
<td>S</td>
</tr>
<tr>
<td>H5: Positive outcome feedback will result in subjects reporting stronger self-efficacy perceptions.</td>
<td>0</td>
</tr>
<tr>
<td>H6: Positive outcome feedback will result in subjects setting more challenging personal goals.</td>
<td>S</td>
</tr>
<tr>
<td>H7: Stronger self-efficacy perceptions will result in subjects setting more challenging personal goals.</td>
<td>S</td>
</tr>
<tr>
<td>H8: More challenging personal goals will result in higher levels of performance, effort, and persistence than less challenging personal goals.</td>
<td>MS</td>
</tr>
</tbody>
</table>

*Note.* 0 = no support; S = statistically significant support; MS = mixed support.

The reported statistics in Table 15 reveal that persistence and effort did not display adequate effect sizes or power. The effect sizes would be categorized as very small (Borenstein & Cohen, 1988). This means that personal goal and self-efficacy effects on these variables were weak in the experiment. For performance, the effect sizes are large and power is high. The large effect size indicates that the influences of personal goals,
self-efficacy, and past performance on performance were strong. Effect sizes are large and power is high for personal goals also, showing that feedback, past performance, and self-efficacy perceptions strongly affected personal goals.

Table 15.

Effect Sizes and Statistical Power for Endogenous Variables in Hypotheses 1-8

<table>
<thead>
<tr>
<th>Endogenous Variable in the Path Analyses</th>
<th>Sample Size</th>
<th>$R^2$</th>
<th>Effect Size$^a$</th>
<th>Statistical Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit Center B</td>
<td>133</td>
<td>.005</td>
<td>.01</td>
<td>.10</td>
</tr>
<tr>
<td>Profit Center C</td>
<td>127</td>
<td>.004</td>
<td>.00</td>
<td>.09</td>
</tr>
<tr>
<td>Profit Center D</td>
<td>122</td>
<td>.014</td>
<td>.01</td>
<td>.20</td>
</tr>
<tr>
<td>Effort</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit Center B</td>
<td>133</td>
<td>.013</td>
<td>.01</td>
<td>.20</td>
</tr>
<tr>
<td>Profit Center C</td>
<td>127</td>
<td>.028</td>
<td>.03</td>
<td>.39</td>
</tr>
<tr>
<td>Profit Center D</td>
<td>122</td>
<td>.004</td>
<td>.00</td>
<td>.08</td>
</tr>
<tr>
<td>Performance</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Profit Center B</td>
<td>133</td>
<td>.366</td>
<td>.58</td>
<td>1.00</td>
</tr>
<tr>
<td>Profit Center C</td>
<td>127</td>
<td>.349</td>
<td>.54</td>
<td>1.00</td>
</tr>
<tr>
<td>Profit Center D</td>
<td>122</td>
<td>.414</td>
<td>.71</td>
<td>1.00</td>
</tr>
<tr>
<td>Personal Goals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit Center B</td>
<td>133</td>
<td>.487</td>
<td>.95</td>
<td>1.00</td>
</tr>
<tr>
<td>Profit Center C</td>
<td>127</td>
<td>.611</td>
<td>1.57</td>
<td>1.00</td>
</tr>
<tr>
<td>Profit Center D</td>
<td>122</td>
<td>.663</td>
<td>1.97</td>
<td>1.00</td>
</tr>
<tr>
<td>Self-Efficacy Perceptions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit Center B</td>
<td>133</td>
<td>.141</td>
<td>.16</td>
<td>.99</td>
</tr>
<tr>
<td>Profit Center C</td>
<td>127</td>
<td>.033</td>
<td>.03</td>
<td>.45</td>
</tr>
<tr>
<td>Profit Center D</td>
<td>122</td>
<td>.015</td>
<td>.02</td>
<td>.21</td>
</tr>
</tbody>
</table>

Note. a. Effect Size is expressed in the $F^2$ statistic.
The self-efficacy effect size for Profit Center B is close to medium-sized, reflecting the influence of past performance on self-efficacy, and power is high. The effect size for self-efficacy is dramatically smaller and power is lower in Profit Centers C and D, however, due to the lack of feedback and past performance influence. Self-efficacy’s small effect size can be contrasted with the medium and large effect sizes that were calculated from past research to determine the desired sample size for this study (see Table 10). In several of these past studies, the same computer simulation task was used, and the task may not have been as complex or uncertain as the task used in the present study. This difference in complexity level could account for the discrepancy between this study’s effect sizes and the effect sizes in Table 10.

In sum, the effect sizes are large and statistical power is strong for performance and personal goals in Profit Centers B, C, and D. The effect size is moderate and power is strong for self-efficacy in Profit Center B, but these statistics weaken in Profit Centers C and D. The effect sizes for persistence and effort in all of the Profit Centers are very small, accompanied by weak power. Because sample size is consistent within each Profit Center analysis and all power calculations are not low, it can be concluded that the effect sizes for persistence, effort, and self-efficacy perceptions are the reason for the low statistical power. Statistical power may be the reason for results that are inconsistent with expectations.

Post hoc path analyses. The path models for Profit Centers B and C reveal that the data fit the proposed model, but all paths are not significant. Therefore, post hoc path
models were created based on the Wald statistics that are provided by SAS. The Wald statistic provides information concerning which paths should be removed from the model to increase significance of the remaining paths and to improve the fit of the model. For the models presented here, nonsignificant paths were removed until all remaining paths displayed significant t-values of at least \( p < .10 \). A post hoc model also was created for Profit Center D because the original path model did not display good fit statistics. In addition, paths may be added to the model as a result of Lagrange multipliers, which are provided by SAS. A Lagrange multiplier provides information about how much the chi-square statistic would be decreased if a suggested path was added to the model. In the present analyses, however, no paths were added.

One concern of researchers is that the removal and addition of paths is not based on theoretical reasoning (Pedhazur & Schmelkin, 1991). Theoretical explanations for path removals are offered in this section. First, the fit statistics are presented for Profit Center B, C, and D, and then the results of deleting and adding paths are presented. After the path and regression analyses are presented, the results are synthesized.

All paths became significant at the \( p < .10 \) level for the Profit Center B data when five paths were removed. The original path model provided good fit statistics, so improvement of these statistics was not the reason for creating the post hoc model. Fit statistics did improve slightly, however. The goodness of fit index (.9883) and adjusted goodness of fit index (.9648) are both greater than .9, which is considered a criterion for good fit. The chi-square statistic (\( \chi^2 = 4.8944, df = 7, p < .6728 \)) was not rejected. Finally, the Bentler and Bonett non-normed fit index (1.0145) and normed fit index (.9850) both adhere the
criteria of being greater than .9. The improved model is displayed in Figure 16. Solid lines represent paths and variables that were retained, and dotted lines represent paths and variables that were deleted. Initial numbers on the paths indicate standardized regression coefficients, and numbers in parentheses are first-order correlations.

Figure 16. Post hoc path model for Profit Center B.

Note. Initial numbers on the paths are standardized path coefficients; numbers in parentheses are first-order correlations.
* Correlations are significant at the .05 level.
** Correlations are significant at the .01 level.
a. Significant at the .10 level in t-test (1-tailed).
b. Significant at the .005 level in t-test (1-tailed).
c. Significant at the .0005 level in t-test (1-tailed).

All paths became significant at the $p < .10$ level for the Profit Center C data when five paths were removed. The same paths were removed in the Profit Center C post hoc model.
as were removed in the Profit Center B post hoc model. The original path model provided good fit statistics, so improvement of these statistics was not the reason for creating the post hoc model. Fit statistics did improve slightly, however. The goodness of fit index (.9885) and adjusted goodness of fit index (.9655) are both greater than .9. The chi-square statistic ($\chi^2 = 4.503, df = 7, p < .7204$) was not rejected. Finally, the Bentler and Bonett non-normed fit index (1.0219) and normed fit index (.9826) both adhere the criteria of being greater than .9. The improved model is displayed in Figure 17.

Figure 17. Post hoc path model for Profit Center C.

Note. Initial numbers on the paths are standardized path coefficients; numbers in parentheses are first-order correlations.
* Correlations are significant at the .05 level.
** Correlations are significant at the .01 level.
a. Significant at the .05 level in t-test (1-tailed).
b. Significant at the .0025 level in t-test (1-tailed).
c. Significant at the .0005 level in t-test (1-tailed).
All paths became significant at the $p < .10$ level for the Profit Center D data when five paths were removed. The original path model did not display good fit statistics, and the chi-square statistic was rejected. Some fit statistics improved slightly in the post hoc model, but the chi-square statistic did not improve. The goodness of fit index (.9290) is greater than .9, but the adjusted goodness of fit index (.6451) is not. This is a slight improvement over the goodness of fit index (.9133), but not over the adjusted goodness of fit index (.6965) in the original model. The chi-square statistic ($\chi^2 = 24.0164, df = 3, p < .0001$) was rejected, though, as it was in the original model ($\chi^2 = 45.1269, df = 8, p < .0001$). Finally, the Bentler and Bonett non-normed fit index (.7365) does not adhere to the criterion of being greater than .9, but the normed fit index (.9129) does adhere to this criterion. These indexes are improved over the non-normed (.6770) and normed (.8602) indexes in the original model. The post hoc model is displayed in Figure 18.

Results from the three post hoc path models indicate similar findings. Persistence was removed from the post hoc path analyses in Profit Centers B, C, and D because the paths from self-efficacy and personal goals to persistence were removed. This indicates that persistence is not a required variable to explain the data. The path from personal goals to effort was removed in all Profit Center analyses. The path from self-efficacy to effort was removed in the Profit Center D analysis, also, causing the effort variable to be removed from the model in this analysis. The path from self-efficacy to effort was significant at a marginal level ($p < .10$) in Profit Center B and at a conventional level in Profit Center C ($p < .05$), and this indicates that effort is still a needed part of the model. The interesting
finding, though, is that these path coefficients from self-efficacy to effort are negative, indicating that effort decreased as self-efficacy perceptions strengthened. Stronger self-efficacy perceptions also predicted lower effort levels ($p < .05$) in the original path analysis for Profit Center C. Reasons for the negative coefficients are discussed further in the post hoc regression analyses and in the Chapter 5 discussion.

**Figure 18.** Post hoc path model for Profit Center D.
The path from feedback to self-efficacy was removed in the Profit Center B and C analyses. Feedback is important, however, in significantly affecting personal goals in all of the post hoc analyses \((p < .0005)\). Feedback is needed to predict self-efficacy perceptions in Profit Center D, but only when accepting a marginal significance level \((p < .10)\).

In Profit Center D, the path from past performance to self-efficacy perceptions was removed, although this path was retained for Profit Centers B \((p < .0005)\) and C \((p < .05)\). Finally, self-efficacy is not required to explain performance in Profit Centers B and C, so this path was removed. In Profit Center D, however, the path from self-efficacy to performance was retained.

In sum, each of the post hoc path analyses indicates similar results in terms of the importance of effort and persistence. In Profit Centers B, C, and D, persistence was removed from the model because the paths from self-efficacy and personal goals to persistence are not required. The paths from both personal goals and self-efficacy to effort were removed in Profit Center D, eliminating effort from this model. The path from personal goals to effort was removed in Profit Centers B and C. Self-efficacy predicts effort in Profit Centers B and C, but the path coefficient is negative. A negative coefficient indicates that stronger self-efficacy perceptions led subjects to put forth less effort. In post-experiment interviews, many subjects stated that they did not feel that effort would make a difference in performance in this complex, uncertain task. This response may explain subjects' decreased effort despite their strong reported self-efficacy.
The post hoc path models reveal that feedback is not important for predicting self-efficacy in Profit Centers B and C. In Profit Center D, subjects appear to rely more on feedback to determine self-efficacy perceptions because the path from feedback to self-efficacy is retained in the model and is significant. The path from past performance to self-efficacy is significant for Profit Centers B and C, but is removed from the Profit Center D model. Feedback and past performance are significant predictors of personal goals in all Profit Centers. Self-efficacy significantly predicted performance in Profit Center D, but this path was removed in Profit Centers B and C. Personal goals predicted performance significantly in each Profit Center.

Post hoc regression analyses. Next, regression analyses were used to investigate hypotheses effects outside the system of influences in the path model. The use of path analysis follows research by Bandura and his colleagues (e.g., Bandura & Wood, 1989), who stated that self-efficacy should be viewed as a part of a system of external influences, cognitive variables, outcomes, and feedback. The wording of the hypotheses indicates that regression is an appropriate method for analysis. Therefore, regression equations for each hypothesis were constructed for this post hoc analysis to compare to path analyses results.

Table 16 displays the F-values and p-values for the individual regression equations that resulted in different findings from the original path analyses used to test Hypotheses 1-8. This means that results in Table 16 are significant where nonsignificant results were found in the original path analyses, or are not significant where significant results were found in these path analyses.
Table 16

**Multiple Regression Results Inconsistent with Original Path Analyses Results**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Profit Center</th>
<th>df</th>
<th>T-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Stronger self-efficacy perceptions will result in higher levels of</td>
<td>B (perf.)</td>
<td>1,156</td>
<td>7.534</td>
<td>.007</td>
</tr>
<tr>
<td>performance, effort, and persistence.</td>
<td>C (perf.)</td>
<td>1,156</td>
<td>10.293</td>
<td>.002</td>
</tr>
<tr>
<td>H2: Higher past performance will result in subjects reporting stronger</td>
<td>C</td>
<td>1,136</td>
<td>6.700</td>
<td>.011</td>
</tr>
<tr>
<td>subsequent self-efficacy perceptions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H3: Higher past performance will result in subjects setting more</td>
<td>C</td>
<td>1,133</td>
<td>-1.722</td>
<td>.087</td>
</tr>
<tr>
<td>challenging subsequent personal goals.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H5: Positive outcome feedback will result in subjects reporting stronger</td>
<td>B</td>
<td>1,156</td>
<td>13.684</td>
<td>.000</td>
</tr>
<tr>
<td>self-efficacy perceptions.</td>
<td>C</td>
<td>1,155</td>
<td>9.320</td>
<td>.003</td>
</tr>
<tr>
<td>D</td>
<td>1,157</td>
<td>7.749</td>
<td>.006</td>
<td></td>
</tr>
<tr>
<td>H8: More challenging personal goals will result in higher levels of</td>
<td>B (perf.)</td>
<td>1,137</td>
<td>-3.405</td>
<td>.001</td>
</tr>
<tr>
<td>performance, effort, and persistence than less challenging personal goals.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Hypothesis 1, it was proposed that self-efficacy perceptions would positively affect performance, effort, and persistence. Self-efficacy significantly and positively predicted performance in Profit Center D ($p < .0005$) in the original path analyses, and also positively predicted performance using regression in Profit Center B, $F(1, 156) = 7.534$, $p < .007$, and in Profit Center C, $F(1, 156) = 10.293$, $p < .002$.

In the original path analyses, the effects of self-efficacy on effort and persistence are nonsignificant in each Profit Center. Using multiple regression, these effects also are
nonsignificant. Post-task interviews confirm that most subjects doubted that effort was valuable for the task, and some subjects reported that they performed better when they decreased their effort. In fact, self-efficacy is negatively related to effort in the post hoc Profit Center B and C path analyses and in the original Profit Center C analyses. These findings suggest that self-efficacy perceptions did not lead to higher effort levels because subjects decreased their effort as they reported higher confidence. Because subjects discussed effort in terms of whether it led to performance, the relationship between effort and performance also was investigated. Effort is not significantly related to performance for Profit Center A \( (r = -0.1078, n = 160, p < .175) \), but is negatively related to performance in Profit Centers B \( (r = -0.2949, n = 160, p < .000) \), C \( (r = -0.2846, n = 160, p < .000) \), and D \( (r = -0.3044, n = 160, p < .000) \). Subjects' perceptions suggest that the research model may be better conceptualized with effort and persistence as mediators between cognitive variables (self-efficacy and personal goals) and performance. The post hoc path analyses does not suggest that this would be a better model, however. The Lagrange multiplier statistics do not indicate that the paths from effort to performance or from effort to persistence would be valuable to add to the model. Because subject perceptions are the key element in this study, however, this relationship may be valuable to explore in the future.

In Hypothesis 8, the effects of personal goals on performance, effort, and persistence were investigated. The regression analyses reveals that the effects of personal goals on effort and persistence are nonsignificant, and this is consistent with the original path analyses. In the path analyses, more challenging personal goals resulted in higher
performance in Profit Centers C ($p < .0025$) and D ($p < .05$). Regression results reveal that personal goals significantly affected performance in Profit Centers C and D, and also in Profit Center B, $F(1, 137) = -3.405, p < .001$. The negative $T$-value indicates that as subjects set more challenging personal goals, they made fewer prediction errors.

When regression was used to analyze the hypotheses relating to self-efficacy perceptions, interesting effects occurred. The regression analysis revealed additional support for Hypothesis 2, that higher past performance resulted in stronger self-efficacy perceptions in Profit Center C, $F(1, 136) = 6.7, p < .011$. The effects on self-efficacy in Hypothesis 5 became significant from the path models to the regression analyses. The effects of feedback on self-efficacy are nonsignificant in the path analyses, but are significant and positive in the regression analyses for Profit Center B, $F(1, 156) = 13.684, p < .000$, for Profit Center C, $F(1, 155) = 9.32, p < .003$, and for Profit Center D, $F(1, 157) = 7.749, p < .006$.

A comparison of the path and regression analyses reveals that the differences in effects on self-efficacy may be due to the joint effects of past performance and feedback, versus the individual effects of these variables. Higher past performance results in stronger self-efficacy perceptions in Profit Centers B and C when it is an individual predictor (Hypothesis 2), but does not affect self-efficacy in Profit Centers C and D when feedback is also included in the model. Similarly, positive feedback results in stronger self-efficacy perceptions in all Profit Centers when it is an individual predictor (Hypothesis 5), but does not affect self-efficacy in any Profit Center when past performance is also included in the model. Past performance is defined as the amount of
error a subject experienced in the previous Profit Center. Feedback is defined as the
difference between a subject’s assigned goal and performance. It may be that these
variables are redundant, and that they are competing with each other in the model. In fact,
feedback and past performance are significantly related in Profit Centers B ($r = -.8292,$
$n = 161, p < .000$), C ($r = -.6914, n = 139, p < .000$), and D ($r = -.6883, n = 139,$
$p < .000$). Sample sizes are decreased in Profit Centers C and D because standardized
residuals are used as past performance measures in Hypotheses 3 and 4. The calculation
of these standardized residuals relies on the presence of both a self-efficacy and personal
goal measure for that Profit Center. The negative correlation occurred because more
positive feedback is related to subjects making fewer errors.

Another consideration is that the effect sizes calculated (see Table 15) indicate that
the influences of feedback and past performance on self-efficacy are small (.02 to .16).
Statistical power relating to self-efficacy effects is low to moderate, and detecting effects
on self-efficacy in the path model also may have been difficult for this reason.

**Summary of post hoc analyses.** In sum, the post hoc analyses of Hypotheses 1-8
expand on the results from the original path analyses. First, effect sizes are large and
power is strong for performance. The path from self-efficacy to performance was
removed in the post hoc path analyses for Profit Centers B and C, although this
relationship is significant in Profit Center D and according to regression analyses in each
Profit Center. Personal goals significantly and positively affected performance in post hoc
and original path analyses.
The effect sizes and power are low for effort and persistence, and this suggests the variables were not affected strongly by self-efficacy and personal goals. The post hoc path models reveal that effort and persistence are not important variables in the models. In fact, the path from self-efficacy to effort became significant and negative in the post hoc path analyses for Profit Centers B and C, as it did in the original Profit Center C path analysis. This is opposite to the expected results, and indicates that subjects with stronger self-efficacy perceptions put forth less effort.

The findings that effort and persistence are unimportant may be attributed to the complex, uncertain nature of the task. Post-experiment interviews revealed that subjects were not convinced that their striving was necessary for performance in this task. In fact, persistence data indicate that subjects put forth less effort as the experiment progressed. Therefore, persistence and effort may not be good indications of self-efficacy strength and personal goal setting in a highly complex, uncertain task such as this one, in which subjects are unsure that effort will make a difference in their performance. In addition, subjects discussed effort in terms of whether it would lead to performance, and correlations reveal that effort is negatively related to performance. These subject perceptions suggest that the research model (Figure 6) should reflect that effort mediates the relationship between cognitive variables and performance if subject perceptions are of primary interest. The Lagrange multiplier statistics do not indicate that effort and persistence should serve as mediators in the model, however.

In the path analyses, effects on self-efficacy perceptions are mixed. The effects of feedback on self-efficacy perceptions are not significant in the path analyses, but are
significant and positive when the variables are isolated in the regression analyses. The effects of past performance on self-efficacy are improved somewhat when isolated from the effects of feedback, also. The joint effects of past performance and feedback on self-efficacy, versus their individual effects, may be distorted in the path analysis because the two variables are significantly correlated and redundant. The effects of feedback and past performance on personal goals are significant and positive in both the path analyses and the regression analyses. The difference in the effects on self-efficacy and personal goals may be because the effect size for personal goals is large and power is strong. Small effect sizes also indicate that the experimental manipulations were not strong enough to affect self-efficacy in this complex, uncertain task.

Analyses of Hypotheses 9-12

Hypotheses Results

Hypothesis 9. Before the data were analyzed, Normal PP Plots and Levene's homogeneity test were used to examine the assumptions of normality and homogeneous variances. Data passed these tests. Where significant $F$-values were found in the ANOVAs, multiple comparison tests were performed to show where these differences occurred. The Newman-Keuls multiple comparison test was used because it is neither very conservative nor very liberal in its comparisons (Huck, et al., 1996). Duncan's multiple range test, a more liberal multiple-comparison test, also was used to compare to the Newman-Keuls results. Duncan's multiple range test results are only presented where
Newman-Keuls test results are nonsignificant. These tests are two of the five most used multiple comparison tests.

A MANOVA was used to test Hypothesis 9. It was expected that assigned, easy goals would result in stronger self-efficacy perceptions than moderate or impossible goals. Hypotheses 9 and 10 only involve data for Profit Centers B, C, and D because subjects' self-efficacy and personal goals were not assessed prior to Profit Center A. For the MANOVA analysis, SPSS provides the Pillai's, Hotelling's, and Wilk's statistics to determine significance. In Hypothesis 9, significant $F$-values of these statistics would indicate that the effect of the independent variable, assigned goals, significantly influenced self-efficacy perceptions, which are the dependent variables for the three Profit Centers. In order to use MANOVA, the dependent variables must be correlated significantly. Self-efficacy perceptions are correlated significantly for Profit Centers B and C ($r = .662, p < .000, n = 158$), B and D ($r = .585, p < .000, n = 159$), and C and D ($r = .874, p < .000, n = 158$). The three MANOVA test statistics in Table 17 are nonsignificant: Pillai's, $F(6, 308) = 1.510, p < .174$; Hotelling's, $F(6, 304) = 1.492, p < .180$; and Wilk's, $F(6, 306) = 1.501, p < .177$.

The conclusion of Hypothesis 9 is a rejection of the statement that easy goals led subjects to report stronger self-efficacy perceptions versus moderate and impossible goal subjects. MANOVA results are nonsignificant.
Table 17

MANOVA Results for Hypothesis 9

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Approximate F</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pillai’s</td>
<td>.057</td>
<td>1.510</td>
<td>6</td>
<td>308</td>
<td>.174</td>
</tr>
<tr>
<td>Hotelling’s</td>
<td>.059</td>
<td>1.492</td>
<td>6</td>
<td>304</td>
<td>.180</td>
</tr>
<tr>
<td>Wilk’s</td>
<td>.944</td>
<td>1.501</td>
<td>6</td>
<td>306</td>
<td>.177</td>
</tr>
</tbody>
</table>

Hypothesis 10. In Hypothesis 10, it was proposed that assigned, easy goals would result in subjects setting more challenging personal goals than moderate or impossible goals. Subjects were asked before Profit Centers B, C, and D to indicate their personal goal levels. Subjects reported that they would minimize their prediction errors to zero, 1, 2, 3, 4, 5, or 6 units of error, or that they had “no particular goal.” Because inclusion of the “no particular goal” option makes this variable non-continuous, those who answered in this manner were removed from analyses. Personal goal level was operationalized as the difference between subjects’ assigned goals and personal goals. A more positive number indicates a more challenging personal goal versus the assigned goal and a negative number indicates a less challenging personal goal versus the assigned goal.

Hypothesis 10 was first tested using a MANOVA. The dependent variables in the MANOVA are the personal goal levels set by subjects before Profit Centers B, C, and D. As MANOVA requires, these dependent variables are significantly correlated: Profit Centers B and C: ($r = .9008, p < .000, n = 138$), B and D ($r = .8637, p < .000, n = 137$),
and C and D ($r = .9483, \ p < .000, \ n = 138$). MANOVA results reveal that assigned goal
level did significantly affect subjects' personal goal levels. The three test statistics in
Table 18 are significant: Pillai's, $F(6, 262) = 12.8461, \ p < .000$; Hotelling's,
$F(6, 258) = 17.8836, \ p < .000$; and Wilk's, $F(6, 260) = 15.3259, \ p < .000$. To further
investigate the nature of these group differences, ANOVAs were conducted for Profit
Centers B, C, and D.

Table 18

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>Approximate $F$</th>
<th>Hypothesis $df$</th>
<th>Error $df$</th>
<th>Significance of $F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pillai's</td>
<td>.260</td>
<td>12.8461</td>
<td>6</td>
<td>262</td>
<td>.000</td>
</tr>
<tr>
<td>Hotelling's</td>
<td>.336</td>
<td>17.8836</td>
<td>6</td>
<td>258</td>
<td>.000</td>
</tr>
<tr>
<td>Wilk's</td>
<td>.745</td>
<td>15.3259</td>
<td>6</td>
<td>260</td>
<td>.000</td>
</tr>
</tbody>
</table>

The ANOVA results in Table 19 reveal significant $F$-values for each of the Profit
Centers: Profit Center B, $F(2, 139) = 48.846, \ p < .000$; Profit Center C,
$F(2, 139) = 44.527, \ p < .000$; and Profit Center D, $F(2, 138) = 51.84, \ p < .000$. Newman-
Keuls multiple comparison test results for Profit Center B show that easy goal subjects set
significantly more challenging personal goals (mean = .809) than moderate goal
(mean = -.872) and impossible goal subjects (mean = -1.833). A negative mean value
indicates that subjects set a personal goal that was less challenging than their assigned
goal. The Newman-Keuls test in Profit Center C also shows that easy goal subjects set significantly more challenging personal goals (mean = 1.0) versus moderate (mean = -.875) and impossible goal (mean = -1.553) subjects. Similarly, easy goal subjects in Profit Center D set significantly more challenging personal goals (mean = 1.361) compared to moderate (mean = -.66) and impossible goal (mean = -1.553) subjects. In each of the Profit Centers, easy goal subjects set a more challenging goals versus their assigned goals, while moderate and impossible goal subjects set less challenging personal goals versus their assigned goals.

In sum, Hypothesis 10 is supported because assigned, easy goals led subjects to set more challenging personal goals. Subjects who were assigned easy goals challenged themselves more than other subjects by setting more stringent personal goals relative to their assigned goals. Subjects who were assigned moderate goals set goals that were less challenging than their assigned goals in each Profit Center, indicated by these subjects' negative personal goal mean values. Subjects who were assigned impossible goals set the least challenging personal goals relative to their own assigned goals.

Hypothesis 11. Multiple regression analysis was used to test Hypotheses 11 and 12. Regression was chosen for these tests because the independent variables are continuous in each hypothesis.

Hypothesis 11 states that self-efficacy perceptions should have a more positive effect on performance in later than in earlier trials. The regression equation for Hypothesis 11 is: Performance = Self-Efficacy + Number of Trials + (Self-Efficacy X Number of Trials).
Table 19

**ANOVA Results for Hypothesis 10**

**Profit Center B**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F Ratio</th>
<th>F Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2</td>
<td>169.506</td>
<td>84.753</td>
<td>48.846</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>139</td>
<td>241.177</td>
<td>1.735</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>141</td>
<td>410.683</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assigned Goal Group</th>
<th>Personal Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impossible Goal</td>
<td>-1.833</td>
</tr>
<tr>
<td>Moderate Goal</td>
<td>-.872</td>
</tr>
<tr>
<td>Easy Goal</td>
<td>.809</td>
</tr>
</tbody>
</table>

**Profit Center C**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F Ratio</th>
<th>F Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2</td>
<td>164.570</td>
<td>82.285</td>
<td>44.527</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>139</td>
<td>256.867</td>
<td>1.848</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>141</td>
<td>421.437</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assigned Goal Group</th>
<th>Personal Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impossible Goal</td>
<td>-1.553</td>
</tr>
<tr>
<td>Moderate Goal</td>
<td>-.875</td>
</tr>
<tr>
<td>Easy Goal</td>
<td>1.000</td>
</tr>
</tbody>
</table>

**Profit Center D**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F Ratio</th>
<th>F Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2</td>
<td>209.631</td>
<td>104.816</td>
<td>51.840</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>138</td>
<td>279.021</td>
<td>2.022</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>140</td>
<td>488.653</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assigned Goal Group</th>
<th>Personal Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impossible Goal</td>
<td>-1.553</td>
</tr>
<tr>
<td>Moderate Goal</td>
<td>-.660</td>
</tr>
<tr>
<td>Easy Goal</td>
<td>1.362</td>
</tr>
</tbody>
</table>

Note. Personal goal values represent subjects' assigned goal less the number of units of error subjects reported they would minimize their error to in the next Profit Center. A negative value indicates that subjects set lower personal goals than their assigned goals, and a positive value indicates that subjects set higher personal goals than their assigned goals.
A coded variable was created so that Number of Trials = x1, x2. This makes the regression equation as follows: Performance = Self-Efficacy + x1 + x2 + (Self-Efficacy X x1) + (Self-Efficacy X x2). Profit Center B was coded as x1 = 1, x2 = 0; Profit Center C was coded x1 = 0, x2 = 1; and Profit Center C was coded as x1 = 0, x2 = 0. The Number of Trials variables (x1, x2) were entered into the equation individually in addition to the interaction term at the suggestion of Cortina (1993), who stated that including the nonlinear terms can help avoid artificial significance levels due to the overlap of nonlinear and linear variance in the interaction term. All variables were entered into the analysis simultaneously because no theoretical reason called for them to be entered in a stepwise fashion.

Assumptions of regression were tested in SPSS before proceeding with the analysis. Normal PP plots show that variables adhere to approximately normal distributions. Equal variance on the criterion variables also was confirmed. Independent variables do not display any multicollinearity problems. Finally, errors were checked to assure they were not correlated according to the Durbin-Watson test.

The regression equation results reveal that self-efficacy is the only significant predictor of performance ($T = -4.207, p < .000$). The negative regression coefficient ($T$-value in SPSS) indicates that stronger self-efficacy perceptions predict lower average errors, or better performance. The other predictors, x1, x2, and the interaction of x1 and x2 with self-efficacy, are nonsignificant. The overall $R^2$ shows that the amount of variance the model explains is 7.6%. These values are presented in Table 20.
Table 20

**Multiple Regression Results for Hypothesis 11**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beta</th>
<th>T</th>
<th>Significance of T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Efficacy</td>
<td>-.321</td>
<td>-4.207</td>
<td>.000</td>
</tr>
<tr>
<td>Time 1 (x1)</td>
<td>-.026</td>
<td>-.249</td>
<td>.804</td>
</tr>
<tr>
<td>Time 2 (x2)</td>
<td>-.048</td>
<td>-.438</td>
<td>.661</td>
</tr>
<tr>
<td>Time 1 X Self-Efficacy</td>
<td>.102</td>
<td>.942</td>
<td>.347</td>
</tr>
<tr>
<td>Time 2 X Self-Efficacy</td>
<td>.071</td>
<td>.626</td>
<td>.532</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>22.599</td>
<td>.000</td>
</tr>
</tbody>
</table>

$R^2 = .076$

Adjusted $R^2 = .066$

Standard Error = 1.004

The conclusion of these findings is a rejection of Hypothesis 11. Self-efficacy did not exert a more positive influence on performance in later trials than in earlier trials. Self-efficacy is a significant predictor of performance in this equation, but the interaction of self-efficacy with the number of trials variable is nonsignificant.

**Hypothesis 12.** Multiple regression also was used to test Hypothesis 12 (see Table 21). It was proposed that personal goals would have a more positive effect on performance in later trials than in earlier trials. The regression equation for Hypothesis 12 is: Performance = Personal Goals + Number of Trials + (Personal Goals X Number of Trials). When the Number of Trials variable is coded as it was for Hypothesis 11, the equation becomes: Performance = Personal Goals + $x_1 + x_2 + (Personal Goals \times x_1) + (Personal Goals \times x_2)$. Regression assumptions were tested, verifying that the data is
appropriate for this analysis. All variables were entered in the equation simultaneously because no theoretical reason called for them to be entered in a stepwise fashion.

Personal goals significantly predict performance, $T = -2.879$, $p < .004$. The negative coefficient indicates that as subjects set more challenging personal goals relative to their assigned goals, their errors decreased. The coded variables representing number of trials and the interaction terms are nonsignificant. The amount of variance explained by the model is 6.6%. The regression results are presented in Table 21.

Table 21

**Multiple Regression Results for Hypothesis 12**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beta</th>
<th>$T$</th>
<th>Significance of $T$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Goal</td>
<td>-0.225</td>
<td>-2.879</td>
<td>.004</td>
</tr>
<tr>
<td>Time 1 (x1)</td>
<td>0.016</td>
<td>0.272</td>
<td>.786</td>
</tr>
<tr>
<td>Time 2 (x2)</td>
<td>-0.016</td>
<td>-0.284</td>
<td>.776</td>
</tr>
<tr>
<td>Time 1 X Personal Goal</td>
<td>-0.045</td>
<td>-0.665</td>
<td>.506</td>
</tr>
<tr>
<td>Time 2 X Personal Goal</td>
<td>-6.456E-04</td>
<td>-0.010</td>
<td>.992</td>
</tr>
<tr>
<td>Constant</td>
<td>37.456</td>
<td></td>
<td>.000</td>
</tr>
</tbody>
</table>

$R^2 = .066$

Adjusted $R^2 = .054$

Standard Error = .969

In conclusion, Hypothesis 12 is not supported by the data. Personal goal level did not become a more positive influence on performance over trials. More challenging personal goals are significant predictors of higher performance in this analysis, but did not strengthen as predictors over the Profit Centers.
Post Hoc Analyses for Hypotheses 9-12

Power analyses. A post hoc analysis was performed to determine effect sizes and statistical power. This information was compared to the effect sizes computed in Chapter 3. According to Cohen’s (1988) suggestions, alpha was set at .05, and desired power was .80.

Effect sizes and statistical power were computed for Hypotheses 9-12, and these values are displayed in Table 22. The MANOVA $F$-values were used to calculate effect sizes and power for Hypotheses 9 and 10, and the results for the Pillai’s, Hotelling’s, and Wilk’s statistics are displayed. For Hypothesis 9, the effect size is very small and power is moderately low. These statistics may explain why assigned goals did not affect self-efficacy perceptions. It appears that the treatment was not strong enough to affect self-efficacy in a task as complex and uncertain as the one used in this study. Past researchers used this same task and assigned goal manipulation to successfully affect performance (e.g., Taylor, 1992). A difference in the present study is that more questionnaires were administered to subjects, and these extra steps added to the amount of information the subjects had to deal with in addition to the complexity of the task. This could have added enough complexity to weaken the treatment.

Power is high for Hypotheses 10, and the effect sizes are medium-sized. The indication is that assigned goals did not affect self-efficacy perceptions strongly in this task, but that assigned goals did affect personal goals. Because the assigned goal manipulation is similar to setting personal goals, the stronger effect of the manipulation on personal goals versus on self-efficacy can be understood.
Table 22

Effect Sizes and Statistical Power for Hypotheses 9-12

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Sample Size</th>
<th>Test Statistic</th>
<th>Effect Size</th>
<th>Statistical Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>H9: Assigned, easy goals will result in stronger self-efficacy perceptions than moderate or impossible goals.</td>
<td>158</td>
<td>Pillai’s</td>
<td>.029</td>
<td>.58</td>
</tr>
<tr>
<td></td>
<td>158</td>
<td>Hotelling’s</td>
<td>.029</td>
<td>.58</td>
</tr>
<tr>
<td></td>
<td>158</td>
<td>Wilk’s</td>
<td>.029</td>
<td>.58</td>
</tr>
<tr>
<td>H10: Assigned, easy goals will result in subjects setting more challenging personal goals than moderate or impossible goals.</td>
<td>135</td>
<td>Pillai’s</td>
<td>.227</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>135</td>
<td>Hotelling’s</td>
<td>.294</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>135</td>
<td>Wilk’s</td>
<td>.261</td>
<td>1.00</td>
</tr>
<tr>
<td>H11: Self-efficacy perceptions will have a more positive effect on performance in later than in earlier trials.</td>
<td>169</td>
<td>$R^2$</td>
<td>.08</td>
<td>.82</td>
</tr>
<tr>
<td>H12: Personal goals will have a more positive effect on performance in later trials than in earlier trials.</td>
<td>169</td>
<td>$R^2$</td>
<td>.06</td>
<td>.70</td>
</tr>
</tbody>
</table>

Note. a. Effect Size is expressed in the $F^2$ statistic.

$R^2$ values from multiple regression analyses were used to calculate power and effect sizes for Hypotheses 11 and 12. For these hypotheses, power is not high and the effect sizes are small. The conclusion is that the combined effects of the number of trials and self-efficacy on performance are weak. Similarly, the combined effects of the number of trials and personal goals on performance are weak. Therefore, the reason for the lack of effects in Hypotheses 11 and 12 may be due to the inability of self-efficacy or personal goal effects to strengthen in the few number of trials of this experiment.

In sum, effect sizes for Hypothesis 9 are small, and this appears to have caused low power for this analysis. Hypothesis 10 effects are close to medium-sized, and power is
high. Power is not large and effect sizes for Hypotheses 11 and 12 are small. The power analysis results indicate that small effect sizes may be the reason for a rejection of Hypotheses 9, 11, and 12.

Additional post hoc analyses. Hypothesis 9 results reveal that assigned goals did not significantly affect self-efficacy perceptions in Profit Center B, C, or D. Although not hypothesized, it is also helpful to review the effects of assigned goals on performance, because assigned, easy goals positively affected performance in past research using the task that was used in this study (e.g., Taylor, et al., 1992). Assigned goals did not significantly affect performance in Profit Center B, $F(2, 158) = 2.15, p < .120$, in Profit Center C, $F(2, 158) = 1.39, p < .253$, or in Profit Center D, $F(2, 158) = .958, p < .386$. Stronger self-efficacy resulted in higher performance in Profit Centers B ($p < .007$), C ($p < .002$), and D ($p < .000$), however (see Table 16). The conclusion is that the rejection of Hypothesis 9 is not because self-efficacy did not operate according to theory. Self-efficacy should positively predict performance. Instead, the assigned goal treatment did not affect self-efficacy perceptions or performance. The weakness of the treatment on self-efficacy is also evident in the post hoc path analyses, in which feedback is not important in influencing self-efficacy perceptions, and past performance’s influence is moderate.

A possible explanation for the results of Hypotheses 11 and 12 is that the number of trials was not sufficient for subjects to develop more stable feelings of self-efficacy or to set more accurate personal goals than in earlier trials. The complexity and uncertainty in this task most likely complicated subjects’ estimation of their self-efficacy, and this is
partly confirmed by post-task interviews. In these interviews, several subjects stated that they were not sure they understood the task or the cue–criteria relationships. The uncertainty that subjects experienced during the study also was evident in the fact that approximately 30% of subjects asked questions to clarify the task during the study. Post-task questionnaire items confirm this point. Subjects reported that they understood the task moderately well, where 0 = did not understand at all and 100 = understood extremely well (mean = 48.28). Subjects also perceived the task to be unusual (mean = 65.85) on a scale of not unusual at all (0) to extremely unusual (100).

In sum, Hypothesis 9 post hoc analyses indicate that self-efficacy predicted performance. This confirms that the reason assigned, easy goals did not result in stronger self-efficacy perceptions was not due to the inability of self-efficacy to predict performance.

The results of Hypotheses 11 and 12 also appear to have been affected by the high degree of complexity and uncertainty of the task used, and this is confirmed by post-task interviews and post-experiment assessments. Subjects’ self-efficacy perceptions and personal goals did not become more influential over the trial blocks. The effect size in the regression analysis is very small, and this may also reflect the weak effects of repeated trials for this task.

Summary for Hypotheses 9-12

Table 23 displays the results for Hypotheses 9-12. Assigned, easy goals did not result in stronger self-efficacy perceptions than moderate or impossible goals, so Hypothesis 9
is not supported. Post hoc analysis reveals that the lack of support may be due to small effect sizes and low power, meaning that the assigned goal manipulation did not affect self-efficacy perceptions. Consistent with theory, self-efficacy predicted performance significantly, and this further indicates that weak effects of assigned goals on self-efficacy caused Hypothesis 9 results.

The effects of assigned goals on personal goals are significant according to MANOVA results. ANOVA group comparisons reveal that assigned, easy goals resulted in subjects setting more challenging personal goals relative to their assigned goals. Moderate or impossible goals resulted in subjects setting less challenging personal goals relative to their assigned goals.

Multiple regression results reveal that self-efficacy did not become a more positive influence on performance over trials in the experiment, as was expected in Hypothesis 11. Stronger self-efficacy significantly predicted better performance in the regression equation, but the interaction with the number of trials is not significant. Similar results for Hypothesis 12 indicate that personal goals did not become a more positive influence on performance over trials. Personal goals significantly and positively predicted performance, but the interaction of personal goals with the number of trials is not significant. The post hoc power analysis for Hypotheses 11 and 12 show that small effect sizes may have been the reason for the lack of findings. Power is high, but this appears to be due to the larger sample sizes represented by repeated measures. The small effect size can be attributed to the complexity and uncertainty of the task and the few number of trials in this experiment.
Table 23

Results for Hypotheses 9-12

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>H9: Assigned, easy goals will result in stronger self-efficacy perceptions</td>
<td>0</td>
</tr>
<tr>
<td>than moderate or impossible goals.</td>
<td></td>
</tr>
<tr>
<td>H10: Assigned, easy goals will result in subjects setting more challenging</td>
<td>S</td>
</tr>
<tr>
<td>personal goals than moderate or impossible goals.</td>
<td></td>
</tr>
<tr>
<td>H11: Self-efficacy perceptions will have a more positive effect on</td>
<td>0</td>
</tr>
<tr>
<td>performance in later than in earlier trials.</td>
<td></td>
</tr>
<tr>
<td>H12: Personal goals will have a more positive effect on performance in</td>
<td>0</td>
</tr>
<tr>
<td>later trials than in earlier trials.</td>
<td></td>
</tr>
</tbody>
</table>

Note. S = statistically significant support; 0 = no support.

Post-Task Assessments

Items on the post-task questionnaire reveal subjects' reactions to the experiment and their involvement in the task. They also point toward explanations for hypotheses results. First, subjects' answers to post-task questions relating to their feelings about the task and their performance are presented. Second, the importance of gender is discussed.

Post-task perception measures. Subjects were asked if they enjoyed the task, and the mean of their answers indicates moderate enjoyment, mean = 44.30, SD = 23.82, where a low score reflects that they enjoyed it a great deal. Subjects may not have enjoyed the task a great deal because of its complexity, or because of their preference for structured problems. Significantly more subjects reported that they prefer a mathematical problem with a "right" answer (n = 116, 73%) versus a novel problem with no clear "right" answer
(n = 42, 27%), $\chi^2 = 34.66, p < .000$. Subjects also reported their moods to be between feeling disinterested and tired, and feeling enthusiastic, alert, and energetic (mean = 49.3, $SD = 19.96$; 0 = tired and disinterested, 100 = enthusiastic, alert, and energetic). Mood is not significantly related to performance or self-efficacy perceptions. Task enjoyment is significantly correlated with performance in Profit Centers A ($r = .1995, p < .011, n = 160$), B ($r = .2381, p < .002, n = 160$), C ($r = .3005, p < .000, n = 160$), and D ($r = .1423, p < .073, n = 160$). Subjects who performed better (lower errors) enjoyed the task more, where a low task enjoyment score means higher enjoyment. Task enjoyment is also significantly correlated with self-efficacy in Profit Centers B ($r = -.2734, p < .001, n = 158$), C ($r = -.2704, p < .001, n = 157$), and D ($r = -.3208, p < .000, n = 158$). According to the negative correlations, stronger self-efficacy perceptions are associated with higher task enjoyment, which is represented by a lower score.

In one questionnaire item, subjects were asked if they were more interested in reaching their goal, receiving course credit, both of these options, or neither. Most subjects ($n = 93, 58\%$) answered that they were interested in both, while fewer reported being only interested in reaching their goals ($n = 26, 16\%$), course credit ($n = 39, 24\%$), or neither ($n = 3, 2\%$). These proportions are significantly different, $\chi^2 = 108.69, p < .000$. That most subjects were interested in reaching their goals is an important finding because it suggests that subjects were involved in performing the task.

Another indication that subjects were involved in task performance was the self-reported commitment measure. Subjects reported that they were committed to their goals
(mean = 58.84, $SD = 21.4$; 0 = not committed at all and 100 = extremely committed).

These responses do not differ according to goal level, course section, experimental group, or gender. This goal commitment measure correlates significantly with subjects' actual commitment decisions in Profit Center A ($r = -.158, p < .048, n = 158$), Profit Center B ($r = -.186, p < .02, n = 158$), Profit Center C ($r = -.247, p < .002, n = 158$), and Profit Center D ($r = -.256, p < .001, n = 158$). The negative $r$-value is due to the relationship between higher actual commitment values indicating that the subject waited longer to commit (lower commitment), and higher reported overall commitment values indicating more perceived commitment. This analysis validates that the perception measure assessed actual subject commitment.

Subjects were asked how much time they would have preferred to complete predictions in all four Profit Centers. A chi-square analysis reveals a significant difference between preferences for 15 minutes ($n = 33, 21\%$), 30 minutes ($n = 34, 22\%$), 45 minutes ($n = 27, 17\%$), 60 minutes ($n = 45, 28\%$), or 75 minutes or more ($n = 19, 12\%), $\chi^2 = 11.62, p < .02$. It appears that subjects differed in their opinions of how much time they would like to have to complete the task, but these responses do not differ significantly according to goal assignment, course section, experimental group, or gender.

Subjects actually finished the task, including questionnaires, in approximately 45 to 90 minutes. It is suspected that some subjects' responses to this question may reflect the time they would have preferred to spend participating in the experiment, versus the time they actually felt was necessary to perform the task.
Subjects’ perceptions of their performance are important in this study because perceptions are distorted in complex, uncertain tasks (Taylor, et al., 1992). Subjects reported that they displayed a moderate amount of improvement over the course of the study (mean = 51.31, SD = 23.05, 0 = no improvement at all, 100 = a great deal of improvement). These responses did not differ based on goal assignment, course section, experimental group, or gender.

Subjects also were asked for their perceptions of how they performed in the study. The mean response indicates that they tended to judge their performance as slightly poorer than average (mean = 56.62, SD = 21.49; 0 = extremely good performance, 100 = extremely poor performance). These responses do not differ according to course section, experimental group, or gender, but differ by goal assignment when a marginal significance level is adopted, $F = 2.62, p < .076$. Duncan’s multiple range post hoc test reveals that moderate goal subjects reported their performance to be significantly poorer (mean = 60.48) than easy goal subjects (mean = 51.41). Impossible goal subjects’ perceptions are not significantly different from either group (mean = 58.0). These findings reflect the distortion in perceptions that occurs in a complex, uncertain task. Assigned, moderate goals were detrimental to subjects’ perceptions.

Subjects’ perceptions of goal difficulty do not differ significantly according to goal level ($F = 2.22, p < .11$). It is important to note, however, that easy goal subjects still perceived their goals as difficult (mean = 42.46, SD = 22.8; 0 = impossible, 100 = not difficult at all). Moderate (mean = 37.15, SD = 21.41) and impossible (mean = 33.17,
SD = 24.35) goal subjects also perceived their goals as difficult. This is evidence of the distortion in subject perceptions that occurs in complex, uncertain task performance. These findings are similar to those found by Taylor, et al. (1992), in which subjects assigned easy goals in a complex task perceived their goals to be difficult, or closest to a 50% perceived probability of success (63.65%) versus moderate (37.31%) or impossible (16.28%) goal subjects.

Gender. In past research, men reported stronger self-efficacy perceptions than women in mathematical and financial tasks (e.g., Betz & Hackett, 1986). Because of the financial terminology in the present task, it was expected that gender might be a significant covariate that would explain results. Using a marginal significance level of .10, men’s reported task enjoyment was significantly higher ($t = -1.82, p < .071$) than women’s reports. Men’s reported moods reflected moods that were significantly less tired and disinterested versus women’s reported moods ($t = 1.73, p < .086$). When asked how useful the task instructions were, men reported higher usefulness than women did ($t = 2.04, p < .043$). These findings are consistent with past research in which men preferred mathematical/financial tasks more than women did.

Gender does not correlate significantly with self-efficacy perceptions, although it was expected that men’s perceived capabilities would be greater than women’s perceptions of their own capabilities. The task complexity and uncertainty may have affected subjects’ self-perceptions in relation to the task. Gender differences in self-efficacy perceptions may have not been evident because of small effect sizes calculated (see Table 15 and
Table 22). Gender correlates significantly with personal goal level, however, in Profit Centers B \((r = .1577, p < .046, n = 161)\), C \((r = .1828, p < .02, n = 161)\), and D \((r = .2306, p < .003, n = 160)\). Men’s personal goal levels were more challenging than women’s personal goal levels, and this is consistent with the theory from past research that men’s self-perceptions of their capabilities in financial/mathematical tasks are greater than women’s self-perceptions in these tasks.

Summary of post-task measures. Post-task perception measures indicate that subjects reported moderate levels of task enjoyment and mood, although men reported higher mean values on these measures. Subjects reported that they prefer tasks with a clear “right” answer, and this may help explain their lack of high enjoyment. Performance and self-efficacy perceptions are significantly and positively related to task enjoyment, also. Post-task measures indicate that subjects were involved in the task. The majority of subjects reported that they were interested in reaching their goal and obtaining course credit, and subjects reported moderately high commitment levels. Subjects were asked how much time they would have preferred to complete the task, and their answers vary widely. This variation may be because some subjects reported how long they would have preferred the experiment to take.

Subjects’ perceived improvement does not differ according to assigned goal level. Perceived performance does differ according to goal level using a marginal significance level, and a multiple comparison test shows that easy goal subjects perceived that their performance level was significantly higher than moderate goal subjects. Easy goal
subjects perceived that their goals were difficult, and this is consistent with past research that complex, uncertain tasks distort subjects' perceptions about task difficulty.

It was expected that gender may account for differences in self-efficacy perceptions. Self-efficacy differences based on gender do not exist, but men's reported levels of task enjoyment are higher than women's reported levels, and men set more challenging personal goals than women set for themselves. These results are consistent with past research that indicates men's higher preferences for mathematical/financial tasks versus women's preferences, and men's higher self-perceptions of skill level in these types of tasks as compared to women's self-perceptions.

Summary

The purpose of this chapter was to use the data collected in the main experiment to analyze the hypotheses presented in Chapter 2. In addition, subjects' post-task perceptions were explored in order to reveal how these results relate to the task and its effectiveness. The effects of these findings, along with explanations for hypotheses results, are discussed in Chapter 5.

Manipulation checks were assessed, and these indicate that the experiment was successful in the assignment of easy, moderate, and impossible goal levels to subjects. Subjects accepted their goals, also.

MANOVA, ANOVA, multiple regression, and path analysis methods were used to determine results. Statistical assumptions were tested for, and data passed these tests. Self-efficacy, personal goals, and past performance significantly and positively affected
performance, and this is reflected in the post hoc power analyses showing the large effect sizes and high power for the performance variable. Although self-efficacy significantly and positively predicted performance in the post hoc regression analysis, the path from self-efficacy to performance was removed from two post hoc path analyses. The weak effect size may explain this discrepancy.

The effects of self-efficacy and personal goals on effort and persistence are not positive and significant. Power analyses reveal small effect sizes and low power for these variables, and post hoc path analyses show that these variables are not required as part of the model. The post hoc path analyses indicate that persistence is not a required variable to include in the path model, and that the path from personal goals to effort should be removed. In addition, self-efficacy negatively and significantly predicted effort, showing that as subjects’ self-efficacy strengthened, they exerted less effort. Post hoc interviews confirm that this negative effort-performance relationship may be due to the complexity and uncertainty of the task and because subjects did not consider effort as necessary for performance. Effort is negatively related to performance, and subject perceptions indicate that effort may be better represented in the research model as a mediator between cognitive variables and performance.

Past performance significantly and positively affected self-efficacy perceptions and personal goals in the path analyses. Feedback significantly and positively affected personal goals, but did not affect self-efficacy. The path from feedback to self-efficacy was removed in the post hoc path analyses. Post hoc analyses reveal that effects on self-efficacy were weak to moderate, and power was low to moderate. A post hoc regression
analysis indicates that, while past performance and feedback significantly and positively predict self-efficacy in individual regression equations, the joint effects of past performance and feedback are nonsignificant in predicting self-efficacy. The conclusion is that past performance and feedback may be redundant variables because of their similar operationalizations, and may conflict in their joint prediction of self-efficacy. Last, stronger self-efficacy perceptions resulted in subjects setting more challenging personal goals.

Overall, the path analyses indicate that the effects on personal goals are strong, and that the effects on self-efficacy perceptions are weak to moderate. This is confirmed by the calculated effect sizes and statistical power. The performance variable displays adequate effect sizes and power, but the effect sizes and power for persistence and effort are weak. These weak effects are consistent with the nonsignificant influence of these variables in the post hoc path models.

The data support Hypothesis 10, that assigned, easy goals resulted in subjects setting more challenging personal goals versus their assigned goals. Moderate and impossible goal subjects set less challenging personal goals relative to their assigned goals. Effect sizes are large for the effects of assigned goals on personal goals, and power is high. Hypotheses 9, 11, and 12 results are not significant. Assigned, easy goals did not result in stronger self-efficacy perceptions as proposed in Hypothesis 9, and this is reflected in the weak effect sizes and low power. A post hoc analysis confirms that self-efficacy predicts performance, and suggests that the lack of effects is due to the weak influence of the goal manipulation on self-efficacy. In the analysis of Hypothesis 11 and 12, the strength of the
effects of self-efficacy and personal goals on performance did not increase over the course of the experiment as expected. Self-efficacy and personal goals are significant, positive predictors of performance, but no interaction with the number of trials is evident. Effect sizes are small for the influences of self-efficacy perceptions, personal goals, and the number of trials on performance in Hypotheses 11 and 12. It may be that the complexity and uncertainty of the experiment affected the ability of the subjects to solidify their self-efficacy perceptions and personal goal levels over the few trials in this experiment.

Post-task measures reveal some information about subjects. These findings indicate that subjects reported moderate levels of task enjoyment and mood, although task enjoyment is related to higher performance and stronger self-efficacy perceptions. Subjects reported that they were involved in task performance and were committed to their goals. Subjects who were assigned easy goals perceived that they performed significantly better than subjects who were assigned moderate goals when a marginal level of statistical significance is used. Easy goal subjects perceived that their goals were difficult, reflecting the distortion in perceptions that occurs in a complex, uncertain task. This distortion indicates how easy goals may appear most motivating because they are perceived as difficult. Finally, men's reported task enjoyment was significantly higher than women's reported task enjoyment, and men set more challenging personal goals than women set. These findings are consistent with past research indicating that men's reported enjoyment of and self-perceptions of skill in mathematical/financial tasks are greater than women's.
CHAPTER 5

DISCUSSION OF RESULTS

Overview

The purpose of this chapter is to discuss the hypotheses and post hoc analyses. Some 
of the results in Chapter 4 were not as expected, and explanations are investigated here. 
Study limitations are then discussed in terms of validity. Potential contributions of this 
study are outlined in terms of implications for research and practice. Finally, future 
research is suggested.

Discussion

Discussion of Hypotheses 1-8 Results

In the path analyses, relationships between past performance, feedback, self-efficacy, 
personal goals, performance, effort, and persistence were proposed. These effects were 
investigated using path analysis because Bandura proposed in his theory that self-efficacy 
acts as part of a system of influences. Results of Hypotheses 1-8 indicate that self-efficacy 
and personal goals positively predict performance, although the path between self-
efficacy and performance was removed in two of the post hoc path analyses. This may be 
attributed to self-efficacy’s weak effect size.

Self-efficacy and personal goals do not positively predict effort and persistence. Post-
task interviews with subjects indicate that they doubted that increased effort was related
to task success. Effort and performance are negatively correlated, and this confirms subjects' perceptions. A few subjects suggested in their post-task interviews that they performed better when they did not put forth as much effort. Perceived task attributes are an important input to the formation of self-efficacy perceptions (see Figure 2). Subjects may have reported stronger self-efficacy perceptions and more challenging personal goals, but did not put forth more effort. In fact, Mitchell, et al. (1994) found that subjects reported that task attributes such as perceived complexity, novelty, and difficulty were more important to the estimation of self-efficacy earlier in task performance versus later in task performance. In self-efficacy theory, Bandura (1997) proposed that stronger self-efficacy perceptions lead to more effort. The present study results suggest that, in a complex task, stronger self-efficacy may not lead to more effort because subjects do not perceive effort to be necessary for task success. Researchers in two complex task self-efficacy studies investigated the effects of verbal persuasion (Stone, 1995) and assigned goals (Stock & Cervone, 1990) on effort, and they found that self-efficacy positively affected effort. Because few studies have been conducted on this effort in complex tasks, however, more research must be done before conclusions are drawn.

An issue related to the roles of effort, persistence, and performance is whether the research model in this study is correct (see Figure 6). In the post-task interviews, subjects referred to effort and persistence in terms of whether or not they predicted performance. Their perceptions of the effort–performance relationship suggest that the model should be drawn as in Figure 19. In post hoc analyses, however, the Lagrange multiplier statistics do not indicate that a path is needed between effort or persistence and performance to
improve the path model fit. Subject perceptions are a key element in a study such as this one, however, and further investigation of the effort–performance relationship appears to be necessary.

Figure 19. Alternative research model.

![Alternative research model diagram]

The representation in Figure 19 also is valuable because it allows for further investigation of the difference between perceived effort–performance relationships in simple and complex tasks. Kanfer (1990) suggested that researchers should explicitly consider the effort–performance relationship in complex task studies, rather than assuming that effort is a proxy measure for performance. The analysis here also suggests that, although effort and performance may be positively related in simple tasks, they may be unrelated or negatively related in complex tasks. Task complexity may be a moderator of the effort–performance relationship.
Positive feedback did not affect self-efficacy in the path model, and past performance positively affected self-efficacy in one Profit Center. Post hoc path analyses confirmed that the feedback–self-efficacy paths are not required, and that one past performance–self-efficacy path is not required. The feedback and past performance variables may be competing in the path model. Feedback is a significant, positive predictor of self-efficacy perceptions when it is used as a singular predictor. Past performance also is a significant, positive predictor of self-efficacy when isolated from the path model. When the two variables are entered into a regression model together, however, they are both nonsignificant predictors of self-efficacy. The operational definitions of these variables are similar because feedback is the discrepancy between desired performance (in terms of the assigned goal) and actual performance, and past performance is the actual performance level. The variables are significantly correlated, further suggesting that they may be redundant as separate predictors. This redundancy, combined with self-efficacy’s weak effect size, helps to explain the inconsistency of feedback and past performance as predictors of self-efficacy. This problem may not have been evident for personal goals because of the variable’s effect sizes are strong and power is high.

Small to moderate effect sizes and low to moderate power levels suggest that a stronger manipulation is needed to affect self-efficacy perceptions in a complex, uncertain task such as the one used in this study. The indication is that self-efficacy perceptions are resilient to change when subjects do not have full information about a task. The
theoretical model for this study (Figure 2) includes past experiences as an input to self-efficacy formation, and perceived task attributes are inputs as well. The present task is complex and uncertain, and subjects may have relied on their past, related experiences to form their self-efficacy perceptions while they were diagnosing the task requirements. This diagnosis may have been necessary over a few experimental trials, versus in a simple task in which an immediate assessment of task requirements could have been made.

Effect sizes are large and power is strong for the positive effects of feedback, past performance, and self-efficacy on personal goals, and this indicates that personal goals are more easily influenced in this experiment. This easier influence may be attributed to the fact that an assigned goal manipulation was used, and this manipulation more closely guided the setting of personal goals versus the formation of self-perceptions.

In sum, the lack of confirmation of hypotheses in the path analyses can be explained by post hoc interpretations. First, effort and persistence are of little value in the path model or in individual regression equations. Subjects' stronger self-efficacy and more challenging personal goals did not predict effort because subjects did not perceive that effort was necessary in the complex task used here. A possible reformulation of the research model (Figure 19) would focus on the relationship between effort and persistence as mediators between cognitive influences and performance. Focusing on the effort–performance relationship may also help to explain a moderating influence of task complexity on subjects' perceptions of effort necessary for performance.

The influences of feedback and past performance on self-efficacy highlight self-efficacy's weak to moderate effect sizes in this task. Feedback and past performance
appear to be redundant variables and to compete in the path model. This redundancy may be overcome by focusing on one of these variables. Or, as in the case of personal goals, if self-efficacy’s effect size is stronger, the negative effects of the redundancy may be avoided. A stronger manipulation appears to be necessary for self-efficacy in this complex, uncertain task. Self-efficacy is a more resilient construct to the influence of assigned goals in a task such as this one versus personal goals. This easier influence of personal goal setting may be due to the coherence of the assigned goal manipulation to the setting of personal goals.

Discussion of Hypotheses 9-12 Results

Hypothesis 9. Hypothesis 9 states that assigned, easy goals will result in subjects reporting stronger self-efficacy perceptions than moderate or impossible goals. The post hoc power analysis in Chapter 4 shows that the effect size is small and power is low for this hypothesis. The small effect size suggests that, as in the path analyses, the manipulation in this experiment was not strong enough to affect self-efficacy perceptions. Medium to large effect sizes were found for self-efficacy past complex task studies (Table 10). In addition, researchers were able to affect performance using this same task and goal manipulation in past studies (e.g., Taylor, et al., 1992). The difference between these past studies and the present one is that questionnaires were administered to subjects after each Profit Center versus only after the last Profit Center. Therefore, subjects were asked to comprehend more instructions and to pause between predictions. This may have caused overload in the amount of information subjects were asked to process.
Interestingly, subjects did not take a significantly longer amount of time to complete the task in the present study versus in the past studies in which fewer questionnaires were used. This suggests that the extra demands on subjects in this experiment may have compromised their attention to the task.

In Hypothesis 9, as in the path analyses, it appears that self-efficacy perceptions are resilient to the influence of new, complex, uncertain information. Subjects appeared to rely on past information about their abilities in related tasks to form their self-efficacy, consistent with the theoretical model in Figure 2. After more experimental trials and when subjects became more familiar with the task, they may have been influenced more by outside influences such as assigned goals.

Overall, Hypothesis 9 was rejected due to weak effects on self-efficacy perceptions and low statistical power. According to the total time spent in the experiment, subjects did not apply themselves in the experiment as much as they did in past experiments using the same task but fewer questionnaires. The conclusion is that the design of the present study may have overloaded subjects with information, which weakened the effectiveness of the assigned goal manipulation on self-efficacy. Instead of affecting self-efficacy perceptions with the manipulation, subjects may have relied on past, related experiences to form self-efficacy perceptions. More trials appear to be necessary to solidify the effects of assigned goals when using the present task.

Hypothesis 10. In Hypothesis 10, it was proposed that assigned, easy goals would result in subjects setting more challenging personal goals. Personal goal level was operationalized as the discrepancy between subjects' assigned and personal goal levels. A
comparison of Hypothesis 10 results with Hypothesis 9 results is highlighted by the
strength of the assigned goal manipulation. The manipulation was strong enough to affect
personal goals with large effect sizes and strong statistical power levels. The stronger
effects may be explained by the closer coherence of the manipulation (assigned goals) to
the personal goals construct.

Subjects who were assigned easy goals set more challenging goals versus their
assigned goals. Interestingly, subjects who were assigned moderate and impossible goals
set less challenging goals versus their assigned goals. The detrimental effects of moderate
and impossible goals, therefore, are evident in the short term for this experiment.
According to goal theory, moderate goals should lead to the highest performance levels,
but the complexity and uncertainty of this task appeared to distort these moderate goals
and discourage subjects from challenging themselves. Impossible goal subjects, similarly,
challenged themselves less compared to their assigned goals. The conclusions from
Hypothesis 10 clearly indicate that assigned, easy goals are preferable in complex,
uncertain task performance in order to encourage subjects to challenge themselves. A
concern is the detrimental effects of moderate and impossible goals on subjects’ self-
challenge.

Hypotheses 11-12. Hypothesis 11 states that the influence of self-efficacy perceptions
on performance will become more positive over trials. This hypothesis is not supported
by the data. In Hypothesis 12, it was proposed that the influence of personal goals on
performance would become more positive over trials. The results for this hypothesis also
are not significant. Effect sizes are weak, and this indicates that the number of trials was
not sufficient for self-efficacy perceptions or personal goals to strengthen as predictors of performance. The task was sufficiently complex so that more experimental trials may be necessary to allow subjects to solidify their estimations of self-efficacy and personal goals. The task was designed to induce perceptions of uncertainty about the relationship of cues to criteria. The theoretical model for the present study (Figure 2) shows that perceived task attributes are an important input into estimations of self-efficacy and personal goal level. In past research, subjects also perceived that task attributes are more important to the estimation of self-efficacy early in task performance versus later (Mitchell, et al., 1994). If subjects could not determine these relationships, they would not become more confident about the task attributes and improve in their ability to predict their performance.

The fact that the task was perceived as complex appears to have affected these hypotheses, but it does not conflict with the purpose of the study. The purpose of the study was to investigate self-efficacy and personal goals in a complex task. The results here indicate that this is a complex and uncertain task, but that subjects may take more experimental trials than they were given to solidify their feelings of efficacy and the accuracy of their personal goal levels. In other self-efficacy studies, complex tasks were used and self-efficacy perceptions became a more positive influence over three trials (e.g., Bandura & Jourden, 1991). In these tasks, researchers may have provided subjects with more knowledge about the relationship between ability and performance, while the current task involved a great deal of uncertainty about these relationships.
In sum, more experimental trials may be necessary to observe an improvement in the accuracy of subjects' estimations of self-efficacy perceptions and personal goal levels. The failure to accept Hypothesis 11 and 12 actually confirms the level of uncertainty and complexity that subjects experienced in the experiment, and shows that task attributes are important inputs into the formation of cognitive constructs such as self-efficacy and personal goals.

**Discussion Summary**

One important issue from the path analysis relates to Hypotheses 1 and 8, or the ability of self-efficacy and personal goals to predict effort and persistence. Stronger self-efficacy and more challenging personal goals resulted in higher performance, but the relationship of these cognitive variables to effort and persistence was not positive and significant. In fact, subjects stated in post-experiment interviews that they did not feel that effort was important for task performance. Some subjects also indicated that they felt their performance improved when they put forth less effort. These responses suggested that the effort–performance relationship is important in complex task studies, and that the research model may be better represented as in Figure 19, with effort and persistence mediating the effects of cognitive variables on performance. Post hoc correlations show that effort and performance are negatively and significantly correlated in this study. This negative correlation is important because it illustrates subjects' perceptions of the value of effort. The subjects may have reported strong self-efficacy perceptions and set challenging personal goals, but this did not lead to higher levels of effort and persistence.
as self-efficacy theory proposes. Task complexity may be a moderator of the effort-performance relationship so that increased task complexity weakens the relationship. In this task, subjects appeared to consider the task uncertainty and complexity as an input to the estimation of their self-efficacy and personal goals, and effort was unaffected because it was believed to be unimportant based on these inputs.

The relationship between feedback and past performance is interesting because the two variables are significantly correlated. This did not affect the findings relating to personal goals because of this variable's large effect size. The self-efficacy effect size is small, however, and the redundancy of feedback and past performance when they are both entered into the path analyses appears to mask effects on self-efficacy. When feedback and past performance are used as individual predictors of self-efficacy, they are both significant. Therefore, a stronger assigned goal manipulation may lessen the effects of jointly examining feedback and past performance. Another consideration is that feedback and past performance may not be necessary as joint predictors because they are redundant.

Self-efficacy's small effect size affected the analysis of Hypothesis 9 as well as the path analyses. The assigned goal manipulation was not strong enough to result in changes in self-efficacy or in performance, although the same manipulation and task were successfully used to affect performance in past studies (e.g., Taylor, et al., 1992). The difference in the present study is that more questionnaires were used with additional instructions, which could have overloaded subjects in performing the task. The time subjects spent in the task was not significantly longer than in past studies, though, further
indicating that they were overloaded and may have worked faster than in past studies. A stronger goal manipulation or fewer questionnaires should increase the effect size of self-efficacy using this same task.

Hypothesis 10 results reveal that assigned, easy goals are superior over moderate or impossible goals in a complex, uncertain task such as the one used here. Subjects who were assigned easy goals set more challenging personal goals versus their assigned goals. A disturbing result is that subjects who were assigned moderate and impossible goals set less challenging personal goals versus their assigned goals, meaning that the assigned goals were detrimental to their aspirations for task performance. These results support past research that subjects' perceptions of goal difficulty are distorted in complex tasks.

Based on Hypotheses 11 and 12, it was expected that self-efficacy and personal goals would become more positive influences on performance over the experimental trials. The number of trials variable exhibited weak effects, however, indicating that subjects did not have enough task experience to strengthen their self-efficacy perceptions or personal goal predictions as predictors of performance. This confirms that the task is complex and that subjects experienced uncertainty in their understanding of the task relationships, but also suggests that more trials are needed in a task of this complexity level.

Study Limitations

For the theoretically-driven empirical researcher, internal validity is the most important concern, followed by construct validity, statistical conclusion validity, and external validity (Cook & Campbell, 1977). In this section, threats to these types of
validity in the present study are discussed along with safeguards that were used to combat them.

**Internal Validity**

Internal validity refers to the ability to draw conclusions from data that a causal relationship exists or does not exist (Cook & Campbell, 1977). Cook and Campbell discussed many threats to internal validity, and those that posed issues in the present study are discussed here. First, subjects were tested repeatedly on some measures, and subjects may have become familiar with test items and answered without careful consideration. Although self-efficacy perceptions were assessed prior to Profit Centers B, C, and D, the measure is slightly different in that subjects are not reporting general perceptions, but those directed at the next Profit Center. Therefore, the questionnaire changed in the object of the perceptions. In addition, many researchers of self-efficacy studies conducted over trials found that the construct changed over time in response to experimental manipulations (e.g., Wood & Bandura, 1989b), reflecting that subjects did not simply report the same answers continually.

A second issue related to testing subjects repeatedly is statistical regression, or the tendency of scores to regress toward the mean (Cook & Campbell, 1977). This potential problem was combated by using a representative sample of subjects from the population of interest. The population of interest was adults who make decisions in a complex task, and adult students are representative of this group.
Third, volunteers were used in this study, which may have caused the sample to be different from nonvolunteers on some factors. Subjects were not told the purpose of the experiment. Therefore, subjects who volunteered did not choose to participate because they enjoyed the subject of the study or believed they were skilled in this type of task. In addition, repeated measures were used to study within-subject changes. Repeated measures analysis provided more information about the experimental effects than a correlational analysis because subject reactions were studied in a causal fashion over trials. Subjects were given extra credit to participate in the study, so subjects with lower grades may have been encouraged to participate. This is not expected, however, because subjects participated in the first month of the semester and had not taken any exams yet.

Fourth, subjects who finished the experiment may have had the opportunity to speak to subjects who had not yet participated. Small groups were used in the experiment, but these groups met on successive days with a separation between groups on the same day to minimize interaction. Because interaction could not be completely avoided, though, subjects were kept naive as to the purposes of the study until all experimental groups were finished. In addition, subjects were given a slip of paper when they left the experiment that stated they would lose their extra credit points if they discussed the experiment with anyone before all groups were finished participating.

A fifth concern was if subjects perceived treatment differences existed. Subjects may have resented their assigned goal, or they may have felt a rivalry with other groups and exerted extra effort (Cook & Campbell, 1977). Post-task analyses indicate that effort does not differ according to assigned goal level. To combat this potential problem, terms in the
task instructions that referred to goal level did not refer to the person’s assignment to a group. Further, subjects were given no indication of how difficult their goal was. They discovered the degree of goal difficulty through their own task experience. When subjects asked questions during the experiment, the experimenter never referred to their numerical goal level out loud so that other subjects could hear. Subjects also were seated with at least one chair between them during the experiment.

Construct Validity

Construct validity refers to whether the theoretical construct is actually what is measured (Kerlinger, 1986). Construct validity is critical to ensure that theory and measurement are linked. Mono-operation bias was not avoided here because the same measurements were used repeatedly. This is consistent with other self-efficacy studies in which construct validity was confirmed, however (e.g., Bandura & Jourden, 1991). Mono-method bias was avoided because performance was objectively measured, although all other measures were self-reported. Two types of effort measures were used, however, and these correlated significantly. Researchers criticized the attribution of causality to cognitions (e.g., self-efficacy perceptions and personal goals) because they are measured indirectly and based on self-report data (Hawkins, 1995). The nature of cognitions makes indirect measurement necessary, however. Cognitions are helpful to provide a more detailed explanation of motivation over external influences alone, so this is a limitation that is noted when results attributed to cognitions are discussed in terms of subject perceptions. The construct validity was checked in this experiment by regression results that showed

A second construct validity problem may have occurred in this experiment if subjects guessed the purposes of the experiment and, then, were affected in their answers and effort level by this knowledge (Cook & Campbell, 1977). If subjects were aware of the experimenter’s desired results, they may have answered questionnaires in a way that sought to confirm these results. This is unlikely because of the complexity of the relationships hypothesized. No mention was made in the task instructions or materials that referred to the goals of the experiment or to self-efficacy perceptions. Post-task interviews clearly indicated that subjects did not understand the purpose of the experiment.

Third, subjects may have been apprehensive about their performance, especially if they perceived the experimenter was evaluating them in relation to their decision-making ability. Therefore, subjects were assured of anonymity of results and mention of issues relating to experimenter evaluation were minimized. Although subjects were aware that their decision-making quality would be evaluated after the experiment in order to award extra credit points (even though all received the maximum number of points), they evaluated their own decision quality privately during the experiment.

Fourth, the experimenter knew the desired results of the study, and this may have affected her behavior toward subjects and her answers to subject questions. To combat this problem, she read a script to subjects before the experiment began, and she used prepared answers to commonly-asked questions in order to avoid leading the subjects.
**Statistical Conclusion Validity**

Statistical conclusion validity refers to the ability to draw conclusions about causality based on statistical procedures (Cook & Campbell, 1977). Manipulation checks, random assignment of subjects to experimental groups, testing for assumptions, and a controlled experimental setting helped to control many potential threats to this type of validity. Each self-efficacy questionnaire is unique, so reliability was assessed in the pilot study and main experiment. The questionnaire was deemed reliable based on Cronbach’s alpha and test-retest correlational analyses. Past studies also provided information on effect sizes to ensure that an adequate sample size was used for statistical power. A limit in this study is that adequate power was not found for all variables. Specifically, it appears that the effects of the assigned goal treatment were not potent enough to affect self-efficacy perceptions. This limitation will provide valuable information for future researchers using this task or tasks of similar complexity.

**External Validity**

External validity refers to the ability to extend conclusions of a study to other settings, time, operations, functional relationships, and populations (Taylor, 1997). External validity is often discussed only in terms of population validity, however. Population validity is not the focus of this study, and the positive effects of easy goals on performance have been found in past studies in which researchers used the present task and varied sample types. Student subjects display the same cognitive capabilities for decision making that are common to all adult humans, and this allows for broad
population validity in this study. All results from the task used in this study are
generalizable to the adult population.

The operations and functional relationships were the main concerns of this
experiment in terms of external validity. The goal of this study is to generalize the results
concerning functional relationships to situations with these same relationships outside the
experimental situation. The relationships represented by the Brunswik (1955) lens model
are those common to strategic decision-making situations. The researcher is able to create
uncertain, complex relationships that model situations decision makers encounter. The
control of the experiment allows for precise investigation of effects by isolating important
effects from others that are not of interest. The coherence of the relationships between
cues and criteria in the current experiment and those that decision makers find in complex
decision making situations allows for the generalizability of this study's results to other
complex, uncertain decision making situations.

Finally, the goal of every experiment is not to establish external validity (Cook &
Campbell, 1977). The experiment took place in a classroom setting, and this control was
necessary for internal validity, the primary goal of theoretically-driven research.
Functional relationships were of primary interest, and the lens model provided the
opportunity to accurately model the relationships of a complex, uncertain decision
making situation.
Contributions and Implications of the Study

The results of this study can contribute to the literature on self-efficacy perceptions, goal setting, feedback, and complex tasks. In this research, some relationships were investigated due to a proposed need for more study. In other cases, the relationships were unresearched in the literature. The discussion here centers on key findings and their implications for research.

First, further definition of the self-efficacy construct is necessary (Gist & Mitchell, 1992) and more knowledge is needed of how these perceptions are formed (Bandura, 1997). One way to develop the construct is to extend knowledge of how it operates in different tasks and domains. Few researchers investigated the effects of self-efficacy perceptions in complex, uncertain environments, and researchers in only two studies used the MCPLP and/or the Brunswik (1955) lens model for this purpose. In many of these complex task studies, researchers also used the same computer simulation task, and other researchers suggested that different complex tasks should be used (Cervone & Wood, 1995; Stone, 1994). The use of a different MCPLP task and the lens model helps to extrapolate these findings to new tasks and environments.

Findings in this study indicate that a highly uncertain, complex MCPLP task affects the strength of manipulations and expected results as they relate to self-efficacy. Effect sizes of variables' influences on self-efficacy are small, and this is contrary to medium to large effect sizes found in past complex task self-efficacy studies. The implication is that researchers must realize that degrees of task complexity exist (Wood, 1986), and that higher degrees of complexity and uncertainty may lessen the effects of external influences.
such as assigned goals on self-efficacy. When considering their ability to perform a task, subjects may not be affected by external influences when they have not yet determined the task attributes. Subjects focus on task attributes as important determinants of self-efficacy early in task performance (Mitchell, et al., 1994), and this further suggests that task complexity and uncertainty may have caused subjects to rely on past experiences to determine their self-efficacy. This conclusion is also consistent with the theoretical model of this study (see Figure 2) in which a primary input to the formation of self-efficacy perceptions is an analysis of the task requirements.

The data here indicate that self-efficacy is a distinct construct from effort-performance expectancy, E1. Self-efficacy perceptions predicted future performance better than E1. Little research was conducted comparing these two constructs, and the findings here support the theoretical definition of self-efficacy. Self-efficacy is a more broad construct than E1 that encompasses the consideration of the task, the person, and the situation versus only whether effort will lead to performance.

Second, researchers in two studies investigated the effects of easy goals on self-efficacy perceptions and personal goals, but they did not propose that easy goals would lead to positive effects. Little is known about the effects of assigned goals on self-efficacy perceptions in complex task environments, and results in past studies were mixed. Researchers suggested that task complexity may moderate the relationship between goal difficulty and performance (Wood, et al., 1987), and this may explain the positive effects of easy goals in complex tasks (Taylor, et al., 1992). Although assigned goals did not affect self-efficacy perceptions in this study, other post-experiment measures indicate that
task complexity did affect perceptions. Subjects' perceived performance was distorted so that easy goal subjects perceived that they performed better than moderate goal subjects, although they did not. Easy goal subjects also perceived that their goals were difficult, and this reflects the distortion of the uncertain, complex task that made objectively easy goals seem difficult. These findings lend support to the suggestion that assigned goals do not operate as expected in complex task environments. Again, the implication is that degrees of task complexity should be measured in studies, and that more complexity affects subject perceptions. These perceptions are important to help determine exactly how and why complexity affects performance.

Third, the effects of assigned goals on personal goals in this study were considered important to investigate because little past research was conducted on these effects. Of primary interest is the effect of assigned, easy goals on personal goals in complex task performance because this has not been studied. Results confirm the hypothesis that easy goal subjects set the most challenging personal goals (relative to their assigned goal) versus moderate or impossible goal subjects. Moderate or impossible goals did not challenge subjects to set stricter goals relative to their assigned goals; in fact, these subjects set more lenient goals. This implies that moderate or impossible goals may discourage people from working harder on a complex, uncertain task. In contrast, easy goals appear to encourage people to push themselves. These results are important because they suggest not only that easy goals positively influence subjects in complex tasks, but that moderate and impossible goals are detrimental in these tasks.
Fourth, the complexity and uncertainty of this task may have influenced the effects of repeated trials in this experiment. It was expected from past research that self-efficacy perceptions and personal goals would become stronger influences on performance over repeated trials. The results do not support these expectations, and possible reasons relate to the ability of subjects to determine the attributes of the task. Four repeated trials of this task may not have been sufficient to strengthen cognitive influences on performance. Given the high degree of complexity and uncertainty, more trials may have been necessary. Small effect sizes also suggest that this may be true. Researchers must determine the degree of complexity and uncertainty of a task, and realize that these attributes may affect the number of trials necessary to change the influence of cognitive variables. The implication is that when people perform a highly complex task, they may need more experience to solidify their self-perceptions than in a simpler task.

Fifth, effort and persistence are not well understood variables in the literature as they relate to complex task performance (Kanfer, 1987). The present analysis indicates that these variables are not important in this complex, uncertain task. Post-task interviews further suggest that subjects were not convinced that effort was necessary to perform the task well. In fact, the relationship between self-efficacy and effort is negative in the post hoc path analyses and in the original Profit Center C analysis. As self-efficacy perceptions strengthened, effort decreased. These effects can be explained by the theoretical model in this study (Figure 2) that illustrates how knowledge about task attributes is necessary to influence self-efficacy, a primary determinant of effort. If subjects perceived that effort was not necessary to perform a task, then their estimates of self-efficacy would not
influence effort. This implies that effort–performance relationships should be clarified in performance situations. Otherwise, subjects may not perceive that effort is necessary, and that performance is more dependent on luck or inherent ability. Past complex task self-efficacy studies investigated the effects of inducing ability conceptions in subjects and affecting self-efficacy perceptions (e.g., Wood & Bandura, 1989a). These ability conceptions may be one element that determines whether effort is expended.

Based on subjects' post-experiment statements, the research model may be better represented as in Figure 19, showing that effort and persistence mediate the relationship between cognitive self-influences and performance. A representation of the model in this manner illustrates subjects' perceived relationship between effort and performance. Because of the findings here, task complexity may be added to this model as a potential moderator of the effort–performance relationship.

Last, gender effects were found in past studies in which mathematical/financial tasks were used (e.g., Betz & Hackett, 1986). Specifically, men reported stronger self-efficacy perceptions and preferences for these tasks versus women's reports. Gender differences in this study do not exist for self-efficacy perceptions, but men's reports of task enjoyment are significantly higher than women's. In addition, men set more challenging personal goals than women set. This latter finding is important for complexity research because it indicates that men challenge themselves more in a complex, financial-related task versus women, and this may be due to their enjoyment of these types of tasks. The implication is that men will push themselves more in these tasks and perhaps create a gender
performance gap. A related finding of this study in Hypothesis 10 suggests that easy goals may help to lessen this gap, given that easy goals encourage subjects to challenge themselves more, regardless of gender.

In summary, the relationships between self-efficacy perceptions, feedback, and goals in complex task performance received limited attention in the literature. These relationships and variables are necessary to further understand how self-efficacy perceptions operate in complex task environments so that performance can be optimized through the influence of self-efficacy. The findings here indicate that these relationships are important, and that the degree of task complexity and uncertainty plays a key role in how external influences are able to affect self-efficacy perceptions, how effort–performance relationships are perceived, and how long it takes people to solidify their self-efficacy perceptions and personal goal levels. Assigned, easy goals encourage people to challenge themselves, but moderate or impossible goals may be detrimental in this respect. In addition, assigned, easy goals may lessen gender gaps in tasks such as the one in this study by encouraging all people to challenge themselves more.

Future Research Suggestions

The goal of this research was not only the confirmation of hypotheses, but the encouragement of future research to extend the understanding of these relationships and constructs. One logical extension of this research is the examination of the same hypotheses using a different task, different subject types, or a different setting. This will help generalize results and allow the findings to be implemented in more situations. Of
primary interest, however, are the functional relationships and operations of this study. Several avenues for future research in these areas are detailed here.

A first suggestion is that task complexity and uncertainty should be quantified in future research (e.g., Wood, 1986). A unique model that allows this quantification is the Brunswik (1955) lens model, which was used in this study. The lens model allows researchers to create a desired level of uncertainty based on the amount of variance cues explain in a criterion. The number of cues can also be varied in order to create or reduce complexity and uncertainty. An ideal type of task that is used with the lens model is a multiple cue probability task such as the one used in this study. By quantifying complexity and uncertainty, researchers can compare the effects of different types of tasks on variables such as self-efficacy. The task used in this study may have been more complex and uncertain versus those used in past complex task self-efficacy studies. This added complexity and uncertainty would explain the smaller effect sizes and lower statistical power of experiment manipulations. In future studies, researchers may investigate task complexity as a moderator of the relationship between external influences and self-efficacy perceptions. This research will also help to provide a guide for sample size determination of statistical power.

Related to this point are subjects' perceptions of task complexity and uncertainty. Although objective task characteristics are specified in a study, subjects' perceptions are of primary interest because they determine reactions. For example, easy goal subjects in this experiment perceived that they performed better than moderate and impossible goal subjects, although they did not. Also, easy goal subjects perceived that their assigned goal
was difficult, even though their goal was objectively determined to be “easy.” These results are consistent with perceptual distortion found due to task complexity in Taylor, et al. (1992). Task complexity research always should accompany perception measures, and the present study provided further evidence of this.

Second, researchers should replicate this study with stronger manipulations of assigned goals. This may be done by more explicitly defining subjects’ assigned goal levels, and by reminding them of their goal level throughout the experiment. Past studies using this same task have been successful in the strength of their manipulations, and the reason may be that fewer questionnaires were used and subjects were not interrupted with questionnaires between Profit Centers. In the future, researchers may replicate the current experiment with fewer questionnaires and interruptions to improve effect sizes. The effects of assigned, easy goals are still of interest because of their lack of attention in self-efficacy literature, and a replication with more statistical power would be valuable.

Third, further investigation into the effects of assigned, easy goals on personal goals is necessary. Easy goal subjects challenged themselves more than moderate or impossible goal subjects, and the reasons for this effect needs more explanation. In addition, the nature of the implications for moderate and impossible goal subjects is of interest. Moderate and impossible subjects challenged themselves less versus their assigned goals. For example, a longer-term study may investigate the lasting effects of challenging oneself less than an assigned goal and whether the results relate to satisfaction with performance, task enjoyment, or perseverance. Findings in this study also indicate that men set more challenging personal goals for themselves than women, and future
researchers can investigate whether assigned, easy goals lessen this gap in complex task performance.

Fourth, self-perceptions other than self-efficacy may help explain how subjects dealt with task complexity and uncertainty. In the post-task interviews, some subjects reported that they decided that performance was not dependent on their ability. Other subjects stated that they felt “inadequate” after performing the experiment. The difference in these two groups is of interest because it may explain effects on self-efficacy perceptions. One construct that may aid in this explanation is locus of control, which suggests whether people feel that they are controlled by external events or have more internally-based control (Rotter, 1966). Another avenue for research is the role of ability attributions, as were investigated by Wood and Bandura (1989). If subjects decided that this task was ability-based, their self-efficacy would more likely be weakened.

Effort–performance relationships are a fifth area of interest. It appears in this study that subjects did not feel that effort led to performance. This is evident in the fact that effort and persistence are not useful variables in the path analyses, and was reflected in post-task interviews in which several subjects stated that they believed effort was not a factor in performance. Researchers of future studies may compare subjects who are told explicitly that effort leads to performance to those who are not told this. This may or may not be used as truthful information. Subjects’ attributions about performance ability would be of interest here, as well. Kanfer (1987) suggested that effort and performance are often not linearly related in complex tasks, but that researchers usually do not consider this fact. Further research into subjects’ perceptions about these relationships,
and the effects of inducing knowledge about them would add to this research. In future studies, the research model in this study (Figure 6) may be modified so that effort and persistence are mediators of the relationship between cognitive variables and performance. The illustration in Figure 19 may better represent subjects' perceptions of the relationships among these variables. The addition of task complexity as a possible moderator of the effort–performance relationship would also be of interest.

Sixth, a study using the present task and research design would be valuable over more trial blocks. The study may need to be modified so that subjects fill out fewer questionnaires, because the increased number of trials would make the experiment very time consuming. More trial blocks would allow for the investigation of self-efficacy and personal goal effects as they influence performance. In the present study, these effects were not found, and the lack of effects may be because changes would have appeared in later trials. Other researchers may consider task complexity as a moderator of the time effects and determine whether more task experience affects the influence of self-efficacy and personal goals on performance.

Summary

The goal of this study was to contribute to self-efficacy perceptions, goal setting, feedback, and task complexity research. Results of the hypotheses indicate that this goal was reached. The complex, uncertain nature of tasks emerged as one important issue in explaining results. Specifically, more knowledge is needed of how the degree of task complexity and uncertainty influences effect sizes and the ability to affect self-efficacy
perceptions. In addition, more research should reveal how the degree of complexity and uncertainty affects the changing influences of personal goals and self-efficacy over repeated trials.

Perceptions played a key role in this study. Task complexity has been demonstrated in this and other studies to distort subjects’ perceptions about their performance and their goal difficulty, and also did so here. These findings add to existing evidence that easy goals appear difficult to subjects in highly complex task performance and that subjects misperceive their performance levels in these situations. The present study shows that the Brunswik (1955) lens model is an ideal framework for this type of research because objective and subjective task characteristics can be compared with precision.

An important finding in this study is that assigned, easy goals result in subjects challenging themselves more than moderate or impossible goals. Subjects who were assigned easy goals set the most challenging personal goals relative to their assigned goal level. In fact, moderate and impossible goal subjects set lower personal goals than their assigned goals. Important future considerations of these results include the detrimental effects of setting lower personal goals than assigned goal levels, and the positive effects of challenging oneself over and above assigned goal levels. Researchers of gender issues should also be concerned with these results because males set more challenging personal goals than females set in this study, regardless of their assigned goal level. An important future consideration is whether assigned, easy goals can dissipate these effects in complex task performance.
In this task, subjects conceptualized effort as a determinant of performance, and expressed that they did not believe the two variables were related. It appears that the complexity and uncertainty of the task influenced this finding, and that subjects’ strong self-efficacy did not lead to increased effort because subjects felt that effort was unnecessary. Effort is negatively related to performance, and effort and persistence are not significant variables in the present study. Self-efficacy perceptions and personal goals do predict performance, but do not predict effort or persistence. This finding implies that the prediction of effort and persistence may not be taken for granted in a highly complex task environment in which subjects are unsure as to the influence of exerting more effort. Future research involving more experimental trials may reveal additional information concerning these issues, as would a reformulation of the research model to reflect effort and persistence as mediators between cognitive variables and performance. Subjects’ perceptions about complex task performance and its relation to effort or ability conceptions also may be helpful.

A debate in the motivation literature concerns whether self-efficacy is a different construct from effort-performance expectancy, E1. In this study, self-efficacy’s discriminant validity from E1 is displayed in its superior predictive ability. This issue received little past empirical research attention.

In sum, valuable results of this study relate to the effects of assigned, easy goals on personal goal levels, and the effects of complexity and uncertainty on task performance and subjects’ perceptions. Additional important findings concern the role of gender in personal goal setting, and the relationships between effort, persistence, and performance.
It can be concluded that the goals of this study, to add to existing literature and to guide future research, were reached.
TASK INSTRUCTIONS
INSTRUCTIONS

Please read these instructions carefully. You will make decisions on an individual basis; therefore, please do not talk during the study. Talking during the study will result in your disqualification from participation. Do not write your name on any of your materials.

PROCEDURE

Assume that you are a financial manager for ABCD Electronics, Inc. Forecasting key financial outcomes is your primary responsibility. One outcome that ABCD is particularly interested in is the price-earnings (P/E) ratio. ABCD has assigned you the responsibility for predicting future P/E ratios.

You will consider data for four independent divisions of ABCD, Inc. Each division is represented by a stack of 20 3” x 5” cards. These divisions are labeled A, B, C, and D and are called Profit Centers. Each card represents a month of operation; thus, you have data for 20 months within each division.

Based on three pieces of known financial data, you should predict the monthly P/E ratios. On side 1 of each card you will be given the known financial information:

a) the current ratio
b) the inventory turnover
c) the debt-to-equity ratio

Each monthly prediction should be done as follows:

1. Consider the three financial “input” values on side 1 of the “top” card for Profit Center A.

2. Based on these three numbers, record your prediction of the P/E value in the proper space on the form entitled “P/E Predictions - Profit Center A.”

3. Turn the card over and view the correct response.

4. Continue to the next card, using the feedback from previous predictions to assist your decisions.

It is important to note that for each Profit Center, you should be figuring how much weight to place on each input value (current ratio, inventory turnover, debt-to-equity ratio) to minimize prediction error.

Don’t worry if you are unfamiliar with this financial terminology. Your job is to use the three input numbers to forecast P/E values.
EXAMPLE: Start with the top card in Profit Center A. Let’s say it appears as:

Cue Input
Month 1
Current Ratio = 10
Inventory Turnover = 10
Debt-to-Equity Ratio = 10

You should consider as “input” the numbers 10, 10, and 10. Based on these three numbers, you predict the P/E ratio for month 1. Assume you decide to predict 10. Record a 10 in the first blank under the predict column.

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<thead>
<tr>
<th>Month</th>
<th>Predict</th>
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<td>10</td>
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</tbody>
</table>

Now, flip the card over and view the correct response. Let’s say the correct P/E ratio for month 1 was 9. This means you experienced 1 unit of error.

**You may turn each card over to view the correct response only after you have made your prediction for that month. Turning over the card before making your prediction is considered cheating and will result in your disqualification from participation in the experiment.**

Move to month 2 using the information from month 1 to help you predict in month 2. Continue for each Profit Center.

You will find, as in the “real world,” that there is some uncertainty in the input-criterion relationships. There is, however, some statistical relationship between the inputs and criteria values. Your job is to determine their relationships (over time) and make predictions with minimum error.

**PERFORMANCE GOAL**
You may work toward a goal of averaging no more than 1 unit of error for each Profit Center (20 months). For each Profit Center, you will be allowed at any point during your
decisions to commit to 1 unit of average error as your goal. (Remember, if the correct P/E ratio is, say, 15, then 1 unit of error would be a prediction of either 16 or 14). The earlier you commit to your goal, the more you stand to win if you attain your goal. If you did not attain your goal, the earlier you commit, the more you will lose. In fact, you may decide to never commit to your goal and not risk any loss.

Depending on when you decide (if ever) to commit to your goal, this will determine the level of your earnings. Remember, you do not have to commit to the goal you have been assigned. If you want to earn more extra credit points, however, commitment is necessary. Points you earn in each Profit Center will be translated into extra credit points after the experiment. The payoff schedule for each trial is as follows:

**PROFIT CENTER A, B, C, or D**
Initial Stake = 100 points per Profit Center

<table>
<thead>
<tr>
<th>Trial</th>
<th>Wager</th>
<th>Reward</th>
<th>Protect</th>
<th>Total Payoff</th>
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<td>1.</td>
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<td>3.</td>
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<td>5</td>
<td>10</td>
<td>95</td>
<td>= 105</td>
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</table>

*The longer you delay in committing to your goal, the less you can earn.*

<table>
<thead>
<tr>
<th>Trial</th>
<th>Wager</th>
<th>Reward</th>
<th>Protect</th>
<th>Total Payoff</th>
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<td>10.</td>
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*The longer you delay in committing to your goal, the more points you protect.*

*If you never commit to your goal, you will still receive 100 points.*
Example:

Let's say you have made nine predictions without committing to your goal. You now decide to commit to your goal after decision #9 and before decision #10. You check the commitment space next to #10 on the answer sheet. Then, draw a line through the remaining commitment spaces for that Profit Center. This same procedure applies to all Profit Centers. An example is provided on the next page. There are two possible results from this commitment decision:

(1) If successful in achieving your goal, you would receive 155 points for that Profit Center.

(2) If unsuccessful in achieving your goal, you would receive 45 points for that Profit Center.
P/E Predictions - Profit Center A

Record your predictions in the proper spaces.

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<th>Commit</th>
<th>Month</th>
<th>Predict</th>
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<tbody>
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<td>______</td>
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**REMEMBER:** Prior to the month (trial) you decide to commit to your goal, mark the space next to that month on your answer sheet. You must do this before moving on to the next decision in order to validate your earnings. Do not go back and check or change a commitment block after committing and making predictions. Always make all 20 predictions in each Profit Center. Don’t forget to draw a line through the rest of the spaces after committing. Then continue to make the remaining predictions in the Profit Center.
After you have completed reading these instructions, raise your hand. Wait until everyone finishes reading the instructions, and the monitor will inform you when to begin Profit Center A’s predictions. Before you begin your predictions in a Profit Center, write down your starting time on your answer sheet. Then you may begin your predictions. If you have any questions during the task, raise your hand. Remember, once you have recorded a prediction, do not go back and change your decision or you will be disqualified. You may, however, go back and consider these instructions at any time during the study.

After you are finished predicting for Profit Center A, write down your finishing time on your answer sheet, bring your Profit Center A materials to the front, and the experimenter will give you Profit Center B materials. Before making Profit Center B predictions, you will complete a questionnaire that is in the front of the packet. Continue this procedure for Profit Centers C and D. Good luck!
P/E Predictions - Profit Center A

Record your predictions in the proper spaces. Before you begin, record your beginning time for this Profit Center in the blank below in the form hours:minutes (example: 5:30). When you are finished with your last prediction, record your ending time.

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Beginning Time: _______ : _______

Ending Time: _______ : _______

REMEMBER: Prior to the month (trial) you decide to commit to your goal, mark the space next to that month on your answer sheet. You must do this before moving on to the next decision in order to validate your earnings. Do not go back and check or change a commitment block after committing and making predictions. Always make all 20 predictions in each Profit Center. Don't forget to draw a line through the rest of the spaces after committing. Then continue to make the remaining predictions in the Profit Center.
### P/E Predictions - Profit Center B

Record your predictions in the proper spaces. Before you begin, record your beginning time for this Profit Center in the blank below in the form hours:minutes (example: 5:30). When you are finished with your last prediction, record your ending time.

**Beginning Time:** _____ : _____

<table>
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<tr>
<th>Commit</th>
<th>Month</th>
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</table>

**Ending Time:** _____ : _____

**REMEMBER:** Prior to the month (trial) you decide to commit to your goal, mark the space next to that month on your answer sheet. You **must** do this before moving on to the next decision in order to validate your earnings. Do not go back and check or change a commitment block after committing and making predictions. Always make all 20 predictions in each Profit Center. Don’t forget to draw a line through the rest of the spaces after committing. Then continue to make the remaining predictions in the Profit Center.
**P/E Predictions - Profit Center C**

Record your predictions in the proper spaces. Before you begin, record your beginning time for this Profit Center in the blank below in the form hours:minutes (example: 5:30). When you are finished with your last prediction, record your ending time.

<table>
<thead>
<tr>
<th>Commit</th>
<th>Month</th>
<th>Predict</th>
</tr>
</thead>
<tbody>
<tr>
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<td>20</td>
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</tbody>
</table>

**Beginning Time:** _____:_____

**Ending Time:** _____:_____

**REMEMBER:** Prior to the month (trial) you decide to commit to your goal, mark the space next to that month on your answer sheet. You *must* do this before moving on to the next decision in order to **validate your earnings**. Do not go back and check or change a commitment block after committing and making predictions. Always make all 20 predictions in each Profit Center. Don't forget to **draw a line** through the rest of the spaces after committing. Then continue to make the remaining predictions in the Profit Center.
P/E Predictions - Profit Center D

Record your predictions in the proper spaces. Before you begin, record your beginning time for this Profit Center in the blank below in the form hours:minutes (example: 5:30). When you are finished with your last prediction, record your ending time.

<table>
<thead>
<tr>
<th>Commit</th>
<th>Month</th>
<th>Predict</th>
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</thead>
<tbody>
<tr>
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<td>1</td>
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<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Beginning Time: ______:_____

Ending Time: ______:_____

**REMEMBER:** Prior to the month (trial) you decide to commit to your goal, mark the space next to that month on your answer sheet. You must do this before moving on to the next decision in order to validate your earnings. Do not go back and check or change a commitment block after committing and making predictions. Always make all 20 predictions in each Profit Center. Don’t forget to draw a line through the rest of the spaces after committing. Then continue to make the remaining predictions in the Profit Center.
INFORMED CONSENT FORM
Informed Consent

I agree to participate in a research study investigating individual decision making. I understand that my participation in this study will not take more than two hours, although times will vary for different individuals. I understand that there is minimal personal risk or discomfort associated with participation in the study.

I understand that all information obtained in this study will be recorded with a code number that is associated with my name, and that my name will not be revealed in any results. Megan Endres, the study investigator, will keep any information documenting my participation in this study in a locked cabinet. Under this condition, I agree that information obtained from this research can be used in any way thought best for publication or education.

I understand that I have the opportunity to obtain up to ten extra credit points added to my grade through my participation in this experiment. My participation is voluntary and my refusal to participate will not result in any penalty. I can discontinue my participation at any time, but I understand that I must complete the entire experiment in order to be awarded the extra credit points. I understand that I will be informed of the purposes of this study and the number of extra credit points I will receive in the week following the experiment.

If I have any questions or problems that arise in connection with my participation in this study, I should contact Megan Endres at (940) 565-3140 (work), (817) 923-2480 (home), or in her office in BA 314.

Date

Signature of Participant

Date

Signature of Investigator

THIS PROJECT HAS BEEN REVIEWED BY UNIVERSITY OF NORTH TEXAS COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (Phone: 565-3940).
QUESTIONNAIRES
Example Rating Form

To familiarize you with the rating form, please read the following two examples.

EXAMPLE 1: Use the following scale to indicate your confidence in answering the questions such as those provided below.

<table>
<thead>
<tr>
<th>Confidence Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot do at all</td>
</tr>
<tr>
<td>0 10 20 30 40 50 60 70 80 90 100</td>
</tr>
</tbody>
</table>

The answers below indicate that you are completely confident that you can lift 10 or 20 pounds, have low to moderate confidence that you can lift 50 pounds, and are certain you cannot lift 80 pounds.

**PHYSICAL STRENGTH**

<table>
<thead>
<tr>
<th>CONFIDENCE (0-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can lift a 10 pound object. 100</td>
</tr>
<tr>
<td>I can lift a 20 pound object. 100</td>
</tr>
<tr>
<td>I can lift a 50 pound object. 30</td>
</tr>
<tr>
<td>I can lift an 80 pound object. 0</td>
</tr>
</tbody>
</table>

EXAMPLE 2: In response to questionnaire items using the following scale, mark an “x” on the line indicating your answer. For example, if you are of moderate to low certainty that you can lift a 50 pound object, you would mark something like:

I can lift a 50 pound object.

<table>
<thead>
<tr>
<th>Cannot do at all</th>
<th>Certain can do</th>
</tr>
</thead>
</table>

Do not circle the words at the ends of the scale.
Decision-Making Inventory

Considering the next 20 P/E predictions you will make, answer the following eight questionnaire items. Using the confidence scale provided, indicate your confidence in the following statements.

Confidence Scale

<table>
<thead>
<tr>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannot do at all</td>
<td>Moderately certain can do</td>
<td>Certain can do</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. I can predict P/E ratios within an average of 0 units of error. ________
2. I can predict P/E ratios within an average of 1 unit of error. ________
3. I can predict P/E ratios within an average of 2 units of error. ________
4. I can predict P/E ratios within an average of 3 units of error. ________
5. I can predict P/E ratios within an average of 4 units of error. ________
6. I can predict P/E ratios within an average of 5 units of error. ________
7. I can predict P/E ratios within an average of 6 units of error. ________
8. If I put forth effort, I can predict P/E ratios. ________

INSTRUCTIONS: Circle the number that corresponds with your answer.

9. My personal goal is to predict the P/E ratios in the next Profit Center within an average of:
   1. 0 unit of error
   2. 4 units of error
   3. 1 “
   4. 5 “
   5. 2 “
   6. 3 “
   7. no particular goal
INSTRUCTIONS: In response to the following statements, mark an “x” on the line indicating your answer. Do not circle the words at the ends of the scale.

10. Indicate how you feel about your performance on the last 20 P/E predictions.

Dissatisfied  ____________________________ Satisfied

11. How much effort did you exert to make the last 20 P/E predictions?

No effort  ____________________________ A great deal of effort
at all
Decision-Making Inventory

Considering the next 20 P/E predictions you will make, answer the following eight questionnaire items. Using the confidence scale provided, indicate your confidence in the following statements.

Confidence Scale

0 10 20 30 40 50 60 70 80 90 100
Cannot do at all  Moderately certain can do  Certain can do

CONFIDENCE (0-100)

1. I can predict P/E ratios within an average of 0 units of error. ______
2. I can predict P/E ratios within an average of 1 unit of error. ______
3. I can predict P/E ratios within an average of 2 units of error. ______
4. I can predict P/E ratios within an average of 3 units of error. ______
5. I can predict P/E ratios within an average of 4 units of error. ______
6. I can predict P/E ratios within an average of 5 units of error. ______
7. I can predict P/E ratios within an average of 6 units of error. ______
8. If I put forth effort, I can predict P/E ratios. ______

INSTRUCTIONS: Circle the number that corresponds with your answer.

9. My personal goal is to predict the P/E ratios in the next Profit Center within an average of:
   1. 0 unit of error
   2. 1 "
   3. 2 "
   4. 3 "
   5. 4 units of error
   6. 5 "
   7. 6 "
   8. no particular goal
INSTRUCTIONS: In response to the following statements, mark an “x” on the line indicating your answer. Do not circle the words at the ends of the scale.

10. Indicate how you feel about your performance on the last 20 P/E predictions.

Dissatisfied  

Satisfied

11. How much effort did you exert to make the last 20 P/E predictions?

No effort

A great deal of effort

at all
Decision-Making Inventory

Considering the next 20 P/E predictions you will make, answer the following eight questionnaire items. Using the confidence scale provided, indicate your confidence in the following statements.

Confidence Scale

<table>
<thead>
<tr>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
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</tbody>
</table>

1. I can predict P/E ratios within an average of 0 units of error.

2. I can predict P/E ratios within an average of 1 unit of error.

3. I can predict P/E ratios within an average of 2 units of error.

4. I can predict P/E ratios within an average of 3 units of error.

5. I can predict P/E ratios within an average of 4 units of error.

6. I can predict P/E ratios within an average of 5 units of error.

7. I can predict P/E ratios within an average of 6 units of error.

8. If I put forth effort, I can predict P/E ratios.

CONFIDENCE (0-100)

INSTRUCTIONS: Circle the number that corresponds with your answer.

9. My personal goal is to predict the P/E ratios in the next Profit Center within an average of:

1. 0 unit of error
2. 1 “
3. 2 “
4. 3 “
5. 4 units of error
6. 5 “
7. 6 “
8. no particular goal
INSTRUCTIONS: In response to the following statements, mark an “x” on the line indicating your answer. Do not circle the words at the ends of the scale.

10. Indicate how you feel about your performance on the last 20 P/E predictions.

Dissatisfied _____________________________ Satisfied

11. How much effort did you exert to make the last 20 P/E predictions?

No effort _____________________________ A great deal of effort
at all
Decision-Making Inventory

INSTRUCTIONS: In response to the following statements, mark an “x” on the line indicating your answer. Do not circle the words at the ends of the scale.

10. Indicate how you feel about your performance on the last 20 P/E predictions.

Dissatisfied ................................................................. Satisfied

11. How much effort did you exert to make the last 20 P/E predictions?

No effort ................................................................. A great deal of effort
at all

GO TO NEXT PAGE
Post-Experiment Questionnaire

INSTRUCTIONS: Mark an “x” on the line associated with each question indicating your answer. Do not circle the words at the ends of the scales.

1. Indicate how you feel today.

Tired __________________________ Alert and Energetic

2. How useful did you find the instructions?

Not useful __________________________ Extremely useful
at all

3. How carefully did you read the instructions?

Extremely __________________________ Not carefully
carefully __________________________ at all

4. How difficult was it for you to meet your assigned goal?

Impossible __________________________ Not difficult at all

5. How committed were you to achieving your goal?

Not committed __________________________ Extremely
at all committed

6. Did you enjoy making the predictions?

Yes, I enjoyed __________________________ No, I did not
it a great deal __________________________ enjoy it at all

7. How unusual did you find the task to be?

Not unusual __________________________ Extremely
at all unusual
8. How do you feel today?

Enthusiastic ---------------------------------- Disinterested

9. How well do you feel you performed in this study?

Extremely good performance ---------------------------------- Extremely poor performance

10. Overall, how much effort did you exert to make predictions?

No effort at all ---------------------------------- A great deal of effort

11. How much did you improve from beginning to end?

No improvement at all ---------------------------------- A great deal of improvement

12. How well did you understand the task?

Not well at all ---------------------------------- Extremely well

**INSTRUCTIONS**: Please circle the number of the response that best answers the question.

13. What was your assigned goal?
   1. 1 unit of error
   2. 3 units of error
   3. 5 units of error

14. Did you accept (really pursue) the goal you were assigned?
   1. Yes
   2. Only part of the time
   3. No
15. Were you more interested in your course credit or in reaching your goal?
   1. Course credit
   2. Reaching my goal
   3. Both
   4. Neither

16. How many finance courses have you taken?
   1. 1
   2. 2
   3. 3
   4. more than three

17. Approximately how much total time would you have liked to complete the predictions in all four profit centers?
   1. 15 minutes
   2. 30 minutes
   3. 45 minutes
   4. 60 minutes
   5. 75 minutes or more

18. For what type of problem would you prefer to generate solutions?
   1. A mathematical problem with a “right” answer.
   2. A novel problem with no clear “right” answer.

19. Are you a finance major?
   1. Yes
   2. No

20. What is your gender?
   1. Male
   2. Female
DEBRIEFING SHEET
In the present experiment, you were asked to predict P/E ratios based on three financial ratios that served as cues. This was a complex, uncertain task. You may have received an easy, moderate, or impossible goal.

The relationship of the financial cues with the P/E ratios is uncertain, and this may explain why you could not predict with accuracy. This is not a reflection of your skill or ability level in finance tasks, but an experimental manipulation used to study complex, uncertain decision making. Therefore, you should not draw any conclusions from the experiment about your ability.

Your self-efficacy perceptions were measured in this experiment. Self-efficacy perception is your perceived ability to perform a specific task. It is an important concept because it predicts your future effort, performance, positive self-reactions, and personal goal setting. From this experiment, more knowledge may be gained about self-efficacy perceptions and how they are affected by assigned goals and complex tasks. It is predicted that those who received an easy goal will perform best, set highest personal goals, and perceive themselves as being more capable to perform than other groups. This is important knowledge to managers who managers use goals to motivate their employees. The implication is that paying attention to employees' self-efficacy, combined with the use of easy goals, may be most effective in raising performance.

If you would like to receive the results of this study, this information will be available to you when the analyses are completed. You can obtain this information by contacting Megan Endres at (817) 923-2480 (home), (940) 565-3140 (work), or megendres@aol.com.

Although you were led to believe that you risked your extra credit points in this experiment, every subject will receive the maximum number of extra credit points available (ten points).
REFERENCES


