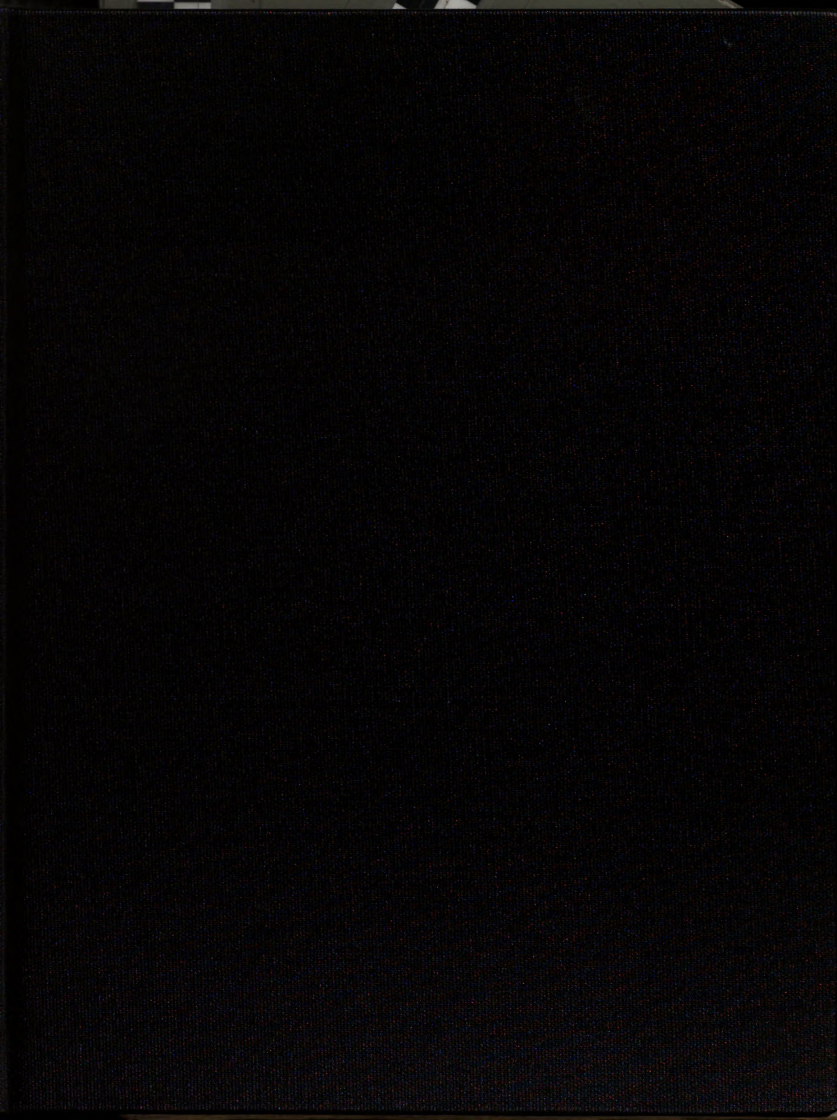




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DISENTANGLING THE EFFECTS OF GOAL SPECIFICITY**

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**LEARNING AND PERFORMANCE GOALS: DISENTANGLING THE EFFECTS OF
GOAL SPECIFICITY**

By

Gordon Bruce Schmidt

A THESIS

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ABSTRACT

LEARNING AND PERFORMANCE GOALS: DISENTANGLING THE EFFECTS OF GOAL SPECIFICITY

By

Gordon Bruce Schmidt

Goal-setting research has consistently entangled goal specificity in goal content manipulations. This entanglement makes it unclear as to what degree both specificity and goal content effect task performance and related beneficial task learning outcomes. This research proposed a cross experiment design of goal specificity (specific vs. vague) and goal content (learning vs. performance) in a complex task. Results found goal content and goal specificity to be entangled within the experimental conditions. Extensive post-hoc testing was done to find a reason for this entanglement, but no satisfactory explanations were found. While the thesis could not answer the main question it posed, strong relationships were found for magnitude of goal discrepancy on important task cognitions. Implications for future research on goal discrepancy, goal content, and goal specificity is discussed.

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Introduction

The significant impact that goals can have on improving task performance is exhaustively documented (Locke & Latham 1990). Increasing employee performance is a key goal of virtually all businesses, and thus, the push to find the “best” types of goals and methods for implementation has led to a great deal of research. The largest and most robust finding has been that, in general, difficult and specific goals of a performance focused nature lead to the highest level of task performance (Locke & Latham 1990).

While this general effect has been well documented, at the same time, boundary conditions have been found. The benefit of specific, difficult, performance goals has not been found in conditions where tasks are difficult, the situation is novel, and/or strategic decision-making is required for success. In such situations, goals that are mastery-focused, allow exploration, encourage discovering strategies, and/or are less specific result in the highest levels of task performance (Winters & Latham, 1996; Earley, Connolly, & Ekegren, 1989; Vollmeyer, Burns, & Holyoak, 1996; Vollmeyer & Burns, 2002).

While these studies identify factors that result in better performance in such boundary conditions, they still leave various factors entangled with each other. This makes it impossible to tell the actual main effects of each component, as well as any interactive effects that may exist between factors. These factors need to be disentangled in research designs before we can discover each factor’s true effect on increased task performance and related, favorable task outcomes. Research into disentangling the factors of goal setting has been initiated by Kozlowski and Bell (2006), who examined, in a cross design, the effects of goal content, goal frame, and goal proximity on task

performance and related learning outcomes. While this is a step in the right direction, one major factor that is often entangled with other goal setting factors, and which still needs to be explored, is goal specificity.

Goal specificity has a significant place in Locke and Latham's (1990) general finding for the best type of goal being, "difficult and *specific*" [emphasis added], however, they have argued, and found some empirical support, that specificity has no effect on its own (Locke, Chah, Harrison, & Lustgarten 1989). Researchers have taken different approaches with regard to goal content and specificity. Some researchers have treated goal specificity as an inherent difference between learning and performance goals (Kozlowski, Gully, Brown, Salas, Smith, & Nason, 2001; Kozlowski and Bell, 2006). Others have tried to hold specificity constant across goal content types (Winters & Latham, 1996; Seijts & Latham 2001, Seijts, Latham, Tasa, & Latham 2004), though it is an open question as to whether it has been fully controlled within their designs. In order to understand the impact of goal specificity on task performance and desired learning outcomes, specificity and goal content need to be fully decomposed.

Types of Goals

Performance Goals

The type of goals that are extensively used in goal-setting research are best characterized as performance goals. Such goals set a standard that focuses attention on accomplishing a certain level of task performance. This set level of task performance is usually given as a specific score or performance level target that is presented in numerical form (Latham & Locke 1990). Performance goals thus focus on successful performance of a task, rather than on other potential objectives, such as learning or gaining new competencies.

Empirical goal-setting research examining the types of goals that were most beneficial for improving performance have found that, in general, specific and difficult performance goals are the best at improving task performance, with an effect size ranging from .42 to .80 (Locke & Latham 1990). In these tests of what goals are “best,” specific, difficult goals were generally compared to just the vague goal of “do-your-best.” “Do-your-best” goals are basically a “straw man” goal, however, since they contains no task relevant content, no induction of mindset, or standard to reach. In fact, their lack of substantive content suggests that empirical results showing their lack of effectiveness could be taken as mere replications of prior research that has found that people’s self-set goals are usually only moderately difficult, and thus experimenter imposed difficult goals are better at improving performance (Locke & Latham, 2002). Moreover, most goal-setting research on performance goals has been conducted using simple tasks, where effort was the main determinant of performance (Locke & Latham, 1990).

When goal-setting was examined in more varied tasks and with more varied opposing goals, boundary conditions were found for the usefulness of specific, difficult performance goals. Research by Earley, Connolly, and Ekegren (1989) found that in a stock prediction task, a vague “do-your-best” goal resulted in better performance than a specific, difficult performance goal did. The stock market prediction task they used had a dominant strategy that was difficult to evaluate and thus, sticking with a strategy for repeated trials was important for its discovery. Earley and colleagues (1989) argued that people needed to develop a “meta” strategy for the task in order to learn how the task worked. People with a performance goal wasted significant effort in search costs from constantly changing strategies. The results suggest that in a task where a strategy needs to be learned, specific difficult performance goals were worse than vague “do-your-best” goals.

The decrease in benefit of specific, difficult, performance goals in tasks that are complex and/or involve strategies was illustrated by meta-analysis. In a meta-analysis by Wood, Mento, and Locke (1987), the effect size of specific, difficult goals was .77 for simple tasks and just .41 for complex tasks. This result suggests that specific difficult performance goals may not be the best type of goal across all types of tasks, which has led to a greater elaboration of another type of goal, the learning goal, to which we will now turn our attention.

Goal Orientation and Learning Goals

Learning goals are conceptualized as goals that focus attention on building competencies and mastering the task at hand (Dweck & Leggett 1988). Persons who adopt learning goals have the implicit assumption that with effort and practice, performance of a task can improve significantly. This is in contrast to performance goals since instead of a focus being placed on high task performance, the focus is placed on acquiring the competencies of the task and improving task mastery. Learning goals do not assume that a person already possesses the skills and abilities needed to perform the task. Learning goals put a focus on discovering how to do the task and developing its related competencies.

Learning goals were initially examined in terms of goal orientation. Goal orientation is a construct related to how a person conceptualizes doing tasks. Goal orientation is both an individual trait and a state that can be induced by manipulation (Martocchio, 1994; Button, Mathieu, Zajac, 1996; Elliot & Church, 1997). There are two types of goal orientation: a performance orientation and a mastery orientation. These map onto learning and performance goals, as people with a mastery orientation generally set for themselves learning goals while people with a performance orientation generally set for themselves performance goals. Thus, a goal orientation leads people to adopt goals of the corresponding type, a result found by Brett and Vandewalle (1999). Brett and Vandewalle (1999) used LISREL to support a mediated model where induced goal orientation was found to relate to the content of goals adopted for a training program. Significant correlations were found between learning goal orientation and the learning

goal facet of development ($r = .33$) and also between performance goal orientation and the performance goal facet of comparison ($r = .35$).

People with a performance goal orientation focus their attention on showing their task ability. They want to demonstrate that their ability is at a high level. This focus means that skill development only takes place as a function of trying to demonstrate their ability (Button, Mathieu, and Zajac, 1996). Just like people given performance goals, people with a performance goal orientation are focused on successful task performance, not on learning or other relevant task outcomes.

People with a mastery goal orientation focus on mastering tasks, as they believe that their abilities and competencies will grow over time as long as they expend effort. In contrast to people with a performance goal orientation, getting better at the task and learning about the task are focused on rather than achieving a specific score level. (Button, et. al., 1996). Thus, people with a mastery goal orientation act similarly to people given learning goals, as a focus is placed on learning the task and building task related competencies.

A significant amount of research has been done examining the impact of goal orientation on task performance and learning outcomes. A Meta-analysis by Utman (1997) summarized the state goal orientation findings where goal orientation was induced via the provision of cues. Utman (1997) found a positive impact of learning goal orientation on general task performance with an effect size of $d = .53$, a moderate effect size according to Cohen (1988). Utman (1997) also examined whether task complexity was a moderator. He found that learning goal orientation had an insignificant impact on task performance in simple tasks ($d = -.03$) but a large significant effect size on task

performance in complex tasks, $d = 1.18$. Thus, this finding is consistent with findings about the differential impact of learning and performance goals on simple vs. complex tasks.

While much of the early work on learning goals examined them within a mastery goal orientation, research has turned in the direction of giving participants learning goals or performance goals and examining their impact. This body of research will be discussed in more detail below, but significant work has been done by Kozlowski and colleagues (Kozlowski, et al., 2001; Kozlowski & Bell, 2002; Kozlowski & Bell, 2006) as well as Latham, Seijts and colleagues (Winters & Latham, 1996; Seijts & Latham 2001, Seijts, et al., 2004).

Goal Content and Goal Specificity

One significant aspect that is mostly ignored in the comparisons of performance and learning goals is a difference in goal specificity between the two goal types.

Performance goals are generally framed as a specific score goal, a standard which participants must reach in order to successfully accomplish their goal (Latham & Locke 1990). A numerical goal is a very specific standard and, when a person doesn't score as high as her performance goal dictates, it is clear that she has not reached her goal.

Learning goals, meanwhile, have been traditionally framed in terms of participants mastering the task at hand and building task related competencies (Dweck & Leggett 1988). "Mastering" a task is a more subjective personal assessment than the specific score target offered by a performance goal. Learning goals, as traditionally

conceptualized, are more vague than performance goals, since for a learning goal a participant needs to make a more ambiguous judgment in terms of whether they have mastered the task or fully learned a new competency. Thus, goal content (performance vs. learning) is entangled with specificity in traditional research conceptualizations. This means we do not know to what extent specificity contributes to the effects that have been found on task performance and learning outcomes that have been attributed to goal content due to the confound of the two.

One perspective on the issue of goal content and goal specificity is offered by Heckhausen and Kuhl (1985). They propose a three level goal hierarchy where each level represents an increase in goal specificity and a move from internal toward external consequences.

The first level of the hierarchy is called “actions” which is the level where the desired end state of the person doing the task is the activity itself. This means a person is doing the task for its own sake, as no reward is given for performing the task well or in a certain way. A task where a person would just have an action goal is a task where doing the task is inherently enjoyable (Heckhausen & Kuhl, 1985). For example, a child swinging on a swing set gains pure enjoyment from the task and generally does so without any desire to master the art of swinging nor because of some external reward given for swinging. For an action goal the goal is intrinsic to the task (performing the task itself) and very vague (no specific end state or objectives given).

The next level is “outcome,” where the desired end-state is mastery of the task, as mastering the task provides characteristics that are inherently valuable to the person. Thus, merely doing the task is no longer a sufficient reason for undertaking the task, as it

was for a person at the “action” level. Now the task is something that the individual wants to increase her competency in and to master. The participant wants to master the task for its own sake, not to gain some external outcome (Heckhausen & Kuhl, 1985). An example of this would be playing recreational baseball. While there is no monetary or other external reward for getting better at a recreational sport, a person doing such a sport may want to improve their skills and become a better ball player, as doing well in the task is something valued in itself. This level of the hierarchy is intrinsic (mastering the elements of the task for its own sake) and more specific (focusing effort and attention on becoming better at the task).

The final level of the hierarchy is “consequences,” where the end state sought by the person is to achieve a certain task outcome in order to receive other desirable outcomes outside of the task. Thus, the task itself is not the target of the goal, rather performance within the task is done only so as to gain an external favorable outcome (Heckhausen & Kuhl, 1985). An example of this would be a person’s job. Jobs are often performed in order to gain money or prestige rather than because of an inherent desire to master the job for its own sake (With the exception of I/O psychologists of course!). The “consequences” level is external in nature (as the task itself isn’t valued, rather doing well on the task to gain some desired outcome is) and the most specific (performing a task to certain level or by a specific method so as to attain a certain reward).

Learning and performance goals can be placed within this hierarchy. Learning goals belong in the second level, which are “outcome” goals. Learning goals focus on improving task performance for its own sake, meaning that getting better at task skills is

seen as an end in itself. Improving task performance has intrinsic value. This puts them cleanly at the second level of the hierarchy.

Performance goals meanwhile belong in the highest level of the hierarchy, “consequence” goals. People with a performance goal do the task in order to fulfill the desired outcome of demonstrating high ability at the task to others (Button et al. 1996). The task itself is not the focus of the goal, but rather the external reward gained from performing well, demonstrating high ability in front of others. The hierarchy would suggest that learning goals are inherently more vague than performance goals due to their position in the hierarchy.

From the perspective of Heckhausen and Kuhl (1985), the reason that performance and learning goals differ in specificity, as traditionally conceptualized, is because they are on different levels of the hierarchy. Performance goals are consequence goals and are inherently more specified because of the presence of a specified desired outcome to be gained from performing the task. Meanwhile, learning goals are outcome goals which are one step below in the hierarchy, and thus inherently more vague and ambiguous. The Heckhausen and Kuhl (1985) hierarchy suggests that specificity is inherently entangled with performance and learning goals, an idea set forth by Kozlowski and Bell (2006).

Theory by Kanfer (1990) offers conceptual advantages that could be gained by having vague goals. One major area where vague goals could be beneficial is in the interpretation of goal discrepancy. Goal discrepancy is the process by which people compare their current state of performance to their goal state. In most situations, a discrepancy will exist, as the person has not yet reached her goal. In the case of the

specific and difficult performance goals usually given to participants in goal-setting research, the standard set is higher than an individual would normally set on her own (Locke & Latham, 2002). Since goals are usually set at the 85th or 90th percentile of task performance (Winters & Latham, 1996; Seijts & Latham, 2001), most people will fail to reach this goal. This means that people in general will have relatively large goal discrepancies, as their goal state will never be reached. Performance goals suggest that the reason for failure is a lack of ability, and thus a very large goal discrepancy is seen as being the result of lack of ability, which will lead to goal abandonment and decreased task interest. Learning goals suggest improvement and mastery will come over time. Both of these rationales make sense in the context of how we conceptualize learning and performance goals.

However, Kanfer (1990) also sees an effect of goal specificity as well. Vague goals make judging the size of the discrepancy difficult. Participants with a vague goal are less likely to see the discrepancy as large as it should be for an average participant. Vague goals also allow participants more leeway to set their own goals. What exactly is “doing your best” or “mastering all aspects of the task?” Such a lack of specification makes it ambiguous how well a participant is doing, making them less likely to see reaching the goal as impossible and less likely to withdraw from the task.

While Kanfer (1990) gives a suggestion of how vague goals could help, the lack of research in this area leaves the question empirically unanswered. Do vague goals make goal discrepancies seem smaller than a more rigid exact standard would, or rather does the lack of specification mean that participants have a greater ability to explore the task and find their own way, since no clear path to their goal is given to them? A person can

tell how many more points they need to reach his/her goal score given his/her current score, but it is not nearly as clear whether a current knowledge level and competency in a task constitutes “mastery” or “best” performance.

Research by Locke, Chah, Harrison, and Lustgarten (1989) attempted to show that goal level was the factor causing goal-setting theory effects, not goal specificity. Locke et al. (1989) began by asserting that goal-setting theory makes no claims that specificity is in itself a good thing, rather that specificity is only beneficial when paired with difficult performance goals. They attempted to show this through two experimental tasks, the first using simple reaction times to a signal light and the second a task of listing ways to improve an undergraduate program. Each experiment had three goal levels of easy, medium, difficult. For the reaction time experiment, the goal was to react within a certain amount of time with harder goals requiring quicker reaction times. For the listing task the goal involved the number of suggestions offered, with a harder goal being to make a greater number of suggestions.

The three goal levels were also crossed with 3 levels of goal specificity: vague, moderately specific, and very specific. For very specific goals, an exact number was given (“Do exactly X schedules” or “Respond in exactly X seconds”). What number was given was based on pre-testing for what levels of performance constituted easy, medium, and difficult performance. For the moderately specific goals participants were asked to score within a certain range of values (“Do between X and Y schedules” or “Respond between X and Y

seconds”). The vague goals for the signal reaction time were “as fast as you can” (difficult), “moderately fast” (medium), and “slowly” (easy). For the suggestion listing task, vague goals were to list a “small”, “medium”, or “large” number of ways to improve the program (Locke et al., 1989).

Both experiments found a strong main effect on performance for goal difficulty, as predicted by goal setting theory (Locke & Latham, 1990). No specificity main effect on performance was found, although a difficulty and specificity interaction effect was found. The only effect found for specificity was that there was significantly greater variance in performance for vague goals when compared to very specific goals. Based on these findings, Locke and colleagues (1989) concluded that there was no independent effect of specificity on performance, a conclusion they still stick to rigidly to this day (Locke & Latham, 2002).

While the Locke and colleagues study (1989) has been used as a justification for ignoring a potential specificity effect (Locke & Latham 2002), the study is rife with problems in terms of its generalizability to modern goal-setting research.

The first area where problems are apparent is in the methodology. The testing of reaction time is not something often used in the context of goals. It raises questions of how difficulty can be correctly specified and assessed. The easy and medium difficulty conditions participants were asked to respond slower than they likely would have normally. This is different from an easy goal in a

traditional goal-setting task, such as reaching a certain score level. A score is something that can be met or surpassed, but a reaction time value suggests that the participant should try to come as close as possible to that value. No guidance is given as to whether a quicker or slower reaction time would be considered “better.” Thus it is possible that the “easy” goal condition is difficult for participants, as they have to expend effort monitoring and waiting for the correct time interval to pass. While there may be a limit as to how quickly a person can respond, there is no real way to quantify how easy or difficult it is to “wait” in your response to a stimulus.

If participants were all trying to get exactly the reaction time (or range of times) that they were given as a goal, such a situation would produce the exact same pattern of effects that took place in the experiment. This raises questions about the validity of the results drawn from this task by Locke et al. (1989).

A similar problem exists in the second experiment, as people who were told to write exactly 3 improvement suggestions in the medium goal difficulty condition, or exactly 2 improvement suggestions in the easy difficulty condition, may have taken those goals literally and only done that many suggestions. This would depress their scores to a level less than those in the high difficulty condition, who were told to find exactly 4. In fact, an examination of the means for people in the low goal difficulty group reveals that participants with a vague goal to come up with a “small” number of suggestions came up with the most, a mean of 2.92, while the participants with moderately specific and very specific

goals came up with a mean number of ways of 2.42 and 2.17 respectively (Locke et. al., 1989). Thus, in the easy goal condition, where most people could easily meet their goal, we see a consistent trend of the number of suggestions becoming closer to the easy “target” performance level as specification of the easy target performance level becomes more clear. If people see their specific numerical goal or range as something to be equal to instead of more than or less than the construction of the goals explains the effect found for goal content and no effect found for specificity.

One area that limits the application of the results of Locke et al. (1989) to this study being proposed that Locke et al. (1989) do not deal with goal content in their design. The experiments give score goals that range in difficulty and specificity but the goals do not contain any goal content in terms of showing ability (i.e. performance goals) or mastering the task (i.e. learning goals). At best, the goals used could be seen as performance goals and thus no test of specificity on mastery goals is offered. The relationship of learning and performance goals with specificity is still unclear.

Also potentially limiting the applicability of the Locke et al. (1989) research is the fact that both tasks used were very simple tasks. Most of the research that has shown an advantage for vague goals (Sweller, 1988; Earley et al., 1989; Vollmeyer, Burns, & Hollyoak, 1996) has been in complex tasks. Locke et al. (1989) gives no guidance on whether a main effect for specificity might exist in complex tasks, which is the area that this research examines.

Given the methodological problems, the lack of guidance on goal content-specificity effects, and the simple tasks used in the experiment, it is difficult to accept the idea that Locke et al (1989) decisively answers the question of whether goal specificity has its own impact on task performance across all experimental conditions and levels of task complexity.

The application of Locke et al. (1989) is bounded by its experimental conditions to be only relevant in simple tasks where only performance goals are given. As such, there is a great deal more that can be illuminated on the impact of specificity in situations where goal content differs and the experimental task is complex. I will now turn to examining the literature on goal content and examine how researchers have dealt with the potential entanglement of specificity and goal content.

Research on Goal Content

Research by Kozlowski and a number of colleagues has examined the combine effects of goal content and goal orientation inductions in a complex task setting (Kozlowski et al. 2001; Kozlowski & Bell, 2006). This research has found a general positive effect of learning goals on complex task outcomes such as transfer task performance, beneficial self-regulatory behavior, and self-efficacy (Kozlowski et al., 2001; Kozlowski & Bell, 2006).

Research by Kozlowski and Bell (2006) has begun to disentangle the individual effects of various parts of goal-setting manipulations, specifically the effects of goal content, goal frame, and goal proximity. Usually these factors are manipulated at the same time, making it unclear to what degree each individual part contributes to beneficial self-regulation outcomes. To test the individual effects of each, a 2 (goal frame: learning vs. performance) x 2 (goal content: learning vs. performance) x 2 (goal proximity: proximal vs. distal) cross design was used. Goal content was found to explain the most amount of self-regulatory variance (10%) with both goal frame (4%) and goal proximity (4%) also explaining significant portions of variance. This work helps to parcel out what parts of common goal manipulations explain what parts of self-regulatory behavior variance (Kozlowski & Bell, 2006).

While this research is an important step in the disentangling of goal effects, it has kept goal specificity and goal type entangled in its manipulations. Performance goals are conceptualized as a specific score goal while learning goals are conceptualized as a vague goal of “mastering” various task aspects that have been determined to be essential in performing basic and strategic task performance (Kozlowski & Bell, 2006). Thus, the results found do not offer any guidance as to what effect specificity may play in the goal content effects found. Kozlowski and Bell (2006) mention this specificity issue briefly, referencing the Heckhausen and Kuhl (1985) hierarchy so as to argue that specificity is an inherent difference between learning goals and performance goals. Whether that theoretical conceptualization can be supported empirically is not clear from the literature, leaving the question open.

Research by Latham, Seijts and colleagues has examined the effects of goal content while attempting to keep goal specificity constant (Winters & Latham 1996, Seijts & Latham 2001, Seijts et al., 2004). Keeping specificity constant was attempted by having specific numerical learning goals to compare against the traditional specific score performance goals. These learning goals usually come in the form of “come up with X strategies” (Winters & Latham, 1996). The number of strategies to develop is norm referenced to the number of strategies developed by participants who score at the 90th percentile of task performance. The 90th percentile task performance score is used as the performance goal score for these studies. (Winters & Latham 1996). While using these specific learning goals the learning goal advantage in reasonably complex tasks has been duplicated (Winters & Latham 1996, Seijts & Latham 2001, Seijts et al., 2004).

Research by Winters and Latham (1996) examined the effects of goal type and task complexity. Three goal types were examined; a specific learning goal (number of shortcuts/ strategies), a specific performance goal (number of completed schedules) and a no goal/”do-your-best” condition best characterized as a mix of a vague performance and learning goal (get as many schedules AND strategies as possible). Both the learning goal and the performance goal were raised incrementally each trial and set at the 90th percentile level as found in a pilot study. The task used was to make unique schedules for five college classes, a task first developed and used by Earley (1985). The task was made complex by increasing both information level and diversity of schedules. (Winters & Latham, 1996).

Winters and Latham (1996) found that in the simple task, people with performance goals had significantly better performance than the ones with “do-your-best” goals, but not significantly better performance than those participants with learning goals.

On the complex task, people with a learning goal had better performance than both people with a performance goal or a “do-your-best” goal. In addition, for the complex condition, learning goal participants developed and used more effective strategies than either of the other goal type participants and also had increased self-efficacy (Winters & Latham, 1996).

Research by Seijts and Latham (2001) examined the effects of goal content and goal proximity on a complex task. They used the same task as Winters and Latham (1996), (the task of creating a number of unique schedules). Goal type was a specific performance goal (complete a specific number of schedules) versus. a specific learning goal (come up with a specific number of strategies). These were both set at the 90th percentile using data from a pilot study that used the same task (Winters & Latham, 1996). Goal proximity was broken into three categories: “do-your-best” (do as many as possible), distal (specific number by end of training), and proximal (specific increasing number by the end of each trial). Thus, this was a crossed 2 (goal content) by 3 (goal proximity) design.

Seijts and Latham (2001) found that participants with a specific learning goal (proximal or distal) performed significantly better than those with a vague “do-your-best” learning goal. They also found that participants with a “do-your-best” vague performance goal performed better at the task than participants with a specific performance goal

(proximal or distal), a result in line with the findings of Earley et al. (1989). No significant effects for proximal or distal goals were found in any conditions.

Higher goal commitment was found to lead to a greater number of task-relevant strategies implemented and participants in the learning goal condition were found to be higher in goal commitment than those participants with a performance goal. Self-efficacy was found to increase over the course of the trials for participants with a specific learning goal (proximal and distal) and decrease over the course of the trials for those with a specific performance goal (proximal and distal) (Seijts & Latham, 2001).

Seijts and Latham (2001) suggest two avenues through which learning goals lead to better task performance in complex tasks, greater goal commitment, and increasing task self-efficacy. While this is potentially useful information, some caution needs to be exercised in applying these results, due to some peculiarities in the design. Seijts and Latham (2001) use and examine goal proximity as being an indicator of goal specificity as well, as proximal and distal goals are discussed as “specific” goals and the “do-your-best” proximity goal is discussed as a “vague” goal. As normally used in goal setting research, “do-your-best” is a goal difficulty and specificity condition, not an indicator of proximity specificity as it is used here (Locke & Latham 1990). This confuses the issue, as it is unclear how we should interpret the “do-your-best” proximity. In this experiment it appears to be merely a vague performance or learning goal. Seijts and Latham (2001) offer no real guidance to clear up this confusion.

Research by Seijts, Latham, Tasa, and Latham (2004) examined how goal content affected performance in a complex task. The task used was the “Cellular Industry Business Game,” a task previously used by Audia, Locke, and Smith (2000). It is

classified as a complex task under the criteria set forth by Wood (1986). The task is a computer simulation based on events in the U.S. cellular phone industry, and participants are asked to use complex formulas to link strategic actions to performance outcomes in thirteen rounds. After each round, participants receive feedback on market share, subscribers, and profit.

Three types of goals were examined: a specific learning goal (identify and implement 6 strategies), a specific performance goal (achieve 21% market share), and a “do-your-best” goal that would be characterized as being like a vague performance goal in nature (“do-your-best” to achieve as much market share as possible), which thus confounds specificity with content.

In the goal specificity check used, the specific performance goal was found to be more specific than the “do-your-best” goal, but the specific learning goal was not found to be different from either the specific performance goal or the vague “do-your-best” goal. Seijts et al. (2004) take this to be a successful manipulation check, but the “specific” learning goal is not found to be significantly different than the vague “do-your-best” goal. Since the concern is making the learning goal specific, a failure to find a difference with the vague “do-your-best” goal is a significant problem, as it is ambiguous how specific the learning goal truly is.

To look into the issue more fully, I examined the specificity manipulation check means for each goal content condition. The learning goal has a mean specificity rating of 3.37, $SD = .97$, which is just .01 above that of the “do-your-best” goal, which had a mean of 3.36, $SD = .85$. With such a small mean difference it is no wonder that no significant difference was found between the learning goal and the “do-your-best” goal. The

performance goal had a mean of 3.75, $SD = .85$ (Seijts et al. 2004). This mean is significantly different from the “do-your-best” goal at $p < .05$. Without the actual data, it is impossible to determine whether the learning goal would be at least marginally different than the performance goal, but the small mean difference between the learning and “do-your-best” goals suggests so. This manipulation check shows ambiguity as to whether learning and performance conditions are at the same level of specificity in this experiment.

Turning to the experimental results, it was found that participants in the learning goal condition had higher task performance than participants in either the performance goal or “do-your-best” goal conditions. This replicated the findings for complex tasks reported by Winters and Latham (1996) and Seijts and Latham (2001). No significant difference was found in performance between the performance goal and “do-your-best” goal participants. Participants with a learning goal were found to have stronger goal commitment than participants with a performance goal, a result replicated from Seijts and Latham (2001).

As a whole, the research by Winters & Latham (1996), Seijts & Latham (2001), and Seijts et al. (2004) significantly adds to our knowledge of the impact of goal content. However there are concerns about whether it truly accomplishes what it set out to accomplish, which was to create learning and performance goals that are equivalent in terms of specificity.

In Seijts et al. (2004) only the performance goal is significantly different than the “do-your-best” goal. The learning goal is not significantly different than either goal at the .05 confidence level. This suggests a lack of equivalence in specificity between the

learning and performance goals, as the learning goal is not significantly distinct from the “do-your-best” goal while the performance goal is distinct.

For Seijts and Latham (2001) no manipulation check is made comparing specificity of goal content across conditions, as only a successful manipulation check comparing perceived specificity of the “do-your-best” proximity and the specific proximity (proximal and distal) goal conditions is reported.

Winters and Latham (1996) did not find any difference in specificity between the learning and performance goals. However, this effect could be partially explained by the wording of the manipulation check. For the learning goal condition, participants were asked 3 questions: “To what extent was the goal for identifying short cuts vague?”, “To what extent was the number of shortcuts to be identified specified?” and “To what extent was there uncertainty as to the quantity of shortcuts to be identified?” The performance specificity check had the same three questions, with the only difference being the substitution of “shortcuts” with “schedules” (Winters & Latham, 1996). Looking at these items, only one directly addresses the question of whether identifying shortcuts is a vague or specific goal. The other two items ask about the clarity of the number of shortcuts that were asked to be identified. Since an exact number of shortcuts was given by the goal, the answers given to these questions should be very specific even for participants who find the general idea of identifying shortcuts vague. Thus, the manipulation check item choice could mask a perceived difference in specificity between the learning and performance goals. If the learning goals are still being perceived as more vague than the performance goals, specificity has not been successfully controlled for, and the effects are still entangled.

There is also a significant amount of ambiguity as to whether the specific learning goals are in fact still best characterized as learning goals. An application of the goal hierarchy of Heckhausen and Kuhl (1985) would suggest they are no longer learning goals. The ultimate objective for people in the learning goal condition is no longer “mastering” the task (level 2: outcome goal) but rather it is to get the “score” of a certain number of strategies (level 3: consequence goal). If the goal of developing a specific number of strategies is seen as a standard to reach rather than a method of “mastering” the task, the goal would be more properly characterized as a type of performance goal. Thus, ambiguity exists about the issue of whether the specific learning goals of Winter and Latham (1996) are in fact truly learning goals.

Another area where ambiguity exists is in the standards used to determine the 90th percentile of specific learning goals. The baseline used for all three studies was established in Winters and Latham (1996). They used a pilot study of participants with no goal instructions to create a baseline for the number of strategies generated (specific learning goal) and the performance score standard (specific performance goal). The baseline was set based on the scores of people who scored in the 90th percentile of task performance. The performance goal baseline was the score level of people who performed at the 90th percentile on task performance. Problematically, the number of strategies for the learning goal baseline was set based on the number of strategies generated by people who scored in the *90th percentile on task performance*. This is a problematical because both the performance goal and the learning goal are referenced to the same baseline, while but its appropriateness is not the same for both goal types. For the performance goal the standard matches up well, as the standard for setting the goal

level is the 90th percentile of task scores, the same unit that is used in the performance goal.

The learning goal however is a mismatch. The standard used is the 90th percentile of task scores, which is NOT the unit that is being used in the learning goals. The comparison group is chosen based on a performance standard, not a learning standard as would be appropriate. The baseline for strategies derived from looking at the 90th percentile of task performers is thus a mastery standard that is directly coupled with task performance. This is an inappropriate baseline for setting a 90th percentile learning goal. Ideally the baseline should be drawn from a pilot group given a vague learning goal. Linking to strategies generated by 90th percentile scorers in such a sample would be an indicator of successful learners, while the baseline used by Winters and Latham (1996) is an indicator only of strategies used by successful performers. Another way to derive a more appropriate baseline would be to look at what the 90th percentile was of strategies generated in the pilot study used by Winters and Latham (1996). The number of strategies generated used to represent the 90th percentile of learning goal participants in Winters and Latham (1996) thus, doesn't correspond to the actual 90th percentile of learning goal participants. It ties the learning goal indicator (i.e. number of strategies) directly to a performance standard, presenting a serious confound between goal types.

Another significant problem is that “do-your-best” goals are used ambiguously and inconsistently across this body of research. In Winters and Latham (1996) the do-your-best goal asked participants to do both as many schedules and as many strategies as possible, a goal that is approximately a combination of a vague learning goal and a vague performance goal. In Seijts & Latham (2001) “do-your-best” was not used as a goal, but

rather as a contrast to distal and proximal goals, acting as a vague “control” condition for goal type (Do as many you can of X). In Seijts et al. (2004), meanwhile, the “do-your-best” goal was ““do-your-best” to achieve as much market share as possible.” This was the same target given to the performance goal group and thus the “do-your-best” goal in this experiment is best characterized as a vague performance goal. This inconsistency means that “do-your-best” results and comparisons across studies are entangled based on how “do-your-best” was presented. Thus, a “do-your-best” goal devoid of other goal content was not present in these studies. The interpretation of the relationships between goal content types and “do-your-best” goals needs to be carefully re-examined as well as qualified as applying only to the type of content-embedded “do-your-best” goals used in that particular study.

One final point that needs to be stressed is that across these studies (Winters & Latham 1996, Seijts & Latham 2001, Seijts et al. 2004) the researchers attempted to control for goal specificity across goal type and thus specificity’s potential impact went unexamined. This review clearly shows an entanglement of goal content and specificity. We will now turn to the goal specificity research, which ultimately has the exact same problems of goal content and specificity being entangled within goals.

Goal Specificity Research

While a significant amount of research has examined the effect of goal content on task performance and learning outcomes, there has also been research that has attempted to examine the effect of goal specificity. One of the first works in industrial-

organizational psychology to examine the impact of goal specificity is the work of Earley, Connolly, and Ekegren (1989).

Earley, Connolly, and Ekegren (1989) had participants perform a task of predicting stock prices in a simulation. In the specific difficult goal condition, participants were given the goal of being able to predict stock prices within \$10 of their actual price by the end of the task, a goal that was found to be at the 85th percentile of task performance in pilot testing (Earley et al., 1989). In the “do-your-best” condition, participants were instructed to do their best to come as close as possible to the actual stock value. Examining this “do-your-best” goal for potential latent goal content, the goal appears to be of a performance nature. It focuses on getting as close to a correct prediction as possible instead of focusing on accomplishing task aspects that would be more learning orientated, such as mastering the task or discovering an accurate stock prediction formula. This “do-your-best” goal is focused on high task performance, and thus would be best characterized as a vague performance goal.

One aspect of the task used that differentiates it from the tasks often used in goal-setting research, is that the stock market prediction task had a dominant strategy that was difficult to evaluate. Once the correct formula weights of various factors were determined, task performance was merely using the formula over and over again. Thus, in this task, sticking with a strategy for repeated trials was important for discovering the dominant strategy (Earley et al. 1989).

Earley et al. (1989) found that in the stock prediction task the vague “do-your-best” goal resulted in better performance than the specific, difficult performance goal. People with a performance goal were more likely to quickly change strategies than

people with a “do-your-best” goal. This resulted in performance goal participants giving up on strategies before their value could be fully discovered. Earley and colleagues (1989) argued that participants needed to develop a “meta” strategy for the task, learning how the task worked. People with a performance goal never developed this “meta” strategy and instead constantly changed strategies. This research suggests that in a complex task a vague goal is better than a specific difficult performance goal. However, the interpretation remains ambiguous, as the “do-your-best” goal seems to contain some performance goal content elements. The research by Earley et al. (1989) also does not contain any learning goal condition, so it is impossible to tell whether the vague goal used here would lead to better performance than a learning goal.

Most of the research on the impact of goal specificity draws upon work by Sweller (1988; Sweller & Levine, 1982). Sweller and Levine (1982) examined the differential impact of a means-ends analysis goal and a no goal condition on performance of a maze-tracing experiment. Means-ends analysis is a procedure by which the goal state and the progressive problem states are analyzed in order to find an operator that will maximally reduce the difference between the current state and goal-state (Sweller & Levine, 1982).

Means-ends analysis is somewhat similar to a performance goal, as a standard is specified and participants are focused on reducing the gap between the current state and the standard state. Learning is not a goal of a means end analysis, rather the goal is to merely reduce the discrepancy between goal state and present state. Thus, people who use a means-ends analysis rarely learn much of the actual structure of the task (Egan & Greeno, 1974). Sweller and Levine (1982) created their maze such that a strategy of pure

means end analysis would produce an error at every choice point, i.e. leading away from the goal of exiting the maze. As one might expect with such a set-up, the people in the means-ends analysis group did worse than those with no goal. This effect was duplicated in five other tasks where knowledge of the goal state was a distracter from attaining that goal state. These effects were attributed to the idea that a goal can focus attention away from important structural elements of the problem that are crucial for success. Participants with a goal focused on that goal and did not bother to notice task components essential to successful performance. This suggests that the no goal situation led to greater exploration of the task structure, a benefit often attributed as to coming about due to mastery goals (Kozlowski & Bell, 2006).

This research was followed by Sweller (1988) in a study that examined theoretically and empirically how means-ends analysis goals impeded task schema acquisition. A schema was defined, within the research, as a structure that permits problem solvers to categorize a problem as one that requires certain moves to reach a solution. Sweller (1988) contends that the means-ends analysis procedure causes a great deal of cognitive load, and this makes it difficult to learn the task at the same time as implementing the goal. To test this empirically, trigonometry problems were used. One group was given very specific goals that told an exact order to calculate sine, cosine and related values in order to find side lengths in a given triangle. The nonspecific goal group was given the same triangle but just told to find the lengths of as many sides as possible. Examining both of these goals within a traditional goal-setting framework, both would appear to be of a performance goal nature, with the difference between the two being in terms of specificity. Neither suggests any sort of learning focus that would be consistent

with a mastery goal. Sweller (1988) found that the nonspecific goal group made less task errors than the specific goal group. This finding was explained by Sweller (1988) as resulting from the increased cognitive load of specific goal participants, although the accuracy of such an explanation is in doubt as no such measure of cognitive load was taken.

While these two experiments by Sweller (1988; Sweller & Levine, 1982) do not offer a great deal of illumination on the impact of specificity on performance and related outcomes, they are used as a bedrock for the specificity effects research that has followed. As noted, the goals used in both experiments map onto performance goal content, presented under the guise of means-ends analysis. Thus neither study offers a goal content-free examination of specificity effects.

Research by Vollmeyer, Burns and Hollyoak (1996) examined how goal specificity impacted performance in a biology-based dynamic problem system. In the system, participants were asked to make connections between input and output variables with a total of sixteen variables existing within the task. Participants set the levels of four inputs and observed the resulting values of the outputs. After three learning phases where participants set their own levels of inputs, there was a solution phase where they were asked to produce a specified pattern of output population. This pattern had previously been told to the specific goal participants. After the solution phase there was a transfer trial where participants were asked to produce a different specified pattern of output population. Worth noting is that the task of the solution phase and the transfer trial was the same for the vague goal group, as they had not received information on what the solution trial targets were

going to be. Finally, ten multiple choice prediction questions were given to participants where they predicted the change in population numbers that would result at different input levels (Vollmeyer et al. 1996).

The design used by Vollmeyer, Burns and Hollyoak (1996) was a crossed design between goal specificity (specific vs. nonspecific) and strategy instructions (use of VOTAT [vary only one input variable at a time while keeping the others constant] vs. none). Specific goal participants were given the exact population numbers that would be used for the solution round. This use of an exact numerical standard is consistent with traditional performance goals (Locke & Latham, 1990). In the nonspecific goal condition, participants were told to “just set inputs in order to figure out how the system works.” This goal content is similar to a learning goal, as discovering how the task works and the task’s structure is focused on. Thus, while Vollmeyer and colleagues (1996) present the experiment as testing a specific vs. a nonspecific goal, goal content is clearly entangled, as a specific performance goal is being compared to a vague learning goal. The strategic advice of VOTAT was believed by the experimenters to be the best strategy for success on the task.

As would be expected, based on the effects that have been found in research that has examined goal content effects, the nonspecific (and learning goal contaminated) goal group had a better understanding of the task than the specific (and performance goal contaminated) goal group, as seen through higher knowledge of task structure and higher scores on the prediction task questions.

Participants with a nonspecific goal also had less transfer task errors. Examining the strategy aspect, people who were given the VOTAT strategy instructions had higher scores than those who did not. Interestingly, both groups with a specific goal had a significant linear trend away from the VOTAT strategy and toward a difference reduction strategy, i.e. a strategy where multiple inputs were varied at once. This strategy was thought to be an attempt to reach the solution output levels more quickly (Vollmeyer et al., 1996). This difference reduction strategy seems similar to the means-ends analysis used by Sweller (1988) and the traditional conceptualization of performance goals (Locke & Latham, 1990).

Vollmeyer and Burns (2002) did a follow-up study that had participants use a hypermedia program to learn about the outbreak of World War One. Participants were then asked to answer factual and inferential questions about World War One. There were two goal conditions in the experiment, a specific goal (“find 20 specific dates”) and a nonspecific goal (“explain the reasons for the war”). The entanglement of goal content and specificity is in a similar pattern to Vollmeyer and colleagues (1996), as the specific goal set a numerical standard for performance similar to a specific performance goal while the vague goal focuses on understanding of the war and its general structure, a goal best characterized as a vague learning goal.

The results found were similar to Vollmeyer and colleagues (1996), as well as similar to research that has examined differences between learning and performance goals (Kozlowski & Bell, 2006). Participants with a nonspecific goal had significantly higher knowledge during the task and significantly higher accumulated knowledge, as shown in the questions asked about World War One. Nonspecific goal participants also

were more likely to click on text boxes and view more video clips, a result in agreement with the conceptualization of how people with learning goals focus on understanding (Button et al 1996) and with empirical findings on how they engage in greater task exploration (Greene & Miller, 1996).

Thus, while the research by Vollmeyer and colleagues (1996) and Vollmeyer and Burns (2002) attributes positive learning effects to goal specificity, it is unclear whether the effect is due to specificity or goal content, as the goals used entangle goal content and specificity. This is in some ways the mirror image of the goal setting research previously reviewed, as while in those studies the goal content was given the credit for increased performance and learning outcomes with the potential effect of embedded specificity differences ignored, in these studies specificity is given the credit for the effects, ignoring the entangled goal content. Content and specificity are not separated cleanly enough to determine what part of the effect belongs to which component, or if an interactive effect exists.

Research by Trumpower, Goldsmith, and Guynn (2004) examined the effect of goal specificity on performance at solving training problems from the field of one-way ANOVA for both novice and experts. The novice group was composed of undergraduates with no statistical background, while the expert group was composed of graduate students who had taken advanced courses in statistics. The goals given were specific (solve for SSb) or nonspecific (solve for as many unknown values as possible). Examining these goals from a goal content perspective, both of these goals are focused on successful task performance and make no mention of understanding the task or mastering content, and are best

categorized as performance goals that vary in specificity. Participants were asked to solve three training problems solving for Df , MS , and F given a , MS_w , and F . They were then asked to rate the relatedness of 15 pairwise combinations of the 6 statistical terms. Participants were then asked to solve two structurally identical transfer problems and then two structurally different transfer problems (given values for different statistical terms).

Trumpower et al (2004) found no goal specificity effects for the expert group. For the novice group, nonspecific goal participants solved training problems faster than SG novice participants, solved different transfer tasks quicker, and had more structural knowledge, as shown through the number of relevant links recognized. The results for the novice group are consistent with the findings of Vollmeyer and colleagues (1996, 2002). The results for experts suggest a goal specificity effect is restricted to individuals with low prior domain knowledge, and thus, they are still in the process of learning the task. Trumpower and colleagues (2004) contend that specific goal participants focus attention only on getting to the next attainable state, not on local relations and the relationships between the current state and the next state.

Overall, the research on the impact of goal specificity on task performance and related learning outcomes results in a similar pattern of results as goal-setting research and has a similar pattern of problems. As documented above, most of the specificity research had goal content elements entangled with goal specificity in the goals given to participants. This continues the trend of ambiguity about the source of the advantage seen

for vague learning goals. We cannot definitely attribute these effects to goal specificity, content, or some combination of both based on the research that has previously been done.

Integration/Contribution

A review of both the goal content and goal specificity literature has shown that specificity has consistently remained entangled with goal type in the goals given to participants in research designs. Latham and colleagues (Winters & Latham 1996, Seijts & Latham 2001, Seijts et al., 2004) tried to hold specificity constant, but an examination of their manipulation checks suggests strongly that specificity was not successfully controlled in their research designs. Research by Kozlowski and colleagues (2001, in press) that has examined goal content has done so while acknowledging a difference in specificity between learning and performance goals (Kozlowski & Bell, 2006). Finally, research that has tried to examine goal specificity only (Vollmeyer et al. 1996; Vollmeyer & Burns, 2002; Trumpower et al., 2004) has in fact included a contamination of goal content, making the effect they find ambiguous as to its driving force.

This ambiguity with regard to goal specificity presents a significant gap in the goal-setting literature. This proposal will begin to address this gap empirically and to offer a theoretical conceptualization of how specificity impacts performance and learning outcomes in complex tasks. The model below in Figure 1 and Figure 2 gives a summary of the relationships proposed.

Figure 1: Model of the effects of goal content and goal specificity on task behaviors

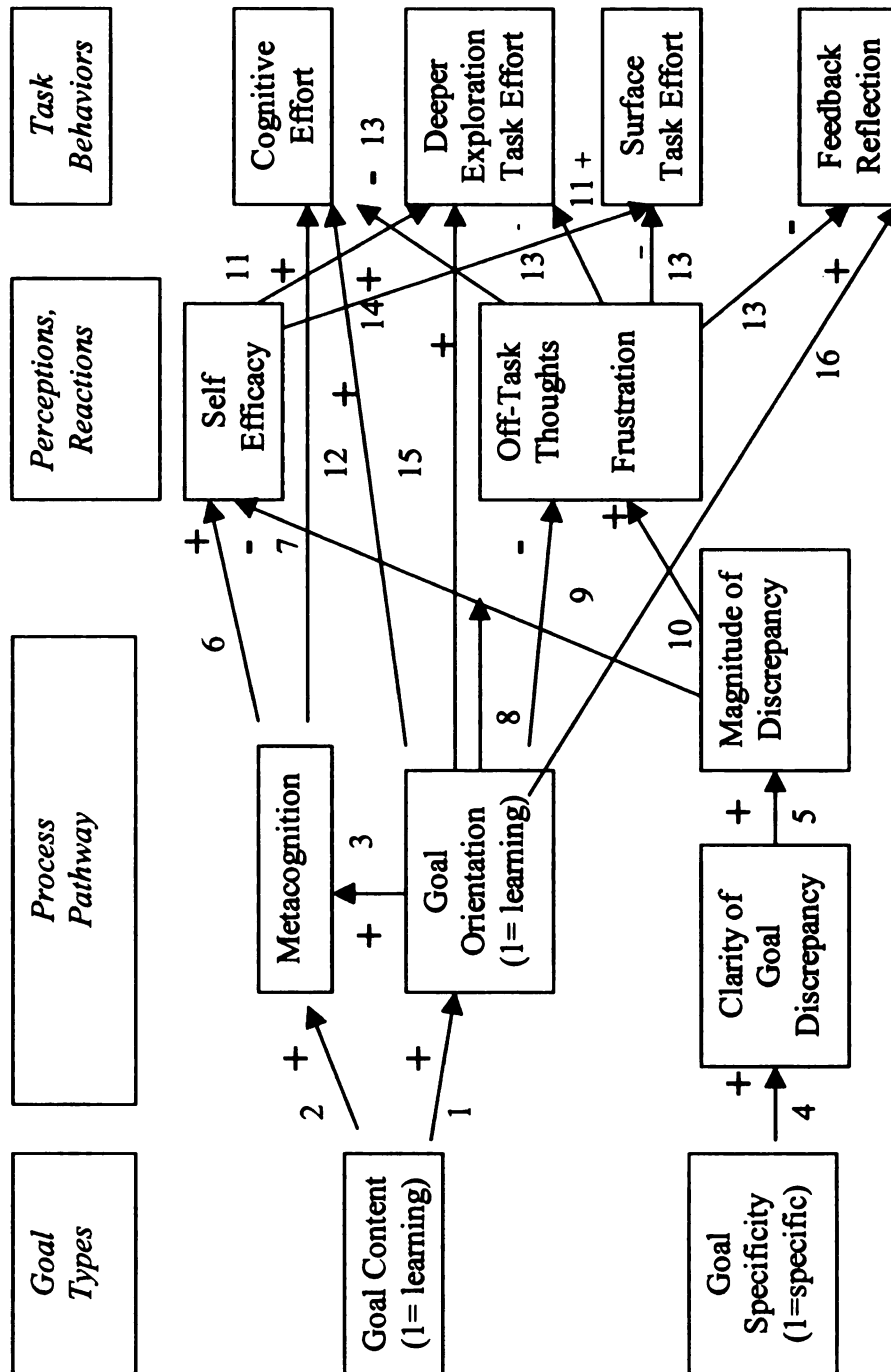
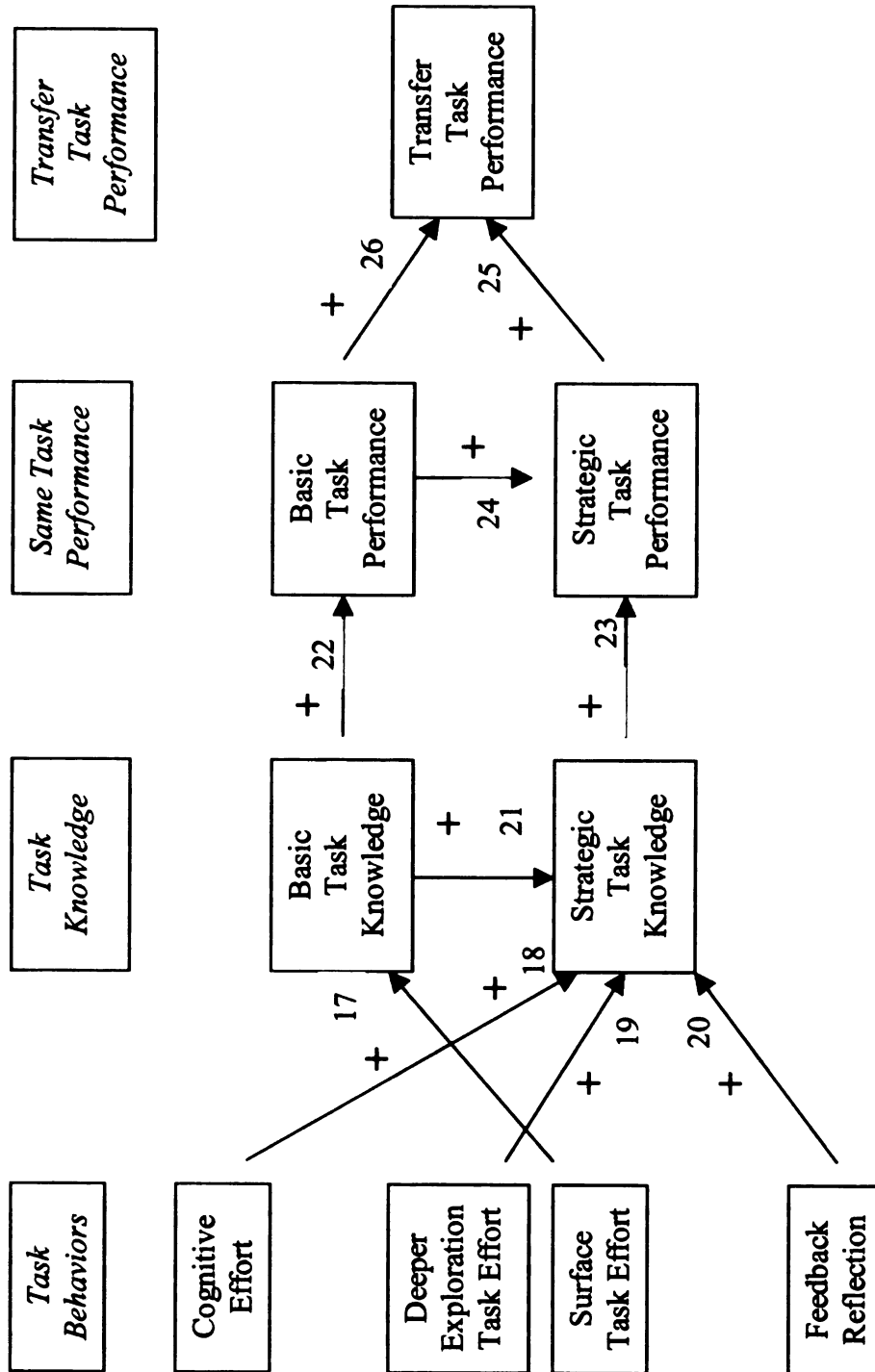


Figure 2: Model of the effect of task behaviors on task performance



Hypotheses

As can be seen in the model, there are two distinct pathways by which goal content and goal specificity lead to self-regulatory process which in turn influence performance and learning outcomes. These pathways are the content pathway and the goal discrepancy pathway. The impact of goal content comes through the content pathway, while the impact of goal specificity comes through the goal discrepancy pathways. These tracks cross in their impacts on withdrawal behaviors and self-efficacy.

The content pathway deals with how a person focuses her attention. Learning or performance goals affect how a person will focus their attention and view task related behaviors. Learning goals focus attention on learning how the task works and on mastering its related competencies (Dweck & Leggett, 1988). Performance goals focus attention on showing task related ability and getting a high score (Button et al., 1996). These goals will result in corresponding self-regulatory processes focused upon what the goal suggests is important.

One self-regulatory mechanism that will be used to meet the learning or performance goal is the induction of the corresponding state goal orientation. In order to meet learning goals, a participant needs to develop a mindset for viewing the task at hand and how effort should be expended. The mastery goal orientation helps to guide their effort in meeting learning goals. A similar pattern will exist for performance goals, as a performance goal orientation will arise to help guide the participant to meet her performance goals. Goal orientation was conceptualized as the idea that people who have a mastery or performance goal orientation set goals of the corresponding type (Button et

al., 1996), an idea that has received empirical support as well (Brett & Vandewalle, 1999). As such, this leads to the first hypothesized relationship of the model:

Hypothesis 1a: A positive relationship will be found between learning goal content and state goal orientation such that people with learning goals will be more likely to have a state mastery goal orientation.

Hypothesis 1b: A positive relationship will be found between performance goal content and state goal orientation such that people with a performance goal will be more likely to have a state performance goal orientation.

The other self-regulation process that will be induced as a means to accomplish learning goals is metacognition. Metacognition has been traditionally defined as “thinking about your thinking” (Flavell, 1979), and thus, is related to decisions on where and how to invest effort in a task and the steps that will be taken to reach desired goals (Schmidt & Ford, 2003). Learning goals ask for people to consider the task and attempt to learn how a task works. In order to reach task mastery, knowledge of the task domain is needed and in order to gain such knowledge a plan needs to be made as to where effort should be invested. Such a need to decide where effort should be invested will result in the activation of planning and monitoring behaviors that are metacognitive in nature.

Empirical work by Miller et al (1996) found a positive correlation between learning goals and what they called deep strategy use ($r = .47$), which includes aspects such as solving a question in multiple ways and classifying problems based on content. This is similar to the planning and categorization that takes place during metacognition. Greene

and Miller (1996) meanwhile found a strong positive correlation between learning goals and meaningful cognitive engagements ($r=.67$), which were defined as participants making plans to achieve a good grade and focusing on understanding class material. This planning aspect is in-line with the conceptualization of metacognition and suggests a positive relationship between learning goals and metacognition.

Hypothesis 2: A positive relationship will be found between learning goal content and metacognition such that participants with a learning goal will have higher levels of metacognition compared to other participants.

In a related vein, state goal orientation should also be related to metacognition. The task mastery focus of a mastery goal orientation requires a greater body of knowledge and skills that need to be learned compared to a performance goal orientation. In such a case it seems likely that metacognition would be beneficial in determining in what areas to monitor progress and allocate resources (Schmidt & Ford, 2003). A mastery goal orientation requires planning of how and where to invest task effort, which is accomplished through metacognition. Ford, Smith, Weissbein, Gully, and Salas (1998) provide support for this empirically, as in a hierarchical regression, with metacognition as the dependent variable, mastery goal orientation was found to explain a significant portion of variance, $\Delta R^2 = .05$. Support for such a link between state mastery goal orientation and metacognition was strengthened by Schmidt and Ford (2003), which found a positive relationship between learning goal orientation and metacognition, even after controlling for ability and experience ($r = .44$).

Hypothesis 3a: State mastery goal orientation will have a positive relationship with metacognition such that a participant with a high state mastery goal orientation will have a higher level of metacognitive activity compared to a participant with low mastery goal orientation.

In contrast, people with a performance goal orientation are only focused on showing their task ability and on avoiding failure. Metacognition is not a salient self regulation tool to people with a performance goal orientation, as their focus is only on getting a high score, not on developing strategies for learning and monitoring their task behaviors and outlooks. The monitoring aspect of metacognition provides only the potentially threatening information to a participant that they don't currently have the ability level needed to be successful in the task. Since ability is seen as fixed (Button et al., 1996), the knowledge provided by metacognition of task deficiencies doesn't offer any constructive information on what to improve, only negative information suggesting low task ability. People with a performance goal will avoid engaging in metacognition since it is not seen as valuable.

This effect is seen strongly in Schmidt and Ford (2003). Participants with a performance-avoidance goal orientation in general engaged in significantly less metacognition, $r = -.35$. In this study, some participants received a metacognitive intervention that was aimed at increasing the participant's levels of metacognition. For people with a performance-avoidance goal orientation, a significant interaction with the metacognitive intervention and participant metacognitive activity level was found, such

that participants high in performance-avoidance orientation actually had decreased levels of metacognitive activity in the metacognitive intervention condition. Thus in a situation where metacognition was made salient (i.e. the intervention), people with a performance orientation reacted by engaging in even less metacognitive activity. This leads to the following hypothesis:

Hypothesis 3b: State performance goal orientation will have a negative relationship with metacognition such that a participant high in state performance goal orientation will have a lower level of metacognitive activity than a participant low in state performance goal orientation.

The second major pathway of the model proposes the effect of goal specificity arising through how the magnitude of goal discrepancy is perceived. As discussed by Kanfer (1990), a large perceived magnitude of discrepancy between a current state and the goal state can lead to a belief that goal attainment is impossible, further leading to task withdrawal and perceptions of low ability. A vague goal creates ambiguity as to the degree of the magnitude of discrepancy, allowing people to underestimate the gap and/or redefine it in a way that makes the discrepancy seem more within their ability to lessen. This pathway suggests that there are two steps in how a vague goal affects the perception of the magnitude of goal discrepancy.

The first way goal specificity should impact how a person performs a task is goal clarity. Specific goals offer clear standards of success, often through the goal being in the

form of an exact quantity (Locke & Latham, 1990), which allows participants to have an extremely clear view of what their goal is. The desired goal state is clear. Vague goals create an ambiguity in terms of what the goal means, which conceptually should lead to a lower level of goal clarity. This is inline with the theoretical arguments offered by Kanfer (1990), as a vague goal makes it unclear what exactly is the standard being compared to, and usually even makes it unclear as to what units the goal can be measured in. This should result in a significant impact on perceived goal clarity based on the specificity of a goal.

Hypothesis 4: Goal specificity will have a positive relationship with goal clarity such that the higher the degree of goal specificity the greater the degree of perceived goal clarity.

Goal clarity should have an effect on the perceived magnitude of discrepancy between current state and goal state. When a goal is clear, a participant can see almost exactly how far they are from a desired goal state. In complex skill acquisition, a significant discrepancy between goal state and current state should exist for much of the experiment, as goals are set pegged to levels that most participants will not obtain, generally the 85th-90th percentiles (Winters & Latham, 1996). With unclear goals, the magnitude of the goal discrepancy is not easy to quantify and measure, which means that participants will have greater latitude in determining how near or far they are from their goal state. In the conceptualization offered by Kanfer (1990), people with an unclear goal will be likely to underestimate the discrepancy magnitude, as the actual magnitude is both difficult to determine due to the goal's ambiguity, and that seeing a larger discrepancy

suggests that the goal may be impossible to reach, due to a lack of ability to perform at such a level. The lack of clarity allows a person to recalibrate the goal to a standard that is more appropriate given current performance, i.e. usually a lower standard. As such it is predicted that:

Hypothesis 5: A positive relationship will be found between goal clarity and magnitude of perceived goal discrepancy such that the higher the goal clarity the greater the perceived magnitude of goal discrepancy.

Both pathways begin by starting self-regulation processes to support their related goal, as described above. As seen in the model, at the process pathway step the content pathway and the magnitude of discrepancy pathway are completely separate paths. While goal content and goal specificity have been entangled in most research designs to this point (Vollmeyer et al. 1996; Seijts & Latham, 2001; Kozlowski & Bell, 2006), this model posits separate pathways in terms of the states they induce and thus the means by which they impact performance and goal related outcomes. While these pathways are separate at the process pathway step, they overlap once we reach the task perceptions and reactions step.

The perceptions and reactions step deals with people's perceptions of their competency in the task and the amount of attention they devote to the task. Self-efficacy is the most direct measurement of the competency a person feels at the task. This is consistent with the definition of self-efficacy as a personal judgment of "how well one can execute courses of actions required to deal with prospective situations" (Bandura,

1982). This perception will be influenced by both the content and magnitude of discrepancy pathways. The other construct at the task perceptions step is withdrawal behaviors. Such behaviors involve both task dissatisfaction (through measuring frustration) and withdrawing effort from the task and investing it in off-task behaviors (shown through off-task thoughts.) Thus, withdrawal behaviors are indicators of perceptions of how participants value a task and whether they believe expending effort in the task is worthwhile. Withdrawal behaviors are affected by both the content and magnitude of discrepancy pathways as well.

In the content pathway metacognition involves people making decisions on which specific areas of a task to focus their time on improving, rather than focusing on large general differences that exist between current state and ultimate goal state, the type of large discrepancies Kanfer (1990) argues lead to task abandonment. Participants engaged in increased levels of metacognition make more informed decisions as to where effort should be expended in a task, which should lead to greater success and thus higher self-efficacy (Schmidt & Ford, 2003). Instead of focusing on overall goal completion, people who engage in metacognition focus their attention on narrower task aspects that are important and that can be accomplished. This allows them to be successful and thus rightly see themselves as efficacious. This conceptual argument for a connection between metacognition and self-efficacy was supported empirically by Ford et al. (1998), whom found metacognition predicted a significant percentage of the variance in self-efficacy, $R^2 = .13$. Schmidt and Ford (2003) showed how robust the effect was as they found that metacognitive activity predicted an additional $R^2 = .12$ in posttraining self-efficacy

after ability and previous experience had been controlled. These results show empirically that metacognition has an effect on self-efficacy. Consistent with these empirical results and the theory that explains them, it is predicted that:

Hypothesis 6: Metacognition will have a positive relationship with self-efficacy such that the greater the amount of metacognition a participant engages in, the greater the perceptions of self-efficacy.

The magnitude of discrepancy pathway also has an impact on participant self-efficacy. A large magnitude of discrepancy between current performance and the goal can be taken as a sign that a participant is far from achieving her goal, and thus she is lacking in task skill. If a person is far from their goal state, he is more likely to surmise he has poor task ability. Conceptually, this should lead to lower task self-efficacy. As noted by Bandura and Cervone (1986), self-monitoring of repeated poor performance leads to the attribution of low ability and a corresponding decrease in self-efficacy. Kanfer (1990) offers similar theoretical support for such a relationship, saying that a large discrepancy between current state and goal state suggests that the reason for the discrepancy is low ability, and thus low efficacy on the task. It is thus hypothesized:

Hypothesis 7: Magnitude of discrepancy should have a negative relationship with self-efficacy such that the larger the perceived magnitude of discrepancy between current state and goal state, the lower the perceived self-efficacy.

While a main effect of magnitude of discrepancy on self-efficacy should exist, this relationship should be moderated by goal orientation such that the negative impact will be lessened. As traditionally conceptualized (Bandura & Cervone, 1986), self-monitoring of repeated poor performance leads to the attribution of low ability and a corresponding decrease in self-efficacy. Poor performance, as conceptualized there, is seen as a sign that the person does not have task efficacy.

People with a mastery goal orientation do not share this outlook. People with a mastery goal orientation believe that their abilities and competencies will grow over time, as long as they put in practice and effort (Dweck & Legget, 1988). Thus, while they may recognize a large discrepancy between current performance and their goal level, a person with a mastery orientation will see this as a gap that can be overcome with increased effort and practice, not as a sign that they lack efficacy in the task. Attention will be focused on building task competencies, and the successful learning of competencies will buffer self-efficacy from the magnitude of discrepancy from goal state. While a large goal discrepancy may still distress a person with a mastery goal orientation to a degree, the belief that with effort they can become more efficacious will help to lessen the detrimental effects of the goal discrepancy on self-efficacy. While the goal state may be far away, a person with a mastery goal orientation will have greater confidence that it can still be reached with hard work (Vandewalle, 1997). Thus it is hypothesized that:

Hypothesis 8: Mastery goal orientation will moderate the relationship between discrepancy magnitude and self-efficacy such that the negative impact of discrepancy magnitude on self-efficacy will be lessened for those high in mastery goal orientation.

Goal orientation has been shown to effect how people look at a task. In most goal-setting experiments people are given a difficult goal that is set to a baseline that most will never reach, the 85th percentile (Winters & Latham, 1996). As such, all participants experience some degree of goal failure, especially during the early part of the task. People with a mastery goal orientation see task difficulty and task failure as reasons to persist and escalate effort. Meanwhile, people with a performance orientation see failure as something that risks showing low ability and thus they will devalue the task by withdrawing to save face (Elliot & Dweck, 1988; Dweck & Leggett, 1988). This conceptualization has found empirical support in Kozlowski and Bell (2006) that found a significant negative correlation between learning orientation and off-task thoughts ($r = -.20$). People with a mastery goal orientation will invest more effort in a task when threatened by failure, while people with a performance goal orientation will withdraw effort from the task to avoid showing low ability. As such it is predicted that:

Hypothesis 9a: A negative relationship exists between state mastery goal orientation and the withdrawal behavior of off-task thoughts such that people high in state mastery goal orientation will engage in less off-task thoughts than people low in state mastery goal orientation.

Hypothesis 9b: A negative relationship exists between state mastery goal orientation and the withdrawal behavior of frustration such that people high in state mastery goal orientation will have less frustration than people low in state mastery goal orientation.

Hypothesis 9c: A positive relationship exists between state performance goal orientation and the withdrawal behavior of off-task thoughts such that people high in state performance goal orientation will engage in more off-task thoughts than people low in performance goal orientation.

Hypothesis 9d: A positive relationship exists between state performance goal orientation and the withdrawal behavior of frustration such that people high in state performance goal orientation will higher frustration than people low in performance goal orientation.

A large magnitude of discrepancy suggests to a participant that reaching her goal state may be impossible. This is likely to result in her becoming frustrated with her goal since it seems like it cannot be attained (Kanfer, 1990). Participants who perceive themselves as far from their goal will often feel powerless to reach their goal state. Effort invested in the task is a waste of energy since failure is inevitable. This will likely be manifested through frustration with the task and through withdrawal of task effort by an increase in off-task thoughts.

Hypothesis 10a: A positive relationship exists between magnitude of discrepancy and the withdrawal behavior of off-task thoughts such that the greater the magnitude of discrepancy, the greater the amount of off-task thoughts.

Hypothesis 10b: A positive relationship exists between magnitude of discrepancy and the withdrawal behavior of frustration such that the greater the magnitude of discrepancy, the greater the amount of frustration.

After the task perceptions step, the model moves from constructs related to how people view the task to actual task behaviors that participants engage in. The perceptions of the task from the previous steps affect how participants act within the task environment in investing their effort. In this step, the task perceptions and some of the states induced have direct effects on actual task behaviors.

People who have a high level of metacognition think about their goals and plan where to invest effort. In order to do this effectively, people need information on the general areas of where effort can be invested (Schmidt & Ford, 2003). Learning how the task works and its related competencies gives information on what parts of the task are important and should be the focus of regulatory effort. Schmidt and Ford (2003) found that metacognitive activity predicted a significant R^2 beyond ability and prior experience for declarative knowledge ($R^2 = .14$). People engaging in heightened metacognitive activity expend more effort in figuring out the workings of the task. Hong and O'Neil (2001) found a significant positive correlation between metacognition and effort, with R^2 ranging between .61 and .71. People high in metacognition plan where to invest effort, and such plans can only be made by expending greater effort in understanding the knowledge domain of the task.

Hypothesis 11: Metacognition will be positively related to cognitive effort such that people who engage in more metacognitive activity will engage in more cognitive effort directed toward learning the task.

People with a mastery orientation are trying to master the task itself and such mastery means an understanding of the structure of the task that is provided, through investing cognitive effort in understanding how the task works. People with a learning goal orientation view effort as instrumental to gaining new abilities, and thus will be willing to expend a greater effort at understanding how the task works (Legget & Dweck, 1986). Empirical work by Miller et al (1996) supports this idea, as they found a positive correlation between learning goals with both overall task effort ($r = .36$) and with deep strategy use (i.e. learning to answer questions in multiple ways, classifying problems into categories) ($r = .47$). “Deep strategy” is knowledge that is gained through effort being invested in learning the knowledge domain of the task. These results suggest that people with a learning goal orientation expend more effort at learning the task, as they engage in several different and complementary ways of learning (Legget & Dweck, 1986).

Hypothesis 12: State mastery goal orientation will be positively related to cognitive effort such that people high in mastery goal orientation will engage in more cognitive effort than people low in mastery goal orientation.

Participants who engage in withdrawal thoughts no longer want to expend significant attentional resources on the task. Withdrawal thoughts are done when effort in the task is

not seen as being useful, as increased effort will not help performance (Kanfer, 1990). As such, their general task effort should decrease on all task related dimensions. Empirical support was found for this idea in Kozlowski and Bell (2006), who found a significant negative correlation between off-task thoughts and self-evaluation activity ($r = -.19$). People who engage in withdrawal behaviors are withdrawing effort and attention from the task to off-task areas of interest.

Hypothesis 13 a-d: The withdrawal behavior of off-task thoughts will have a negative relationship with cognitive effort, surface task effort, deeper exploration task effort and feedback reflection such that the greater the amount of off-task thoughts, the less the cognitive effort, surface task effort, deeper exploration task effort and feedback reflection.

Hypothesis 13 e-h: The withdrawal behavior of frustration will have a negative relationship with cognitive effort, surface task effort, deeper exploration task effort and feedback reflection such that the greater the amount of frustration, the less the cognitive effort, surface task effort, deeper exploration task effort and feedback reflection.

People high in self-efficacy have been found to persist more often at tasks and to invest more effort in performing them (Bandura 1997). They believe that with effort they will perform successfully on the given task. In contrast, people low in self-efficacy doubt that they can successfully perform the task and thus are likely to expend less effort as

such effort is seen as pointless. In a meta-analysis by Multon, Brown, and Lent (1991) an effect size for self-efficacy on persistence was found to be .34. People high in self-efficacy persist more at tasks and, thus, will engage in higher levels of task effort. These results suggest the following related hypotheses:

Hypothesis 14a: Self-efficacy will have a positive relationship with surface task effort such that people high in self-efficacy will engage in higher levels of surface task effort.

Hypothesis 14b: Self-efficacy will have a positive relationship with deeper exploration task effort such that people high in self-efficacy will engage in higher levels of deeper exploration task effort.

While greater self-efficacy should result in both greater surface task effort and greater deeper exploration effort across all trials, time is likely to play a role in the strength of each effect. In complex tasks, basic skills need to be learned and mastered before advanced aspects can be learned (Bell & Kozlowski, 2002). In early trials people will be more likely to be investing their effort in surface task behaviors, as they constitute the basics of how to perform the task. As such, the relationship between self-efficacy and surface task effort should be highest in the earlier trials. Since such a great deal of effort needs to be expended in surface behaviors in early trials, the relationship between self-efficacy and deeper exploration effort should be at its weakest in early trials.

In the later trials the reverse should be true. Participants will have likely learned most if not all of the basic skills and thus be more likely to be investing effort in advanced task aspects, which are represented, by deeper exploration effort. As such, the

relationship between self-efficacy and deeper exploration effort should be at its highest in later trials. It is predicted that:

Hypothesis 14c: The positive relationship between self-efficacy and surface task effort will be moderated by time such that the relationship will be stronger in earlier trials and weaker in later trials.

Hypothesis 14d: The positive relationship between self-efficacy and deeper exploration effort will be moderated by time such that the relationship will be weaker in earlier trials and stronger in later trials.

People with a mastery orientation strive to learn something new (Button, Mathieu & Zajac 1996), which should lead them to explore more aspects of the task even if they are unsuccessful in initial attempts. Those with a performance orientation will want to focus on being “correct” to get a high score and show their ability, avoiding attempts to explore more task aspects that will likely initially result in failures and a lower score, since failure threatens to show they have low ability in the task (Vandewalle, 1997). This should lead to participants with a state mastery goal orientation exploring more aspects of the task, as doing so is related to mastering the knowledge domain and learning new competencies. They want to create organized knowledge structures that allow them to understand the task, which comes from deeper exploration.

Participants with a state performance goal orientation, on the other hand, have no such inherent desire to learn more about the task and will focus only on aspects of the task that will result in increasing their score. Discovering new aspects of the task only

offers to people with a performance goal orientation new avenues to potentially fail and thus suggest they have low ability. People with a mastery orientation will be drawn toward new aspects of a task while people with a performance goal orientation will try to avoid them. Supporting this relationship, Kozlowski and Bell (2006) found that participants with learning goals exhibited a more exploratory focus in practice. Greene and Miller (1996) found a strong positive correlation between learning goals and meaningful cognitive engagements (which were conceptualized as a focus on understanding material and making plans) $r=.67$. Meaningful cognitive engagements are very similar to the concept of deeper task exploration, as understanding the nature of the task is central to both. These results as a whole suggest that:

Hypothesis 15a: State mastery goal orientation will have a positive relationship with deeper exploration effort such that people high in state mastery goal orientation will engage in more deeper exploration effort.

While state mastery goal orientation should result in greater deeper exploration effort across all trials, time is likely to play a role in the strength of the effect. In complex tasks basic skills need to be learned and mastered before advanced aspects can be learned (Bell & Kozlowski, 2002). As such, in early trials even people high in mastery goal orientation will have to invest significant time and effort into basic task components. This need should result in a weaker relationship between state mastery goal orientation and deeper exploration in earlier trials as learning the basics of the task will consume valuable time and effort. It is predicted that:

Hypothesis 15b: The positive relationship between state mastery goal orientation and deeper exploration effort will be moderated by time such that the relationship will be weaker in earlier trials and stronger in later trials.

People with a learning goal orientation view task failure or deficiencies as something that can be overcome by greater effort and solution-oriented self-instruction (Vandewalle 1997). This leads them to perceive a greater value to feedback and to thus seek out more feedback. This effect has been found empirically by Vandewalle (1997), which found a positive relationship ($r = .39$) between mastery goal orientation and feedback seeking. A similar effect was found by Kozlowski and Bell (2006) who found that participants with a learning goal frame exhibited greater self-evaluation activity, which was conceptualized as time spent looking at feedback. People with a performance goal, meanwhile, see ability as fixed and strive to avoid failure (Button, Mathieu & Zajac, 1996). Since ability cannot be improved in the view of people with a performance goal orientation, feedback offers no practical benefit, only the threat of suggesting they have low ability. Thus feedback offers a means to determine where to get better for those with a mastery goal orientation, but for those with a performance goal orientation feedback only offers a reminder of task failure.

Hypothesis 16: State goal orientation will have a positive relationship with feedback reflection such that people with a state mastery orientation will engage in more feedback reflection than people with a state performance orientation.

In complex tasks the development of task knowledge is crucial to success, as effort alone will not result in successful performance. Participants need to figure out how the task works and this requires task knowledge. Task knowledge in complex tasks can generally be broken down into two components: basic knowledge and strategic knowledge (Bell & Kozlowski, 2002).

Basic knowledge is knowledge learned about the fundamental principles of the task and the operations needed to perform it. Basic knowledge includes both declarative knowledge (information on what) and procedural knowledge (information about how; Ford & Kraiger, 1995). Basic knowledge is thus needed in order to perform the task in even a rudimentary fashion.

Strategic knowledge, on the other hand, is knowledge of the underlying structure and deeper complexities of the task. Strategic knowledge isn't just the memorization of facts or basic procedures, but the integration of task elements into task strategies (Bell & Kozlowski, 2002). The focus of strategic knowledge is information on which, why, when, and where to apply task knowledge and skills (Ford & Kraiger, 1995).

Overall task effort involves minimally an exploration of basic task knowledge. Effort invested in the task gives participants procedural knowledge on how the task works and declarative knowledge of task related facts. These are the components of basic task knowledge (Ford & Kraiger, 1995). By expending effort within the task, participants should gain a competency of the basic aspects of the task, which are stored in basic task knowledge. This leads to the hypothesis:

Hypothesis 17: Overall task effort will have a positive relationship with basic task knowledge performance such that people who have higher overall task effort will have higher basic task knowledge.

Strategic task knowledge requires a greater understanding of the structure of a task and the development of related advanced task integrated strategies (Ford & Kraiger, 1995). In order for such an understanding to develop, participants will need to invest cognitive effort in the task. Cognitive effort gives participants a knowledge of how the task is structured and what are the important elements. Cognitive effort lets participants know what exists within the task and how such elements can be used together. This would suggest a positive relationship between strategic knowledge and cognitive effort.

Hypothesis 18: Cognitive effort will have a positive relationship with strategic task knowledge such that people who have engaged in greater cognitive effort will have higher strategic task knowledge.

In a related vein, deeper task exploration effort involves participants exploring a greater amount of the task domain space in greater depth. This exposure to more parts of the task and how they connect together should have a positive impact on strategic task performance. Strategic task knowledge requires a person to understand how the task is structured and to be able to integrate related but distinct task concepts (Bell & Kozlowski, 2002). Deeper task exploration gives participants the exposure they need to be able to make the connects between task related concepts needed in strategic task knowledge.

Hypothesis 19: Deeper task exploration effort will have a positive relationship with strategic task knowledge such that people who engage in greater deeper task exploration effort will have higher strategic task knowledge.

Feedback reflection involves examining feedback to find out in what aspects of the task the participant can improve her ability. People who spend time engaging in feedback reflection are interested in more than just seeing what their score is. Task feedback provides information on how performance in various task aspects connects together. As such, feedback reflection should help participants to develop a great degree of understanding how task elements connect together, which is a major component of strategic knowledge (Ford & Kraiger, 1995).

Hypothesis 20: Feedback reflection will have a positive relationship with strategic task knowledge such that people who engage in greater feedback reflection will have higher strategic task knowledge.

In order for a person to gain strategic knowledge of a complex task a great deal of basic knowledge needs to have been learned. Basic knowledge gives the rudimentary skills needed to perform the task that first must be learned before any attempts at strategic knowledge can be attempted (Bell & Kozlowski, 2002). Since a good deal of basic knowledge needs to be acquired before strategic knowledge can be gained it is predicted that:

Hypothesis 21: Basic task knowledge will have a positive relationship with strategic task knowledge such that the more basic task knowledge a person possesses, the higher the level of basic task performance.

Basic task performance involves person's ability to perform fundamental task operations. In order to be able to perform at even a basic level, a person need to have declarative and procedural knowledge of at least the rudimentary elements of the task (Bell & Kozlowski, 2002). These knowledge elements are contained within basic task knowledge. A person's basic knowledge allows them to understand how to perform the task. As such I predict:

Hypothesis 22: Basic task knowledge will have a positive relationship with basic task performance such that the more basic task knowledge a person possesses, the higher the level of basic task performance.

Strategic performance refers to the ability of participants to perform complex and difficult task operations based on their comprehension of deeper task elements (Bell & Kozlowski, 2002). Strategic performance illustrates the ability of a participant to differentially apply task based skills and constructs in response to task characteristics (Tennyson & Breuer, 1997). For successful strategic performance, a participant needs to have a good understanding of the structure of the task and how its series of related

concepts can be manipulated and integrated to perform complex task actions. This knowledge of the task comes from a person's strategic knowledge. Strategic knowledge is the storehouse of the understanding needed for strategic performance. As such, it is predicted that:

Hypothesis 23: Strategic task knowledge will have a positive relationship with strategic task performance such that the more strategic task knowledge a person possesses the higher the level of strategic task performance.

One aspect of strategic performance that cannot be ignored is that it is an advanced version of basic performance. In order to engage in successful strategic performance, a person must be able to perform the basic task performance elements that are still salient. A person cannot be an expert performer at strategic aspects of the task before first becoming at least a competent performer of basic aspects of the task. For example, a person could learn 50 common chess end games states and how to win them, but if the person don't have knowledge of how the pieces move, her advanced performance ability will go for naught. Strategic performance can only be built on successful basic performance.

Hypothesis 24: Basic task performance will have a positive relationship with strategic task performance such that people who have a higher level of basic task performance will have a higher level of strategic task performance.

Transfer tasks generally involve some elements that are similar to the task the participant was trained on and some that are different. These tasks are usually in the same basic domain and test similar skills (Vollmeyer et al. 1996). They test understanding of the basic structure of the task as opposed to testing knowledge of specific rules. Strategic task performance is a sign that a participant has an understanding of the advanced aspects of the task. As such they most likely have a significant understanding of the content domain of the task structure. This means that when given a transfer task, high performers of strategic task elements should be able to apply their understanding and modify their strategies based on the new task environmental conditions (Tennyson & Breuer, 1997). Such an understanding should be more applicable to transfer task performance than basic task performance because the principles of the task can be applied to the transfer task. People who have high basic task performance do not necessarily understand the task domain, as they may have simply memorized the basic rules and procedures of the normal task. As such, the following is hypothesized:

Hypothesis 25: Strategic task performance will have a positive relationship with transfer task performance such that people with a higher level of strategic task performance will have a higher level of transfer task performance.

Even in a transfer task, basic task behaviors are important for success. In order for a person to successfully adapt to the new changes and challenges offered by the transfer task they need to retain some of the basic skills that are shown in basic task performance (Bell & Kozlowski, 2002). Complex task require a degree of mastery over basic

performance before strategic performance can be improved. The transfer task is a more advanced version of strategic task performance and as such it seems reasonable that basic task performance would have a similar relationship with transfer task performance.

Hypothesis 26: Basic task performance will have a positive relationship with transfer task performance such that people with a higher level of basic task performance will have a higher level of transfer task performance.

Method

254 participants took part in the lab study, engaging in a complex task. The electronic consent form used for all participants and the debriefing form can be found in Appendix A. The task used is a version of a PC-based radar-tracking simulation, called TANDEM (Dwyer et al. 1992). This is a complex task that requires participants to make decisions on how to pursue a number of contacts. This task requires the development of both basic skills and advanced, strategic skills. The basic skills are: to learn how to “hook” targets on the radar screen, collect cue information from a target, make three sub-decisions to classify a target’s characteristics and then use such information to make an overall decision on whether to shoot or clear a target. Participants receive points for correct decisions and lose points for incorrect decisions. The advanced, strategic skills involve: learning how to identify perimeters and defend them, determine which targets are a higher priority, and make tradeoffs between higher priority and lower priority targets. Targets penetrating perimeters result in point penalties.

Design & Procedure

The research was a 2x2 crossed design of goal content (learning vs. performance) and goal specificity (specific vs. vague). There were 254 participants total participants in 4 conditions. The specific learning goal condition had 64 participants. The vague learning goal condition had 59 participants. The specific performance goal condition had 63 participants. The vague performance goal condition had 68 participants. The experiment involved repeated measures of processes (cognitive effort, task effort, and feedback reflection), and outcomes (basic task knowledge, strategic task knowledge, task performance, and strategic task performance). Relevant individual differences (trait goal orientation, cognitive ability) were collected prior to all other measured variables.

The experiment took place during a three and a half hour training session. During each session between 1 and 16 participants learned the radar simulation. Each trial consisted of 3 parts: an opportunity to study the task manual, a chance to practice the task, and then an opportunity to receive task feedback. There was first a baseline trial to familiarize participants with the task. This was followed by 9 practice trials, which were divided into 3 blocks of 3 trials each. Practice was followed by a performance trial of the simulation and then a transfer trial, where the scoring rules of the simulation were changed and the difficulty was be increased due to the presence of many more targets than the practice trials.

Manipulation conditions

Specific Learning Goals. Participants in the specific learning goals condition were told the following goals and were reminded of the goal periodically during the session: “Research has shown that those who are the most successful on this task learn to master the following things during the course of practice: Successfully learn to make correct type/class/intent decisions and correctly prosecute 11 targets. Learn to hook 3 marker targets. Learn how to use the zoom function by zooming 12 times. Master making 10 speed queries. Learn to correctly prosecute 4 pop-up targets. Master successfully combating 7 inner and outer perimeter intrusions.” These values use as a baseline the 85th percentile of learning goal participants who participated in the same version of the TANDEM task in a previous use of the task.

Vague Learning Goals. Participants in the vague learning goals condition were told the following goals and were reminded of the goal periodically during the session: “Research has shown that those who are the most successful on this task learn to master the following things during the course of the practice trials. ‘Successfully learn to make correct type/class/intent decisions and correctly prosecute targets. Learn to hook marker targets. Master making speed queries. Learn to correctly prosecute pop-up targets. Master successfully combating inner and outer perimeter intrusions.’”

Specific Performance Goals. Participants in the specific performance goal condition were told the following goals and were reminded of the goal periodically during the session: “Research has shown that those who are the most successful on this task attain the following during the course of the practice trials. Perform at your maximum to reach the high score of 970 points or higher.” This score goal used as a

baseline the 85th percentile of scores attained by performance goal participants who have participated in the same version of the TANDEM task.

Vague Performance Goals. Participants in the vague performance goal condition were told the following goal and were reminded of the goal periodically during the session: “Research has shown that those who are the most successful on this task do the following thing during the course of practice. Do your best to perform at your maximum to reach a high score.”

After being given their goals, participants were shown the mechanics of using an online instruction manual that contained complete information on all aspects of the simulation. All participants were then given a brief demonstration of the simulation that outlined its aspects and decision rules. After this they were that they would receive feedback at the end of each trial. Once the demonstration was over they were again reminded of their goals.

After these task demonstrations were complete, the participants performed the first trial. This was a baseline trial of the task, labeled Trial 0, so that the participants could get experience at how the task works and set a baseline of performance. This was composed of three components: studying the task manual (2.5 minutes), performing the actual radar-simulation task (4 minutes) and receiving feedback on performance (2 minutes). After this baseline trial, participants were asked to fill out a survey that contained measures of clarity of goal discrepancy and magnitude of discrepancy.

Each participant then went through nine TANDEM trials of eight and a half minutes each that consisted of the same 3 components as the baseline trial. These trials were divided into 3 training blocks of 3 trials each. At the end of training

block one, participants filled out a number of survey questions. After they were finished filling out the questions, they were then given a 5-minute break. Once they returned they began training block 2. After training block 3 was completed, participants were again asked to fill out a number of survey questions and then given a 5-minute break.

When they returned, participants were given a manipulation check on goal content and goal specificity. After that they performed two performance trials. The first performance trial was the same level of difficulty as the practice trials but a different scenario. The rules and procedures were the same as they were for the practice trials. Finally, an adaptive transfer of training task was given. In the task, the time was increased to 10 minutes and there were many more targets than the previous trials. Also the rules were changed with regard to perimeter intrusions, as each intrusion was significantly more points than before, and inner perimeter intrusions were worth more points than outer perimeter intrusions. This meant that they needed to modify their strategy to be successful, changing their task priorities.

Measures (All items used are found in Appendix B).

Manipulation checks: Before the final two trials a manipulation check was given for goal content and goal specificity. All items are rated on a 5-point scale from “strongly disagree” (1) to “strongly agree” (5). The items for each manipulation check can be found in Appendix B.

Control Variables:

Cognitive Ability: Cognitive ability was assessed by having participants report their highest score received on the SAT or ACT. Individuals were told that this information would only be used for research purposes and would be kept confidential. It is generally agreed upon by researchers that SAT and ACT testing have a large general cognitive ability component (Phillips & Gully, 1997). Individuals' ACT or SAT scores were standardized using 1999 norms published by ETS, and this standardized score was used as the measure of cognitive ability.

Trait Goal Orientation: Before the actual lab sessions, participants were asked to complete a 13 item modified version of Vandewalle's (1997) trait goal orientation, where references to the work domain were modified to being task general. This modified version has been used in previous administrations of the TANDEM task (Nowakowski & Kozlowski, 2005). All items are rated on a 6-point scale from "strongly disagree" (1) to "strongly agree" (6). The items for this measure can be found in Appendix B.

Independent Variables:

State Goal Orientation: At the end of the first and third training blocks (3rd and 9th trials), participants completed a 16 item modified version of the Button et al. (1997) trait goal orientation measure, where the measure was modified to measure state rather than trait goal orientation in the task. The measure includes the Button et al. (1997) 8-item performance goal orientation measure and the 8-item learning goal orientation measure.

All items were rated on a 5-point scale from “strongly disagree” (1) to “strongly agree” (5). The items for this measure can be found in Appendix B.

Metacognition: At the end of the first and third training blocks (3rd and 9th trials) participants completed a 12-item metacognitive activity scale developed by Ford et al. (1998) for the TANDEM task. All items were rated on a 5-point scale from “Never” (1) to “Always” (5). The items for this measure can be found in Appendix B.

Clarity of Goal Discrepancy: At the end of the baseline trial (Trial 0) and at the end of the first and third training blocks (3rd and 9th trials), participants completed a 6-item measure of goal discrepancy clarity. This measure was developed for this study and focused on how certain a person was with regard to their ability to recognize their current state and the desired goal state. This measure is based on the conceptualization of clarity of goal discrepancy offered in this proposal and suggested by the work of Kanfer (1990). All items were rated on a 5-point scale from “strongly disagree” (1) to “strongly agree” (5). The items for this measure can be found in Appendix B.

Magnitude of Discrepancy: At the end of the baseline trial (Trial 0) and at the end of the first and third training blocks (3rd and 9th trials) participants completed a 6-item measure of the magnitude of goal discrepancy. This measure was developed for this study and focused on the discrepancy a person perceives to exist between their current state and their goal state. This measure is based on the conceptualization of magnitude of goal discrepancy offered in this proposal and suggested conceptually by the work of Kanfer (1990). All items were rated on a 5-point scale from “very far” (1) to “very close” (5). The items for this measure can be found in Appendix B.

Self-efficacy: At the end of the first and third training blocks (3rd and 9th trials), participants completed an 8-item measure of self-efficacy that was developed for use in this research paradigm (Kozlowski et al, 1996). Within this measure, self-efficacy is operationalized as a “task-focused, self-perception with item content specifically focused on the capability to develop methods to effectively deal with the information, decisions, and challenges of the simulation” (Kozlowski et al., 1996, p. 18). All items were rated on a 5-point scale from “strongly disagree” (1) to “strongly agree” (5). The items for this measure can be found in Appendix A.

Off Task Thoughts: At the end of the first and third training blocks (3rd and 9th trials), participants completed a 7-item measure of off task thoughts based on Kanfer et al. (1994) and adapted for the tandem task by Bell and Kozlowski (2002). All items were rated on a 5-point scale from “Never” (1) to “Always” (5). The items for this measure can be found in Appendix B.

Frustration: At the end of the first and third training blocks (3rd and 9th trials) participants completed a 5-item measure of frustration based on a Kanfer et al. (1994) scale of negative affect that was adapted by Bell and Kozlowski (2002). All items were rated on a 5-point scale from “Never” (1) to “Always” (5). The items for this measure can be found in Appendix B.

Task Knowledge Test: At the end of the first and third training blocks (3rd and 9th trials) participants completed a task knowledge test. It contains 22-items, 11 items testing basic knowledge and 11 items testing strategic knowledge. Each item had 4 answers, only one of which was correct. This knowledge test was used in previous administrations

of this task (Bell & Kozlowski, 2002). The items for this measure can be found in Appendix B.

Task Behaviors

Cognitive Effort: Cognitive effort was measured by the amount of time a participant spent at the beginning of each trial examining the computer-based TANDEM manual. The maximum time allowed to examine the manual in each trial was 2 1/2 minutes. The total amount of time spent during a trial block was calculated and was used as the measure of cognitive effort. Due to a data-writing error corrected in the middle of data collection only 151 participants had data for cognitive effort.

Surface Task Effort: Surface task effort was measured by the amount of targets engaged during a trial. The total number of targets engaged during a trial block was calculated and was used as the measure of surface task effort.

Deeper Exploration Effort: Deeper exploration effort was measured by the number of zooms, number of high priority targets engaged, and marker targets engaged by a participant. The total number of each done during a trial block was calculated and a composite was calculated and used as the measure of deeper exploration effort.

Feedback Reflection: Feedback reflection was measured by time spent examining task given feedback. Participants were given 2 minutes to examine feedback each trial. The total amount of time spent during a training block was calculated, and was used as the measure of feedback reflection

Analysis Plan

All relationships were tested at the end of block one, the end of block three, and the end of the transfer trial, as appropriate. The exact hypotheses, what variable were used, and analysis methods are found below in Table 1.

Table 1: Analysis Plan

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>
0: Overall Omnibus Test	COV: Cog. Ability, Trait G.O. Manipulations: Content, Specificity Time Dependents: Perceptions (Self-efficacy, Withdrawal) and Task behaviors Cognitive effort, Surface task effort, Deeper Exploration Task Effort, Feedback Reflection)	Repeated Measures MANCOVA
1a. + Relationship Learning Goal content and State Mastery Goal Orientation	Learning goal condition and state mastery goal orientation	UNIANOVA After Block 1, After Block 3
1b. + Relationship Performance Goal content and State Performance Orientation	Performance goal condition and state performance goal orientation	UNIANOVA After Block 1, After Block 3
2a. + Relationship Learning Goal content and Metacognition	Goal condition and metacognition	UNIANOVA After Block 1, After Block 3
2b. - Relationship Performance Goal content and Metacognition	Goal condition and metacognition	UNIANOVA After Block 1, After Block 3
3a.+ Relationship State Mastery Goal Orientation and Metacognition	State mastery goal orientation and metacognition Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3

Table 1 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>
4. + Relationship Goal Specificity and Goal Clarity	Specificity condition and goal clarity	UNIANOVA After Baseline Trial, After Block 1, After Block 3
5. + Relationship Goal Clarity and Magnitude of Discrepancy	Goal clarity and magnitude of discrepancy Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
6. + Relationship Metacognition and Self-efficacy	Metacognition and self-efficacy Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
7. – Relationship Magnitude of Discrepancy and Self-efficacy.	Magnitude of discrepancy and self-efficacy Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
8. Moderation of the – relationship between Magnitude Discrepancy and Self-efficacy by State Mastery Goal Orientation.	Magnitude of discrepancy, self-efficacy, state mastery goal orientation Step 1: Cog. Ability, Trait	Moderated multiple regression analysis After Block 1, After Block 3
9a. - Relationship between State Mastery Goal Orientation and Withdrawal Behaviors (Frustration and Off-task thoughts)	State mastery goal orientation, frustration, and off-task thoughts Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
9b. + Relationship between Performance Goal Orientation and Withdrawal Behavior (Frustration and Off-task thoughts)	State performance goal orientation, frustration, and off-task thoughts Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
10. + Relationship Magnitude of Discrepancy and Withdrawal Behaviors (Frustration and Off-task thoughts)	Magnitude of discrepancy, frustration, and off-task thoughts Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
11. + Relationship Metacognition and Cognitive Effort	Metacognition and Manual time Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
12. + Relationship State Mastery Goal Orientation and Cognitive Effort	State mastery goal orientation and manual time Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3

Table 1 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>
13. – Relationship Withdrawal Behavior and Cognitive Effort, Surface Task Effort, Deeper Exploration Effort and Feedback Reflection	Frustration, off-task thoughts, manual time, total task attempts, advanced task attempts, feedback time Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
14a. + Relationship Self-efficacy and Deeper Exploration Task Effort	Self-efficacy and advanced task attempts (number of speed queries made, pop-up targets engaged, and hooked marker targets) Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
14b. + Relationship Self-efficacy and Surface task effort	Self-efficacy and Basic Task attempts (engaging targets) Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
14c. Moderation of the + Relationship Self-efficacy and Deeper Exploration Task Effort by Time	Self-efficacy, advanced task attempts, experimental block Step 1: Cog. Ability, Trait	Moderated multiple regression analysis After Block 1, After Block 3
14d. Moderation of the + Relationship Self-efficacy and Surface Task Effort by Time	Self-efficacy, Basic Task attempts (engaging targets), experimental block Step 1: Cog. Ability, Trait	Moderated multiple regression analysis After Block 1, After Block 3
15a. + Relationship State Mastery Goal Orientation and Deeper Exploration Effort	State mastery goal orientation and advanced task attempts (number of speed queries made, pop-up targets engaged, and hooked marker targets) Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
15b. Moderation of the + Relationship between State Mastery Goal Orientation and Deeper Exploration Effort by Time	State mastery goal orientation, advanced task attempts, experimental block Step 1: Cog. Ability, Trait	Moderated multiple regression analysis After Block 1, After Block 3
16. + Relationship between State Mastery Goal Orientation and Feedback Reflection	State mastery goal orientation and feedback time Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
17. + Surface Task Effort and Basic Task Knowledge	Total task attempts and basic knowledge test score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3, After Trial 10

Table 1 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>
18. + Cognitive Effort and Strategic Task Knowledge	Manual time and strategic knowledge test score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
19. + Deeper Exploration Effort and Strategic Task Knowledge	Total advanced task attempts and strategic task knowledge score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
20. + Feedback Reflection and Strategic Task Knowledge	Feedback time and strategic task knowledge score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
21. + Basic Task Knowledge and Strategic Task Knowledge	Basic knowledge test score and strategic knowledge test score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Block 1, After Block 3
22. + Basic Task Knowledge and Basic Task Performance	Basic knowledge test score and basic task performance score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Trial 10
23. + Strategic Task Knowledge and Strategic Task Performance	Strategic task knowledge score and strategic task performance score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Trial 10
24. + Basic Task Performance and Strategic Task Performance	Basic task knowledge score and strategic task performance score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Trial 10
25. + Basic Task Performance and Transfer Task Performance	Basic task performance score and transfer task performance score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Trial 11
26. + Strategic Task Performance and Transfer Task Performance	Strategic task performance score and transfer task performance score Step 1: Cog. Ability, Trait	Hierarchal Regression, F test After Trial 11

Results

The means, standard deviations, and inter-correlations of all experimental variables can be found in Table 2 of Appendix C. The sample size for all hypotheses is $N = 254$, except for hypotheses except those involving cognitive effort, which has a sample size $N = 151$. The smaller sample size for hypotheses related to cognitive effort is due to an error in the recording of cognitive effort data that was found and corrected after experimental data was already being collected. All hypotheses used cognitive ability, trait mastery goal orientation, trait performance-prove goal orientation, and trait performance-avoid goal orientation as control variable or covariates as appropriate based on analysis type. As noted previously, cognitive ability was measured by standardized ACT/SAT score. All hypotheses can be found in table form in table 3 of Appendix C.

Manipulation Checks

Learning Goal Manipulation Check

A Univariate Analysis of Variance was conducted to examine whether individuals in the learning goal conditions were more willing to endorse learning goal objectives as those goals assigned to them as opposed to those in the performance goal conditions. As expected, people in learning conditions were significantly more likely to endorse learning goal objectives, $F(2, 256) = 17.48, p < .00$. Thus the learning goal manipulation seemed to be effectively noticed and endorsed by participants.

Performance Goal Manipulation Check

A Univariate Analysis of Variance was conducted to examine whether individuals in the performance conditions were more willing to endorse performance goal objectives

as those goals assigned to them as opposed to those in the learning goal conditions. As expected, people in performance goal conditions were significantly more likely to endorse performance goal objectives, $F(2, 256) = 25.39, p < .00$. Thus the performance goal manipulation seemed to be effectively noticed and endorsed by participants.

Goal Specificity Manipulation Check

A Univariate Analysis of Variance was conducted to examine whether individuals in the specific goal conditions were more willing to endorse specific goal objectives as the goals assigned to them as opposed to those in the vague goal conditions. No significant difference in endorsement was found, $F(2, 256) = .71, p > .05$. Thus the vague goal manipulation did not seem to be effectively noticed and endorsed by participants.

Overall RM-MANCOVA

In order to test whether the goal and specificity manipulations had an impact on task behaviors and cognitions a Repeated Measures MANCOVA was run. To account for pre-existing participant traits and qualities cognitive ability, as shown in standardized ACT or SAT, trait mastery goal orientation, trait performance-prove goal orientation, and trait performance-avoid goal orientation were all added as covariates. The task behaviors/cognitions used as dependent variables were self-efficacy, frustration, off-task thoughts, surface task effort, deeper exploratory effort, and feedback reflection. The task behavior of cognitive effort was excluded from the overall RM-MANCOVA because due

to a database error that was caught in the middle of data collection the manual time data used to calculate cognitive effort was not collected for a significant number of participants. Including cognitive effort in the MANCOVA decreased total sample size from 256 to 152. With the number of behaviors and covariates in the RM-MANCOVA the power of the analysis would have been decreased significantly.

The RM-MANCOVA showed a significant overall effect for the goal content manipulation, $F(3, 254) = 3.12, p < .01$. The RM-MANCOVA showed a significant overall effect for the specificity manipulation, $F(3, 254) = 2.71, p < .01$. A non-significant effect was found for the interaction of the goal manipulation and the specificity manipulation $F(3, 254) = 0.57, p > .05$.

Among the covariates, a significant overall effect was found for cognitive ability, $F(3, 254) = 4.34, p < .01$. A non-significant overall effect was found for trait mastery goal orientation, $F(3, 254) = 1.13, p > .05$. A significant overall effect was found for trait performance-prove goal orientation, $F(3, 254) = 2.79, p < .01$. A significant overall effect was found for trait performance-avoid goal orientation, $F(3, 254) = 3.79, p < .01$. The covariates were found to all have significant relationships with at least one task behavior/cognition and thus were used as controls in all hypotheses.

At the within subjects level, time was found to have a significant effect, $F(3, 254) = 4.65, p < .01$. None of the interactions with time were found to be significant. The interaction between time and trait mastery goal orientation was insignificant, $F(3, 254) = .97, p > .05$. The interaction between time and trait performance prove goal orientation was insignificant, $F(3, 254) = .83, p > .05$. The interaction between time and trait performance avoid goal orientation was insignificant, $F(3, 254) = 1.47, p > .05$. The

interaction between time and cognitive ability was insignificant, $F(3, 254) = 1.54, p > .05$. The interaction between time and goal content was insignificant, $F(3, 254) = 1.56, p > .05$. The interaction between time and goal specificity was insignificant, $F(3, 254) = .92, p > .05$. The interaction between time, goal content, and goal specificity was insignificant, $F(3, 254) = .50, p > .05$.

Hypothesis Testing

Hypothesis 1a: Hypothesis 1a predicted a relationship between learning goal content and state mastery goal orientation such that people in the learning goal content conditions would have higher state mastery goal orientation than people in the performance goal content conditions. State mastery goal orientation was measured after block 1 and block 3. This hypothesis was not supported. After block 1 a non-significant effect was found, $F(1, 254) = 0.12, p > .05$. After block 3 a non-significant effect was found, $F(1, 254) = 0.35, p > .05$. Therefore, hypothesis 1a was not supported.

Hypothesis 1b: Hypothesis 1b predicted a relationship between performance goal content and state performance goal orientation such that people in the performance goal content conditions would have higher state performance goal orientation than people in the mastery goal content conditions. State performance goal orientation was measured after block 1 and block 3. This hypothesis was not supported, as a significant result was found in the opposite direction of predicted. After block 1 a marginally significant effect was found, $F(1, 254) = 3.15, p = .077$. After block 3 a significant effect in the reverse

direction was found, $F(1, 254) = 5.89, p < .05$. Therefore, hypothesis 1b was not supported.

Hypothesis 2: Hypothesis 2 predicted a relationship between learning goal content and metacognition such that people in the learning goal content conditions would have higher metacognition than people in the performance goal content conditions. Metacognition was measured after block 1 and block 3. This hypothesis was not supported. After block 1 a non-significant effect was found, $F(2, 254) = 2.05, p > .05$. After block 3 a non-significant effect was found, $F(2, 254) = 0.07, p > .05$. Therefore, hypothesis 2 was not supported.

Hypothesis 3a: Hypothesis 3a predicted a positive relationship would exist between state mastery goal orientation and metacognition at the end of both blocks 1 and 3. Thus, the higher a person was in mastery goal orientation, the greater the amount of metacognition engaged in. This hypothesis was supported. After block 1 a significant effect was found, $F(1,254) = 80.37, p < .01, \Delta R^2 = .240$. After block 3 a significant effect was found, $F(1,254) = 93.33, p < .01, \Delta R^2 = .259$. Therefore, hypothesis 3a was supported.

Hypothesis 3b: Hypothesis 3b predicted a negative relationship would exist between state performance goal orientation and metacognition at the end of both blocks 1 and 3. Thus, the higher a person was in performance goal orientation, the less the amount of metacognition engaged in. This hypothesis was not supported. After block 1 a non-significant effect was found, $F(1,254) = 0.38, p > .05$. After block 3 a significant effect

was found in the reverse of the hypothesized direction, $F(1,254) = 16.01, p < .01, \Delta R^2 = .058$. Thus people higher in state performance goal orientation had higher levels of metacognition in block 3. Therefore, hypothesis 3b was not supported.

Hypothesis 4: Hypothesis 4 predicted that a positive relationship would exist between goal specificity and goal clarity such that people that had more specific goals would have greater goal clarity. This was tested after the baseline trial, after block 1, after block 2, and after block 3. This hypothesis was not supported. After the baseline trial a non-significant effect was found $F(1, 254) = .38, p > .05$. After block 1 a non-significant effect was found $F(1, 254) = .45, p > .05$. After block 2 a non-significant effect was found $F(1, 254) = .42, p > .05$. After block 3 a non-significant effect was found $F(1, 254) = .37, p > .05$. Hypothesis 4 was thus not supported.

Hypothesis 5: Hypothesis 5 predicted that a positive relationship would exist between goal clarity and magnitude of discrepancy such that people with greater goal clarity would perceive greater magnitude of discrepancy. This relationship was tested after the baseline trial, after block 1, after block 2, and after block 3. The reverse of the hypothesized relationship was found. After the baseline trial a significant effect was found $F(1,254) = 17.97, p < .01, \Delta R^2 = .066$. After block 1 a significant effect was found $F(1,254) = 24.67, p < .01, \Delta R^2 = .088$. After block 2 a significant effect was found $F(1,254) = 28.62, p < .01, \Delta R^2 = .097$. After block 3 a significant effect was found $F(1,254) = 107.32, p < .01, \Delta R^2 = .288$. Hypothesis 5 was not supported.

Hypothesis 6: Hypothesis 6 predicted a positive relationship would exist between metacognition and self-efficacy such that the greater the level of metacognition engaged in the greater the self-efficacy. This relationship was tested after block 1 and after block 3. The hypothesis was supported. A significant effect was found after block 1, $F(1,254)=43.17$, $p < .01$, $\Delta R^2 = .145$. A significant effect was found after block 3, $F(1,254)=73.08$, $p < .01$, $\Delta R^2 = .212$. Therefore, hypothesis 6 was supported.

Hypothesis 7: Hypothesis 7 predicted a negative relationship between magnitude of discrepancy and self-efficacy such that the higher the level of magnitude of discrepancy, the lower the self-efficacy at both the end of blocks 1 and 3. This hypothesis was supported. A significant effect was found after block 1, $F(1,254)=99.83$, $p < .01$, $\Delta R^2 = .260$. A significant effect was found after block 3, $F(1,254)=118.59$, $p < .01$, $\Delta R^2 = .302$. Therefore, hypothesis 7 was supported.

Hypothesis 8: Hypothesis 8 predicted that the negative relationship between magnitude of discrepancy and self-efficacy would be moderated by state mastery goal orientation such that the relationship between magnitude of discrepancy and self-efficacy would be weaker for people higher in state mastery goal orientation. This moderation effect was found only after block 3.

Looking at the direct effect after block 1, a significant impact of magnitude of discrepancy on self-efficacy was found $t(1, 256)=2.00$, $p < .05$. A direct effect of state mastery goal orientation on self-efficacy after block 1 was found to only be marginally significant $t(1, 256)=1.82$, $p = .070$. This resulted in a $\Delta R^2 = .390$ over the model with

just the control variables. After block 1 the interaction was found to be non-significant $t(1, 256) = .93, p > .05$.

Looking at the direct effect after block 3, a significant impact of magnitude of discrepancy on self-efficacy was found $t(1, 256) = 3.88, p < .01$. A direct effect of state mastery goal orientation on self-efficacy after block 3 was found to be significant $t(1, 256) = 2.54, p < .05$. This resulted in a $\Delta R^2 = .499$ over the model with just the control variables. After block 1 the interaction was found to be significant $t(1, 256) = 2.38, p < .05, \Delta R^2 = .011$. The interaction was in the correct direction as predicted, weakening the negative effect of magnitude of discrepancy on self-efficacy. Thus hypothesis 8 was supported for block 3.

Hypothesis 9a: This hypothesis predicted a negative relationship between state mastery goal orientation and off-task thoughts such that the higher the level of state mastery goal orientation the lower the level of off-task thoughts. This was measured after block 1 and block 3. A significant effect was found after block 1, $F(1,254) = 23.79, p < .01, \Delta R^2 = .084$. A significant effect was found after block 3, $F(1,254) = 30.12, p < .01, \Delta R^2 = .105$. Therefore, hypothesis 9a was supported.

Hypothesis 9b: This hypothesis predicted a negative relationship between state mastery goal orientation and frustration such that the higher the level of state mastery goal orientation the lower the level of frustration. This was measured after block 1 and block 3. A significant effect was found after block 1, $F(1,254) = 32.67, p < .01, \Delta R^2 = .104$. A

significant effect was found after block 3, $F(1,254)= 36.00, p < .00, \Delta R^2 = .117$.

Therefore, hypothesis 9b was supported.

Hypothesis 9c: Hypothesis 9c predicted a positive relationship between state performance goal orientation and off-task thoughts such that the higher the level of state performance goal orientation the lower the level of off-task thoughts. This was measured after block 1 and block 3. This hypothesis was not supported. A non-significant effect was found after block 1, $F(1,254)= .25, p > .05$. A non-significant effect was found after block 3, $F(1,254)= 2.09, p > .05$. Thus, hypothesis 9c was not supported.

Hypothesis 9d: Hypothesis 9d predicted a positive relationship between state performance goal orientation and frustration such that the higher the level of state performance goal orientation the lower the level of frustration. This was measured after block 1 and block 3. This hypothesis was only marginally supported. A non-significant effect was found after block 1, $F(1,254)= 1.43, p > .05$. A marginally significant effect was found after block 3, $F(1,254)= 3.04, p = .082$. Thus, hypothesis 9d was not supported.

Hypothesis 10a: Hypothesis 10a predicted a positive relationship between magnitude of discrepancy and off-task thoughts such that the higher the level of magnitude of discrepancy, the greater the level of off-task thoughts. This was measured after block 1 and block 3. This hypothesis was supported. A significant effect was found after block 1, $F(1,254)= 13.90, p < .01, \Delta R^2 = .051$. A significant effect was found after block 3, $F(1,254)= 42.67, p < .01, \Delta R^2 = .142$. Thus, hypothesis 10a was supported.

Hypothesis 10b: Hypothesis 10b predicted a positive relationship between magnitude of discrepancy and frustration such that the higher the level of magnitude of discrepancy, the greater the level of frustration. This was measured after block 1 and block 3. This hypothesis was supported. A significant effect was found after block 1, $F(1,254)= 90.73$, $p < .01$, $\Delta R^2 = .239$. A significant effect was found after block 3, $F(1,254)= 92.71$, $p < .01$, $\Delta R^2 = .251$. Thus, hypothesis 10b was supported.

Hypothesis 11: This hypothesis predicted a positive relationship between metacognition and cognitive effort. It suggested that the higher the level of metacognition, the greater the cognitive effort. This was measured after block 1 and block 3. This hypothesis was supported, but only after block 1. A significant effect was found after block 1, $F(1, 151)= 9.18$, $p < .01$, $\Delta R^2 = .056$. A non-significant effect was found after block 3, $F(1, 151)= .437$, $p > .05$. Thus, hypothesis 11 was supported in block 1 only.

Hypothesis 12: Hypothesis 12 predicted a positive relationship between state mastery goal orientation and cognitive effort such that the higher the level of state mastery goal orientation the greater the cognitive effort. This was measured after block 1 and block 3. This hypothesis was not supported. A non-significant effect was found after block 1, $F(1, 151)= 1.66$, $p > .05$. A marginally significant effect was found after block 3, $F(1, 151)= 3.00$, $p = .086$. Thus, hypothesis 12 was not supported.

Hypothesis 13a: Hypothesis 13a predicted a negative relationship between off-task thoughts and cognitive effort. It was predicted the greater the level of off-task thoughts, the lower the cognitive effort. This was measured after block 1 and block 3. This hypothesis was supported after only block 1. A significant effect was found after block 1, $F(1, 151) = 21.81, p < .01, \Delta R^2 = .123$. A non-significant effect was found after block 3, $F(1, 151) = .15, p > .05$. Thus, hypothesis 13a was supported in block 1 only.

Hypothesis 13b: Hypothesis 13b predicted a negative relationship between off-task thoughts and surface task effort. It was predicted the greater the level of off-task thoughts, the lower the surface task effort. This was measured after block 1 and block 3. This hypothesis was not supported. A non-significant effect was found after block 1, $F(1, 254) = 1.88, p > .05$. A non-significant effect was found after block 3, $F(1, 254) = .62, p > .05$. Thus, hypothesis 13b was not supported.

Hypothesis 13c: Hypothesis 13c predicted a negative relationship between off-task thoughts and deeper exploration effort. It was predicted the greater the level of off-task thoughts, the lower the deeper exploration effort. This was measured after block 1 and block 3. This hypothesis was not supported. A non-significant effect was found after block 1, $F(1, 254) = .05, p > .05$. A non-significant effect was found after block 3, $F(1, 254) = 1.77, p > .05$. Thus, hypothesis 13c was not supported.

Hypothesis 13d: Hypothesis 13d predicted a negative relationship between off-task thoughts and feedback reflection. It was predicted the greater the level of off-task

thoughts, the lower the feedback reflection. This was measured after block 1 and block 3. This hypothesis was supported. A significant effect was found after block 1, $F(1,254) = 22.77, p < .01, \Delta R^2 = .089$. A significant effect was found after block 3, $F(1,254) = 12.47, p < .01, \Delta R^2 = .048$. Thus, hypothesis 13d was supported.

Hypothesis 13e: Hypothesis 13e predicted a negative relationship between frustration and cognitive effort. It was predicted the greater the level of frustration, the lower the cognitive effort. This was measured after block 1 and block 3. This hypothesis was supported after only block 1. A significant effect was found after block 1, $F(1, 151) = 7.04, p < .01, \Delta R^2 = .044$. A non-significant effect was found after block 3, $F(1, 151) = .41, p > .05$. Thus, hypothesis 13e was supported in block 1 only.

Hypothesis 13f: Hypothesis 13b predicted a negative relationship between frustration and surface task effort. It was predicted the greater the level of frustration, the lower the surface task effort. This was measured after block 1 and block 3. This hypothesis was supported. A significant effect was found after block 1, $F(1,254) = 8.89, p < .01, \Delta R^2 = .031$. A significant effect was found after block 3, $F(1,254) = 5.64, p < .05, \Delta R^2 = .022$. Thus, hypothesis 13f was supported.

Hypothesis 13g: Hypothesis 13g predicted a negative relationship between frustration and deeper exploration effort. It was predicted the greater the level of frustration, the lower the deeper exploration effort. This was measured after block 1 and block 3. This hypothesis was supported only after block 1. A significant effect was found after block 1,

$F(1,254) = 4.54, p < .05$. A non-significant effect was found after block 3, $F(1,254) = 1.37, p > .05$. Thus, hypothesis 13g was supported only after block 1.

Hypothesis 13h: Hypothesis 13h predicted a negative relationship between frustration and feedback reflection. It was predicted the greater the level of frustration, the less the feedback reflection. This was measured after block 1 and block 3. This hypothesis was not supported. A non-significant effect was found after block 1, $F(1,254) = .88, p > .05$. A non-significant effect was found after block 3, $F(1,254) = .23, p > .05$. Thus, hypothesis 13h was not supported.

Hypothesis 14a: Hypothesis 14a predicted a positive relationship between self-efficacy and deeper exploration effort. It was predicted the greater the level of self-efficacy, the greater the deeper exploration effort. This was measured after block 1 and block 3. This hypothesis was not supported. A non-significant effect was found after block 1, $F(1,254) = .32, p > .05$. A non-significant effect was found after block 3, $F(1,254) = 1.06, p > .05$. Thus, hypothesis 14a was not supported.

Hypothesis 14b: Hypothesis 14b predicted a positive relationship between self-efficacy and surface task effort. It was predicted that the greater the level of self-efficacy, the greater the surface task effort. This was measured after block 1 and block 3. This hypothesis was supported. A significant effect was found after block 1, $F(1,254) = 9.40, p < .01, \Delta R^2 = .033$. A significant effect was found after block 3, $F(1,254) = 5.68, p < .05, \Delta R^2 = .022$. Thus, hypothesis 14b was supported.

Hypothesis 14c: Hypothesis 14c predicted that the positive relationship self-efficacy and surface task effort would be moderated by time such that the later the trial, the weaker the relationship. This hypothesis was not supported. Looking at the direct effects, a significant impact of self-efficacy on surface task effort was found $t(1, 254) = 2.50, p < .05$. A direct effect of time on surface task effort was found to be significant $t(1, 254) = 2.84, p < .01$. The interaction was found to be non-significant $t(1, 254) = 0.46, p > .05$. Thus hypothesis 14c was not supported.

Hypothesis 14d: Hypothesis 14d predicted that the positive relationship between self-efficacy and deeper exploration task effort would be moderated by time such that the later the trial, the stronger the relationship. This hypothesis was not supported. Looking at the direct effects, a non-significant impact of self-efficacy on deeper exploration effort was found $t(1, 254) = .39, p > .05$. A direct effect of time on deeper exploration task effort was found to be non-significant $t(1, 254) = .62, p > .05$. The interaction was found to be non-significant $t(1, 254) = 1.47, p > .05$. Thus hypothesis 14d was not supported.

Hypothesis 15a: This hypothesis predicted a positive relationship between state mastery goal orientation and deeper exploration effort. Thus, the greater the level of state mastery, the greater the deeper exploration effort. This hypothesis was not supported. A non-significant effect was found after block 1, $F(1, 254) = .85, p > .05$. A non-significant

effect was found after block 3, $F(1,254) = .00, p > .05$. Thus, hypothesis 15a was not supported.

Hypothesis 15b: This hypothesis predicted the positive relationship between state mastery goal orientation and deeper exploration effort would be moderated by time, such that the later the trial, the stronger the relationship. This hypothesis was not supported. Looking at the direct effects, a non-significant impact of state mastery goal orientation on deeper exploration task effort was found $t(1, 254) = 0.22, p > .05$. A direct effect of time on deeper exploration effort was found to be non-significant $t(1, 254) = .92, p > .05$. The interaction was found to be non-significant $t(1, 254) = 0.56, p > .05$. Thus hypothesis 15b was not supported.

Hypothesis 16: Hypothesis 16 predicted a positive relationship between state mastery goal orientation and feedback reflection. Thus, the greater the level of state mastery, the greater the feedback reflection. This hypothesis was only marginally supported in block 3. A non-significant effect was found after block 1, $F(1,254) = .12, p > .05$. A marginally significant effect was found after block 3, $F(1,254) = 3.13, p = .078, \Delta R^2 = .012$. Thus, hypothesis 16 was not supported.

Hypothesis 17: Hypothesis 17 predicted a positive relationship between surface task effort and basic task knowledge such that the greater the surface task effort, the greater the basic task knowledge. This hypothesis was supported after block 1 and the reverse relationship was supported after block 3. A significant effect was found after block 1,

$F(1,254) = 7.10, p < .01, \Delta R^2 = .023$. A significant effect was found in the reverse direction after block 3, $F(1,254) = 4.25, p < .05, \Delta R^2 = .015$. Thus hypothesis 17 was supported after block 1 only.

Hypothesis 18: This hypothesis predicted a positive relationship between cognitive effort and strategic task performance. It was predicted the greater the amount of cognitive effort, the greater the strategic task performance. This was tested for the performance trial, trial 10. The hypothesis was not supported. A non-significant effect was found after trial 10, $F(1, 152) = .021, p > .05$. Thus, hypothesis 18 was not supported.

Hypothesis 19: Hypothesis 19 predicted a positive relationship between deeper exploration effort and strategic task knowledge. It was predicted the greater the amount of deeper exploration effort, the greater the strategic knowledge. This hypothesis was supported. A significant effect was found after block 1, $F(1,254) = 28.53, p < .01, \Delta R^2 = .087$. A significant effect was found after block 3, $F(1,254) = 13.99, p < .00, \Delta R^2 = .043$. Thus, hypothesis 19 was supported in both blocks.

Hypothesis 20: This hypothesis predicted a positive relationship between feedback reflection and strategic task knowledge, such that the greater the feedback reflection the greater the strategic task knowledge. This hypothesis was supported. A significant effect was found after block 1, $F(1,254) = 4.44, p < .05, \Delta R^2 = .015$. A significant effect was found after block 3, $F(1,254) = 25.63, p < .01, \Delta R^2 = .076$. Thus, hypothesis 20 was supported in both blocks.

Hypothesis 21: Hypothesis 21 predicted a positive relationship between basic task knowledge and strategic task knowledge. Thus the higher a person's basic task knowledge, the greater the strategic task knowledge. Basic task knowledge and strategic task knowledge was measured after blocks 1 and 3. A significant effect was found after block 1, $F(1,254) = 13.12, p < .01, \Delta R^2 = .043$. After block 3 a significant effect was found as well, $F(1,254) = 70.03, p < .01, \Delta R^2 = .179$. Thus hypothesis 21 was supported.

Hypothesis 22: : Hypothesis 22 predicted a positive relationship between basic task knowledge and basic task performance. Thus, the higher a person's basic task knowledge, the greater the basic task performance. Basic task knowledge was measured after block 3 and compared to basic task performance in the performance trial, trial 10. A significant effect was found, $F(1,254) = 61.08, p < .01, \Delta R^2 = .170$. Thus hypothesis 22 was supported.

Hypothesis 23: Hypothesis 23 predicted a positive relationship between strategic task knowledge and strategic task performance. Thus the higher a person's strategic task knowledge, the greater the strategic task performance. Strategic task knowledge was measured after block 3 and compared to strategic task performance in the performance trial, trial 10. A significant effect was found, $F(1,254) = 41.36, p < .01, \Delta R^2 = .118$. Thus hypothesis 23 was supported.

Hypothesis 24: This hypothesis predicted a positive relationship between basic task performance and strategic task performance. Thus the higher a person's basic task performance, the greater the strategic task performance. Basic task performance and strategic task performance were measured in the performance trial, trial 10. A significant effect was found, $F(1,254) = 21.45$, $p < .01$, $\Delta R^2 = .066$. Thus, hypothesis 24 was supported.

Hypothesis 25: This hypothesis predicted a positive relationship between basic task performance and transfer task performance. Thus, the higher a person's basic task performance, the greater the transfer task performance. Basic task performance was measured in the performance trial, trial 10, and the transfer task performance was from trial 11. A significant effect was found, $F(1,254) = 44.76$, $p < .01$, $\Delta R^2 = .119$. Thus, hypothesis 25 was supported.

Hypothesis 26: This hypothesis predicted a positive relationship between strategic task performance and transfer task performance. Thus the higher a person's strategic task performance, the greater the transfer task performance. Strategic task performance was measure in the performance trial, trial 10 and transfer task performance was measured in trial 11. A significant effect was found, $F(1,254) = 44.08$, $p < .01$, $\Delta R^2 = .118$. Thus hypothesis 26 was supported.

Post-Hoc Analysis Section

As shown in the examination of hypotheses and manipulation checks above, the pattern of results found are not as expected. This is especially true in the early part of the model, the effects of the manipulations on process pathway variables. The lack of impact of manipulations on expected process pathway states and some manipulation check problems raises concerns about the cleanness of the manipulations as independent between goal content (learning and performance) and goal specificity (vague and specific). This suggested a need for further in-depth tests to hopefully clear up such issues. The additional post-hoc tests to gain greater understanding follow. Ultimately, however, they could not clear up the problems and illustrated some other problems in the manipulations that could not be resolved.

Exploratory Repeated Measures MANCOVA

A Repeated Measures MANCOVA was run to look at the effects of the manipulations on the repeated measure model through task knowledge. This test was to examine the effects of the manipulation on all perceptions, task behaviors and reactions that were measured at multiple data points. The variables included as dependent variables were: state performance goal orientation, state mastery goal orientation, metacognition, goal clarity, magnitude of discrepancy, self-efficacy, frustration, off-task thoughts, surface task effort, exploratory effort, feedback reflection, basic task knowledge, and strategic task knowledge. Relevant covariates were also included, which were cognitive

ability, trait mastery goal orientation, trait performance prove goal orientation, and trait performance avoid goal orientation.

Looking to the results of the RM-MANCOVA, specificity was found to have a significant main effect on the dependent variables, $F(3,254) = 2.34, p < .01$. Goal content was found to have a significant effect on the dependent variables, $F(3,254) = 2.68, p < .01$. The interaction between specificity and goal content was found to be non-significant $F(3,254) = .60, p > .05$.

Among the covariates, a significant overall effect was found for cognitive ability, $F(3, 254) = 7.43, p < .01$. A non-significant overall effect was found for trait mastery goal orientation, $F(3, 254) = 1.083, p > .05$. A significant overall effect was found for trait performance-prove goal orientation, $F(3, 254) = 2.50, p < .01$. A significant overall effect was found for trait performance-avoid goal orientation, $F(3, 254) = 3.209, p < .01$.

At the within subjects level, time was found to have a significant effect, $F(3, 254) = 5.05, p < .01$. Only one of the interactions with time was found to be significant. The interaction between time and cognitive ability was significant, $F(3, 254) = 1.83, p < .05$. The interaction between time and trait mastery goal orientation was insignificant, $F(3, 254) = .86, p > .05$. The interaction between time and trait performance prove goal orientation was insignificant, $F(3, 254) = .87, p > .05$. The interaction between time and trait performance avoid goal orientation was insignificant, $F(3, 254) = 1.44, p > .05$. The interaction between time and goal content was insignificant, $F(3, 254) = 1.56, p > .05$. The interaction between time and goal specificity was insignificant, $F(3, 254) = .80, p >$

.05. The interaction between time, goal content, and goal specificity was insignificant, $F(3, 254) = .53, p > .05$.

Looking to the specific variables, specificity had a significant effect on magnitude of discrepancy, $F(3,254) = 5.22, p < .05$. This relationship was in the positive direction, such that the more specific goal led to greater perceived magnitude of discrepancy. Specificity also had a significant effect on self-efficacy, $F(3,254) = 5.37, p < .05$. For specific goals participants had lower self-efficacy. Specificity had a significant effect on feedback reflection, $F(3,254) = 4.34, p < .05$. This relationship was in the positive direction, such that people in the specific conditions engaged in more feedback reflection. Specificity had a marginally significant impact on exploratory effort, $F(3,254) = 3.56, p = .061$. This relationship was in the positive direction, such that people in the specific conditions engaged in more exploratory effort.

Looking to the specific variables, goal content had a significant effect on state performance goal orientation $F(3,254) = 5.00, p < .05$. Goal content was coded with learning goals as zero and performance goals as one. The relationship with performance goal orientation was in the negative direction, opposite of what was hypothesized, with the performance goals leading to lower levels of state performance goal orientation. Goal content also had a significant effect on exploratory effort, $F(3,254) = 24.12, p < .01$. This relationship was in the negative relationship, such that the people in the performance goal conditions engaged in less exploratory effort. Goal content was found to have a marginally significant effect on surface task effort, $F(3,254) = 2.90, p = .090$. This relationship was in the negative relationship, such that the people in the performance goal

conditions engaged in less surface task effort. Goal content was also found to have a marginally significant relationship with strategic knowledge, $F(3,254) = 2.93$, $p = .088$. This relationship was in the negative relationship, such that the people in the performance goal conditions had less strategic knowledge.

As a whole, the Repeated Measures MANCOVA suggested that the manipulations did have an effect on task cognitions and behaviors. While some important process pathway variables were not affected by the manipulation a number of other task related variables and cognitions were affected. This suggests the manipulations did have an impact on participant's behaviors and cognitions and as such a more in-depth analysis was done to look at specific issues with the manipulations in order to makes sense of the manipulation problems.

Problems with Goal Content Manipulation

Goal content did in fact have significant manipulation checks for learning and performance goals with test results of $F(1,254) = 17.48$, $p < .01$, and $F(1,254) = 25.39$, $p < .01$ respectively. While the manipulation checks were successful, the expected relationships with state goal orientations were not found.

The learning goal condition was found to have a non-significant effect on mastery goal orientation for both blocks 1 and blocks 3. Significant positive relationships between learning goals and mastery goal orientation have found in previous studies that used this task (Kozlowski & Bell, 2006) as well as other tasks (Brett & Vandewalle, 1999).

Even more troubling, the performance goal condition was found to have a negative relationship with state performance goal orientation. Significant negative correlations were found between the two after blocks one and three with correlations of $r = -.136$ and $r = -.174$ respectively. A significant negative relationship was found between the performance goal conditions in block 3 with the trait goal orientations and cognitive ability controlled, $F(1,254) = 5.89$, $p < .05$. Due to these abnormalities, a more in-depth examination was begun.

The first examination undertaken was to look at the stability of the state goal orientation measures. State mastery goal orientation was found to have good reliability at both measurement points, after block 1 having a reliability of coefficient alpha = .794 and after block 3 having a reliability of coefficient alpha = .876.

A factor analysis was then run to make sure the mastery goal orientation scale was only measuring one factor. The factor analysis for both time points suggested one factor. After block 1 the items fell cleanly into one factor, which had an Eigenvalue of 3.396 and accounted for 42.54% of the variance. The next highest factor had an Eigenvalue of .998 and accounted for 12.48% of the variance. After block 3 the items fell cleanly into one factor, which had an Eigenvalue of 4.392 and accounted for 54.90% of the variance. The next highest factor had an Eigenvalue of .988 and accounted for 12.35% of the variance. These results suggest that the mastery goal orientation scale was clean and free of abnormalities.

These tests as a whole suggest that the non-significant relationship between condition and state mastery goal orientation were not due to problems with the measurement of state mastery goal orientation as the scale was psychometrically solid.

Attention was then turned to examining the stability of the state performance goal orientation measure. Acceptable reliability for the scale was found at both measurement points. After block 1 the state performance goal orientation measure was found to have a reliability of .725. After block 3 the state performance goal orientation measure was found to have a reliability of .764.

A factor analysis was then run on state performance goal orientation. The factor analysis suggested the potential for two factors at both time points. For measurement after block 1, the first factor had an Eigenvalue of 2.773 and accounted for 34.66% of the variance. The second factor had an Eigenvalue of 1.380 and accounted for 17.26% of the variance. Principle axis factoring was conducted with a varimax rotation used to find an optimal solution. The rotation converged in 3 interactions on the two factors. For measurement after block 3, the first factor had an Eigenvalue of 3.080 and accounted for 38.50% of the variance. The second factor had an Eigenvalue of 1.657 and accounted for 20.72% of the variance. Principle axis factoring was conducted with varimax rotation to find an optimal solution. The rotation converged in 3 interactions on the two factors. For both time points the individual items loaded on the same factors. Items 1,3,4,5, and 6 of the performance goal orientation loaded on the first factor and items 2, 7, and 8 loaded on factor 2. Item 2 had sizable cross factor loading after block 1 (loadings of .357 and .402) and after block 3 (loadings of .357 and .478).

Looking at the actual items for factor two, items 2,7, and 8 all focus on recognition by others of high performance (ex. “Even if I know that I did a good job in the task, I’m satisfied only if others recognize my accomplishments.”). The factor one items, 1,3,4,5,

and 6 focus simply on doing well on the task (ex “In this task the things I enjoy most are the things I do best.” and “I like to work on elements of the task that I have done well on in the past.”). Thus a difference in content could be seen between the two factors, although no such distinction for performance goal orientation exists in the literature.

To see if only one of the factors was responsible for the negative relationship between performance goal content and state performance goal orientation, Univariate Analyses of Variance were conducted with goal content predicting each of the two state goal orientation factors separately with the trait goal orientations and cognitive ability as covariates.

Unfortunately, even with breaking performance into two separate scales the same negative relationship was found for both factors. For the factor focused on simply doing well, no significant relationship was found after block 1, $F(1,254) = .97, p > .05$. However, for the measurement point after block 3 a marginally significant effect was found, $F(1,254) = 3.25, p = .073$. It was in the negative direction. For the factor focused on recognition by others, a marginally significant effect was found in the negative direction after block 1, $F(1,254) = 3.75, p = .054$. For block 3 a significant effect was found in the negative direction, $F(1,254) = 4.3, p < .05$. Thus the problematic negative relationship between learning goal conditions and state performance goal orientation was not solved by splitting the measure.

Overall, the examination of the problems found for the goal content manipulations was unsuccessful in finding a clear reason for the pattern of the results. No rationale was found for state performance goal orientation having a relationship in the wrong direction

with the performance goal conditions. Additionally, no rationale was found for the non-significant relationship of the learning goal conditions with mastery goal orientation. Both scales were found to be reliable and factor analysis gave no clues as to why the goal condition problems existed. The state performance goal orientation did not fall into one factor as expected, but both factors had at least a marginally significant negative relationship with performance goal content at one time point. Thus no resolution was found to the goal content manipulation problems.

Problems with Specificity Manipulation

The specificity manipulation did not have a significant effect on the specificity manipulation check, $F(1,254) = .71$, $p > .05$. This suggested that the goal specificity manipulation was not successful in influencing participants. Additionally, the expected process pathway of goal specificity through goal discrepancy clarity was found to be non-significant, with $F = .38$ after the baseline trial, $F(1,254) = .45$ after block 1, $F(1,254) = .42$ after block 2, and $F = .37$ after block 3. None of these values approached significance at the $p < .05$ level.

Goal specificity was found to have a significant relationship with magnitude of goal discrepancy after the baseline trial and block one even with trait goal orientations and cognitive ability controlled, with $F(1,254) = 10.18$, $p < .01$ and $F(1,254) = 8.04$, $p < .01$ respectively. A marginally significant results was found after block 2 as well, $F(1,254) = 3.09$, $p = .080$. These relationships were in the positive direction, with the specific goal conditions having higher perceived magnitude of discrepancy. These relationships fit with the theoretical conceptualization of this thesis. With a failed manipulation check and

the non-significant results with goal discrepancy clarity, a more in-depth investigation was warranted.

The first examination that was undertaken was to look at the stability of the goal manipulation check measure. It was found to have a high reliability coefficient $\alpha = .902$. A factor analysis was also conducted and a one-factor solution was strongly suggested. The first factor had an Eigenvalue of 4.066 and accounted for 67.76% of the variance. The next highest factor had an Eigenvalue of .819 and accounted for 13.65% of the variance. These results suggest that the goal specificity manipulation check was clean and free of abnormalities.

To examine whether specific items had differing relationships with the goal specificity conditions, item level correlations were run. Specificity was found to have a significant positive correlation with one of the items, item 4 ($r = .124, P < .05$), but none of the other items had significant relationships. The text of item 4 was “My objectives today set a clear standard.” Examining the content of the other items, no theoretical rationale was found for the other items being different in any way from item 4. Overall, these results did not find a scale-based reason for the non-significant relationship between the specificity goal conditions and the specific goal manipulation check.

The variable of goal discrepancy clarity was found to behave differently than expected. It had no relationship with the goal specificity conditions and was found to have a strong negative relationship with the magnitude of goal discrepancy scale, the reverse of the relationship that was predicted by theory. After the baseline trial it had a significant negative relationship, $F(1,254) = 17.97, p < .01$. After block 1 it had a significant negative relationship, $F(1,254) = 24.67, p < .01$. After block 2 it had a

significant negative relationship, $F(1,254) = 28.62, p < .01$. After block 3 it had a significant negative relationship, $F(1,254) = 107.32, p < .01$.

The stability of the goal discrepancy clarity scale was examined. It was found to have a high reliability at all time points, after the baseline trial coefficient alpha = .848, after block 1 coefficient alpha = .889, after block 2 coefficient alpha = .914, and after block 3 coefficient alpha = .930. The factor structure of the scale at each measurement point was examined and a one-factor solution was strongly suggested at each measurement point. First factor Eigenvalues ranged from 3.440 to 4.476, with percentage of variance explained from 57.33 % to 74.59%. Second factor Eigenvalues ranged from .547 to .847. The results as a whole suggested that the goal discrepancy clarity scale were psychometrically sound.

While the scale was methodologically valid, an examination of the actual scale items gave some rationale for the surprising results. The scale for goal discrepancy clarity was conceptualized as being made up of two parts, how clear the goal was and how clear the magnitude of goal discrepancy was. Looking to the actual items, the magnitude of goal discrepancy element may have proven to be problematic. The items could be in fact read as goal progress items due to that element. Some representative example items are: "I am certain how far I am from reaching my goals," and "I know the distance I am from my goal." Each of these items could be read as asking about how far or close a person is to their goal state, not how clear that gap is. While the scale was theoretically distinct from goal progress at its creation, it is quite possible that participants missed the nuance. Looking at the actual means, the goal clarity scale followed a similar trajectory that would be expected of a goal progress scale, with the means increasing from measurement

point to measurement point, with the mean starting at 3.54 and increasing to 3.89 by the last measurement point after block 3. Overall this theoretical post-hoc analysis and examination suggests that participants responded to the scale as a goal progress measure, explaining the relationships found.

Overall, the examination of the problems found for the specificity goal manipulations was unsuccessful in finding a clear reason for the pattern of results. Upon examination, the pattern of results for goal discrepancy clarity does seem reasonable if the items were read as being about goal progress. Removing the goal clarity scale from the model, a direction relationship with goal specificity and goal discrepancy magnitude was found to be significant at 2 of 4 time points and marginally significant at another. While those results are comforting, the non-significant goal specificity manipulation check is still problematic. The specificity manipulation check scale is psychometrically strong and reliable. Only one of the items was found to have a significant positive relationship with goal specificity conditions. No satisfactory answer was found for the non-significant manipulation check.

Manipulation Entanglement Problems

There is also some evidence of entanglement between the conditions of this experiment, with goal content and goal specificity not being independent and completely crossed. A marginally significant negative correlation was found for the performance goal condition on the specificity manipulation check, $r = -.122$, $p = .052$. A marginally significant effect was found for the performance goal condition on the goal specificity

manipulation check with trait goal orientations and cognitive ability controlled, $F(1,254) = 3.63$, $p = .058$. This was in the negative direction, such that people in the performance goal conditions reported lower levels of specificity on the goal specificity manipulation check.

Examination of the means for each condition found that the “do-your-best” condition (vague performance goal) had the lowest mean of all groups, 3.40. Looking at individual conditions, the vague performance goal was found to have a significantly lower mean than the vague learning goal, $F(1,254) = 5.60$, $p = .020$. It was also found to have a marginally significant lower mean than the specific learning goal, $F(1,254) = 3.13$, $p = .079$. No other conditions were found to significantly differ from each other.

As shown earlier, the stability of the specificity manipulation check is not in question. To look and see if specific items were the reason for the relationships, item level correlations were run for each specificity manipulation check item and the performance goal conditions. Items 4 and 5 were found to have a significant positive correlation with performance goal content, $r = .241$, and $r = .272$ respectively. Item 3 was found to have a significant negative correlation with performance goal content, $r = -.247$. The other items had no significant correlation. Item 3 read, “The objectives I was given today were well specified.” Items 4 and 5 were: “My objectives today set a clear standard.” and “It was clear what my objectives were today.” Looking for commonalities and differences among these items, item 3 talks about the degree the objective was “specified” while items 4 and 5 talked about how “clear” objectives were. While that difference can be noted, it is hard

to think of a conceptual reason why people with performance goals would respond to them in different ways than other participants. Performance goal content was supposed to be orthogonal from specificity and this inter-scale conflict does not resolve that entanglement problem.

Overall, the examination of the entanglement of goal content and goal specificity did not clear up the issues found. No complete rationale was found for the marginally significant negative finding on the specificity manipulation check by performance goal content. An examination by condition found that the significant relationship was due to vague performance goals, a “do-your-best” goal, having a lower mean than the other conditions. It had a significantly lower mean compared to a vague learning goal and a marginally significant mean than a specific learning goal. This helps to clarify where the effect comes from but does not offer any conceptual means for understanding the entanglement or the lack of difference between the other conditions. An examination of the correlations between the performance goal conditions and individual items of the specific goal manipulation check found that unexpectedly 2 items had a positive correlation with performance goal content and 1 item had a negative correlation with performance goal content. While this is a strange pattern within a scale, the fact that significant correlations exist at all is a problem since goal content and goal specificity were supposed to be orthogonal. Thus entanglement appears to exist between goal content and specificity.

Other Examinations of the problem

So as to make sure the inconsistencies in the data were not due to technical issues, the data storage and collection method was examined in detail as well. There was no suggestion of items being written to the wrong fields by the data-writing system used for the experiment. High scale reliabilities were found throughout the study, which doesn't suggest data entry being one column off or other common database related problems. To make sure the actual database and experimental conditions were correctly manipulated using the technical system a test run was done for each condition, checking to make sure the correct material were displayed for each condition and that the writing of data was being done to the correct conditions. All such tests checked out fine, with no problems found. These tests generally rule out the possibility of technical problems being the reason for the abnormalities in results.

Despite in-depth testing and additional post-hoc analyses of the data set, no plausible rationale was found for the lack of vital relationships between manipulation conditions and important process variable and manipulation checks. As such, it seems reasonable to conclude that some entanglement of conditions took place. This causes problems for interpretation of the manipulations effect on variables of interest.

Discussion

Overall Summary

While this thesis found its goal content and goal specificity conditions entangled, some significant and valuable contributions were made. One significant contribution is empirical evidence of the impact of magnitude of goal discrepancy on important task-related cognitions. Theory by Kanfer (1990) had suggested that higher goal discrepancies lead people to withdraw effort from a task. This idea found empirical support in this work, as perceived magnitude of goal discrepancy was found to relate positively to the withdrawal behaviors of off-task thoughts and frustration.

Work by Bandura and Cervone (1986) found that continued poor performance led to decreased self-efficacy. Extending these results theoretically, it would seem plausible that self-efficacy would have a similarly negative relationship with magnitude of goal discrepancy. This idea was given empirical support in this study, as magnitude of goal discrepancy did have a sizable negative effect on self-efficacy with a correlation of $r = -.58$ after block 1 and $r = -.53$ after block 3.

Magnitude of goal discrepancy also was found to have significant relationships with important process pathway variables that were not hypothesized. It had significant negative correlations with both state mastery goal orientation and metacognition. This suggests magnitude of discrepancy has a more central role in the goal implementation process than previously thought.

These results that suggest the importance of magnitude of goal discrepancy in effecting task behaviors and cognitions led to additional analyses. Since conditions were not orthogonal for specificity and goal content, an additional repeated-measure MANCOVA was run to examine the effect of condition on magnitude of goal discrepancy. Cognitive ability, trait mastery goal orientation, trait performance-prove goal orientation, and trait performance-avoid goal orientation were included as covariates in the analysis. Condition was found to have an overall main effect on magnitude of goal discrepancy between subjects, $F(3,254) = 3.37, p < .05$. This suggested that condition did have an effect on perceived magnitude of goal discrepancy.

To make sense of this effect, two additional RM-MANCOVAs were run. One RM-MANCOVA used just learning goal participants and the other used only the performance goal participants. Within each goal content type the effect of specificity on magnitude of goal discrepancy was examined. The same covariates (Cognitive ability, trait mastery goal orientation, trait performance-prove goal orientation, and trait performance-avoid goal orientation) were used. For the learning goal conditions the overall main effect of specificity on magnitude of goal discrepancy between subjects was found to not be significant, $F(1,123) = 2.35, p > .05$. For the performance goal conditions the overall main effect of specificity on magnitude of goal discrepancy between subjects was found to be significant, $F(1,131) = 5.60, p < .05$. This relationship was found to be in the negative direction, such that the people in the specific performance goal condition had higher perceived magnitude of goal discrepancy than those in the vague performance goal condition. This result suggests that specificity did work as expected within the performance goal conditions.

While not the focus of this research project, the basic model of how state cognitions affect task behaviors, which in turn affect performance and knowledge in the tandem task environment found in previous studies was also replicated in this study (Bell & Kozlowski, 2002; Nowakowski & Kozlowski, 2005; Bell & Kozlowski, 2006).

Overall, these findings suggest a valuable contribution of this thesis even with the goal content and goal specificity manipulation entanglement found.

Thesis Purpose

The purpose of this thesis was to disentangle the confound of goal content and goal specificity found in most of the goal-setting research contrasting learning and performance goals. Most of the research has featured specific performance score goals compared to vague learning goals focused on “mastering” the task (Bell & Kozlowski, 2006). Work by Latham and various colleagues (Winters & Latham, 1996; Seijts & Latham 2001, Seijts, Latham, Tasa, & Latham 2004) created more specific mastery goals but did not include a complete cross between goal content (learning or performance) and specificity (specific or vague). Without such a cross it is impossible to figure out exactly what parts of specificity or goal content lead to well-documented goal-setting effects for goal content.

This study attempted to address the entanglement of goal content and goal specificity by using a completely crossed design of goal content (learning or performance) and specificity (specific or vague) using a complex radar simulation task.

This thesis also tried to take the explanation a step further, by not only showing the differential effects of goal content and goal specificity but explain the different induced state pathways that were created for each type. For learning goal content, states of greater mastery goal orientation and metacognition were expected to be induced, which in turn which would lead to beneficial task behaviors and outcomes. For specific goals it was theorized that greater goal discrepancy clarity would be induced which then would lead to a greater perceived magnitude of goal discrepancy. Magnitude of discrepancy was conceptualized to let to lower self-efficacy and task withdrawal as had been previously conceptualized (Kanfer, 1990).

Problems Encountered

While making goal content and specificity orthogonal in the manipulations was the driving force of this thesis, experimental indicators in the data set suggested that this attempt was unsuccessful. The manipulations did not seem successful in both breaking up specificity and content as well as inducing the correct states that were specified in the theoretical model as the process pathway.

For the specificity manipulation this problem was shown in the non-significant manipulation check results for goal specificity across conditions. It was also shown in the non-significant relationship between goal specificity conditions and goal clarity, although post-hoc examination of the scale suggests that goal discrepancy clarity may not have

been responded to as intended by participants and instead treated as a goal progress measure. These results as a whole cast doubt on the success of the goal specificity manipulation.

The goal content manipulation also appeared problematic. While manipulation checks were indeed significant, the relationships with corresponding state goal orientations were not as expected. The learning goal conditions were found to have a non-significant relationship with state mastery goal orientation despite a strong relationship found in most other studies in the research area (Brett & Vandewalle, 1999; Kozlowski & Bell, 2006). Meanwhile, the performance goal conditions were found to have a significant negative relationship with performance goal orientation, a finding at odds with both the theoretically conceptualization of the relationship between the two (Button et al., 1996) and previous empirical results (Brett & Vandewalle, 1999). These finding raise doubts as to the success of the goal content manipulation.

There also exists some evidence of entanglement between goal content and goal specificity in the manipulations. Performance goal content was found to have marginally significant negative relationship with the goal specificity manipulation check. This suggests that the performance goal conditions were less specific than the learning goal conditions, a clear problem when goal content and goal specificity were meant to be orthogonal. These results as a whole cast doubt on the effectiveness and interpretability of the experimental manipulations.

Potential Reasons for Experimental Problems

With such problems inherent in the data received in this experiments, the first question that must be asked is why? What went wrong? This section will look at some potential explanations for the problematic manipulation results.

One potential problem is the level of the manipulation strength. Participants were told their goal at the beginning of the experiment and reminded of it the beginning of each trial block. While on the face of it this seems like a reasonable enough manipulation, it could have been strengthened. The task or the goals being given could have been framed as being of a high level of importance, so as to increase participant attention and effort on the task. Increasing participant perceived importance of the task could have lead them to pay greater attention to the goals and incorporate them better into their task related thoughts and cognitions. Participants also could have been asked to state their assigned goals orally or in written goal form. This could have acted to increase the degree they paid attention to the assigned goal and internalized it as their goal for the session. Such strengthening of the manipulation could have helped the manipulation to have an impact on participant's thoughts and behaviors during the simulation.

At the heart of an examination of what when wrong during the experiment is a careful consideration of what specificity actually means. In the conceptualization of specificity offer by Latham and his colleagues in a variety of papers, being specific means that a person is given a specific number of something to do (Winters & Latham, 1996; Seijts & Latham, 2001; and Seijts et al., 2004). The participants in the specific

learning goal condition of their studies were told to generate a specific number of “strategies” while the participants in the specific performance goal condition were told to reach a specific “score” or produce a certain number of task outcomes. The assumption these studies are based on is that the fact that since both types of goals have a number attached to it that it makes that goal specific as opposed to vague.

This assumption is not completely supported by their pattern of manipulation checks results however. As previously noted, Seijts et al (2004) did not find a significant difference between the “specific” learning goal of developing a certain number of task strategies and a “vague” “do-your-best goal” of getting the highest score possible. Such a result casts some doubt on the idea that a number inherently makes a goal more specific. A number can make a goal seem more specific to a participant, but what type of behavior that number is attached can also play a role. In the manipulation used in Seijts et al. (2004), the performance goal was tied to a very specific behavior of generating an exact number of college schedules while the learning goal was tied to the less straight forward behavior of coming with task strategies. While a person can easily tell if they are done with a schedule, what exactly constitutes a successfully strategy is less clear. This difference in the clarity of the task to be done is a plausible explanation for the performance goal being seen as significantly more specific than the “do-your-best” but a non-significant difference in specificity found between the learning goal and the “do-your-best” goal.

This clarity of the task behavior that needs to be done has particular relevance to this experiment. The performance goal conditions in this experiment both were single sentence goals. The specific performance goal was: “Perform at your maximum to reach

the high score of 970 points or higher “ The vague performance goal was: “Do your best to perform at your maximum to reach a high score.” While they varied in terms of whether a number was given, the thrust was the same, simply to get a high score. No behavioral advice was given on how to achieve the goal.

The learning goal conditions, however, offered specific task behaviors to perform. The basic template for the learning goals were: “Successfully learn to make correct type/class/intent decisions and correctly prosecute targets. Learn to hook marker targets. Master making speed queries. Learn to correctly prosecute pop-up targets. Master successfully combating inner and outer perimeter intrusions.” The difference between conditions was that for the specific condition a number was given for each behavior based on the 85th percentile of learning goal participants’ behaviors in a previous administration of the task.

While the specific performance goal may have used an exact numerical score to shoot for, both learning goal conditions gave exact behaviors to perform and master. While work by Latham (such as Winters and Latham, 1996) suggest that it is a the presence or absence of a numerical anchor that makes a goal specific or not, a broader examination of what makes a goal specific and how specific needs to be conducted. The learning goal conditions in this study both give clearer behavioral instructions than the performance goal conditions. Such a broader conceptualization of goal specificity offers some rationale for the entanglement of specificity and goal content found.

In any examination of why an experimental manipulation failed to act as anticipated a greater scrutiny of the purpose of the study and theoretical model proposed

is needed. Failed relationships could be due to inaccurate or flawed theory. While this a concern, in the case of this thesis the purpose and need for this study is still on firm ground. As previously documented, most of the research looking at learning versus performance goals as well as research looking at goal specificity effects has entangled goal content and goal specificity. Research has generally looked at specific numerical goals compared to vague mastery goals (Bell & Kozlowski 2006). Research by Latham and his colleagues (Winters & Latham, 1996; Seijts & Latham, 2001; and Seijts et al., 2004) attempted to create learning and performance goals with the same specificity but as documented the success of this is ambiguous and no clear crossed test of specificity and goal content has been attempted before this thesis.

While this need for disentanglement still seems acute, the exact pathways by which goal content and goal specificity affected task behaviors, cognitions, and performance need to be re-examined. The clean break-up of the goal content and goal specificity pathway may not be as independent as theoretically proposed. Significant correlations were found between the goal content and the goal specificity process pathway variables. Magnitude of discrepancy was found to have a significant correlation with state mastery goal orientation after both block 1 ($r = -.40$) and after block 3 ($-.42$). Magnitude of discrepancy was found to have a significant correlation with metacognition after both block 1 ($r = -.25$) and after block 3 ($r = -.39$). With the entanglement of goal content and goal specificity in this experiment it is difficult to determine whether these relationships hold in general or if they are in whole or in part due to the entanglement. As such, the pathways need to be reconsidered, although future research without such an entanglement could find them to exist as conceptualized here.

Overall the examination of the problems found in this experiment suggests a greater need to consider manipulation strength and to develop a more complete theoretical framework for understanding and classifying goal specificity. These issues and the lesson learned from them will be discussed in more detail in the next section.

Lessons Learned

One of the lessons learned from this thesis is the need for greater consideration of manipulation strength. Greater care should have been taken in making sure the goals seemed more salient to participants. This could have been done through a cover story or through asking participants to write out their goals or verbally commit to them. Such interventions might have helped the manipulations to have an impact.

Another lesson learned is the importance of pilot testing. Due to delays in the automation of the ADAPT lab for several months and the need to get data collection done by the end of Spring semester 2007 no pilot testing was done for the experiment. Pilot testing could have caught the failure of the manipulations to work as they were conceptualized to work and allowed time for reassessment. With the use of a new conceptualization of specific learning goals and the use of new measures for clarity of goal discrepancy and magnitude of goal discrepancy careful pilot consideration of whether they were working would have been very helpful. Pilot testing should have been done, even with the time pressures involved, for the good of the experiment and testing the theoretical model offered.

One other lesson learned was a need for greater attention to how items are actually read. For the measure of goal discrepancy clarity it was created with a theoretical distinction with goal progress, as goal discrepancy clarity was only supposed to examine how clear a participant felt the distance from his/her goal state was. While this difference made sense conceptually, it did not mean that participants would necessarily be able to make that distinction when actually filling out the questionnaire scale. As discussed previously, participants did not seem to understand this distinction. Looking to the scale post-experiment, the scale may be too loaded with content and fine-grained to expect participants to distinguish it. The scale had both a goal clarity part and a goal discrepancy part. The compound variable that resulted appears to have proved too complicated to get the desired responses. The concepts would have been better served broken up into scales of goal clarity and some other factor focused on discrepancy. How participants would see and respond to scales needed to be more thought out in this thesis.

Discussion of results found

While the manipulations were entangled in this thesis, significant results were found for a number of hypotheses that can potentially inform the body of literature of task cognition and behavior effects and point to future areas for research.

One variable for which meaningful results were found was magnitude of goal discrepancy. While goal discrepancy is talked about theoretically as important to goal-directed behavior by Kanfer (1990) it has gone unmeasured in goal-setting research. The use of goals set at the 85th percentile found in a number of goal-setting studies (Winter & Latham, 1996), sees such manipulations as being of goal difficulty and just assumes significant discrepancies between participant performance levels and ultimate goal states. Goals set at the 85th percentile of participant performance inherently mean that most participants will never reach their set goals and will have significant goal and current performance goal discrepancies.

This thesis created a measure for perceived magnitude of discrepancy and found it to have strong effects with a number of variables of interest. It was found to have a correlation of $r = -.53$ with self-efficacy after block 1 and a correlation of $r = -.58$ after block 3. In hierarchical regression, magnitude of discrepancy was found to predict incremental variance of $\Delta R^2 = .260$ after the trait goal orientations and cognitive ability were entered in the first step after block one, and $\Delta R^2 = .302$ after block 3. This effect was conceptually suggested by Bandura and Cevone (1986), whom found that repeated

self-monitoring of poor performance lead to decreased self-efficacy. The larger the goal discrepancy, the poorer current performance is compared to the goal state.

Magnitude of discrepancy was also found to have significant positive relationships with the withdrawal behaviors of frustration and off-task thoughts. In hierarchical regression, after block 1 magnitude of discrepancy was found to predict incremental variance of $\Delta R^2 = .239$ after the trait goal orientations and cognitive ability were entered in step one for frustration. After block 3, magnitude of discrepancy was found to predict incremental variance of $\Delta R^2 = .251$ for frustration. For off-task thoughts after block 1 magnitude of discrepancy was found to predict incremental variance of $\Delta R^2 = .051$ after the trait goal orientations and cognitive ability were entered in the first step. After block 3, magnitude of discrepancy was found to predict incremental variance of $\Delta R^2 = .142$ for off-task thoughts. Both of these results suggest that greater magnitude of goal discrepancy leads to greater levels of task withdrawal by participants.

These results taken as a whole suggest that magnitude of goal discrepancy does indeed play a significant impact in task related cognitions, supporting the theoretical work of Kanfer (1990) and extending the work on self-efficacy and task withdrawal by Bandura and Cevone (1986). Future research should examine these issues more fully and could potentially use the measure of magnitude of goal discrepancy developed in this thesis.

While there were problems with the manipulations, the specific goal conditions did in fact impact variables of interest. It was theorized that more specific goals would result in greater magnitude of discrepancy, as participants would be able to more clearly see how far they were from their goals set at the 85th percentile. While the intervening

variable of goal discrepancy clarity was not found to have a relationship with the goal specificity manipulation, the goal specificity manipulation was found to have a significant relationship with magnitude of discrepancy in the MANCOVA run for the process pathway variables. Looking to the correlations, Goal specificity had significant correlations with magnitude of discrepancy after the baseline trial ($r = .19$) and after block 1 ($r = .17$). These were both in the correct direction, suggesting the conditions with greater goal specificity had greater magnitude of goal discrepancy. Even with the failed specificity manipulation check, these results are suggestive of the predicted relationship of goal specificity and magnitude of discrepancy. Future research needs to examine this relationship with a cleaner manipulation to see if these results will still hold.

Conclusion

This thesis attempted to disentangle the confound that exists in the goal-setting literature about learning and performance goals between goal content and goal specificity. Due to manipulation problems, this thesis cannot offer compelling evidence on the issue of whether learning and performance goal effects found in the literature are due to goal content, goal specificity, or some combination of both. While we are unable to answer the question that this thesis set forth to answer, this thesis does point the way for future directions and potential pitfalls to avoid when examining the entanglement of goal content and goal specificity. It also highlights the importance of magnitude of goal discrepancy on task-related cognitions, a relationship that has been discussed theoretically (Kanfer, 1990) but has not received empirical support until this thesis. Future research needs to be done in this area of goal-setting to better understand goal

content and goal specificity effects and hopefully this thesis can help to inform such future endeavors.

Appendix A: Experimental Consent and Debrief Forms

Consent Form

Project Title:

Tactical Radar Project

Investigator Name:

Gordon Schmidt

Description and Explanation of Procedure:

Participation in this study is completely voluntary. This research is being conducted as part of completion of a master's thesis. The Tactical Radar Project (TRP) is a study about computer-based training, learning, and performance in a radar simulation. During the study you will learn how to identify the attributes of radar targets and how they should be responded to within the simulation. You will also fill out some questionnaires to help us understand your characteristics and how you work within the radar simulation. If you voluntarily agree to participate in this study, you will first answer a questionnaire online and then schedule a lab session later on to perform the radar simulation part of this experiment. Once you have indicated your consent below, the online questionnaire will begin. It should take approximately 30 minutes (1 credit). It will ask questions about a number of your characteristics relevant to the simulation task, as well as demographic information and your SAT/ACT score. At the appointed time you have signed up for the lab portion you will go to the ADAPT lab (204 Psychology Building) and perform the computer radar simulation for approximately 3 and ½ hours (7 credits). You will be given basic training on how to do the radar simulation task and will be given time to practice the task. During the practice you will be asked questions about your reactions. At the end of the practice sessions you will show what you have learned about the task. Awards are available. One set of awards will be given for the two people who answer the questions the best, in the amounts of \$20 and \$10 respectively. Prizes will also be given to the 2 who do the best on the final session in amounts of \$20 and \$10 respectively. The awards are independent of each other, so it is possible to win a prize in both categories. If you qualify for a prize you will be contacted by the experimenter via the email address you have provided at the end of the data collection period or the end of the spring semester, whichever comes first.

Estimate Required Time:

30 minutes for online questionnaire (1 Psychology subject pool credit)

3 1/2 hours for the ADAPT lab session (7 Psychology subject pool credits)

Risks and/or Discomforts:

No discomforts are expected, although you may experience some fatigue during the experiment. Your privacy will be protected to the maximum extent allowable by the law but there is a small amount of risk of loss of privacy of data given in this experiment.

Benefits:

This study will give you experience with several often used psychological measures. You will also gain experience in filling out online and computer-based surveys. As employment and education move toward a more online focus this experience will prove useful. You will gain experience in performing computer-based simulation tasks. Finally, you will gain knowledge about the process of psychological research.

Researcher Contact Information:

If so desired, you will be able to view your responses and be fully debriefed on what they mean at a later date. The investigators are available to answer any questions you may have about this study. If you want further explanation you can contact the lead experimenter (Gordon Schmidt, schmi306@msu.edu; 353-9166), the responsible project investigator (Steve Kozlowski, Ph.D. (stevekoz@msu.edu; 353-8924), or the Head of the Department of Psychology, Neal Schmitt (schmitt@msu.edu, 353-9563).

IRB Contact Information:

If you have questions with regard to your role and rights as a research participant, you may contact Peter Vasilenko, Ph.D., Director of Human Research Protections (phone: 517-355-2180, fax: 517-432-4503, e-mail: irb@msu.edu, mailing address: 202 Olds Hall, Michigan State University, East Lansing, MI 48824-1047), who is independent of anyone involved in this research project.

Consent Statement:

Please remember, your agreement to participate in this research is completely voluntary. You are free to withdraw this consent and discontinue participation in this experiment at any time without penalty. If you choose to withdraw from the experiment prior to its completion, you will receive credit for the time spent in the study. Within one year of your participation, a computer copy of this consent form can be provided to you upon request.

If you voluntarily agree to participate in this experiment, you will be asked to check a box below that indicates your consent. Also, you will be asked to report your NAME, PID, and email address at the beginning of the online questionnaire. The reason that you are asked for this information is to ensure that you receive full due credit for your participation in this study, and to contact you if you win an award. Your identity and

your responses will be kept secure and confidential. Your privacy will be protected to the maximum extent allowable by the law.

Debriefing Form

Debriefing Sheet

Tactical Radar Project

The study in which you just participated was designed to examine how people react to different types of objectives (i.e. goals) due to the way they are framed, and how these reactions influence motivation, learning and performance. We are also interested in examining whether individuals' different objectives lead to different types of task behaviors and task focus.

During this study, you operated a radar simulation known as TANDEM. TANDEM simulates the complex physical performance, information processing, and decision-making demands required to perform fast-paced, critical tasks. To perform the TANDEM simulation, you needed to learn how to operate the task and develop strategies for effective task performance. TANDEM required you to gather information about the objects on the screen, make decisions, and take actions based on the information you gathered. We will use the information gathered during the study to link your performance on the task to your knowledge of the task.

In addition, we will examine how the objectives you possessed impacted these outcomes. For example, the objective you had could have resulted in you spending more time examining the task manual and feedback provided. They could have also led you to engage in certain task behaviors more frequently. We will be able to test the relationship between objectives, because different groups of subjects are receiving different types of feedback during each session.

If you have any questions about this study or would like to receive a copy of the results when they are complete, please notify the investigator now. If, in the future, you have any questions about the study or would like to receive the results when they are complete, please call the investigator listed below. Finally, thank you for participating in this study. If you have any other questions or comments please do not hesitate from contacting the experimenter.

Investigators:

Gordon Schmidt	353-9166	schmi306@msu.edu
Steve Kozlowski	353-8924	stevekoz@msu.edu

Appendix B: Scale Items Used

Goal Content Manipulation check

Please answer the following questions on your scantron sheet, starting with number 119.

The following questions ask you to rate the extent to which you were told and heard the objectives listed below during this study. Please use the scale below to answer the following questions:

1	2	3	4	5
Strongly	Disagree	Neither Agree	Agree	Strongly
Disagree		nor Disagree		Agree

During this session, were you told and did you hear that your objectives were to:

1. Successfully learn to make correct type/class/intent decisions and correctly prosecute targets?
2. Master successfully combating inner and outer perimeter intrusions?
3. Master making speed queries?
4. Achieve a high score in TAP?
5. Get a high score in the TAP task?
6. Attempt to increase your score to a high level?

Goal Specificity Manipulation check

Please answer the following questions on your scantron sheet, starting with number 119.

The following questions ask you to rate your agreement with the following statements. Please use the scale below to answer the following questions:

1	2	3	4	5
Strongly	Disagree	Neither Agree	Agree	Strongly
Disagree		nor Disagree		Agree

1. The objectives I was given today were vague in nature.
2. I was unclear what my objectives were today for the experiment.
3. The objectives I was given today were well specified.
4. My objectives today set a clear standard.
5. It was clear what my objectives were today.
6. It was unclear what exactly my objectives set as a standard.

Goal Commitment (Hollenbeck, Klein, O'Leary, & Wright, 1989)

This set of questions asks you to rate your commitment to the goals you just wrote for yourself during this study. Thinking about your goals, please use the scale shown below to make your ratings for Questions 1-7.

1	2	3	4	5
Strongly	Disagree	Neither Agree	Agree	Strongly
Disagree		nor Disagree		Agree

1. It's hard for me to take my goals seriously.
2. It's unrealistic for me to expect to reach my goals.
3. It is quite likely that my goals may need to be revised, depending on how things go.
4. Quite frankly, I don't care if I achieve my goals or not.
5. I am strongly committed to pursuing my goals.
6. It wouldn't take much for me to abandon my goals.
7. I think my goals are good goals to shoot for.

Trait Goal Orientation Measure (VandeWalle, 1997, modified to fit general domain by Nowakowski and Kozlowski, 2005)

This set of questions asks you describe your general work orientation. Please make your ratings by clicking on one of the buttons below each question.

1	2	3	4	5	6
Strongly	Moderately	Slightly	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree	Agree	Agree	Agree

1. I am willing to select a challenging assignment that I can learn a lot from.
2. I often look for opportunities to develop new skills and knowledge.
3. I enjoy challenging and difficult tasks where I'll learn new skills.
4. For me, development of my ability is important enough to take risks.
5. I prefer situations that require a high level of ability and talent.
6. I'm concerned with showing that I can perform better than others.
7. I try to figure out what it takes to prove my ability to others.
8. I enjoy it when others are aware of how well I am doing.
9. I prefer projects where I can prove my ability to others.

10. I would avoid taking on a new task if there were a chance that I would appear rather incompetent to others.
11. Avoiding a show of low ability is more important to me than learning a new skill.
12. I'm concerned about taking on a task at work if my performance would reveal that I had low ability.
13. I prefer to avoid situations where I might perform poorly.

State Goal Orientation (Adapted from Button et al. 1996 to be a task specific state goal orientation measure).

This set of items asks you a few questions about the task and your feelings throughout training. Please use the scale shown below to make your ratings.

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

1. In this task the things I enjoy most are the things I do best.
2. The opinions other have on about how well I can do certain things in the task are important to me.
3. I feel smart when I do something in the task without making any mistakes.
4. I like to be fairly confident that I can successfully perform aspects of this task before I attempt them.
5. I like to work on elements of the task that I have done well on in the past.

6. I feel smart when I can do better on the task than most other people.
7. Even if I know that I did a good job in the task, I'm satisfied only if others recognize my accomplishments.
8. It is important to impress others by doing a good job on the task.
9. The opportunity to do challenging work within the task is important to me.
10. When I fail to complete a difficult aspect of the task, I plan to try harder the next time I work on it.
11. I prefer to work on elements of this task that force me to learn new things.
12. The opportunity to learn new things in the task is important to me.
13. I do my best when I'm working on a fairly difficult aspect of the task.
14. When I have difficulty solving a problem within the task, I enjoy trying different approaches to see which one will work.
15. On most aspects of this task, people can pretty much accomplish whatever they set out to accomplish.
16. Your performance in this task increases with the amount of effort you put into it.

Metacognition (Ford et al., 1998).

For each of the items below, rate the extent to which you were thinking about these issues during the past three practice trials. Please use the scale below to make your ratings and make your ratings on the scantron sheet.

1	2	3	4	5
Never	Rarely	Sometimes	Frequently	Always

8. While practicing the simulation, I monitored how well I was learning the requirements.
9. I thought carefully about my performance on the previous trial before selecting what to study and practice.
10. As I performed in the practice trials, I evaluated how well I was learning the skills of the simulation.
11. When my methods were not successful, I experimented with different procedures for performing the task.
12. I considered the skills that needed the most work when choosing what to study and practice.
13. I tried to monitor closely the areas where I needed the most study and practice.
14. I noticed where I made the most mistakes during practice and focused on improving those areas.
15. I carefully determined what to study and practice in order to improve on weaknesses identified in previous trials.
16. I used my performance on the previous trial to revise how I would approach the task on the next trial.
17. I thought about new strategies for improving my performance.
18. I thought ahead to what I would do next to improve my performance.
19. I told myself things to encourage me to try harder.

Clarity of Goal Discrepancy

1	2	3	4	5
Strongly	Disagree	Neither Agree	Agree	Strongly
Disagree		nor Disagree		Agree

1. I have a clear idea how my current accomplishments compare with my ultimate goals.
2. I am certain that I will know that I have met my goals.
3. I could give an accurate estimate of how far I am from achieving my goal levels.
4. I am certain how far I am from reaching my goals.
5. I can give a reasonable estimate of my current accomplishments and how they compare to my goals.
6. I know the distance I am from my goal.

Magnitude of Discrepancy

1	2	3	4	5
Very	Far	Moderate	Close	Very
Far				Close

1. I am _____ from reaching my goal.
2. When comparing my current level of performance to my goals, I am _____ to accomplishing my goals.
3. The distance to my goal is _____ .
4. The gap between my current performance and goal performance is _____
5. When thinking of my ultimate goal I feel I am a _____ distance from it.
6. The goal I have seems _____ from my current level of performance.

Self-efficacy (Kozlowski et al. 1996).

This set of questions asks you to describe how you feel about your capabilities for performing the simulation. Please use the scale shown below to make your ratings.

1	2	3	4	5
Strongly	Disagree	Neither Agree	Agree	Strongly
Disagree		nor Disagree		Agree

1. I can meet the challenges of this simulation.
2. I am confident in my understanding of how information cues are related to decisions.
3. I can deal with decisions under ambiguous conditions.
4. I am certain that I can manage the requirements of this task.
5. I believe that I will fare well in this task if the workload is increased.
6. I am confident that I can cope with this simulation if it becomes more complex.
7. I believe I can develop methods to handle changing aspects of this task.
8. I am certain I can cope with task components competing for my time.

Off Task Thoughts (Kanfer et al., 1994; adapted by Bell & Kozlowski, 2002).

For each of the items below, rate the extent to which you were thinking about these issues during the past three practice trials.

1	2	3	4	5
Never	Rarely	Sometimes	Frequently	Always

1. I took “mental breaks” during the task.
2. I daydreamed while doing the task.
3. I lost interest in the task for short periods.
4. I thought about other things I have to do.
5. I did not focus my total attention on the task.
6. I thought about the difficulty of the task.
7. I thought about other things that have happened in the past few days.

Frustration (Kanfer et al., 1994; adapted by Bell & Kozlowski, 2005).

For each of the items below, rate the extent to which you were thinking about these issues during the past three practice trials.

1	2	3	4	5
Never	Rarely	Sometimes	Frequently	Always

1. I became frustrated with my inability to improve my performance.
2. I thought about how poorly I was doing.
3. I was satisfied with my overall performance.
4. I got mad at myself during the task.
5. I wanted to give up.

Knowledge Test (Bell & Kozlowski, 2002).

The following is a knowledge test about the simulation. Please use the scantron sheet to answer the following questions. Bubble in the correct letter for each question, making sure the question numbers match the answer spaces on your scantron sheet.

1]. If a Response is Given, what is the likely Intent of the target?

- a. Military
- b. Hostile
- c. Civilian
- d. Peaceful

2]. A submarine may have which of the following characteristics?

- a. Speed 30 knots, Altitude/Depth -20, Communication time 85 seconds
- b. Speed 30 knots, Altitude/Depth 0, Communication time 30 seconds
- c. Speed 20 knots, Altitude/Depth 0, Communication time 80 seconds
- d. Speed 20 knots, Altitude/Depth -20, Communication time 90 seconds

3]. A Maneuvering Pattern of Code Delta indicates the target is which of the following?

- a. Air
- b. Military
- c. Surface
- d. Civilian

4]. A Blue Lagoon Direction of Origin indicates the target is which of the following?

- a. Unknown
- b. Sub
- c. Civilian
- d. Military

5]. If a target's Altitude/Depth is 10 feet, what is the Type of the target?

- a. Air
- b. Surface
- c. Submarine
- d. Unknown

6]. If a target's Intelligence is Unavailable, what Class does this suggest for the target?

- a. Air
- b. Civilian
- c. Military
- d. Unknown

7]. If a target's characteristics are Communication Time = 20 seconds and Speed = 50 knots, which of the following actions should you take?

- a. Choose Intent is Peaceful
- b. Choose Type is Surface
- c. Get another piece of information
- d. Choose Type is Air

8]. A Communication Time of 52 seconds indicates that the target is likely:

- a. Air
- b. Surface
- c. Submarine
- d. Unknown

9]. If a target's characteristics are Intelligence is Private and Maneuvering Pattern is Code Foxtrot, which of the following actions should you take?

- a. Choose Class is Military

- b. Choose Intent is Peaceful
- c. Choose Class is Civilian
- d. Choose Intent is Unknown

10]. If a target's Maneuvering Pattern is Code Echo, this suggests that the target falls into which category?

- a. Class is Unknown
- b. Class is Military
- c. Class is Hostile
- d. Class is Peaceful

11]. If a target's Speed is 40 knots, what does this suggest about the target?

- a. The target is Air
- b. The target is Surface
- c. The target is Civilian
- d. The target is Military

12]. Your Outer Defensive Perimeter is located at:

- a. 64 nm
- b. 128 nm

- c. 256 nm
- d. 512 nm

13]. If you've just noticed three targets near your inner perimeter, which of the following should you do next?

- a. Engage the target nearest the inner perimeter
- b. Engage the fastest target near the inner perimeter
- c. Zoom-Out to check the outer perimeter
- d. Zoom-In to check how close targets are to the inner perimeter

14]. If you Zoom-Out to find three targets clustered around your Outer Perimeter, how would you determine which target is the marker target?

- a. Check to see which target is closest to the outer perimeter
- b. Check the speeds of the targets
- c. Check to see which target is Civilian
- d. Check to see which target is Hostile

15]. What is the purpose of marker targets?

- a. To determine which Targets are Hostile and which are Peaceful
- b. To locate your Inner Defensive Perimeter

- c. To quickly determine the speeds of targets near your perimeters
- d. To locate your Outer Defensive Perimeter

16]. Which of the following pieces of information is NOT useful for prioritizing targets?

- a. The distance of targets from the outer defensive perimeter
- b. Whether the target is peaceful or hostile
- c. The distance of targets from the inner defensive perimeter
- d. The speed of targets near your inner and outer defensive perimeters

17]. Which of the following functions is most useful for identifying marker targets?

- a. Zoom-in
- b. Right-button feedback
- c. Engage Shoot or Clear
- d. Zoom-out

18]. If three Targets are about 10 miles outside your outer defensive perimeter, which of the following should you do to prioritize the Targets?

- a. Engage the fastest Target
- b. Engage the hostile Target

- c. Engage the closest Target
- d. It makes no difference in what order you engage the Targets

19]. On the average, approximately how many Targets pop-up during each practice trial?

- a. 1
- b. 3
- c. 6
- d. 9

20]. Which of the following would be the most effective strategy for defending your outer defensive perimeter?

- a. Zoom-out to 128 nm, locate the Marker Targets, and check the speed of targets near the outer perimeter
- b. Zoom-out to 256 nm, locate the Marker Targets, and check the speed of targets near the outer perimeter
- c. Zoom-out to 128 nm, locate a Hostile Air Target, and check the speed of targets near that target
- d. Zoom-out to 256 nm, locate a Hostile Air Target, and check the speed of targets near that target

21]. If all penalty intrusions cost -100 points, which would be the most effective strategy?

- a. Do not allow any Targets to enter your Inner Defensive perimeter, even if it means allowing targets to cross your Outer Defensive perimeter
- b. Do not allow any Targets to enter your Outer Defensive perimeter, even if it means allowing targets to cross your Inner Defensive perimeter
- c. Defend both your Inner and Outer Defensive perimeters equally
- d. None of these are effective strategies

11]. It is important to make trade-offs between targets:

- a. That are Hostile and those that are Peaceful
- b. Approaching your Inner and Outer perimeters
- c. That are Civilian and those that are Military
- d. That have already crossed your Inner Defensive perimeter, and those that are approaching your Outer Defensive perimeter

Appendix C: Experimental Results

Table 2 . Means, Standard Deviations and Correlations of Experimental Variables

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Goal Type														
0= Learning														
1 = Performance	0.52	0.50												
2. Specificity														
0= Vague														
1= Specific	0.50	0.50	-0.04											
3. Standardized SAT/ACT	0.12	0.73	-0.09	0.01										
4. Trait Mastery Goal Orientation	4.36	1.18	0.01	-0.02	0.12									
5. Trait Performance Prove Goal Orientation	4.04	1.12	-0.04	0.02	0.15	0.45								
6. Trait Performance Avoid Goal Orientation	3.28	0.96	-0.07	0.12	-0.01	-0.14	0.19							
7. Training Block 1 Goal Commitment	3.81	0.61	0.10	-0.06	0.00	0.16	0.03	-0.15						
8. Training Block 2 Goal Commitment	3.72	0.67	0.07	-0.06	0.04	0.09	0.09	-0.11	0.69					
9. Training Block 3 Goal Commitment	3.78	0.69	0.08	-0.07	0.07	0.03	0.08	-0.15	0.63	0.77				
10. Clarity of Goal Discrepancy after baseline	3.54	0.65	0.03	0.03	0.03	0.14	0.04	-0.03	0.43	0.35	0.35			
11. Clarity of Goal Discrepancy after block 1	3.66	0.61	0.03	0.05	0.11	0.12	0.05	0.05	0.31	0.35	0.32	0.50		
12. Clarity of Goal Discrepancy after block 2	3.74	0.64	0.01	0.04	0.08	0.13	0.07	0.03	0.30	0.34	0.40	0.48	0.54	

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
13. Clarity of Goal Discrepancy after block 3	3.89	0.68	0.00	0.03	0.11	0.06	-0.01	-0.09	0.27	0.31	0.40	0.44	0.50	0.68
14. Magnitude of Goal Discrepancy after baseline	3.58	0.82	0.10	0.19	-0.05	-0.01	0.09	-0.02	-0.42	-0.34	-0.30	-0.26	-0.18	-0.05
15. Magnitude of Goal Discrepancy after block 1	3.08	0.89	0.08	0.17	-0.17	0.01	-0.01	0.02	-0.30	-0.39	-0.41	-0.23	-0.31	-0.30
16. Magnitude of Goal Discrepancy after block 2	2.74	0.99	0.08	0.11	-0.22	-0.05	-0.10	0.06	-0.23	-0.29	-0.39	-0.17	-0.33	-0.33
17. Magnitude of Goal Discrepancy after block 3	2.46	1.03	0.06	0.08	-0.21	-0.06	-0.05	0.04	-0.14	-0.19	-0.30	-0.12	-0.30	-0.29
18. State Mastery Goal Orientation after block 1	3.73	0.50	0.00	-0.12	-0.04	0.15	-0.01	-0.25	0.45	0.50	0.46	0.41	0.38	0.32
19. State Mastery Goal Orientation after block 3	3.80	0.55	-0.02	-0.11	0.04	0.08	0.03	-0.22	0.32	0.40	0.49	0.40	0.29	0.40
20. State Performance Goal Orientation after block 1	3.43	0.49	-0.14	0.07	0.12	0.03	0.28	0.22	0.03	0.07	0.09	0.16	0.16	0.20
21. State Performance Goal Orientation after block 3	3.39	0.55	-0.17	0.07	0.11	-0.04	0.23	0.22	0.00	0.07	0.14	0.13	0.11	0.28
22. Metacognition after Block 1	3.87	0.64	0.09	-0.08	0.06	0.08	0.08	-0.08	0.32	0.33	0.35	0.21	0.25	0.22
23. Metacognition after block 3	3.87	0.70	0.02	-0.03	0.12	0.07	0.06	-0.18	0.32	0.35	0.42	0.26	0.28	0.32
24. Self-efficacy after block 1	3.48	0.70	-0.01	-0.15	0.17	0.15	0.08	-0.23	0.30	0.41	0.43	0.28	0.29	0.31

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
25. Self-efficacy after block 3	3.76	0.76	-0.10	-0.15	0.19	0.10	0.09	-0.16	0.31	0.37	0.46	0.28	0.36	0.39
26. Frustration after Block 1	2.54	0.75	0.03	0.08	-0.24	-0.13	-0.02	0.21	-0.23	-0.32	-0.34	-0.16	-0.17	-0.19
27. Frustration after block 3	2.24	0.74	0.05	0.12	-0.20	-0.06	-0.04	0.19	-0.32	-0.43	-0.51	-0.21	-0.24	-0.27
28. Off-task Thoughts after Block 1	1.87	0.71	0.05	-0.03	-0.12	-0.10	-0.03	0.13	-0.26	-0.37	-0.39	-0.11	-0.13	-0.20
29. Off-task Thoughts after block 3	1.90	0.85	0.01	0.00	-0.13	-0.04	0.02	0.11	-0.30	-0.38	-0.49	-0.17	-0.22	-0.28
30. Basic Knowledge after Block 1	8.50	2.27	0.06	-0.05	0.36	0.13	0.10	-0.14	0.08	0.17	0.12	-0.02	0.08	0.12
31. Strategic Knowledge after block 1	6.17	2.47	-0.15	0.01	0.38	0.10	0.13	-0.03	-0.05	0.03	0.02	-0.01	0.11	0.02
32. Basic Knowledge after Block 3	9.46	2.02	0.00	0.00	0.28	0.09	0.03	-0.11	0.05	0.16	0.16	-0.03	0.11	0.09
33. Strategic Knowledge after block 3	7.51	2.48	-0.09	-0.01	0.42	0.04	0.07	-0.10	0.02	0.08	0.11	-0.03	0.03	0.00
34. Cognitive Effort Block 1	435.85	23.41	0.02	0.07	0.07	0.12	0.12	0.19	0.00	0.01	0.02	-0.09	-0.06	0.07
35. Cognitive Effort Block 2	381.86	90.48	0.20	0.10	-0.28	-0.07	0.05	0.05	0.01	0.03	-0.04	0.08	0.02	0.03
36. Cognitive Effort Block 3	286.42	144.00	0.05	0.07	-0.25	-0.04	-0.02	0.07	0.00	0.06	0.02	0.04	0.05	0.01

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
37. Feedback														
Reflection Block 1	158.73	41.72	0.11	0.14	-0.05	0.06	0.10	-0.08	0.01	0.06	0.04	-0.06	0.03	0.01
38. Feedback														
Reflection Block 2	114.95	37.12	0.06	0.03	-0.01	-0.05	0.03	-0.03	-0.05	0.03	0.09	-0.02	0.07	-0.04
39. Feedback														
Reflection Block 3	86.67	30.72	-0.03	0.05	0.03	-0.04	0.01	-0.04	-0.11	-0.06	0.04	-0.01	0.06	-0.09
40. Block 1 Total														
Surface Task Effort	21.51	5.70	-0.09	-0.01	0.30	0.01	0.02	0.00	0.06	0.07	0.02	0.02	0.07	0.09
41. Block 1 High														
Priority Targets														
Engaged	8.46	4.99	0.02	0.00	0.33	0.05	0.09	-0.05	0.00	0.07	0.00	-0.12	0.03	0.03
42. Block 1 Marker														
Targets Hooked	0.78	1.74	-0.20	0.00	0.26	-0.01	0.04	0.00	0.03	0.04	0.04	0.04	0.10	0.05
43. Block 1 Total														
Zooms	19.39	22.20	-0.33	0.16	0.11	0.01	0.01	0.04	-0.03	-0.05	-0.03	-0.04	0.00	0.03
44. Block 1 Total														
Exploratory Effort	28.63	23.82	-0.32	0.15	0.19	0.02	0.03	0.02	-0.02	-0.03	-0.02	-0.06	0.01	0.04
45. Block 3 Total														
Surface Task Effort	29.10	7.63	-0.13	-0.04	0.17	0.03	0.06	0.00	0.09	0.12	0.09	0.11	0.11	0.18
46. Block 3 High														
Priority Targets														
Engaged	13.16	5.44	-0.09	-0.08	0.21	0.08	0.13	-0.03	0.09	0.13	0.11	-0.05	0.08	0.09
47. Block 3 Marker														
Targets Hooked	3.57	3.49	-0.13	0.07	0.41	0.07	0.10	-0.10	0.01	0.10	0.11	-0.04	0.02	-0.06
48. Block 3 Total														
Zooms	32.51	32.90	-0.24	0.09	0.22	0.02	0.06	0.00	-0.07	0.00	0.02	-0.07	0.04	-0.05

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
49. Block 3 Total	49.24	35.29	-0.25	0.08	0.28	0.04	0.09	-0.02	-0.05	0.03	0.04	-0.08	0.05	-0.04
Exploratory Effort														
50. Trial 10 Surface	10.24	2.56	-0.17	0.00	0.13	0.02	0.07	0.08	0.04	0.01	-0.02	0.09	0.05	0.11
Task Effort														
51. Trial 10 High														
Priority Targets														
Engaged	53.66	16.38	-0.09	-0.04	0.19	0.06	0.09	-0.09	0.08	0.07	0.13	0.03	0.08	0.12
52. Trial 10 Marker														
Targets Hooked	12.95	13.08	-0.11	0.09	0.37	0.03	0.01	-0.05	0.03	0.05	0.07	0.02	0.07	-0.04
53. Trial 10 Total														
Score	816.06	394.14	-0.08	0.01	0.37	0.14	0.14	-0.14	0.15	0.18	0.23	0.06	0.17	0.13
54. Trial 10 Basic														
Score	855.12	370.49	-0.06	0.01	0.33	0.14	0.14	-0.13	0.15	0.18	0.23	0.06	0.16	0.13
55. Trial 10 Strategic														
Score	-39.06	53.26	-0.17	0.02	0.40	0.05	0.07	-0.10	0.10	0.10	0.15	0.01	0.13	0.05
56. Trial 11 Surface														
Task Effort	24.24	7.32	-0.15	-0.04	0.06	-0.01	0.02	0.07	0.06	0.04	-0.01	0.12	0.03	0.11
57. Trial 11 Total														
Score	6.10	1011.77	-0.10	0.01	0.46	0.07	0.14	0.04	0.12	0.17	0.18	0.06	0.13	0.20

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	13	14	15	16	17	18	19	20	21	22	23	24
13. Clarity of Goal Discrepancy after block 3	3.89	0.68												
14. Magnitude of Goal Discrepancy after baseline	3.58	0.82	-0.09											
15. Magnitude of Goal Discrepancy after block 1	3.08	0.89	-0.39	0.53										
16. Magnitude of Goal Discrepancy after block 2	2.74	0.99	-0.48	0.33	0.72									
17. Magnitude of Goal Discrepancy after block 3	2.46	1.03	-0.56	0.18	0.57	0.80								
18. State Mastery Goal Orientation after block 1	3.73	0.50	0.45	-0.27	-0.40	-0.36	-0.30							
19. State Mastery Goal Orientation after block 3	3.80	0.55	0.56	-0.18	-0.37	-0.44	-0.42	0.68						
20. State Performance Goal Orientation after block 1	3.43	0.49	0.23	0.02	-0.06	-0.13	-0.13	0.14	0.26					
21. State Performance Goal Orientation after block 3	3.39	0.55	0.38	-0.01	-0.15	-0.23	-0.27	0.18	0.38	0.78				
22. Metacognition after Block 1	3.87	0.64	0.28	-0.09	-0.25	-0.31	-0.29	0.49	0.38	0.02	0.09			
23. Metacognition after block 3	3.87	0.70	0.44	-0.08	-0.26	-0.34	-0.39	0.57	0.54	0.10	0.22	0.75		
24. Self-efficacy after block 1	3.48	0.70	0.41	-0.28	-0.53	-0.50	-0.39	0.58	0.50	0.12	0.12	0.40	0.46	

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	13	14	15	16	17	18	19	20	21	22	23	24
25. Self-efficacy after block 3	3.76	0.76	0.60	-0.25	-0.47	-0.55	-0.58	0.52	0.64	0.17	0.30	0.39	0.51	0.69
26. Frustration after Block 1	2.54	0.75	-0.24	0.27	0.53	0.45	0.33	-0.36	-0.22	0.08	0.08	-0.20	-0.24	-0.65
27. Frustration after block 3	2.24	0.74	-0.46	0.29	0.50	0.53	0.54	-0.37	-0.38	0.03	-0.09	-0.29	-0.40	-0.56
28. Off-task Thoughts after Block 1	1.87	0.71	-0.25	0.05	0.24	0.25	0.24	-0.31	-0.19	0.04	0.00	-0.44	-0.40	-0.49
29. Off-task Thoughts after block 3	1.90	0.85	-0.40	0.15	0.30	0.36	0.40	-0.35	-0.34	0.03	-0.07	-0.42	-0.50	-0.44
30. Basic Knowledge after Block 1	8.50	2.27	0.22	0.04	-0.21	-0.28	-0.28	0.23	0.17	0.04	0.05	0.33	0.33	0.46
31. Strategic Knowledge after block 1	6.17	2.47	0.14	0.00	-0.17	-0.23	-0.20	-0.02	0.00	0.09	0.09	0.04	0.09	0.25
32. Basic Knowledge after Block 3	9.46	2.02	0.25	0.07	-0.13	-0.24	-0.30	0.22	0.22	0.07	0.11	0.34	0.40	0.40
33. Strategic Knowledge after block 3	7.51	2.48	0.12	-0.02	-0.17	-0.27	-0.23	0.09	0.11	0.01	0.01	0.24	0.26	0.34
34. Cognitive Effort Block 1	435.85	23.41	0.07	0.11	-0.05	-0.11	-0.14	0.08	0.00	0.04	0.04	0.24	0.21	0.20
35. Cognitive Effort Block 2	381.86	90.48	-0.02	0.15	0.14	0.09	0.09	0.03	0.01	0.07	0.08	0.18	0.05	-0.05
36. Cognitive Effort Block 3	286.42	144.00	0.05	-0.03	0.02	-0.04	-0.04	0.11	0.13	0.11	0.17	0.09	0.02	-0.01

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	13	14	15	16	17	18	19	20	21	22	23	24
37. Feedback Reflection Block 1	158.73	41.72	0.07	0.29	0.08	-0.05	-0.05	0.05	0.05	-0.07	-0.04	0.17	0.15	0.01
38. Feedback Reflection Block 2	114.95	37.12	0.08	0.18	0.00	-0.12	-0.15	0.11	0.15	0.03	0.08	0.21	0.22	0.08
39. Feedback Reflection Block 3	86.67	30.72	0.03	0.14	-0.04	-0.10	-0.17	0.09	0.12	-0.05	0.00	0.22	0.21	0.07
40. Block 1 Total Surface Task Effort	21.51	5.70	0.11	-0.16	-0.18	-0.14	-0.14	0.00	-0.03	0.02	-0.04	0.03	0.08	0.22
41. Block 1 High Priority Targets Engaged	8.46	4.99	0.07	-0.03	-0.14	-0.17	-0.19	0.03	0.03	0.00	0.04	0.10	0.13	0.30
42. Block 1 Marker Targets Hooked	0.78	1.74	0.07	-0.17	-0.16	-0.15	-0.14	-0.04	-0.04	0.02	-0.01	-0.04	0.02	0.15
43. Block 1 Total Zooms	19.39	22.20	-0.01	-0.14	-0.06	-0.10	-0.05	-0.08	-0.07	0.06	0.05	-0.02	-0.02	-0.02
44. Block 1 Total Exploratory Effort	28.63	23.82	0.01	-0.15	-0.10	-0.14	-0.09	-0.07	-0.06	0.06	0.06	-0.01	0.01	0.06
45. Block 3 Total Surface Task Effort	29.10	7.63	0.09	-0.12	-0.17	-0.17	-0.12	0.10	0.15	0.02	0.08	0.02	0.01	0.19
46. Block 3 High Priority Targets Engaged	13.16	5.44	0.08	-0.03	-0.12	-0.24	-0.21	0.10	0.16	0.05	0.10	0.06	0.13	0.31
47. Block 3 Marker Targets Hooked	3.57	3.49	0.11	-0.05	-0.16	-0.22	-0.21	0.04	0.05	0.03	0.07	0.09	0.11	0.22
48. Block 3 Total Zooms	32.51	32.90	0.02	-0.09	-0.12	-0.14	-0.13	-0.10	-0.01	0.06	0.06	0.01	0.05	0.04

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	13	14	15	16	17	18	19	20	21	22	23	24
49. Block 3 Total														
Exploratory Effort	49.24	35.29	0.04	-0.09	-0.15	-0.19	-0.17	-0.08	0.02	0.06	0.08	0.02	0.08	0.11
50. Trial 10 Surface Task Effort	10.24	2.56	0.01	-0.06	-0.10	-0.11	-0.04	0.02	0.04	0.03	0.05	-0.01	-0.02	0.15
51. Trial 10 High Priority Targets														
Engaged	53.66	16.38	0.12	0.01	-0.11	-0.26	-0.26	0.08	0.15	0.08	0.11	0.17	0.19	0.29
52. Trial 10 Marker Targets Hooked	12.95	13.08	0.11	-0.05	-0.15	-0.21	-0.20	0.03	0.05	-0.01	0.04	0.10	0.10	0.19
53. Trial 10 Total Score	816.06	394.14	0.20	0.00	-0.15	-0.35	-0.34	0.20	0.24	0.12	0.14	0.27	0.31	0.41
54. Trial 10 Basic Score	855.12	370.49	0.18	0.01	-0.13	-0.33	-0.32	0.21	0.25	0.12	0.13	0.27	0.31	0.40
55. Trial 10 Strategic Score	-39.06	53.26	0.17	-0.08	-0.21	-0.31	-0.30	0.03	0.07	0.11	0.12	0.13	0.13	0.27
56. Trial 11 Surface Task Effort	24.24	7.32	-0.03	-0.09	-0.07	-0.01	0.04	0.00	0.04	-0.04	-0.01	-0.03	-0.03	0.08
57. Trial 11 Total Score	6.10	1011.77	0.19	-0.06	-0.19	-0.22	-0.20	0.11	0.12	0.08	0.10	0.18	0.20	0.30

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	25	26	27	28	29	30	31	32	33	34	35	36
25. Self-efficacy after block 3	3.76	0.76												
26. Frustration after Block 1	2.54	0.75	-0.40											
27. Frustration after block 3	2.24	0.74	-0.66	0.67										
28. Off-task Thoughts after Block 1	1.87	0.71	-0.39	0.38	0.49									
29. Off-task Thoughts after block 3	1.90	0.85	-0.51	0.32	0.61	0.80								
30. Basic Knowledge after Block 1	8.50	2.27	0.42	-0.36	-0.37	-0.40	-0.38							
31. Strategic Knowledge after block 1	6.17	2.47	0.18	-0.27	-0.18	-0.17	-0.13	0.34						
32. Basic Knowledge after Block 3	9.46	2.02	0.43	-0.21	-0.32	-0.39	-0.41	0.66	0.31					
33. Strategic Knowledge after block 3	7.51	2.48	0.29	-0.27	-0.23	-0.33	-0.27	0.46	0.59	0.53				
34. Cognitive Effort Block 1	435.85	23.41	0.09	-0.19	-0.18	-0.35	-0.26	0.31	0.12	0.27	0.17			
35. Cognitive Effort Block 2	381.86	90.48	-0.09	0.16	0.15	-0.16	-0.01	-0.09	-0.22	0.02	-0.13	0.08		
36. Cognitive Effort Block 3	286.42	144.00	0.02	0.19	0.11	0.04	0.01	-0.11	-0.14	0.06	-0.12	0.11	0.61	

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	25	26	27	28	29	30	31	32	33	34	35	36
37. Feedback Reflection Block 1	158.73	41.72	0.05	0.05	0.00	-0.29	-0.19	0.19	0.11	0.31	0.21	0.22	0.21	0.11
38. Feedback Reflection Block 2	114.95	37.12	0.16	0.08	-0.04	-0.25	-0.27	0.21	0.03	0.32	0.26	0.16	0.26	0.22
39. Feedback Reflection Block 3	86.67	30.72	0.15	0.06	-0.04	-0.20	-0.22	0.14	0.08	0.30	0.29	0.09	0.11	0.13
40. Block 1 Total														
Surface Task Effort	21.51	5.70	0.16	-0.24	-0.19	-0.11	-0.11	0.25	0.28	0.09	0.19	0.02	-0.25	-0.22
41. Block 1 High Priority														
Targets Engaged	8.46	4.99	0.21	-0.34	-0.21	-0.09	-0.04	0.35	0.29	0.21	0.30	0.11	-0.18	-0.22
42. Block 1 Marker														
Targets Hooked	0.78	1.74	0.12	-0.19	-0.13	-0.06	-0.07	0.11	0.48	0.11	0.33	-0.05	-0.25	-0.14
43. Block 1 Total Zooms	19.39	22.20	0.01	-0.09	-0.04	-0.01	-0.01	-0.14	0.29	-0.08	0.15	-0.04	-0.25	-0.19
44. Block 1 Total														
Exploratory Effort	28.63	23.82	0.06	-0.17	-0.09	-0.03	-0.03	-0.05	0.36	-0.03	0.22	-0.02	-0.30	-0.23
45. Block 3 Total														
Surface Task Effort	29.10	7.63	0.18	-0.18	-0.18	-0.06	-0.07	0.07	0.16	-0.07	0.02	0.01	-0.04	-0.04
46. Block 3 High Priority														
Targets Engaged	13.16	5.44	0.29	-0.25	-0.27	-0.10	-0.07	0.21	0.21	0.17	0.18	0.02	-0.02	-0.02
47. Block 3 Marker														
Targets Hooked	3.57	3.49	0.20	-0.28	-0.19	-0.21	-0.18	0.29	0.55	0.21	0.55	0.09	-0.07	0.01
48. Block 3 Total Zooms	32.51	32.90	0.06	-0.12	-0.07	-0.10	-0.09	-0.02	0.29	-0.01	0.25	-0.04	-0.12	-0.09

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	25	26	27	28	29	30	31	32	33	34	35	36	
49. Block 3 Total															
Exploratory Effort	49.24	35.29	0.12	-0.17	-0.13	-0.13	-0.13	-0.12	0.04	0.35	0.04	0.32	-0.02	-0.13	-0.09
50. Trial 10 Surface															
Task Effort	10.24	2.56	0.09	-0.15	-0.10	0.02	0.02	0.08	0.17	-0.10	0.00	-0.02	0.00	-0.06	
51. Trial 10 High															
Priority Targets															
Engaged	53.66	16.38	0.36	-0.15	-0.29	-0.16	-0.17	0.36	0.19	0.31	0.24	-0.03	0.02	0.03	
52. Trial 10 Marker															
Targets Hooked	12.95	13.08	0.16	-0.25	-0.15	-0.18	-0.19	0.26	0.48	0.15	0.49	0.09	-0.13	-0.08	
53. Trial 10 Total															
Score	816.06	394.14	0.47	-0.28	-0.39	-0.30	-0.32	0.52	0.32	0.50	0.50	0.09	-0.06	-0.04	
54. Trial 10 Basic															
Score	855.12	370.49	0.47	-0.25	-0.38	-0.30	-0.31	0.50	0.27	0.50	0.46	0.09	-0.06	-0.03	
55. Trial 10 Strategic															
Score	-39.06	53.26	0.27	-0.30	-0.23	-0.17	-0.16	0.32	0.47	0.24	0.49	0.02	-0.04	-0.10	
56. Trial 11 Surface															
Task Effort	24.24	7.32	0.04	-0.08	-0.05	0.04	0.06	-0.06	0.05	-0.21	-0.11	-0.09	-0.02	-0.01	
57. Trial 11 Total															
Score	6.10	1011.77	0.33	-0.25	-0.22	-0.26	-0.24	0.33	0.38	0.31	0.38	0.11	0.03	-0.05	

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	37	38	39	40	41	42	43	44	45	46	47	48
37. Feedback Reflection Block 1	158.73	41.72												
38. Feedback Reflection Block 2	114.95	37.12	0.61											
39. Feedback Reflection Block 3	86.67	30.72	0.52	0.75										
40. Block 1 Total Surface Task Effort	21.51	5.70	-0.24	-0.26	-0.20									
41. Block 1 High Priority Targets Engaged	8.46	4.99	-0.06	-0.13	-0.11	0.61								
42. Block 1 Marker Targets Hooked	0.78	1.74	-0.07	-0.06	-0.06	0.33	0.22							
43. Block 1 Total Zooms	19.39	22.20	-0.02	-0.08	0.00	0.12	0.03	0.47						
44. Block 1 Total Exploratory Effort	28.63	23.82	-0.03	-0.10	-0.03	0.26	0.25	0.56	0.97					
45. Block 3 Total Surface Task Effort	29.10	7.63	-0.23	-0.18	-0.12	0.56	0.34	0.18	0.10	0.18				
46. Block 3 High Priority Targets Engaged	13.16	5.44	-0.03	-0.02	-0.02	0.39	0.68	0.23	0.06	0.22	0.59			
47. Block 3 Marker Targets Hooked	3.57	3.49	0.09	0.15	0.20	0.28	0.30	0.43	0.33	0.40	0.24	0.24		
48. Block 3 Total Zooms	32.51	32.90	-0.05	0.00	0.00	0.08	0.07	0.30	0.56	0.56	0.05	-0.01	0.51	

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	37	38	39	40	41	42	43	44	45	46	47	48
49. Block 3 Total														
Exploratory Effort	49.24	35.29	-0.04	0.02	0.02	0.16	0.20	0.36	0.56	0.59	0.16	0.16	0.61	0.98
50. Trial 10 Surface Task Effort	10.24	2.56	-0.27	-0.23	-0.17	0.49	0.33	0.15	0.14	0.21	0.84	0.51	0.21	0.04
51. Trial 10 High Priority Targets														
Engaged	53.66	16.38	0.00	0.01	-0.02	0.32	0.39	0.12	-0.07	0.03	0.40	0.56	0.04	-0.08
52. Trial 10 Marker Targets Hooked	12.95	13.08	0.04	0.20	0.21	0.22	0.24	0.37	0.29	0.35	0.19	0.14	0.86	0.45
53. Trial 10 Total Score	816.06	394.14	0.11	0.15	0.12	0.34	0.46	0.23	-0.09	0.03	0.36	0.53	0.32	-0.01
54. Trial 10 Basic Score	855.12	370.49	0.12	0.15	0.11	0.32	0.43	0.18	-0.14	-0.03	0.33	0.51	0.24	-0.08
55. Trial 10 Strategic Score	-39.06	53.26	-0.01	0.07	0.07	0.32	0.37	0.40	0.33	0.42	0.34	0.37	0.70	0.48
56. Trial 11 Surface Task Effort	24.24	7.32	-0.31	-0.24	-0.20	0.52	0.26	0.14	0.13	0.18	0.79	0.47	0.10	0.01
57. Trial 11 Total Score	6.10	1011.77	-0.01	0.04	0.09	0.45	0.32	0.30	0.10	0.19	0.44	0.35	0.47	0.21

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 2 (cont'd).

	Mean	SD	49	50	51	52	53	54	55	56	57
49. Block 3 Total											
Exploratory Effort	49.24	35.29									
50. Trial 10 Surface											
Task Effort	10.24	2.56	0.14								
51. Trial 10 High											
Priority Targets											
Engaged	53.66	16.38	0.02	0.44							
52. Trial 10 Marker											
Targets Hooked	12.95	13.08	0.53	0.21	-0.03						
53. Trial 10 Total											
Score	816.06	394.14	0.10	0.31	0.78	0.24					
54. Trial 10 Basic											
Score	855.12	370.49	0.02	0.28	0.78	0.16	0.99				
55. Trial 10 Strategic											
Score	-39.06	53.26	0.58	0.38	0.38	0.64	0.50	0.39			
56. Trial 11 Surface											
Task Effort	24.24	7.32	0.10	0.82	0.33	0.10	0.19	0.17	0.23		
57. Trial 11 Total											
Score	6.10	1011.77	0.30	0.41	0.38	0.39	0.51	0.47	0.50	0.39	

Note. N = 254 for all relationships but those with cognitive effort, for which N = 151. Correlations in **BOLD** are significant at the p = 0.05 level (2-tailed).

Table 3: Hypothesis Results

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
0: Overall Omnibus Test	COV: Cog. Ability, Trait G.O. Manipulations: Content, Specificity Time Dependents: Perceptions (Self-efficacy, Frustration, Off-task Thoughts) and Task behaviors (Surface task effort, Deeper Exploration Task Effort, Feedback Reflection)	Repeated Measures MANCOVA	Yes Goal content Specificity No Interaction		 F= 3.12 p = .001 F= 2.71 p = .003 F= .567
Manipulation check: Learning Goal	Learning goal manipulation check, Goal content condition Covariates: trait goal orientations, general ability.	UNIANOVA	Yes		F = 17.48, p = .000
Manipulation check: Performance Goal	Performance goal manipulation check, Goal content condition Covariates: trait goal orientations, general ability.	UNIANOVA	Yes		F = 25.39 p = .000

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
Manipulation check: Goal Specificity	Specificity goal manipulation check, Goal Specificity condition Covariates: trait goal orientations, general ability.	UNIANOVA	No		F = .71
1a. + Relationship Learning Goal content and State Mastery Goal Orientation	Learning goal condition and state mastery goal orientation Covariates: trait goal orientations, general ability.	UNIANOVA After Block 1, After Block 3	B1: No B3: No		B1: F = .12 B3: F = .35
1b. + Relationship Performance Goal content and State Performance Orientation	Performance goal condition and state performance goal orientation Covariates: trait goal orientations, general ability.	UNIANOVA After Block 1, After Block 3	B1: No B3: No		B1: F = 3.15 p = .077 B3: F = 5.89 p = .016
2. + Relationship Learning Goal content and Metacognition	Goal condition and metacognition Covariates: trait goal orientations, general ability.	UNIANOVA After Block 1, After Block 3	B1: No B3: No		B1: F = 2.05 B3: F = .07

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
3a. + Relationship State Mastery Goal Orientation and Metacognition	State mastery goal orientation and metacognition Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .240$ B = .661 $\Delta R^2 = .259$ B = .664	F = 80.37 p = .000 F = 93.33 p = .000
3b. - Relationship State Performance Goal Orientation and Metacognition	State performance goal orientation and metacognition Step 1: Cog. Ability, Trait Performance Prove	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No	$\Delta R^2 = .058$ B = .324	F = .02 F = 16.01 p = .000
4. + Relationship Goal Specificity and Goal Discrepancy Clarity	Specificity condition and goal clarity Covariates: trait goal orientations, general ability.	UNIANOVA After Baseline Trial, After Block 1, After Block 2, After Block 3	B0: No B1: No B2: No B3: No		F = .38 F = .45 F = .42 F = .37
5. + Relationship Goal Discrepancy Clarity and Magnitude of Discrepancy	Goal clarity and magnitude of discrepancy Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After baseline, Block 1, Block 2, Block 3	B0: No B1: No B2: No B3: No	$\Delta R^2 = .066$ B = -.329 $\Delta R^2 = .088$ B = -.436 $\Delta R^2 = .097$ B = -.489 $\Delta R^2 = .288$ B = -.820	F = 17.97 p = .000 F = 24.67 p = .000 F = 28.62 p = .000 F = 107.32 p = .000

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
6. + Relationship Metacognition and Self-efficacy	Metacognition and self-efficacy Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .145$ B = .135 $\Delta R^2 = .212$ B = .519	F = 43.17 p = .000 F = 73.08 p = .000
7. - Relationship Magnitude of Discrepancy and Self-efficacy.	Magnitude of discrepancy and self-efficacy Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .260$ B = -.410 $\Delta R^2 = .302$ B = -.418	F = 99.83 p = .000 F = 118.59 p = .000
8. Moderation of the – relationship between Magnitude Discrepancy and Self-efficacy by State Mastery Goal Orientation.	Magnitude of discrepancy, self-efficacy, state mastery goal orientation Step 1: Cog. Ability, Trait	Moderated multiple regression analysis After Block 1, After Block 3	B1: No B3: Yes	 $\Delta R^2 = .011$ B = .106	t = .93 t = 2.38 p = .018
9a. - Relationship between State Mastery Goal Orientation and Off-task thoughts	State mastery goal orientation, off-task thoughts Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .084$ B = -.435 $\Delta R^2 = .105$ B = -.514	F = 23.79 p = .000 F = 30.12 p = .000
9b. - Relationship between State Mastery Goal Orientation and Frustration	State mastery goal orientation, frustration Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .104$ B = -.506 $\Delta R^2 = .117$ B = -.477	F = 32.67 p = .000 F = 36.00 p = .000

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
9c. + Relationship between Performance Goal Orientation and Off-task thoughts	State performance goal orientation, off-task thoughts Step 1: Cog. Ability, Trait performance prove	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No		F= .25 F= 2.09
9d. + Relationship between Performance Goal Orientation and Frustration	State performance goal orientation, frustration Step 1: Cog. Ability, Trait performance prove	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No	$\Delta R^2 = .011$ B= -.153	F= 1.43 F= 3.04 p = .082
10a. + Relationship Magnitude of Discrepancy and Off-task thoughts	Magnitude of discrepancy, off-task thoughts Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .051$ B= .184 $\Delta R^2 = .142$ B= .319	F= 13.90 p= .000 F= 42.67 p= .000
10b. + Relationship Magnitude of Discrepancy and Frustration	Magnitude of discrepancy, frustration Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .239$ B= .417 $\Delta R^2 = .251$ B= .372	F= 90.73 p= .000 F= 92.71 p= .000
11. + Relationship Metacognition and Cognitive Effort	Metacognition and Manual time Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: No	$\Delta R^2 = .056$ B= 8.523	F= 9.18 p= .003 F= .437
12. + Relationship State Mastery Goal Orientation and Cognitive Effort	State mastery goal orientation and manual time Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No	$\Delta R^2 = .019$ B= 34.718	F= 1.66 F= 3.00 p= .086

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
13a. – Relationship Off-task Thoughts and Cognitive Effort	Off-task thoughts, manual time. Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: No	$\Delta R^2 = .123$ B = -11.40	F = 21.81 p = .000 F = .15
13b. – Relationship Off-task Thoughts and Surface Task Effort	Off-task thoughts, total task attempts. Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No		F = 1.88 F = .62
13c. – Relationship Off-task Thoughts and Deeper Exploration Effort	Off-task thoughts, advanced task attempts. Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No		F = .05 F = 1.77
13d. – Relationship Off-task Thoughts and Feedback Reflection	Off-task thoughts, Feedback reflection. Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .089$ B = -17.113 $\Delta R^2 = .048$ B = -8.024	F = 22.77 p = .000 F = 12.47 p = .000
13e. – Relationship Frustration and Cognitive Effort	Frustration, manual time. Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: No	$\Delta R^2 = .044$ B = -6.914	F = 7.04 p = .009 F = .41

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
13f. – Relationship Frustration and Surface Task Effort	Frustration, total task attempts. Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .031$ B = -1.433 $\Delta R^2 = .022$ B = -1.566	F = 8.89 p = .003 F = 5.64 p = .018
13g. – Relationship Frustration and Deeper Exploration Effort	Frustration, advanced task attempts. Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: No	$\Delta R^2 = .017$ B = -4.445	F = 4.54 p = .034 F = 1.37
13h. – Relationship Frustration and Feedback Reflection	Off-task thoughts, Feedback reflection. Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No		F = .88 F = .23
14a. + Relationship Self-efficacy and Deeper Exploration Task Effort	Self-efficacy and advanced task attempts (number of zooms, high priority targets engaged, and hooked marker targets) Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No		F = .32 F = 1.06

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p</u> (as appropriate)
14b. + Relationship Self-efficacy and Surface task effort	Self-efficacy and Basic Task attempts (engaging targets) Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .033$ B = 1.548 $\Delta R^2 = .022$ B = 1.523	F = 9.40 p = .002 F = 5.68 p = .018
14c. Moderation of the + Relationship Self-efficacy and Surface Task Effort by Time	Self-efficacy, Basic Task attempts (engaging targets), experimental block Step 1: Cog. Ability, Trait	Moderated multiple regression analysis After Block 1, After Block 3	No		t = .46
14d. Moderation of the + Relationship of Self-efficacy and Deeper Exploration Task Effort by Time	Self-efficacy, advanced task attempts, experimental block Step 1: Cog. Ability, Trait	Moderated multiple regression analysis After Block 1, After Block 3	No		t = 1.47
15a. + Relationship State Mastery Goal Orientation and Deeper Exploration Effort	State mastery goal orientation and advanced task attempts (number of speed queries made, pop-up targets engaged, and hooked marker targets) Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No		F = .85 F = .00

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
15b. Moderation of the + Relationship between State Mastery Goal Orientation and Deeper Exploration Effort by Time	State mastery goal orientation, advanced task attempts, experimental block Step 1: Cog. Ability, Trait	Moderated multiple regression analysis After Block 1, After Block 3	No		t = .56
16. + Relationship between State Mastery Goal Orientation and Feedback Reflection	State mastery goal orientation and feedback time Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No	$\Delta R^2 = .012$ B = 6.399 (SB = .114)	F = .12 F = 3.13 p = .078
17. + Surface Task Effort and Basic Task Knowledge	Total task attempts and basic knowledge test score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: No	$\Delta R^2 = .023$ B = .064 $\Delta R^2 = .015$ B = -.033	F = 7.10 p = .008 F = 4.25 p = .040
18. + Cognitive Effort and Strategic Task Knowledge	Manual time and strategic knowledge test score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: No B3: No		F = 1.64 F = .00
19. + Deeper Exploration Effort and Strategic Task Knowledge	Total advanced task attempts and strategic task knowledge score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .087$ B = .031 $\Delta R^2 = .043$ B = .015	F = 28.53 p = .000 F = 13.99 p = .000

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
20. + Feedback Reflection and Strategic Task Knowledge	Feedback time and strategic task knowledge score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .015$ B = .007 $\Delta R^2 = .076$ B = .022	F = 4.44 p = .036 F = 25.63 p = .000
21. + Basic Task Knowledge and Strategic Task Knowledge	Basic knowledge test score and strategic knowledge test score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Block 1, After Block 3	B1: Yes B3: Yes	$\Delta R^2 = .043$ B = .244 $\Delta R^2 = .179$ B = .545	F = 13.12 p = .000 F = 70.03 p = .000
22. + Basic Task Knowledge and Basic Task Performance	Basic knowledge test score and basic task performance score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Trial 10	T10: Yes	$\Delta R^2 = .170$ B = 79.285	F = 61.08 p = .000
23. + Strategic Task Knowledge and Strategic Task Performance	Strategic task knowledge score and strategic task performance score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Trial 10	T10: Yes	$\Delta R^2 = .118$ B = 8.179	F = 41.36 p = .000

Table 3 (cont'd).

<u>Hypothesis</u>	<u>Variables</u>	<u>Analysis Tool</u>	<u>Hypothesis Supported?</u>	<u>ΔR^2, beta weight (B)</u>	<u>F, t, p (as appropriate)</u>
24. + Basic Task Performance and Strategic Task Performance	Basic task knowledge score and strategic task performance score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Trial 10	T10: Yes	$\Delta R^2 = .066$ B = .040	F = 21.45 P = .000
25. + Basic Task Performance and Transfer Task Performance	Basic task performance score and transfer task performance score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Trial 11	T11: Yes	$\Delta R^2 = .119$ B = 1.019 (SB = .373)	F = 44.76 p = .000
26. + Strategic Task Performance and Transfer Task Performance	Strategic task performance score and transfer task performance score Step 1: Cog. Ability, Trait	Hierarchical Regression, F test After Trial 11	T11: Yes	$\Delta R^2 = .118$ B = 7.181 (SB = .378)	F = 44.08 p = .000

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