Working Smarter and Working Harder: Combining Learning and Performance Goals to Improve Performance in a High-Complexity Task Environment

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of my thesis, including any required final revisions, as accepted by my examiners.

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ABSTRACT

In a high-complexity task environment individual productivity can be improved through exerting more effort (i.e., working harder) as well as by learning improved task strategies. I examine the productivity effects of both learning goals and performance goals in such an environment. I argue that in a high-complexity task environment learning can often be an important predictor of task performance. As such, focusing on learning may be at least as important as working harder. Using an experiment with graduate and undergraduate accounting student participants, I predict and find that learning goals alone lead to increased learning relative to performance goals alone and that directing effort away from conventional performance toward learning does not impair task performance. I further predict that productivity can be enhanced by combining learning and performance goals. I predict that when assigning both goal types simultaneously, the presence of a performance goal will impair learning. However, I find that combining the two goal types simultaneously does not harm learning and improves performance. I further predict and find that assigning both goal types sequentially such that performance goals are assigned only after learning goals have induced learning leads to better performance than using learning goals in isolation. My results provide an understanding of the relationships among goal type, learning, and performance. This understanding contributes to the extant academic literature on goal setting and will be relevant to managers when designing and implementing management control systems.

Keywords: learning, learning goal; performance goal; productivity; task complexity

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DEDICATION

This thesis is dedicated to my family and friends, especially wife Suzy, my mother Susan, and my sons Tycho and Frederick. Thank you for being my biggest supporters. This never would have been possible without you.

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CHAPTER 1: INTRODUCTION

Goal setting is an organizational practice that is central to the control systems of many organizations (Kelly et al. 2015) and a number of accounting studies have demonstrated a positive relationship between performance-based goal (hereafter "performance goal") difficulty and performance (e.g., Chen et al. 2017; Hirst and Lowy 1990; Presslee et al. 2013; Webb et al. 2010). Perhaps due to the demonstrated efficacy of performance goals, they are used in a variety of organizational tasks and settings including when employees are still learning (Masuda et al. 2015). However, prior research demonstrates that when individuals are still learning and therefore lack the knowledge and/or skills necessary to effectively perform a task, performance goals can overly tax the cognitive resources required for learning new knowledge and skills and therefore lead to worse outcomes than foregoing a performance goal entirely and instead simply instructing individuals to "do your best" (Kanfer and Ackerman 1989; Locke and Latham 1990, 2002).

To induce individuals to discover new knowledge, new skills, and effective task strategies, goal setting theory suggests that individuals should pursue learning goals rather than performance goals (Seijts and Latham 2001; Winters and Latham 1996). Like performance goals, learning goals are designed to increase task performance, but they do so indirectly by inducing individuals to acquire knowledge, learn skills, or develop strategies that are performance enhancing (Seijts and Latham, 2005). As an example of these two goal types, a salesperson given a dollar sales target for the month has a performance goal and a salesperson told to identify three new potential markets for an existing product has a learning goal.

Although prior research has examined both learning goals and performance goals separately, few studies have examined combining the two goal types (Locke and Latham 2012; Seijts et al. 2013). I am unaware of any accounting research that has examined learning goals and no prior research in any discipline that has compared the effects of using learning and performance goals in isolation to employing them jointly. Therefore, whether or not learning and performance goals can be combined to increase performance relative to either goal type in isolation is an important empirical question. As a result, prominent goal setting researchers have called for further research examining the learning and performance effects of combining learning and performance goals (Latham and Locke 2007; Locke and Latham 2002; Seijts et al. 2013).

The purpose of this study is to investigate whether learning and performance goals can be combined such that when used together they are more effective than either goal type in isolation. When employees are still learning, the best practice based on findings from academic research is that only a learning goal should be assigned and performance goals should not be assigned (Seijts and Latham 2001, 2005). The importance of learning is recognized in practice as evidenced by frequent business press articles opining on how to achieve continual learning in the work place (e.g., Dearborn 2013; Kolodny 2016; Whitmore 2015). However, in applied settings employees are frequently asked to learn while also attempting to achieve an assigned performance goal (Masuda et al. 2015). This is a discrepancy between prescriptive norms from academia and what is actually observed in practice. Given the lack of empirical evidence on the effects of combining learning and performance goals, more research is needed in order for academic research to inform goal setting as currently used in applied settings. This gap in the literature is an opportunity for accounting research to contribute to extant knowledge.

Prior research suggests that the mere presence of a performance goal may tax the cognitive resources required for learning as well as direct effort away from learning toward traditional avenues for performance thereby impeding the learning process; this is especially true for environments where the task itself places heavy demands on an individual's cognitive resources; i.e., complex task environments (Kanfer and Ackerman 1989; Seijts and Latham 2005, 2006; Winters and Latham 1996). Therefore, I predict that, in a complex task environment, learning goals alone will lead to more learning than performance goals alone. This is important because I am interested in settings where learning is an important determinant of performance. Although performance goals interfere with learning, they also induce individuals to increase effort intensity; i.e., they work harder within the confines of their extant learning (Seijts and Latham 2006). Therefore, the decreased learning engendered by the presence of a performance goal may be at least partially offset by the increased performance-directed effort induced by a performance goal. I therefore make a null prediction with respect to the effect of performance goals on performance.

My remaining predictions relate to the effects of combining learning and performance goals. I predict that when learning and performance goals are assigned simultaneously, the presence of a performance goal will impede the learning process and thus lead to less learning than a learning goal in isolation. As with a performance goal in isolation, the decreased learning engendered by a performance goal may be at least partially offset by the increase in performance-directed effort engendered by a performance goal. I therefore make a null prediction with respect to the effect of learning and performance goals combined simultaneously on performance compared to learning goals alone. However, theory suggests learning goals and performance goals can be effectively combined to increase performance. I predict that assigning learning goals initially and then assigning performance goals after significant learning has already taken place will lead to higher performance than learning goals alone. I expect this temporal separation of goal assignment will leverage the benefits of learning goals by allowing individuals to learn more quickly and completely than would be possible without a learning goal and will also leverage the benefits of performance goals by inducing individuals to apply what they learn to a greater extent than they would without a performance goal. As such, I predict that sequential introduction of learning and performance goals will allow organizations to reap the attendant benefits of both goal types.

I test my predictions using a lab experiment in which participants are paid a fixed wage to perform a complex letter search task modified from Webb et al. (2013) and are randomly assigned to one of four conditions that use learning and performance goals either in isolation or in combination: (1) a learning goal assigned in isolation, (2) a performance goal assigned in isolation, (3) both goal types assigned simultaneously, or (4) a learning goal and a performance goal assigned sequentially such that a learning goal is assigned first followed by assigning a performance goal once learning is substantially completed. In the letter search task, participants receive several pages of boxes of letters (18 columns X 7 rows) and, for each box, record the number of times a given search letter appears. Participants can search for the correct answer either by following a conventional task approach, counting the number of times a letter appears in a box, or they can learn 'shortcuts' that allow them to more efficiently determine how many times a letter appears without counting. Shortcut discovery is complex because it requires understanding difficult patterns between boxes across pages, between boxes on the same page, and within boxes (Wood 1986). Learning is measured as the number of shortcuts discovered and performance is measured as the number of correct answers entered.

Consistent with my first prediction, I find that individuals assigned only a learning goal discover more shortcuts than individuals assigned only a performance goal. However, in keeping with my second prediction this additional learning does not translate into higher performance relative to individuals assigned a performance goal. This indicates that participants assigned a performance goal were able to offset their decreased learning with increased performance-directed effort intensity and suggests that performance goals may be acceptable substitutes for learning goals in some settings, even when learning is a critical determinant of performance.

Inconsistent with my third prediction, I fail to detect any impairment in shortcut discovery due to the presence of a performance goal when learning and performance goals are paired simultaneously. I further find that contrary to my fourth hypothesis, when combining the two goal types simultaneously, overall performance is improved relative to a learning goal alone. These findings are in stark contrast to extant literature, which suggests that performance goals will per se interfere with learning even when paired with a learning goal (e.g., Seijts and Latham 2001, 2005; Winters and Latham 1996). It is worth noting that this assertion has never been explicitly tested in the prior literature as far as I am aware. I believe this finding may partially explain why firms continue to use performance goals when learning is important even though extant academic research recommends foregoing performance goals in such settings (see for example Seijts and Latham 2001, 2005). Finally, consistent with my last hypothesis, I find that introducing learning and performance goals sequentially leads to better performance than assigning a learning goal only.

My study contributes to a considerable body of research on goal setting in accounting, management, and psychology by examining an important gap in the extant literature. Despite its practical applicability, prior research has not examined the joint effects of learning and performance goals relative to the two goal types in isolation. This gap in the extant literature is important to address because it limits the ability of accounting research to speak to settings in which opportunities for performance-enhancing learning exist.

I first replicate prior research by demonstrating that learning goals alone lead to increased learning relative to performance goals alone in a complex task environment. Additionally, I demonstrate that performance goals interfere with the learning process despite the fact that individuals assigned a performance goal spent roughly the same amount of time trying to learn as participants assigned a performance goal. Although prior research has already identified mechanisms other than effort direction through which performance goals can interfere with learning, mine is the only study I am aware of to explicitly rule out effort direction as the sole explanation for differences in learning outcomes between learning goals and performance goals.

I additionally find that, in my setting, individuals assigned a performance goal alone are able to offset their decreased learning with increased effort intensity such that overall their performance does not suffer. This is a novel finding that comes as a consequence of the setting that I operationalize to study combined goals. Prior research comparing learning goals to performance goals typically operationalizes settings for which learning predicts performance but the impact of performance directed effort intensity is eliminated through experimental design.

In order to study the joint effects of learning and performance goals, I examine a setting in which both learning and performance directed effort intensity can positively influence performance. This is because learning is the chief consequence of learning goals and performance directed effort intensity is the chief consequence of performance goals. To properly examine the joint effects of combined goal types I needed to operationalize a setting for which both of those mechanisms are able to influence performance. My results therefore suggest a previously unexplored environmental factor that moderates the primacy of learning goals over performance goals for settings in which learning is a critical determinant of performance. That is, even when learning is an important determinant of performance, performance goals may still be viable if working harder can compensate for less learning.

I also demonstrate that learning goals can be used either simultaneously or sequentially with performance goals to achieve superior performance by encouraging learning while also inducing individuals to employ what they learn to enhance performance. My findings are particularly important for firms that focus on learning and rely on continual process improvement as part of their ongoing business strategy; e.g., Toyota (Liker and Meier 2006). More generally, my results are applicable to any organization that must balance the dual objectives of encouraging learning and maintaining high levels of performance.

The next chapter provides a review of the extant goal setting theory literature, the learning literature, and the task complexity literature. Chapter 3 develops my hypotheses. Chapter 4 describes the experimental task setting I use to test my hypotheses. Chapter 5 discusses the results of my experiment and tests my hypotheses. Chapter 6 discusses the limitations and implications of my study and provides concluding remarks.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this chapter, I use the existing accounting and psychology literature to examine the relationships among goal setting, performance, learning, and task complexity. This chapter is organized as follows. In section 2.2, I provide a broad overview of goal setting theory. In section 2.3 I discuss learning as a construct. In section 2.4 I introduce task complexity as a construct and discuss its relationship to goal setting. This chapter concludes with section 2.5.

2.2 Goal Setting Theory

In this section, I define goals and describe necessary conditions for goals to be effective drivers of performance. I explore various mechanisms through which goal setting operates as well as moderators of the efficacy of goal setting. I also discuss relevant literature on learning and performance goals. These two goal types are central to my research.

2.2.1 An Overview of Goal Setting

Goals, which are defined as the “aim or end of an action” (Locke and Latham, 1990 p. 7), have consistently been demonstrated to positively affect performance in both lab and organizational settings (Latham and Locke 2007; Locke and Latham 1990; Locke and Latham 2002). An example of a goal that could be assigned in an organizational setting is to generate $500 in sales for the day. Furthermore, when controlling for difficulty, goal setting induced performance gains persist irrespective of the method used for setting goals: assigned, self-set, or participatively set (Latham et al. 1988; Latham and Frayne 1989, Latham et al. 1982).[1] Performance gains from goal setting are also stable across cultures and countries (Latham and Locke 2007; Locke and Latham 2002) and are effective over both short- and long-term horizons (Latham and Baldes 1975; Latham and Locke 2007; Locke and Latham, 1990).

In order to be effective, goals generally must satisfy three conditions. A goal must be appropriately difficult, specific, and goal type must be matched to the task (Locke and Latham, 2007). An appropriately difficult goal is one that cannot be easily attained but that still falls within the limits of an individual's ability. This ability qualifier is important because goal difficulty has a positive linear relationship with performance only within the confines of an individual's ability (Locke and Latham 1990, 2002). Prior research suggests that goals induce the highest levels of effort when they are difficult and induce the lowest levels of effort when they are either very easy or very hard (Locke and Latham 2002). Goals that are too easy limit total effort because goal attainment serves as an inflection point for satisfaction so when individuals meet their goal they suffer decreased motivation from that point forward (Locke and Latham 2002). Conversely, goals that are too difficult also yield low effort, but this is mediated through expectancy. That is, when a goal is so difficult that is likely unattainable, individuals will not be motivated.

Goal specificity is also important as it acts to reduce outcome variance by reducing ambiguity about what is to be attained (Locke and Latham 1990, 2002). An example of a goal that lacks specificity is "produce a lot of units" whereas a specific goal may be to "produce 15

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[1] Assigned goals refers to a superior determining the appropriate goal for a subordinate. Self-set goals are when individuals are allowed to self-determine the appropriate goal. Participatively set goals refers to a hybrid goal setting method in which superiors determine the appropriate goal with input from their subordinate (Locke and Latham 1990).

units.” In the first case individuals can substitute reinterpreting the goal condition for effort and therefore goal ambiguity typically leads to decreased effort and thus lower performance.

The final condition necessary for goals to be effective is that goal type must be matched to the individual as well as to the type of task. For example, for individuals who are already sufficiently expert or tasks that are highly routine, goals aimed primarily at increasing effort intensity and/or duration are most appropriate. Conversely, for individuals who are still learning or for tasks that are novel and not yet mastered goals that focus on knowledge and skill acquisition and/or strategy development may be more appropriate. This concept is central to my research and will be discussed at length in subsection 2.2.4.

Once these three conditions are met, goals can be a useful tool in helping individuals to reach desired end states. There are multiple possible mechanisms through which goals may function. Additionally, there are several potential moderating variables of goal setting. The mediators and moderators of goal setting theory will be discussed in the next two subsections.

2.2.2 Mediating Mechanisms of Goal Setting

The high-performance cycle (see for example Latham and Locke 2007; Locke and Latham 2002) is a conceptual model that attempts to explain how challenging goals can lead to high performance. It identifies four key mechanisms through which the effects of goal setting are mediated. These mechanisms, as described in the high-performance cycle depicted in Figure 1, are (1) direction, (2) persistence, (3) effort, and (4) task specific strategies. Although the terminology used in the psychology literature differs from the accounting literature, these four mechanisms mirror the four components of effort outlined in Bonner and Sprinkle (2002); i.e., direction, duration, intensity, and strategy development. In other words, the effects of goal setting on performance are mediated primarily through the four components of effort.[2] As this paper is intended primarily for an accounting audience, I adopt the terminology used in Bonner and Sprinkle (2002) and discuss the relationship between goal setting and each effort component in turn.

"Effort direction refers to the task or activity in which an individual chooses to engage" (Bonner and Sprinkle 2002 p. 306). Goals acts as a determinant of effort direction because individuals alter their behavior and shift their attentional resources away from tasks and activities that are unlikely to lead to goal attainment toward tasks and activities that are likely to lead to goal attainment (Locke and Latham 1990, 2002). Effort direction is particularly important in multi-task environments where different tasks generate differential value for individuals or their firms.

"Effort duration refers to the length of time an individual devotes cognitive and physical resources to a particular task or activity" (Bonner and Sprinkle 2002 p. 306). Goals increase effort duration by providing individuals a benchmark for success as well as a goal post for when it is acceptable to discontinue effort; i.e., once the goal has been attained (Latham and Locke 2007; Locke and Latham 1990, 2002). Goals are so effective at prolonging effort duration that prior research in psychology demonstrates that many individuals suffer negative emotional and physical health consequences that stem from an insufficient ability to disengage from goals that they do not properly recognize as unattainable (Wrosch et al. 2007).

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[2] It should be noted that the psychology literature is not entirely consistent in its usage of terminology in this respect. For example, Locke and Latham (2002) use the terms "direction," "persistence," "effort" and "task specific strategies" but Latham and Locke (1991) employ the terms "direction," "duration," and "intensity" consistent with the terminology used in the accounting literature.

Effort intensity refers to the proportion of an individual's cognitive and physical resources that are directed toward performing a task (Bonner and Sprinkle 2002). Individuals increase effort intensity in response to a goal because doing so increases the likelihood of goal attainment and increased satisfaction is inherent in goal attainment. Satisfaction is inherent in goal attainment because, in addition to being an outcome to aim for, goals are a standard for judging satisfaction (Locke and Latham 2002). Locke and Latham (2002 p. 708-709) assert that for any given goal "exceeding the goal provides increasing satisfaction as the positive discrepancy grows, and not reaching the goal creates increasing dissatisfaction as the negative discrepancy grows." Therefore, it is natural that individuals increase effort intensity in response to a goal in order to pursue satisfaction as well as to eschew the dissatisfaction inherent in not attaining the goal.

The final component of effort affected by goal setting is strategy development. Strategy development is learning aimed at improving task performance and consists of "conscious problem solving, planning, or innovation on the part of the person performing the task" (Bonner and Sprinkle 2002 p. 307). Strategy development is particularly important when the relationship between effort or other inputs and final outcomes is poorly understood. In these instances systematically analyzing the relationship between inputs and outputs and generating an appropriate strategy from the resultant data may be the only way to perform at a high level.

Goal setting frequently leads to strategy development as a consequence of the self-regulatory mechanisms induced by goals. When an individual has a goal and receives feedback concerning their performance in relation to their goal it causes them to engage in self-regulation (Latham and Locke 1991; Williams et al. 2000). In other words when an individual receives feedback they evaluate their progress toward goal attainment. To the extent that feedback indicates that their progress is unsatisfactory, individuals may be induced to reevaluate their inputs and engage in strategy development (Williams et al. 2000). Additionally, goals can lead to strategy development by explicitly incorporating strategy development as part of the goal. For example, a salesperson could be assigned a goal to identify three new markets in which to sell an existing product. This concept is central to my research and will be discussed at length in subsection 2.2.4.

2.2.3 Moderators of Goal Setting

In addition to enumerating several important mediators of the effects of goal setting, the high-performance cycle also identifies important moderators of the effects of goal setting. The moderators listed in the high-performance cycle are ability, goal commitment, feedback, self-efficacy, situational constraints, and task complexity (Latham and Locke 2007; Locke and Latham 2002). I will discuss in turn how each of these act as moderators.

Ability is a moderator of goal setting in that goal difficulty has a positive linear relationship with performance only within the confines of an individual's ability (Locke and Latham 1990, 2002). When goals are too easy relative to an individual's ability, little satisfaction is derived from high achievement as the goal itself serves as an inflection point for satisfaction. That is individuals experience dissatisfaction that increases with discrepancy when failing to meet a goal as well as satisfaction that increases with discrepancy when attaining a goal. However, these gains are marginally diminishing so the low inflection point inherent in an easy goal leads to lower overall effort and therefore lower overall performance (Latham and Locke 2007). When goals are too difficult relative to an individual's ability this also decreases effort and performance but via a different mechanism. When goals are too difficult, expectancy is low which can lead to procrastination or goal abandonment (Locke and Latham, 1990, 2002). This effect can be understood within the framework of Vroom's (1964) valence-instrumentality-expectancy theory which states that force to act is a multiplicative combination of valence, instrumentality, and expectancy.[3] In either case of too easy or too difficult goals, a goal that is not properly calibrated to an individual's ability is likely to engender low goal commitment, which is the next important moderator of goal setting.

Goal commitment is an individual's "determination to try for a goal (or to keep trying for a goal)" (Locke et al. 1981 p. 143) and is an important antecedent of goal attainment (Hollenbeck and Klein 1987; Locke et al. 1988; Locke and Latham 2002). Commitment to a goal is necessary to observe its positive effects because if an individual is not committed to a goal then that goal will not induce any greater effort or change in behavior relative to no goal at all (Locke, Latham, and Erez 1988). Goal commitment can be influenced by several factors including authority of the individual assigning the goal, peer group influence, external rewards and incentives, participation in the goal setting process, expectancy, self-efficacy, and internal rewards (Locke et al. 1988).

In order for goals to be effective, individuals generally require summary feedback that reveals their progress in relation to the goal (Locke and Latham 1990, 2002). Feedback is a moderating mechanism because goals induce a self-regulatory process in which individuals compare their progress toward their goal to some benchmark. To the extent that expectations differ from reality, individuals either increase effort or try a new strategy to achieve their goal

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[3] In Vroom's (1964) theory, valence refers to anticipated satisfaction, instrumentality is the belief that performance will lead to rewards, and expectancy is the belief that effort will lead to the performance needed to attain rewards.

(Latham and Locke 2007).[4] Feedback may therefore be especially important when many possible strategies exist and the effort-performance relationship of any given strategy is unclear *ex ante*.

Self-efficacy, which is defined in the goal setting literature as task-specific confidence, also moderates the effects of goal setting (Locke and Latham 2012). If an individual's self-efficacy is low this will lead to low goal commitment, which in turn lessens the positive goal-performance relationship. Conversely, if self-efficacy is high this will lead to high goal commitment, which strengthens the positive goal-performance relationship.[5] Self-efficacy can also impact the goal-performance relationship indirectly when goals are participatively or self-set. Individuals with low self-efficacy may self-select easier goals (Bandura, 1977). Because the relationship between goal difficulty and performance is generally positive, this negatively impacts performance. It is further worth noting, that when goals are either assigned or set participatively, the existence of the goal can positively influence self-efficacy as the goal acts as a signal about the goal assignor's belief in the assignee's ability to perform (Bandura 1977)

The next moderator of the effects of goal setting is situational constraints. Situational constraints moderate goal effectiveness by influencing the link between effort and performance (Latham and Locke 2007). For example, resource constraints may impose a limit on performance as is the case in raw materials limiting production. In that setting, a production goal would only be effective to the extent that the raw materials necessary for production remained available.

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[4] Although feedback is important because it enables individuals to assess and evaluate their goal-related task strategies, whether or not feedback will help or harm goal attainment is context and person specific. In particular, negative feedback may reduce expectancy, commitment, and effort and therefore lead to worse outcomes than no feedback at all.

[5] Self-efficacy as used in the psychology literature primarily refers to Bandura's (1977) social cognitive theory. Self-efficacy is influenced by four information sources—performance accomplishments, vicarious experience, verbal persuasion, and physiological information—as well as internal personal factors and external environmental factors (van der Bijl and Shortridge-Baggett (2001).

The final moderator of goal setting listed in the high performance cycle, is task complexity. Task complexity is "the amount of processing or attention required by a task, or amount of structure or clarity provided by a task," (Bonner and Sprinkle 2002, p. 319). Task complexity is an important moderator of goal setting and Bonner and Sprinkle (2002 p. 319) refer to task complexity as "one of the most important determinants of performance in accounting settings." Therefore, I will discuss task complexity as a moderator at length in subsection 2.3.2.

2.2.4 Goal Types

Matching goal type to the task or activity being performed is one of the core components of effective goal setting (Latham and Locke 2007; Locke and Latham 2002). The psychology literature contains examples of many different goal types, but the two most important types for purposes of this research are performance goals and learning goals.[6]

Performance goals are aimed at performance outcomes and are typically based on objective measures of performance. For example, a salesperson can set a performance goal to make at least 10 sales per week. Performance goals have been studied extensively by accounting researchers and have been shown to positively affect performance (e.g., Chen et al. 2017; Kelly et al. 2015; Presslee et al. 2013; Webb et al. 2010; Webb et al. 2013). Performance goals lead to higher performance by inducing individuals to use the knowledge, skills, and strategies they have already acquired in a manner that enhances their performance to meet the goal (Locke and Latham 1990; Seijts and Latham, 2005; Webb, et al. 2013). Performance goals are therefore most

[6] The mediators and moderators discussed earlier have been tested most extensively with performance goals. However, learning goals operate through the same mediating mechanisms and share the same moderators as performance goals.

appropriate when individuals already possess the knowledge, skills, and strategies necessary to perform at a high level.

When individuals still need to acquire these knowledge, skills, or strategies, performance goals may be maladaptive (Kanfer and Ackerman 1989; Kanfer et al. 1994). Prior research demonstrates that performance goals interfere with mastering new tasks and learning new skills for tasks in which individuals have not yet developed the necessary skills to perform effectively (Kanfer and Ackerman 1989; Locke and Latham 1990, 2002; Seijts and Latham 2005, 2006; Winters and Latham 1996). One example of performance goals impairing learning can be found in Mone and Shalley (1995). The authors examine two versions of a human resources staffing simulation, a low complexity version and a high complexity version. In the high complexity version of the task, learning is required in order to perform well. For the complex version of the task, participants assigned performance goals are outperformed by participants instructed simply to "do your best."[7] The authors attribute this finding to participants in the "do your best" condition systematically searching for effective task strategies, which in turn increased performance. In other words, participants with performance goals were unable or unwilling to systematically search for effective task strategies to the same extent as those who did not have performance goals.

As a result of Mone and Shalley's (1995) study as well as many similar studies, the consensus in the extant literature is that until individuals acquire the necessary knowledge or

[7] Goal specificity was manipulated as follows. In the simple version of the task, participants were asked to do their best to make as many hiring decisions as possible in the do your best condition or were asked to make at least 24 hiring decisions in the performance goal condition. For the complex version of the task the do your best condition asked participants to make as many hiring salary and placement decisions as they could and the performance goal condition asked participants to make 17 hiring, salary, and placement decisions.

skills to perform at a high level, learning goals are superior to performance goals (Locke and Latham 1990, 2002; Seijts and Latham 2001; Winters and Latham 1996). Learning goals, in contrast to performance goals, focus on motivating the acquisition of the knowledge and skills necessary for effective task performance as well as developing effective task strategies (Locke and Latham 1990; Seijts and Latham 2005). For example, a salesperson can set a goal to learn a new sales technique each month. Unlike performance goals, I am unaware of any studies in accounting that examine learning goals. Outside of the accounting literature, learning goals have been studied, but less extensively than performance goals. Although many goal setting studies have been conducted in both laboratory and organizational settings (Latham and Locke 2007; Locke and Latham 2002; Seijts et al. 2013) relatively few of these studies have examined learning goals (Latham, 2012).

The reason that learning goals are advisable in situations where learning is still required is that prior research concludes that performance goals interfere with the learning process (Kanfer and Ackerman 1989; Locke and Latham 1990, 2002; Seijts and Latham 2005, 2006; Winters and Latham 1996). One important mechanism through which performance goals interfere with learning is that they strain the cognitive resources required for learning to take place (Kanfer and Ackerman 1989; Kanfer et al. 1994; Masuda et al. 2015).[8] However, the assertion that performance goals interfere with learning may be too broad. Extant research demonstrates the efficacy of learning goals relative to performance goals, but, by only comparing the two goal types in isolation, does so in a manner that precludes the possible joint effects of combining the two goal types. Thus, it is unclear whether or not performance goals still impede

[8] Performance goals also interfere with learning by simply directing effort away from learning and toward trying to perform the task at a high level within the confines of existing knowledge, skills, and task strategies.

learning in the presence of a learning goal. To date, I am aware of only a few studies that assign both learning and performance goals to each participant (see for example Masuda et al. 2015; Miron-Spektor and Beenen 2015).

Masuda et al. (2015) combine both learning and performance goals by assigning each participant both goal types simultaneously. The difficulty of each goal assigned is also varied across conditions. The findings of Masuda et al. (2015) are inconsistent with the assertion that the mere presence of a performance goal necessarily harms performance. The authors find an inverted U-shaped relationship between total goal difficulty and performance. The decline in performance beyond a certain level of difficulty is consistent with the assertion that heavily taxing cognitive resources when learning will impair performance (see for example Kanfer and Ackerman 1989; Kanfer et al. 1994). However, the authors find neither a main effect nor an interaction effect of goal type on performance. That is, only total goal difficulty mattered, irrespective of whether difficulty related to a learning goal or to a performance goal. This suggests, in contrast with prior literature, that the mere presence of a performance goal may not hinder performance even in situations where individuals are still learning how to perform the task.

One feature not present in the design of any study to date, of which I am aware, is separate conditions contrasting each goal type in isolation to a combination of the two goal types. For example, the Masuda et al. (2015) study has neither a condition in which participants are assigned only learning goals nor a condition in which participants are assigned only performance goals. As a result, although their findings suggest that the presence of a performance goal does not necessarily interfere with learning, Masuda et al. (2015) cannot definitively speak to the efficacy of combining goal types relative to either goal type in isolation. Whether or not the mere presence of a performance goal interferes with learning is an empirical question.

2.3 Learning

Learning is central to this study and an important part of the theories I rely on to inform my hypotheses. As such, it is prudent to discuss learning in depth as a construct. Learning is important in a wide variety of applied settings and is studied across a broad cross section of academic disciplines such as psychology, organizational behavior, education, economics, medicine, and accounting. As a result, terminology related to learning is frequently used imprecisely and inconsistently both within and between academic disciplines (Cassidy 2004). To the extent possible, my usage of the term learning is consistent with its common usage in the accounting and psychology literatures. However, I am unaware of research in any discipline which rigorously and systematically defines learning as a construct. Various aspects of learning such as learning agility or learning styles have been defined and discussed in the extant literature at great length (see for example Akande et al. 2016; De Meuse 2017; Sadler-Smith 1997; Smith 2015; Wintergerst 2001), but I have not observed the construct of learning itself explicitly defined.

For purposes of this paper, I define learning as the acquisition of new knowledge, skills, or strategies. This conceptualization of learning is consistent with learning as it is used in the learning goal literature (e.g., Seijts and Latham 2005). This definition is not likely to cover comprehensibly every facet of learning examined in every academic discipline, but I believe it is consistent with the term's usage in accounting and related disciplines. Learning, as I have defined it, is important in applied settings. Firms actively seek out capable learners and Delaney

(2013) refers to the learning agility (i.e., the ability to learn quickly) as the most in demand business skill of the 21st century. However, in addition to recruiting capable learners, firms should actively encourage and facilitate learning and doing so falls within the purview of the management control system. In fact, Atkinson (1997) asserts that facilitating learning is a fundamental objective of managerial accounting systems.

2.3.1 Learning and Implicit Theories of Intelligence

Although intelligence does predict learning outcomes, implicit beliefs about intelligence also predict learning outcomes across levels of intelligence. Most individuals subscribe either implicitly or explicitly to one of two theories of intelligence: entity theory or incremental theory both of which are depicted in Figure 2 (Dweck 1986; Dweck and Leggett 1988).[9] Under entity theory, individuals view intelligence as fixed. Individuals who view intelligence in this manner tend to naturally orient themselves toward performance goals and use these goals as an opportunity to demonstrate competence. Any negative feedback or failure to meet a goal is potentially a reflection of low intelligence for an entity theorist. As such, when self-efficacy is low entity theorists will avoid challenging goals and abandon difficult goals readily in order to preserve their self-image.

In contrast to entity theorists, individuals who subscribe to incremental theory believe that intelligence is malleable; i.e., the brain, like muscles, can be strengthened through concerted effort. Incremental theorists naturally orient themselves toward learning goals and see their goals as opportunities to increase competence (Dweck 1986; Dweck and Leggett 1988). As such, entity theorists seek out challenging learning goals and are not readily deterred by negative

[9] Intelligence, as used by Dweck (1986) and Dweck and Leggett (1988), is synonymous with cognitive ability.

feedback or failure to attain goals and are likely to tenaciously pursue their goals irrespective of whether their initial self-efficacy is high or low.

I am unaware of any research that has definitively determined to what extent intelligence is either fixed or malleable. However, several studies have empirically demonstrated that, even after for controlling for ability, individual beliefs about intelligence predict both learning and academic performance. That is, individuals who believe intelligence is malleable learn more and do better academically (Dweck 1986; Dweck and Leggett 1988; Eison 1982). This is important because the relationship between goal type and beliefs about intelligence is reciprocal (Zimmerman 1989, 1990). In other words, assigning a performance goal may lead individuals toward an entity theorist conceptualization of their own intelligence. This is significant because this belief about intelligence is maladaptive with respect to learning. Furthermore, assigning a learning goal may lead individuals toward an incremental theorist conceptualization of their own intelligence, which is well suited to learning. As such, individuals assigned a learning goal will behave more like incremental theorists; i.e., they will not be easily deterred by negative feedback and will tenaciously pursue their learning goal in the name of mastery.

2.4 Task Complexity

When goal-setting research examines the effects of learning goals, it is typically in the context of a complex task environment (Seijts and Latham 2005). This is at least in part because the extent of possible learning frequently scales positively with task complexity. Furthermore, Bonner and Sprinkle (2002 p. 319) call task complexity “one of the most important determinants of performance in accounting settings.” Therefore, the next subsection will define and discuss task complexity as a construct. The following subsection will review the relevant literature on task complexity as a moderator of goal setting.

2.4.1 Defining and Discussing the Construct

Task complexity is defined in the accounting literature as "the amount of processing or attention required by a task, or the amount of structure or clarity provided by a task," (Bonner and Sprinkle 2002, p. 319). Wood (1986) outlines three types of task complexity: component complexity, coordinative complexity, and dynamic complexity. Component complexity refers to the number of distinct acts executed and the number of information cues to be processed in order to perform the task. Coordinative complexity refers to the nature of the relationships between task inputs and task products. For example, an ice cream store may see a large boost in sales from putting an employee in front of the store to hand out coupons on a hot day but see little or no effect of handing out coupons on a cold day. In this case, the relationship between the input, handing out coupons, and the output, sales, changes depending on the temperature. This is an example of coordinative complexity. The form and strength of the relationships between information cues, acts, and products, as well as the sequencing of inputs are all aspects of coordinative complexity. Dynamic complexity is the extent to which component and coordinative complexity change over time.

Task complexity varies widely in applied settings (Berger 2017). There can even be considerable variation within a single job. For example, a waiter's task of taking orders is low complexity when patrons order from the menu but grows increasingly complex as patrons demand more specialization; e.g., substituting fries for a baked potato, asking for sour cream on the side, etc.

2.4.2 Task Complexity as a Moderator of the Goal-Performance Relationship

Task complexity is an important moderator of many of the empirical findings of goal setting theory (Latham and Locke 2007; Seijts and Latham 2005). The positive goal difficulty-performance link, which is well documented in the extant literature, grows weaker as task complexity increases. For example, a meta-analysis of 125 goal-setting studies (Wood et al. 1987) finds that the magnitude of effects for both goal specificity and difficulty are more pronounced for simple tasks than for complex tasks. Variability in task complexity is of interest because task complexity can affect the relationship between goals and performance (Wood and Bandura, 1989), the effort directed toward strategy development (Bonner and Sprinkle, 2002), and the relationship between effort and performance (Bonner and Sprinkle, 2002). As such, task complexity is considered one of the most important determinants of performance in accounting studies (Bonner, 1994; Bonner and Sprinkle, 2002).

2.5 Conclusion

This chapter reviewed the relevant psychology and accounting research that examines the relationships among goals, learning, and performance. Furthermore, this chapter defines and discusses learning as a construct. This chapter further reviewed research examining task complexity as a moderator of the goal-performance relationship. Overall, the literature suggests that for a complex task in which some learning is required to perform at a high level, the assignment of learning goals leads to better outcomes than the assignment of performance goals. However, there is no clear consensus in the extant literature on if or how performance goals can be used to supplement learning goals in these settings. Some research suggests that the mere presence of a performance goal will be harmful as it will interfere with the learning process

(Kanfer and Ackerman 1989; Seijts and Latham, 2005, 2006; Winters and Latham 1996). Still other research suggests that when a learning goal is present the mere presence of a performance goal may or may not be enough to interfere with the learning process (Masuda et al. 2015). This issue will be examined in greater detail in Chapter 3 in developing my hypotheses.

CHAPTER 3: DEVELOPMENT OF HYPOTHESES

3.1 Introduction

In this chapter I use goal-setting theory to develop hypotheses about individual behavior in response to the assignment of learning and performance goals both separately and together. It is unclear from the prior research reviewed in the previous chapter what value, if any, there may be in combining learning and performance goals. However, using the two goal types together may produce some synergies. Indeed, several researchers have called for research on combining learning and performance goals (Latham and Locke 2007; Locke and Latham 2002; Seijts et al. 2013), but to date little work has been done in this area.

One possible reason for the lack of research being done on combining the two goal types is that the two goal types are generally most effective for different types of tasks. For a low complexity task, assigning learning goals would be atypical as opportunities to enhance performance via learning tend to scale with task complexity. Conversely, for a high complexity task, extant research suggests that performance goals may harm performance. As a result, there is a gap in the extant literature with respect to examining the two goal types together.

To understand why learning goals might be combined with performance goals to improve performance, some of the mechanisms through which each goal type leads to increased performance need to be identified. One of the primary mechanisms that mediates the performance outcomes of learning goals is increased learning via directing effort toward learning activities (Noel and Latham 2006; Seijts and Latham 2011). Learning can manifest in several ways including acquiring new knowledge, skills, or strategies. A learning goal affects effort direction such that individuals' efforts are directed away from performing the task using existing skills, knowledge, or strategies and toward one or more forms of learning (Seijts and Latham 2005). By contrast, performance goals lead to improved performance by directing effort toward the application of previously learned knowledge, skills, and strategies. That is, performance goals induce greater effort within the scope of an individual's extant knowledge and skills (Seijts and Latham 2005). As a result, individuals pursuing only a performance goal will spend relatively less time attempting to learn new knowledge or skills.

The different mechanisms through which learning and performance goals operate will be differentially effective based on the characteristics of the task and the environment in which an individual is operating. It follows that findings relating to the efficacy of the two goal types, either jointly or in isolation may not be informative for dissimilar settings. I therefore discuss important features of my setting in the next following subsection.

3.2 Setting Features

My setting is a complex task environment where learning has high payoffs with respect to performance and performance is relatively insensitive to simple increases in effort intensity without first engaging in learning. Although the impact of learning on performance will vary in practice, I chose this setting because, on average, simply increasing effort becomes less effective as task complexity increases (Bonner and Sprinkle 2002) and I wish to generalize my theory to complex task environments. Additionally, I believe it is important to examine a complex task environment because complexity is a common feature in organizational settings. Indeed, complexity is so common in organizational settings that in a global survey of executives conducted by KPMG, 94% of respondents identified business complexities as their greatest challenge (KPMG 2011). Furthermore, in my setting learning takes time to occur and there is a trade-off between focusing on learning and focusing on short-term performance. Directing attentional resources and effort toward learning means that individuals are unable to focus as intensely on traditional task performance. I believe this design choice is representative of many applied settings where time and attention are finite resources.

I assign challenging yet attainable goals where goal attainment is decoupled from financial incentives. A challenging yet attainable goal is one that an individual can attain if she works at or near the limits of her ability but that she will fail to attain otherwise. Challenging but attainable goals are recommended in the extant literature as they induce the greatest levels of effort (e.g., Locke and Latham 2002). Challenging yet attainable goals are preferable because, as discussed previously, goals that are too easy do not require as much effort to attain and thus induce less effort and goals that are too difficult may be seen as futile and therefore also do not induce as much effort as challenging but attainable goals.

Decoupling goal attainment from financial incentives means that individuals are paid the same irrespective of whether they attain their goals or not. I decouple goals from financial incentives because prior research yields mixed results with respect to the effects of incentives on learning and performance in settings where learning is closely linked to performance (Sprinkle 2002). Given the dearth of literature on the joint effects of learning and performance goals, I believe that exploring the potential effects of financial incentives is best left to future research.[10]

[10] This feature of the setting provides a stringent test of theory because decoupling financial incentives from goal attainment will likely lead to lower goal commitment. However, it also limits my ability to generalize my theory to settings for which it is important to link goal attainment to financial rewards; e.g., settings where goal commitment is too low absent an extrinsic motivator tied to goal achievement.

3.3 Learning and Performance Goals in Isolation

Prior research demonstrates that assigning a learning goal induces individuals to learn more by directing their effort away from short-term task performance toward learning (Seijts and Latham 2005, 2006; Seijts et al. 2013). In contrast, assigning performance goals for complex tasks requiring learning can be counter-productive as performance goals direct effort away from learning toward short-term task performance. Performance goals can further harm learning even if effort is directed at learning by taxing the cognitive resources required for that effort to be effective (Kanfer and Ackerman 1989; Seijts and Latham 2005). In fact, assigning only performance goals for a complex task has been shown to result in less learning and worse performance outcomes than simply instructing individuals to do their best regarding performance outcomes either with or without also assigning them learning goals (Kanfer and Ackerman 1989; Locke and Latham 1990, 2002; Seijts and Latham 2001; Winters and Latham 1996). I therefore predict that assigning learning goals alone and instructing individuals to do their best regarding performance outcomes will direct effort and attentional resources away from short-term performance and toward learning compared to assigning performance goals alone. I predict this shift in effort direction and attentional resources will yield more learning

Learning and performance goals may also induce different implicit conceptualizations of intelligence. Learning goals tend to induce an incremental theory conceptualization of intelligence which is mastery oriented and resilient to negative feedback. Performance goals tend to induce an entity theory conceptualization of intelligence which is not resilient to negative feedback. As a result, individuals assigned a performance goal may more readily abandon their attempts to learn. Just as the shift in attentional resources induced by a performance goal harms learning when a performance goal is assigned, I expect the different beliefs about implicit intelligence induced by the two goal types to lead to increased learning with a learning goal relative to a performance goal. I therefore state my first hypothesis as follows:

> **H1:** Individuals assigned only a learning goal will learn more than individuals assigned only a performance goal.

In addition to affecting learning, I also expect the presence of a learning goal to influence performance indirectly through learning. Performance in a complex task environment is generally insensitive to simply exerting more effort as individuals need to first engage in learning activities in order to perform at a high level. Bonner and Sprinkle (2002 p. 320) note this phenomenon by stating that, "task complexity can attenuate the effects of effort on performance because increases in task complexity lead to increases in skill requirements." Learning reduces this problem as individuals acquire knowledge, skills, or strategies that are better suited to the task.

In the short-term, it is unclear what the net effect of a learning goal will be on performance. Any learning that takes place as a result of a learning goal should increase performance but, in the short-term, these performance gains will be at least partially offset by the fact that individuals are directing effort away from traditional task performance in order to facilitate learning. As such, it is reasonable to expect that performance gains from learning will be realized primarily in the long- rather than short-term.

Even in the long-term, it is possible for the increased effort intensity associated with a performance goal to enhance performance more than learning does. However, although individuals assigned only learning goals are unlikely to increase effort intensity with respect to performance outcomes to the same extent individuals assigned a performance goal will, they may still be motivated to perform well by a baseline level of intrinsic motivation.[11] This is consistent with Webb et al. (2013), who find that individuals continue to perform at a high level even in the absence of rewards contingent on goal attainment. Therefore, because assigning a performance goal will have competing effects on performance I state my prediction in the null form as follows:

> **H2:** Individuals assigned only a learning goal will perform no differently in the long-term than individuals assigned only a performance goal.

3.4 Combining Learning and Performance Goals

If learning goals lead to increased learning and performance simply because they direct effort toward learning by signaling the relative importance of learning, then a performance goal would not necessarily harm learning or performance when a learning goal is also present. In this case, performance goals may even lead to more learning as learning goals direct effort toward learning and performance goals motivate higher effort intensity with respect to performance outcomes. However, the negative effects of performance goals on learning may persist despite the presence of a learning goal when learning and performance goals are combined.

Prior research suggests that the negative effects of performance goals on learning are the result of performance goals taxing the cognitive resources necessary to learn (Kanfer and Ackerman 1989; Kanfer et al. 1994; Masuda et al. 2015). Cognitive overload theory provides some insight with respect to why heavily taxing cognitive resources impedes an individual's ability to learn. According to cognitive overload theory, although individuals are capable of

[11] Intrinsic motivation is inherently autonomous motivation stemming from an individual's unprompted interest and enjoyment of the task (Gagné and Deci 2005).

storing large amounts of information in long-term memory, that information must first be processed in the significantly more limited working memory (Paas et al. 2010; Sweller et al. 2011).

Prior research on resource allocation models suggests that the mere presence of performance goals is cognitively demanding because performance goals direct attention to self-regulatory processes such as self-evaluation and attaining results (Kanfer and Ackerman 1989; Kanfer et al. 1994). The increased cognitive demands imposed by these processes may push working memory beyond its capacity thereby interfering with learning. Therefore, performance goals are likely to interfere with learning in a complex task environment as the task itself imposes heavy demands on an individual's working memory and cognitive resources.

Consistent with prior research, I predict that performance goals will be harmful to learning in a complex task setting as they interfere with the ability to learn by taxing the cognitive resources required for learning (Kanfer and Ackerman 1989; Locke and Latham 1990, 2002; Seijts and Latham 2005, 2006; Winters and Latham 1996). Importantly, although it is widely assumed in the extant literature that performance goals will interfere with learning even when coupled with a learning goal, this assumption is largely untested empirically. I expect learning to be impaired even if the simultaneous presence of a learning goal acts as an effective signal to redirect some effort away from traditional task performance toward learning activities. In other words, I expect performance goals to interfere with the learning process irrespective of whether or not they come coupled with a learning goal because the presence of a performance goal will cause effort directed toward learning to be ineffective at yielding additional learning. I therefore expect that pairing a learning goal simultaneously with a performance goal will lead to less learning relative to a learning goal alone and state my next hypothesis as follows.

H3: Individuals simultaneously assigned both learning and performance goals will learn less than individuals assigned only a learning goal.

When the two goal types are assigned simultaneously, individuals will pursue performance-directed effort with greater intensity as a result of the assigned performance goal. Focusing these attentional resources on performance-directed effort will at least partially substitute for learning-directed effort. I predict that this shift away from learning-directed effort will harm learning and by extension harm performance as well. However, this indirect learning effect may be at least partially offset by the increased performance that arises as a direct effect of high levels of performance-directed effort intensity. I therefore state my next hypothesis in the null form as follows:

H4: Individuals simultaneously assigned both learning and performance goals will perform no differently in the long-term than individuals assigned only a learning goal.

The previous hypothesis suggests that the effect of simultaneously assigning learning and performance goals on performance is indeterminate *ex ante*. Rejecting the null hypothesis would be an important finding irrespective of whether performance is higher or lower with simultaneous goals because in either case that result would speak to a discrepancy between practice and theory. Academic research prescribes foregoing performance goals in favor of learning goals when learning is necessary to perform well (e.g., Locke and Latham 1990, 2002; Seijts and Latham 2005, 2006), but in practice individuals in organizational settings are often asked to learn while continuing to perform at a high level (Masuda et al. 2015). For example, probationary employees are frequently judged and either let go or retained as permanent employees on the basis of performance throughout the probationary period.[12] Although I cannot predict *ex ante* whether or not simultaneous assignment of learning and performance goals will drive higher performance, an alternative method of combining goal types may be able to use the two goal types jointly to achieve better performance than either goal type in isolation.

I expect performance goals to be harmful to learning only if those performance goals are present before learning is substantially complete.[13] However, assigning a performance goal *after* a learning goal has been assigned and learning is substantially complete is likely to benefit performance in the periods subsequent to the assignment of a performance goal. Combining goal types sequentially in this manner means that there is not a performance goal present to interfere with the important learning that takes place in the early periods. Additionally, because performance goals induce greater effort intensity with respect to extant knowledge, skills, and strategies, introducing a performance goal after learning has taken place will cause individuals to more effortfully apply what they have learned relative to individuals who lack a performance goal. I therefore predict that combining learning and performance goals will be effective with respect to both learning and performance outcomes, provided the goals are assigned sequentially.

Because sequential goal assignment, by design, does not introduce a performance goal until after learning has already taken place, I do not predict greater learning relative to learning goals in isolation. Rather, the benefits are limited to the increased effort directed toward applying what has already been learned, as motivated by the presence of a performance goal. The motivational effects of a performance goal go beyond the baseline level of intrinsic motivation

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[12] As an example, in a 2012 court case SBLR, a Canadian accounting firm, tried to defend in court the dismissal of a probationary employee on the grounds that the dismissal was based on performance (Rudner 2017)
[13] The functional definition of "substantially complete" may vary greatly from setting to setting. Managers may need to play an important role in determining when employee learning is substantially complete.

that would drive individual performance in the absence of a performance goal. I therefore expect sequential goal assignment will lead to better performance than assigning learning goals only. I state my next hypothesis as follows.

> **H5:** Individuals assigned sequential learning and performance goals will achieve better performance in the long-term than individuals assigned only a learning goal.

3.5 Summary

This chapter develops five hypotheses based on theory drawn primarily from prior psychology research. The overall objective of my hypotheses is to identify how learning and performance goals can be combined to achieve better performance outcomes relative to using either goal type in isolation.

CHAPTER 4: EXPERIMENTAL TASK

4.1 Design Overview

To test my hypotheses, I collect data in two phases. In the first phase I manipulate goal type at two levels between subjects. In this phase, I do not introduce combined goals. Participants are given either a learning goal only or a performance goal only depending on the condition they are randomly assigned to. When collecting data in the first phase, the participant pool available was not sufficiently large to test all four experimental conditions. Therefore, this first phase of data collection was performed to ensure that I correctly operationalize my constructs of interest and that all aspects of my task function as intended before examining the combined goal conditions.

In the second phase of data collection I manipulate goal type at four levels as a between subjects factor. In this phase of data collection participants are assigned a learning goal only, a performance goal only, both goal types simultaneously, or both goal types sequentially. Participants in this phase were drawn from a different participant pool than in phase 1. Specifically, phase 1 used graduate student participants and phase 2 used undergraduate student participants. I use pooled data from both phases of my data collection to test H1 and H2 and use data from the second phase to test all other hypotheses.

The remainder of this chapter is organized as follows. Section 4.2 describes the details of the experiment. Section 4.3 discusses the experimental design. Section 4.4 discusses the dependent variables. This chapter concludes with section 4.5.

4.2 Experiment Details

4.2.1 Task Description

Participants performed a letter-counting task adapted from Webb et al. (2013). In this task participants were given several pages with each page containing six boxes of letters per page and each box containing 7 rows and 18 columns. Participants were asked to count the instances of a given search letter for each box. For example, participants were asked to count the number of instances of the letter “W” in the first box, the letter “J” in the second box, and so on.[14]

4.2.2 Shortcuts

Although I describe the task as a letter-counting task, participants were provided a non-counting alternative method for determining the letter count for any given box. Rather than counting the letters in a box, participants could learn shortcuts, which allowed them to determine the count for a given box without any need for actual counting. Once discovered, the shortcuts were, by design, a more efficient method of determining the count for a given box than counting. An example of a shortcut is that for box 2 on each page the answer counted down by two. Specifically, the answer to box two, page one was 40; box two, page 2 was 38; etc. For a full list of each shortcut see Figure 3.[15] Although these shortcuts are an efficient way of performing the task once discovered, discovering them required individuals to direct some attentional resources away from simply counting letters toward the discovery of shortcuts.[16]

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[14] A sample page containing six letter search boxes can be found in appendix item number 1.
[15] This figure is taken verbatim from Figure 2 (p. 1,444) of Webb et al. (2013), which uses the same task.
[16] Individuals cannot direct all of their attentional resources away from traditional performance because some counting is required in order to discover task shortcuts.

4.2.3 Participants

In order to test my hypotheses I used accounting students from a large North American University. In order to test my hypotheses I need participants who are capable of shortcut discovery. More specifically, I need participants who can form hypotheses about what a shortcut may be and then systematically test those hypotheses. Webb et al. (2013) test statistically whether or not student participants are capable of this sort of hypothesis testing and find that student participants are appropriate for this task. I have no reason to believe that the psychological theories I rely on to inform my hypotheses will be moderated by any characteristics unique to a student population. Therefore I believe student participants are appropriate for my experiment.

In the first phase of my data collection, I recruited 43 student participants from a large North American University. All students were in a master of accounting program and 56% were female. In the second phase of my data collection, I recruited 93 undergraduate participants from a large Canadian University. All students were in either their third or fourth year of undergraduate studies in accounting and 68% were female.

4.3 Experimental Design

Participants first performed the task in a five-minute practice period in which they were paid $.10 per correct box. This practice period allowed participants to familiarize themselves with the task including the process of entering answers into the program. Furthermore, because participants were not informed of the existence of shortcuts prior to the practice round, they could only enter correct answers by counting how many times a letter appeared. The practice round was intended to demonstrate to participants that determining answers via counting is slow and inefficient.

Following the practice round, participants read additional instructions about the three ten-minute production periods they would subsequently complete. The instructions informed participants that there were two ways to identify correct answers for a given box. First, they could count the number of times the search-letter appeared in the box as in the practice round. Second, they could identify shortcuts that allowed them to determine the correct answer for a box without counting. The instructions stated that "shortcuts include patterns in a particular box across pages, patterns across boxes within a single page, and/or patterns within a single box which will help identify the answer." The instructions further stated that the same shortcuts were used on each new page of boxes and they were placed in the same location. For example, if participants identified the shortcut for the first box on page one of the materials, then that shortcut could be applied to the first box on all subsequent pages. Additionally, the same shortcuts were used in each production period so that once discovered a shortcut could be used repeatedly in each production period. Participants were required to correctly answer questions testing their understanding of shortcuts before they were allowed to proceed with the rest of the experiment.

Although participants were instructed about the existence of shortcuts, they were free to use either approach for determining correct answers. I informed participants that counting is a reliable way to complete the task, but is slower than shortcuts once they are discovered. I further instructed them that although shortcuts will initially take some time to discover, doing so would allow them to determine the correct answer for each box much more quickly than counting. This instruction was important to ensure that the assignment of a learning goal did not introduce new information; i.e., participants understood that shortcuts were production enhancing regardless of their assigned goal condition. After receiving these instructions, participants were assigned goals in accordance with the condition into which they were randomly assigned as described in the next subsection. They then completed three consecutive 10-minute production periods. I chose three 10-minute production periods because based on pilot data I expected learning to be sufficiently complete after two 10-minute production periods thus enabling me to effectively operationalize my sequential goal condition. In my pilot data only a single participant completed the learning goal in period three. All other participants who achieved the learning goal did so by the end of the second period.

4.3.1 Goal Conditions

Each participant was randomly assigned to one of four conditions—learning goal only, performance goal only, simultaneous learning and performance goals, and sequential learning and performance goals.[17] Participants in the learning goal condition were assigned a specific difficult learning goal of learning at least three task shortcuts by the end of the experiment. The difficulty of this learning goal is based on learning data from this task in Webb et al. (2013) as well as pilot testing. *Ceterus parabus*, the more difficult a goal is the more heavily it taxes cognitive resources. Taxing cognitive resources is a mechanism through which goals may hinder learning. More difficult goals induce greater use of self-regulatory mechanisms which are inherently cognitively taxing (Seijts and Latham, 2005). This suggests that setting a learning goal that is too difficult may be counterproductive. However, as with any goal, a goal that is too easy

[17] I do not include a control condition in which no goal is assigned. Prior research demonstrates that in complex task environments, not having any goal leads to more learning than having a performance goal (Kanfer and Ackerman 1989). However, learning goals are more conducive to learning than no goal at all (Locke and Latham 2002, 2012). Therefore, I do not expect a control condition to yield any incremental insights.

is also maladaptive. Therefore, the learning goal was set as moderately difficult. I operationalized 'moderately difficult' as a goal that about 50% of participants could achieve.[18] Consistent with prior research on learning goals, participants were instructed to "please do your best" with respect to the letter counting portion of the task. It is important that participants were instructed to please do their best so that they understand that they are expected to apply what they learn toward performance. Their learning goal as well as the instruction to "do your best" on the letter counting task was reiterated to them in the experiment materials immediately prior to each production period.

Participants in the performance goal condition were assigned a difficult goal of entering the correct letter-count for 90 boxes in each of the three production periods. Unlike learning goals, the benefits of performance goals are derived from increased performance-directed effort intensity. Therefore, performance goals should be difficult in order to induce high levels of effort intensity. This goal is taken directly from Webb et al. (2013) where it was used and validated as an appropriately difficult goal. Webb et al. (2013) determined 90 was an appropriately difficult goal by relying on guidance from Locke and Latham (1990) as well as Merchant and Van der Stede (2007) who suggest that an appropriately difficult performance goal is one that is achievable approximately 25% of the time. In Webb et al. (2013) 22.4% of participants achieved the goal of correctly completing 90 boxes each period. Because performance goals are most effective when they are difficult to achieve, assigning participants a moderately difficult or an easy goal would bias performance downward relative to a difficult goal. Furthermore, performance goals are mostly likely to interfere with learning when they are difficult and

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[18] Classifying goals that 50% of participants can achieve as moderately difficult is consistent with Kyllo and Landers. (1995).

therefore using a difficult performance goal provides an appropriately strong test of theory (Seijts and Latham 2005). Participants had their performance goal reiterated to them in the materials immediately prior to each production period.

Participants in the simultaneous goals condition were assigned a learning goal of finding three total shortcuts by the end of the three production periods as well as a performance goal of entering the correct letter-count for 90 total boxes in each period. These goals were reiterated to participants in the experiment materials immediately prior to each production period. Participants in the sequential goal condition were assigned a learning goal of finding three total shortcuts throughout the experiment, which was present throughout all three periods. They were assigned a performance goal of entering the correct letter-count for 90 total boxes in the final period only. [19] This timing was designed to allow participants sufficient time without a performance goal for learning to be substantially completed.

4.3.2 Task Complexity

Ostensibly, counting letters may not seem like a complex task, but the task considered as a whole is complex because participants needed to discover shortcuts in order to perform at a high level; i.e., meet or beat the assigned performance goal. The coordinative complexity of the task is quite high because the relationship between box answers both within and between pages is complex (Wood 1986). For example, in order to discover shortcut three, which was that the answer for box 3 is the sum of box 1's answer and box 2's answer, individuals have to

[19] In order to ensure a clean manipulation of each condition individuals who received a performance goal after a learning goal did not have any foreknowledge of their future performance goal. Whether or not individuals with foreknowledge would behave as though they had implicitly been assigned a performance goal is an interesting question but it falls outside the scope of this paper.

incorporate and apply information from two other boxes. Because the relationships within and between pages are complex, discovering shortcuts requires a great deal of cognitive processing and attention and thus qualifies as high complexity per Bonner and Sprinkle's (2002) characterization of task complexity.

4.3.3 Fixed Wage Incentive

Participants were paid a fixed wage of $7 per production period across all conditions. I made this design choice because the pattern of results discovered in Webb et al. (2013) indicates that on average, paying for goal attainment leads to significantly less learning and worse performance than paying a fixed wage.[20] Furthermore, as Sprinkle (2000) notes, the effects of incentives on learning are complex and the extant literature both in accounting and elsewhere offers mixed results regarding whether incentives help or hinder learning (see for example Bonner et al. 2000; Choi et al. 2016; Hogarth et al. 1991).[21] Therefore, I leave exploring the joint effects of incentives combined with learning *and* performance goals to future research.[22]

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[20] Webb et al. (2013) manipulate pay type as a variable of interest. Participants received either fixed pay of $7 per round or variable pay of $2 per round plus $.10 per answer when meeting or exceeding their target. On average participants assigned a fixed wage learned .7 more shortcuts relative to their counterparts.

[21] Even within individual studies, the learning and performance effects of incentives are often dependent on a moderating variable. For example, Hogarth et al. (1991) finds that incentives aid learning in lenient environments (i.e., environments where deviations from the optimal are not heavily punished) but hinder in exacting environments (i.e., environments where deviations from the optimal are heavily punished). Bonner et al. (2000) conduct a meta-analysis that reveals that incentives only help approximately half the time and are less effective as the gap between complexity and skill widens.

[22] One further issue to note is that incentives can function to increase goal commitment. As goal commitment is an important moderator of the effects of goal setting, I used pilot testing to ensure that goal commitment was sufficiently high even absent incentives.

4.4 Dependent Variables

4.4.1 Performance

Performance is measured as the number of box-counts correctly entered in a given period. Furthermore, because my performance-based hypotheses are partially driven by learning effects, I analyze performance in the last production period when testing my performance hypotheses (H2, H4, and H5). I use the last period because I expect learning to take time in my setting and I therefore expect the effects of learning to be most pronounced in the final period. Participants' performance is objectively calculated by the computer program used to administer my experiment.

4.4.2 Learning

Learning is the other main dependent variable used to test my hypotheses. In order to determine the extent of participant learning, participants were asked in the post-experimental questionnaire to list and explain each shortcut they discovered as well as when it was discovered. Determining whether a participant actually found a shortcut required judgment and is therefore inherently subjective. However, this subjectivity is mitigated by two factors. First, because each shortcut was known to the reviewer, it is typically clear whether or not a participant's description of a shortcut matches the actual shortcut.[23] The second factor that mitigates the subjectivity in evaluation is that the computer collected all participant answers along with timestamp data detailing when each answer was answered. Therefore, if a participant claimed to have discovered

[23] A doctoral student and I coded shortcut discovery blind to treatment condition. Each rater was made blind to condition by presenting shortcut discovery data decoupled from information about what treatment each participant was assigned to. Inter-rater reliability was .95 suggesting excellent inter-rater reliability. Both raters met after independent coding to reconcile any discrepancies.

a shortcut and their description of the shortcut was not sufficiently clear to determine whether or not they really found it, then their pattern of answers was examined to determine whether or not their data was consistent with shortcut discovery.[24]

4.4.3 Time Spent Learning

One of the mechanisms through which I expect assigned goals will operate is effort direction. Therefore, even if my hypotheses about learning and performance outcomes are supported, a measure of time spent learning is a useful process measure to determine the extent to which difference in learning outcomes are attributable to differences in effort direction. That is, I expect that participants who learned more will have directed more effort (time) toward learning. In order to obtain a measure of participants' time spent learning, I asked them in the post-experimental questionnaire to tell me what percentage of their time each period was spent searching for shortcuts. As each period is 10-minutes, their answers can then be multiplied by 10 to determine how many minutes they spent searching for shortcuts in each round. This self-reported measure of time spent searching for shortcuts is identical to the measure used in Webb et al. (2013) and is empirically consistent with the authors' expectations in that study; i.e., more difficult goals lead to more time directed towards searching for shortcuts. I therefore conclude that this measure is a valid proxy for effort direction.

[24] As an example of how this approach works in practice, assume a participant claimed to have discovered the shortcut for box 3 in production period two. Each answer is time stamped in the program. Therefore, if the participant did discover the shortcut for box 3 in production period 2, this would be evidenced by a series of correct box 3 answers in rapid succession.

4.5 Controls and Other Measured Variables

4.5.1 Goal Commitment

Because goal commitment moderates the effects of goal setting, goal commitment is an important construct in the context of my study. Although I designed my experiment with the intent that individuals would be sufficiently committed to their goals, low goal commitment could cause my manipulations to be ineffectual because as goal commitment decreases individuals behave increasingly as though they have no goal assigned at all (Locke et al. 1988). This would be equally problematic for each goal condition. That is, without goal commitment, I would expect participants assigned a learning goal to neither direct more effort toward learning nor learn more. Similarly, without goal commitment, I would not expect participants assigned a performance goal to direct their effort toward performance. It is therefore important that I measure goal commitment to confirm that individuals were committed to their goals. In the case that my hypotheses are not supported, having a measure that confirms individuals were committed to their goals rules out the possibility that a lack of results is driven by a simple lack of goal commitment.

To measure goal commitment I use a modified version of the Hollenbeck et al. (1989) scale, which can be found in appendix item numbers 3 and 4. In this scale, participants are asked a series of five questions measured on a 9-point Likert scale ranging from -4 (strongly disagree) to 4 (strongly agree). Participants were asked these questions before each production period for a total of three times each. Asking these questions before the first production round begins enables me to assess baseline goal commitment uncontaminated by actual performance. Repeating the question before each period allows me to determine whether or not goal commitment changes significantly over time to ensure that participants do not subsequently abandon their goals. A meta-analysis conducted by Klein et al. (2001) determined that the scale I used appropriately captures the construct of goal commitment. Furthermore, this same scale was used by Webb et al. (2013) whose instrument I adapted.

4.5.2 Pilot Testing

Prior to the two phases of data collection used in this study, I pilot tested two of my four conditions. I pilot tested a learning goal only condition as well as a performance goal only condition. I did this to ensure that the goals functioned as intended; i.e., that the assigned goals directed participant's attention and effort. I also used my pilot test as an opportunity to ensure that individuals were sufficiently committed to their goals despite remuneration being independent of goal attainment. The results of my pilot testing showed that individuals did differentially direct effort toward learning based on goal type and also showed that, across conditions, individuals were committed to their assigned goals. In my pilot data, participants assigned a learning goal reported spending more time searching for shortcuts in each period as well as in total relative to participants assigned a performance goal.[25] These differences were statistically significant. Additionally, participants in each condition were committed to their assigned goals on average.[26]

[25] The p-values (not tabulated) for periods 1, 2, and 3, are .04, .01, and .01 respectively. The p-value (not tabulated) for total difference is .01.
[26] Commitment is a composite of five items measured on a 9-point Likert scale ranging from -4 to 4. Participants in the learning goal condition had a mean of 1.4 and participants in the performance goal condition had a mean of .5 (untabulated). These means are unadjusted for factor loadings.

4.5.3 Task Complexity

My theory is specific to a complex task environment. To provide assurance that I have operationalized a complex task environment, participants were asked to rate on a 9-point Likert scale their agreement with assertions "I found this task to be complicated" and "finding shortcuts was complicated."[27] I developed these questions myself, and deemed it appropriate to ask participants directly about their perceptions of complexity because doing so is consistent with Campbell's (1988) conceptualization of task complexity as person specific. These questions were asked at the end of the study. This unfortunately introduces the possibility of individual's performance influencing their responses, but I did not believe they could appropriately answer these questions before actually performing the task.

4.5.4 Analytical Reasoning

Even presuming that participants on average found the task to be complex, I expect the degree to which the task was complex to vary at the individual level as a function of an individual's ability to engage in analytical reasoning.[28] That is, I expect the discovery of shortcuts to have been relatively more complex for individuals with a lower capacity for analytical reasoning. This conceptualization of task complexity is consistent with what Campbell (1988, p. 41) terms "complexity as a person-task interaction." Therefore, a measure of capacity for analytical reasoning may be a useful covariate so I asked participants six questions designed to capture this construct. Even if the capacity for analytical reasoning is evenly distributed across conditions via random assignment, its use as a covariate may increase my statistical power by

[27] These questions can be found in appendix item number 6.
[28] The measure of analytical reasoning I use is taken from Bonner and Walker (1994) and is originally adapted from the GRE where it was designed to measure general problem solving ability.

eliminating noise in outcome variance. The questions used to measure analytical reasoning capability can be found in appendix item number 7. The measure used has been validated by prior research in accounting (e.g., Bonner et al. 1992, Bonner and Walker 1994).

4.5.5 Self-Efficacy

The effects of goal setting can be both mediated through and moderated by self-efficacy (Locke and Latham 2002). Therefore, before each production period, I ask participants two questions per goal type assigned designed to measure their self-efficacy.[29] Asking participants these questions before production begins allows me to observe baseline efficacy uncontaminated by actual performance. Continuing to ask these questions each period allows me to observe whether efficacy changes significantly over time to ensure participants are not becoming discouraged. Participants are asked to rate their agreement on a 9-point Likert scale with assertions that they are confident in their ability to find correct answers as well as their ability to find shortcuts.

4.5.6 Task Attractiveness

Task attractiveness may be an important determinant of effort because when an individual finds a task interesting or attractive they are intrinsically motivated to perform well (Daniel and Esser 1980). Furthermore, the importance of task attractiveness as a determinant of effort is likely increased by the fact that individuals are not paid for goal attainment in my setting; therefore they have no extrinsic reward to act as a substitute for intrinsic motivation. As with analytical reasoning capability, the use of task attractiveness as a covariate may increase my

[29] These questions were adapted from self-efficacy questions used in Webb et al. (2013) in accordance with the guide for creating efficacy scales found in Bandura (2005). These questions can be found in appendix item number 5.

statistical power by reducing noise even if there are no differences, on average, in perceived task attractiveness by condition due to random assignment. Before participants begin the three 10-minute production periods they are asked to rate the task along seven dimensions of task attractiveness on a 7-point Likert scale. I ask participants these questions before the production rounds in order to ensure that their answers are uncontaminated by actual performance. An example of one dimension asked about is “fun.” Participants were asked to rate the task on a scale ranging from extremely fun to extremely tedious. The full set of questions can be found in appendix item number 1 and were taken from Webb et al. (2013).

4.6 Summary

I employ a between subjects design to test the effects of goal type on learning and performance as well as whether learning and performance goals can be combined to enhance learning and/or performance relative to either goal type in isolation. The next chapter discusses the results of this experiment.

CHAPTER 5: RESULTS

In order to ensure that participants correctly understood their assigned goal condition as well as the remuneration structure for the experiment, they were asked to accurately input their assigned goal as well as correctly answer questions about the compensation structure before they were allowed to proceed to the main task. Additionally, to ensure that I correctly operationalized a complex task environment participants were asked to rate their agreement with the statements "I found this task to be complicated" and "finding shortcuts was complicated" on 9-point Likert scale ranging from -4 (strongly disagree) to 4 (strongly agree). Average participant responses were less than zero for the first question and greater than zero for the second question indicating that participants did find shortcut discovery, the part of the task that was supposed to be complex, complex. Descriptive statistics for perceived task and shortcut complexity along with other potential moderating variables and covariates can be found in Table 1 and Table 2 for phase 1 and phase 2 data respectively.

I also measured goal commitment and find that, in each condition, participants were committed to achieving their assigned goals. I use a modified version of the Hollenbeck et al. (1989) scale which can be found in appendix item numbers 3 and 4. I asked participants five questions intended to measure performance goal commitment and five questions intended to measure learning goal commitment. Because this measure of goal commitment has not been validated for use with accounting students to my knowledge, I first performed an exploratory factor analysis on my pilot data. This analysis yielded two factors with Eigen values greater than one (analysis not tabulated) and suggested that using only three of my five questions may more appropriately capture performance goal commitment.[30] However, because my measures of goal commitment are well established in the psychology literature (see for example Hollenbeck 1989; Klein et al. 2001), I perform a confirmatory factor analysis for my measures of goal commitment in which I try alternative specifications of the model using either three questions to measure goal commitment or all five questions. I do this for both learning and performance goals and retain the model with the best fit. I present my model and fit statistics in Figure 4. As Figure 4 indicates, the CFI of my model is above .90, which indicates adequate model fit (Hu and Bentler 1999). However, the RMSEA is above .06, which may indicate poor model fit (Hu and Bentler 1999).[31] These results are mixed, but my measure of goal commitment is well validated in the extant literature (see for example Hollenbeck 1989, Klein et al. 2001).[32]

I additionally measured self-efficacy using four questions found in appendix item number 5. Analysis of participant responses indicates that on average participants agreed with assertions that they were confident in their abilities and found the difficulty of the task manageable.[33] In sum, I believe that I succeeded in correctly operationalizing my constructs of interest and that the data I collected is appropriate for testing my hypotheses.[34]

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[30] Selecting the number of factors based on the number of Eigen values greater than one is consistent with the widely- accepted Kaiser criterion (Kaiser 1960)

[31] Examination of modification indices (not tabulated) suggests that no structural changes (e.g. allowing error terms to covary) can be made to significantly improve the overall fit of my model.

[32] Changes in goal commitment over time were analyzed via a repeated measures ANOVA (not tabulated). Participants increased their commitment to their goals over time. This is likely a response to participants discovering more shortcuts over time thus increasing likelihood of goal attainment.

[33] A repeated measures ANOVA (not tabulated) reveals that participants' perceptions of goal difficulty remained constant over time but their confidence in their ability to meet their goal grew each period. This is likely the result of participants learning more performance-enhancing shortcuts over time.

[34] Descriptive statistics for all of these variables for phase 1 and phase 2 can be found in Table 1 and Table 2 respectively.

5.1 Test of Hypothesis 1

My first hypothesis predicts that individuals assigned only a learning goal will learn more shortcuts than individuals assigned only a performance goal. Panel A of Table 3 provides descriptive statistics for the number of times each shortcut was discovered by participants in the *learning goal only* and *performance goal only* conditions in phases 1 and 2 of my data collection and shows that all shortcuts were discovered at least once. Shortcuts 1, 2, 3, and 6 were discovered by more than half of the participants. This pattern of shortcut discovery is similar to the pattern found in Webb et al. (2013). Panel B shows the average number of shortcuts discovered by experimental condition with participants in the *learning goal only* condition discovering 3.8 shortcuts on average and participants in the *performance goal only* condition discovering 3.5.

Panel C of Table 3 provides the results of an ANCOVA with the total number of shortcuts found as the dependent variable and goal type and phase of data collection as independent variables. Measures of task attractiveness and analytical reasoning capabilities are included as covariates. As reported in Panel C, I observe a marginally significant effect of goal type ($F = 1.96$, $p = .09$). This indicates that participants in the *learning goal only* condition find significantly more shortcuts on average than participants in the performance goal condition, which supports H1.[35] In addition to a difference in mean shortcut discovery, it also worth noting that the standard deviation for shortcut discovery in the *learning goal only* condition is .74 and the standard deviation for shortcut discovery in the *performance goal only* condition is 1.41. This

[35] In addition to the analysis as reported in Panel C, I tried alternative specifications of my analysis (not tabulated) which included both self-efficacy and goal commitment as moderating variables. I do the same in each of my analyses, but neither variable loads as a significant moderator nor has a significant main effect and thus I have omitted the results of these model specifications from the paper.

difference is statistically significant (Levene Statistic = 14.63, $p < .01$, not tabulated). One possible explanation for this decreased variance is that although participants in the *performance goal only* condition likely recognized the importance of learning and may have self-set goals to learn shortcuts, the goal specificity inherent in the goal assigned in the *learning goal only* condition likely helped to reduce outcome variance in learning.

5.1.1 Hypothesis 1 Supplementary Analysis

In addition to testing my hypothesis using total shortcuts discovered, I provide further analyses examining the shortcuts discovered in each individual production period in Table 4, Table 5, and Table 6. ANCOVAs in Panel B of Table 4, Panel B of Table 5, and Panel B of Table 6 indicate that the main effect of goal type on shortcut discovery is not statistically significant in any single period.[36] This suggests that the increased learning present in the *learning goal only* condition was not disproportionately driven by either faster learning or greater persistence of learning.

Although H1 is supported, data on how much time participants spent searching for shortcuts can be further analyzed to determine whether the difference in shortcuts found is attributable to the proposed underlying theoretical mechanisms. That is, I can determine whether or not participants in the *learning goal only* condition changed their effort direction such that

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[36] The analyses also indicate a significant main effect of phase of data collection for periods 1 and 3 (p-values of .09 and .01 respectively) as well as a significant interaction between phase of data collection and goal condition in periods 1, 2, and 3 (p-values of .06, .06 and .09 respectively). The main effect indicates that participants in the first phase of data collection discovered shortcuts more quickly on average than did participants in the second phase of data collection. The first phase is comprised of graduate students and the second phase is comprised of undergraduate students. Undergraduate students go through a selection process before entering their graduate studies. As a result, graduate students are likely higher caliber participants on average, which may explain the discrepancy in how quickly the two groups discover shortcuts. The interaction indicates that performance goals did not negatively impact participants as much for undergraduate students as for graduate students. There is no obvious reason for this interaction, but it is not significant in the main test of H1.

they spent more time searching for shortcuts than did participants in the *performance goal only* condition. Panel A of Table 7 provides descriptive statistics for the number of minutes participants spent on average searching for shortcuts in each production period by condition.

Panel A of Table 7 indicates that participants assigned only a learning goal spent more time in each period searching for shortcuts than did participants in the *performance goal only* condition with participants in the *learning goal only* condition spending 6.0, 7.2, and 7.0 minutes in periods one, two, and three respectively and participants in the *performance goal only* condition spending 5.0, 6.6, and 6.6 minutes in these periods.[37] In Panels B, C, D, and E these differences are tested statistically.[38] Results in these panels indicate that the difference in time spent searching for shortcuts is not statistically significant in any production period. As Panel E indicates, the difference in average time spent searching for shortcuts across all production periods is not statistically significant ($F = 1.26$, $p = .13$). Collectively these results suggest that that the difference in total number of shortcuts found across condition is not likely to be wholly attributable simply to differences in effort direction. Rather it seems the presence of a performance goal interfered with the learning process despite effort still being directed to learning.[39]

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[37] All learning hypotheses were also tested using time spent searching for shortcuts as a covariate (not tabulated). However, time spent searching does not significantly affect shortcut discovery and has been omitted from the final analyses for the sake of parsimony.
[38] Unlike other analyses, this analysis includes neither task attractiveness nor analytical reasoning as a covariate. This is because I lack strong *a priori* reasons to believe either of these variables should affect effort direction. In alternative specifications of the analysis (not tabulated) that do include these covariates neither significantly affects time spent searching for shortcuts. One-tailed p-values for the significance of goal type in periods 1, 2, 3, and overall are respectively .12, .17, .29, and .13.
[39] An alternative explanation may be that the measure used did not capture effort direction. However this measure has been successfully used as a proxy for effort direction in prior accounting literature (Webb et al. 2013).

5.2 Test of Hypothesis 2

My second hypothesis is a null prediction that individuals assigned only a learning goal will perform no differently in the long-term than individuals assigned only a performance goal. I operationalize long-term performance as the total number of boxes completed in period 3, the final production period. Panel A of Table 8 provides descriptive statistics for the number of boxes completed in period 3. Panel A indicates that individuals assigned only a performance goal completed more boxes on average than participants assigned only a learning goal with participants in the *performance goal only* condition successfully entering 76.2 boxes on average and participants in the *learning goal only* condition entering 72.4 correct boxes on average. An ANCOVA in Panel B of Table 8 further reveals that this difference is not statistically significant ($F = .15$, $p = .70$). Therefore, I do not have sufficient evidence to reject the null hypothesis. However, the results suggest that performance was not impaired by assigning a learning goal rather than a performance goal. This is important because it suggests that learning goals are a viable alternative to performance goals when using only a single goal. Conversely, my results also suggest that performance goals may be a viable alternative to learning goals even for settings in which learning is an important determinate of performance. This is important because in some settings management may prefer performance goals as they may be easier to meaningfully quantify.

5.2.1 Hypothesis 2 Supplemental Analysis

In addition to testing my hypothesis using period 3 data, for completeness, I also test for differences in performance for periods 1 and 2 as well as for total performance summed across all periods. These additional tests can be found in Table 9, Table 10, and Table 11. As these tables collectively show, I do not find statistically different performance across conditions in any individual period or in total performance summed across all periods.[40]

Given the results supporting H1 showing that a learning goal only leads to significantly more learning than a performance goal only, failure to reject my null hypothesis in H2 is worthy of further attention since I employ a task setting in which performance is heavily influenced by learning. A possible explanation for participants in the *learning goal only* condition not performing better than participants in the *performance goal only* condition despite learning more is that participants in the *performance goal only* condition offset their lower levels of learning with increased effort intensity. To examine this possibility, I conduct a supplementary analysis of performance conditional on the level of learning, which I operationalize as correct answers per shortcut found. Because H2 is in the context of third period performance, this supplementary analysis is also confined to third period performance.

As Panel A of Table 12 shows, participants in the *learning goal only* condition correctly answered only 19.2 boxes per shortcut found on average compared to 23.7 boxes per shortcut found in the *performance goal only* condition.[41] Further, as Panel B of Table 12 shows, this difference is significant at the .05 level ($F = 4.42$, $p = .02$).[42] This suggests that the reason I am unable to reject the null hypothesis is due to the increased effort intensity induced by the presence of a performance goal. I further test this phenomenon by testing effort intensity in periods 1 and 2 as well as overall. As Panel A of Table 13, Table 14, and Table 15 shows,

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[40] Two-tailed p-values for the effect of goal type on performance in periods 1, 2, and overall are respectively .70, .99, and .53.
[41] Data for two participants in the *performance goal only* condition was dropped as those participants found zero shortcuts across all three periods.
[42] A significant effect of phase of data collection indicates that participants in my first phase of data collection had higher effort intensity relative to participants in phase 2 on average.

participants in the *performance goal only* condition continue to have higher performance per shortcut discovered relative to participants in the *learning goal only* condition in each production period as well as overall. As Panel B of Table 13, Table 14, and Table 15 shows this difference is significant in each period as well as overall.[43] This suggests that in my setting, participants assigned a performance goal were able to offset lower learning with increased performance directed effort intensity. More broadly, this suggests that, for settings where learning is an important determinate of performance, performance goals may be appropriate substitutes for learning goals to the extent that performance is still sensitive to increasing performance-directed effort intensity.

5.3 Test of Hypothesis 3

My third hypothesis predicts that individuals simultaneously assigned learning and performance goals will learn less than individuals assigned only a learning goal. Descriptive statistics for shortcuts found by condition in Panel A of Table 16 indicate that participants in the *learning goal only* condition found 3.7 shortcuts on average and participants in the *simultaneous goal* condition found 3.6 shortcuts on average. However, this difference is negligible and as Panel B of Table 16 shows, it is not statistically significant ($F < .01$, $p = .48$). Therefore, H3 is not supported. Although there is no difference in mean shortcuts found, the standard deviation for shortcuts found does differ by condition. The standard deviation for the *learning goal only* is .75 and the standard deviation for the *simultaneous goal* condition is 1.16 this difference is statistically significant (Levene Statistic = 6.25, $p = .02$, not tabulated). As both conditions were assigned a learning goal, the difference in learning outcome variance cannot be attributed to

[43] One-tailed p-values for the effect of goal type on effort intensity in periods 1, 2, and overall are respectively, .02, .03, and .02.

differences in goal specificity. One possible explanation is that individuals who particularly struggle with learning use the presence of an alternative goal as a justification to allow them to fail to meet their learning goal. This may lead to a thicker tail at the low end of the learning distribution when both goal types are present simultaneously.

5.3.1 Hypothesis 3 Supplemental Analysis

In addition to using total shortcuts discovered as the dependent variable for testing H3, I also perform supplemental testing in which I examine shortcut discovery in each individual production period. Supplemental analyses using shortcuts found in periods 1, 2, and 3 can be found in Table 17, Table 18, and Table 19 respectively. These tables indicate no statistical difference in shortcut discovery in any individual period.[44] This suggests that, in addition to not interfering with the learning process overall; the presence of a performance goal did not impact the speed or the persistence of the learning process.

In order to examine the effort direction component of shortcut discovery between conditions, I tabulate results for time spent looking for shortcuts in Table 20. As Panel A of Table 20 shows, participants in the *learning goal only* condition spend more time on average searching for shortcuts than do their counterparts in the *simultaneous goal* condition. Furthermore, as shown in Panel B, Panel C, Panel D, and Panel E, this difference is at least marginally significant in the first and second production periods as well as overall. This finding suggests that not only did the performance goal in the *simultaneous goal* condition not interfere

[44] Two-tailed p-values for the effect of goal type on shortcut discovery in periods 1, 2, and 3, are respectively, .31, .42, and .99.

with learning, but individuals were actually more efficient at discovering shortcuts per unit of time spent.[45]

5.4 Test of Hypothesis 4

My fourth hypothesis is a null hypothesis that predicts that individuals simultaneously assigned learning and performance goals will perform no differently in the final period than individuals assigned only a learning goal. Descriptive statistics for third period performance by condition in Panel A of Table 21 show that participants in the *learning goal only* condition correctly answered 68.8 boxes on average and participants in the *simultaneous goal* condition correctly answered 80.8 boxes on average. As Panel B of Table 21 shows, this difference is statistically significant ($F = 5.03$, $p = .03$). Therefore, I have sufficient evidence to reject the null hypothesis. Furthermore, the data suggest that combining learning and performance goals simultaneously yields better performance than using learning goals only. This finding speaks directly to the efficacy of combining learning and performance goals.

5.4.1 Hypothesis 4 Supplemental Analysis

In addition to using data from production period 3 to test H4, I provide supplemental analyses comparing performance in periods 1 and 2 as well as total performance summed across all three periods. This data can be found in Table 22, Table 23, and Table 24.[46] As the data show, performance was not statistically different in either of the first two periods nor was total performance statistically different across goal conditions. This finding in conjunction with the

[45] An analysis of shortcuts found per minute spent searching (not tabulated) yields results that are directionally consistent with the assertion that participants in the *simultaneous goal* condition were more efficient, but this difference is not statistically significant.
[46] Two-tailed p-values for the effect of goal type on performance in periods 1, 2, and overall are respectively .67, .33, and .11.

finding that learning did not differ between these two conditions suggests that over time the presence of a performance goal induces individuals to apply what they learn to a greater extent and/or more quickly than they would without a performance goal. It is possible that a performance goal serves to calibrate individuals with respect to how much time to allot to the two tasks competing for their attentional resources; i.e., searching for shortcuts and solving boxes.

5.5 Test of Hypothesis 5

My fifth hypothesis predicts that individuals who are assigned learning and performance goals sequentially will perform better in the final period than individuals assigned only a learning goal. Panel A of Table 25 indicates that participants in the *sequential goal* condition correctly answer 79.2 boxes in the final period compared to participants in the *learning goal only* condition who answered only 68.8 boxes correctly on average.[47] As Panel B of Table 25 shows, these differences are marginally significant ($F = 2.24$, $p = .07$). Therefore, the data provide support for H5. Redoing this analysis (not tabulated) omitting outliers, which I define as participants who did not learn at least one shortcut, causes the data of a single participant to be omitted and yields a p-value of .04 which is significant at the traditional .05 cutoff.

5.5.1 Hypothesis 5 Supplemental Analysis

To test H5 I use all participants in both the *learning goal only* condition and all participants in the *sequential goal* condition. However, my prediction that performance goals

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[47] By design these two conditions should not differ with respect to shortcut discovery. That is, the two conditions are exactly identical through the end of period 2 as the performance goal is not introduced in the *sequential goal* condition until after period 2. The average number of shortcuts discovered was 3.7 for each condition (not tabulated) and there is no statistically significant effect of goal type on shortcut discovery.

will lead to improved performance is predicated on learning being "substantially complete" when the performance goal is assigned. I define learning being "substantially complete" in my setting as participants discovering at least three total shortcuts; i.e., achieving the learning goal.

I therefore redo the analysis for H5 on two different subsamples of my population. In Table 26 I do the analysis including only participants who learned a total of three or more shortcuts throughout all three periods. In Table 27 I impose a stricter criterion and only include participants who learned three or more shortcuts by the end of the second production period. In addition to being a stricter criterion, this is arguably a more meaningful comparison because the *learning goal only* condition and the *sequential goal* condition are identical through the first two periods with respect to each only having a learning goal. As such, any variation in shortcuts found by participants to this point should not be systemically related to goal condition. Furthermore, the performance goal in the *sequential goal* condition was assigned between periods 2 and 3 and therefore this subsample can be most definitively said to have "substantially" completed learning before being assigned a performance goal.

As Panel A of Table 26 indicates, in the subsample of participants who discovered at least three shortcuts across all production rounds, participants in the *learning goal only* condition correctly answered 69.7 boxes on average and participants in the *sequential goal* condition correctly answered 86.0 boxes on average. As Panel B of Table 26 indicates, this difference is statistically significant ($F = 7.21$, $p = .01$). In the more restricted subsample in Table 27, Panel A indicates that among participants who learned at least three shortcuts by the end of the second production period, participants in the *learning goal only* condition correctly answered 70.3 boxes on average and participants in the *sequential goal* condition answered 87.8 boxes on average. Panel B of Table 27 indicates that this difference is statistically significant ($F = 6.67$, $p = .01$).

5.6 Supplementary Analysis of Combined Goals

I reject the null hypothesis posited in H4 and instead find that simultaneous goals lead to higher performance than learning goals alone. I also find support for H5; i.e., I find that sequential goals lead to higher performance than learning goals alone. Given that each method of combining goal types increased performance relative to a learning goal alone, I provide additional supplementary analyses comparing the two combined goal conditions. In Table 28 I compare learning outcomes between my *simultaneous goal* condition and my *sequential goal* condition. As Panel A of Table 28 indicates, participants in the *simultaneous goal* condition discovered 3.6 shortcuts on average and participants in the *sequential goal* condition discovered 3.7 shortcuts on average. This difference is negligible and, as Panel B indicates, not statistically significant (F = .07, p = .80).

I also compare performance in my combined goal conditions in Table 29. As Panel A of Table 29 indicates, participants in the *simultaneous goal* condition correctly entered 80.8 boxes on average and participants in the *sequential goal* condition entered 79.2 boxes on average. However, as Panel B of Table 29 indicates, this difference is not statistically significant (F = .09, p = .77). Overall my analysis of the combined goal conditions suggests that one condition was not differentially more effective than the other either with respect to learning or with respect to performance.

5.7 Summary of Results

My results indicate that learning goals alone lead to increased learning relative to performance goals alone. This finding is largely a replication of prior work, but provides some assurance that I have correctly operationalized key constructs: learning goals, performance goals, and learning. I do not find that performance goals alone harm performance relative to learning goals alone, and therefore I am unable to reject my null hypothesis. I expect performance to be a function of both learning and effort intensity. Performance goals affect each of these constructs such that the net effect on performance depends on the relative strength of these two mediating mechanisms. In my setting, it appears that the performance losses from decreased learning were offset by the increased effort intensity induced by performance goals thus leading to my failure to reject the null hypothesis.

The main research questions of this paper are “Can learning and performance goals be combined to improve performance?” and assuming they can be effectively combined “How should learning and performance goals be combined to improve performance?” My results indicate that learning and performance goals can be effectively combined to improve performance. Furthermore, it does not seem to matter whether the two goal types are combined simultaneously or sequentially.

CHAPTER 6: CONCLUSION

6.1 Introduction

In this chapter I provide an overview of my study in section 6.2 and discuss the results of my various hypotheses in section 6.3. In section 6.4 I identify some of the limitations of this study as well as areas for future research. In section 6.5 I provide concluding remarks.

6.2 Study Overview

In a complex task environment individual performance can be relatively insensitive to simply increasing effort directed toward a conventional task approach but may benefit greatly from learning more efficient task approaches. In such a task environment, firms must make a decision about how best to direct employee effort through the use of goal setting. Learning goals direct effort toward learning and should improve performance indirectly by increasing performance-enhancing learning. Performance goals may harm performance by impairing learning but are also likely to increase effort intensity, which will benefit performance. It is not clear *ex ante* if and how these two goal types can be used jointly to achieve high levels of performance. I use an experiment to examine learning and performance goals in isolation as well as two distinct methods of combining the two goal types: simultaneous goal assignment and sequential goal assignment.

6.3 Results Discussion

As predicted, individuals assigned only a learning goal learn more than individuals assigned only a performance goal. In addition to demonstrating that learning goals alone lead to more learning than performance goals alone, I measure learning-directed effort as the time individuals spend searching for shortcuts and I have empirical evidence that learning-directed effort was similar on average irrespective of which goal type was assigned. This provides unique empirical evidence that differences in learning outcomes are not driven entirely by differences in effort direction. Although the prior studies I rely on to build my theory posit that performance goals interfere with learning via overly taxing cognitive resources (e.g. Kanfer and Ackerman 1989; Masuda et al. 2015), my study is, to the best of my knowledge, the first to explicitly rule out differences in effort direction as the sole cause of differences in learning outcomes. This suggests that, for similar levels of learning directed-effort duration learning goals yield more learning than performance goals. This could be caused by something positive induced by learning goals such as greater learning-directed effort intensity. This could also be caused by something negative induced by performance goals such as focus on performance outcomes taxing the cognitive resources required to learn. Disentangling these two possibilities is an interesting area for future research.

Despite the increased learning associated with learning goals relative to performance goals, participants assigned only a learning goal do not outperform participants assigned only a performance goal. This finding is likely due to the competing effects of assigning a performance goal canceling each other out. That is, performance goals harm performance indirectly by decreasing learning but also aid performance directly by increasing performance-directed effort intensity. Average performance between these two groups of participants is not statistically different. Consistent with extant literature, this finding suggests that learning goals may be a viable alternative to performance goals even when performance, not learning, is of chief importance.

This finding also suggests, in contrast to prior literature, that performance goals can be a viable alternative to learning goals even for settings in which learning is a critical determinant of performance and is not yet complete. Extant studies on learning goals suggest that performance goals are not a viable alternative to learning goals when learning is a critical determinant of performance and may even harm performance relative to no goal at all (e.g., Seijts and Latham 2001, 2005; Winters and Latham 1996). A likely reason for this discrepancy is that I operationalize different setting features than many other studies on learning goals. More specifically, because I am interested in the joint effects of learning and performance goals, I needed to operationalize a setting for which (1) learning is a critical determinant of performance and (2) performance-directed effort intensity is also performance enhancing. This is in contrast to most learning goal studies, which typically operationalize settings for which performance-directed effort intensity does not affect performance. For example, Mone and Shalley (1985) use a human resources staffing simulation in which only learning to make the right staffing choices yields increases in performance. The effects of other possible components of effort such as making choices more quickly through increased effort intensity, or making more choices through increased effort duration are eliminated via experimental design. As a result, I believe my theory will generalize to organizational settings in which both learning and performance-directed effort intensity are drivers of performance.

I also examine combining learning and performance goals as a means to leverage the strengths of each goal type. Contrary to my predictions, when learning and performance goals are assigned simultaneously, performance goals do not appear to interfere with learning. This is in stark contrast to a large extant literature that suggests that the mere presence of a performance goal will interfere with the learning process (e.g., Kanfer and Ackerman 1989; Seijts and Latham

2005, 2006; Winters and Latham 1996), but is consistent with recent findings in Masuda et al (2015) who also fail to find any deleterious effects of performance goals when they are paired simultaneously with learning goals. Collectively, Masuda et al. (2015) and my own failure to find support for H3 suggests that the current academic literature regarding the relationship between performance goals and learning may be incomplete. Specifically, although performance goals on their own have been repeatedly shown to harm learning, I find no evidence that performance goals continue to harm learning when they are paired simultaneously with a learning goal.

One potential caveat to the finding that performance goals do not impair learning when paired with a learning goal is that, although mean levels of learning were comparable across conditions, assigning a learning goal alone leads to less variance in learning outcomes than combining the two goal types. This suggests some limitations on the substitutability of combining the two goal types for learning goals alone. For example, in settings where extremely low levels of learning are disproportionately deleterious, it may still be preferable to assign learning goals alone to avoid outcome variance in learning.

In addition to performance goals not impairing learning when paired simultaneously with a learning goal, performance is higher with a simultaneous pairing of learning and performance goals relative to learning goals only. This suggests that assigning employees a combination of learning and performance goals may lead to better outcomes than learning goals alone. Collectively my findings with respect to simultaneous goal assignment may provide a better understanding of why in organizational settings employees are simultaneously asked to learn and perform at a high level in contrast to the prescriptive norm in the extant literature of assigning only learning goals when learning is necessary to perform at a high level (e.g., Seijts and Latham 2005).

I also find that combining the two goal types sequentially such that performance goals are introduced only after learning has taken place yields better performance than learning goals alone. Taken together, my findings on combining goal types have significant implications for practice as my findings overturn the conventional best practice from the extant literature; i.e., assigning only a learning goal without a performance goal when learning is required to perform at a high level (Seijts and Latham 2001, 2005). Rather, my findings suggest that better performance outcomes are achieved when learning and performance goals are used together either simultaneously or sequentially. I believe this has important implications for the design and implementation of goal setting within management control systems.

6.4 Limitations and Opportunities for Future Research

One limitation of my study is that, because I operationalized a complex task environment, I cannot speak to the relative efficacy of learning and performance goals in a low complexity task environment. This important because, although learning may still be important in a low complexity task environment, it is not clear that performance goals will negatively impact learning in a low complexity task environment as they do in a complex task environment. It is therefore unclear *ex ante* whether or not there is anything to be gained by adding learning goals to performance goals in low complexity task environments. In a low complexity task environment, combined goals may still be effective, but it is also possible that learning goals will interfere with the learning-by-doing that may be induced by performance goals in a low complexity task environment. For example, for tasks such as cooking burgers or folding pizza boxes, the best method of discovering production efficiencies may be to learn from experience by doing the task as many times as possible. If so, then a specific difficult performance goal may lead to more learning alone than in combination with a learning goal.

Furthermore, because my study focuses on individual learning and performance without the possibility for knowledge transfer or spillover, my setting may understate the importance of learning. In an environment where individuals are allowed to communicate with one another, learning by a single individual may have implications for a broader peer group as new learning is shared with colleagues. Examining learning and performance goals in a setting that allows knowledge transfer is an important area for future research. Additionally, my study was necessarily over a relatively short time horizon due to the constraints inherent in conducting a lab-based study. Therefore, I cannot speak to the long-term learning effects of combined goal types relative to either goal type in isolation. In my setting, I did not observe any negative effects related to balancing the competing demands of two different goal types. Over a longer period of time the sustained strain associated with balancing competing demands may take a psychological toll that manifests as poor performance. A longitudinal study examining the joint effects of learning and performance goals may be a fruitful area for future research.

A final limitation of my study is that all participants received a fixed wage. Compensation is an important element of the management control systems. As such, the potential moderating effects of various compensation types on the joint application of learning and performance goals is an important area for future research. A natural extension of my research would be examining the effect of paying a bonus contingent on goal attainment. In particular, it may be interesting to examine the effect of assigning two goal types but only explicitly rewarding a single goal type. In my setting, participants assigned learning and performance goals did not receive any explicit priming about the relative importance of each of their goal types. In practice it may be easier to measure and reward performance goal attainment, but this may also prime individuals to believe that performance goal attainment is more important or more highly valued. Whether or not unrewarded learning goals would continue to effectively drive learning when paired with performance goals that are explicitly tied to financial incentives is an interesting empirical question.

6.5 Conclusions

I believe this study will make a valuable contribution to the goal setting and learning literatures. Existing literature has not examined the joint effects of combining learning and performance goals relative to each of those goal types in isolation. This research contributes to the literature by demonstrating that combining learning and performance goals either simultaneously or sequentially is an effective strategy for improving task performance. I believe this finding will be directly applicable to practice where firms have long been reticent to forego the use of performance goals even in environments for which the prescriptive norm from academia has been to replace performance goals with learning goals.

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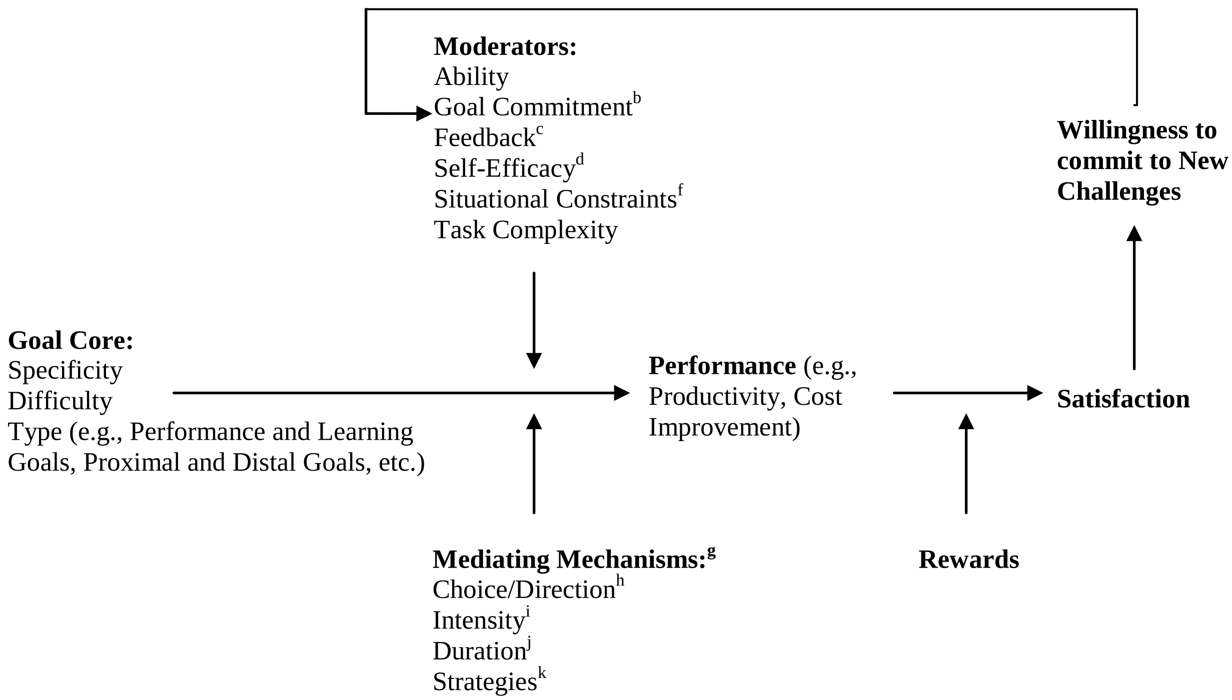
FIGURES

Figure 1[a]
The High Performance Cycle



[a] This figure is adapted primarily from Latham and Locke 2007 and Locke and Latham 2002. The original high performance cycle first appears in Locke and Latham (1990) and is an attempt by the authors to create a conceptual model that explains how challenging goals lead to high performance.
[b] Goal commitment is “an individual’s determination to try for a goal (or to keep trying for a goal)” (Locke et al. 1981 p. 143).
[c] Feedback refers to summary information that reveals progress in relation to a goal (Locke and Latham 2002)
[d] Self-efficacy refers to an individual’s task-specific confidence (Bandura 1977).
[f] An example of a situational constraint is raw materials in manufacturing.
[g] Collectively these mediating mechanisms comprise the four components of effort.
[h] Effort direction refers to the “task or activity in which an individual chooses to engage” (Bonner and Sprinkle 2002 p. 306)
[i] Effort intensity is the proportion of an individual’s cognitive and physical resources that are directed toward performing a task (Bonner and Sprinkle 2002).
[j] Effort duration is “the length of time an individual devotes cognitive and physical resources to a particular task or activity” (Bonner and Sprinkle 2002 p. 306).
[k] Strategy development is “conscious problem solving, planning, or innovation on the part of the person performing the task” (Bonner and Sprinkle 2002 p. 307).

Figure 2[a]

Achievement Goals and Achievement Behavior

Theory of Intelligence	Goal Orientation	Confidence in present ability	Behavior Pattern
Entity Theory → (Intelligence is fixed)	**Performance Goals** (Goal is to gain positive judgments/avoid negative judgments of competence)	**If high** →	**Mastery-oriented** Seek challenge High persistence
		but	
		If low →	**Helpless** Avoid challenge Low persistence
Incremental Theory → (Intelligence is malleable)	**Learning Goals** (Goal is to gain positive judgments/avoid negative judgments of competence)	**If high or low** →	**Mastery-oriented** Seek challenge (for learning) High persistence

[a] This figure is adapted from Table 1 of Dweck (1986).

Figure 3[a]

Task Shortcuts

<u>Box one</u>

Across pages, the answers repeat 1, 2, and 3. That is the answer to Box one, Page one is 1; Box one, Page two is 2; Box one, Page three is 3; Box one, Page 4 was 1; etc.

<u>Box two</u>

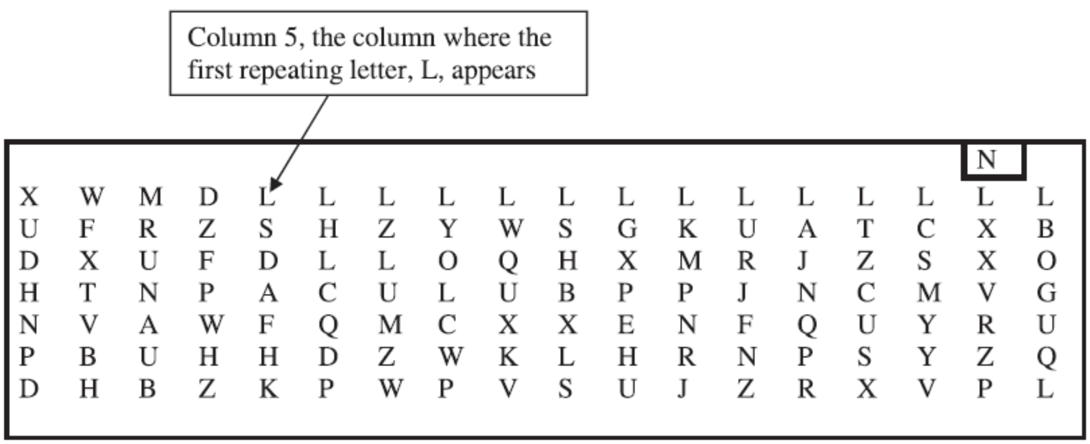
Across Pages, the answers count down by two. Specifically the answer to Box two, Page one is 40; Box two, Page two is 38; Box two, Page 3 is 36; etc.

<u>Box three</u>

On each page, the answer is the sum of the answers from Box one and Box two. For example on page 1 the answer to Box one is 1 and the answer to Box two is 40. Thus the answer to Box three is 41.

<u>Box four</u>

Within the first row of the box, the column in which a repeating letter first appears. Please see the example below.



Answer: 5

<u>Box five</u>

On each page, the answer is box 4 plus one. For example, if the answer to Page one, Box four were 5, then the answer to Page one, Box five would be 6.

<u>Box Six</u>

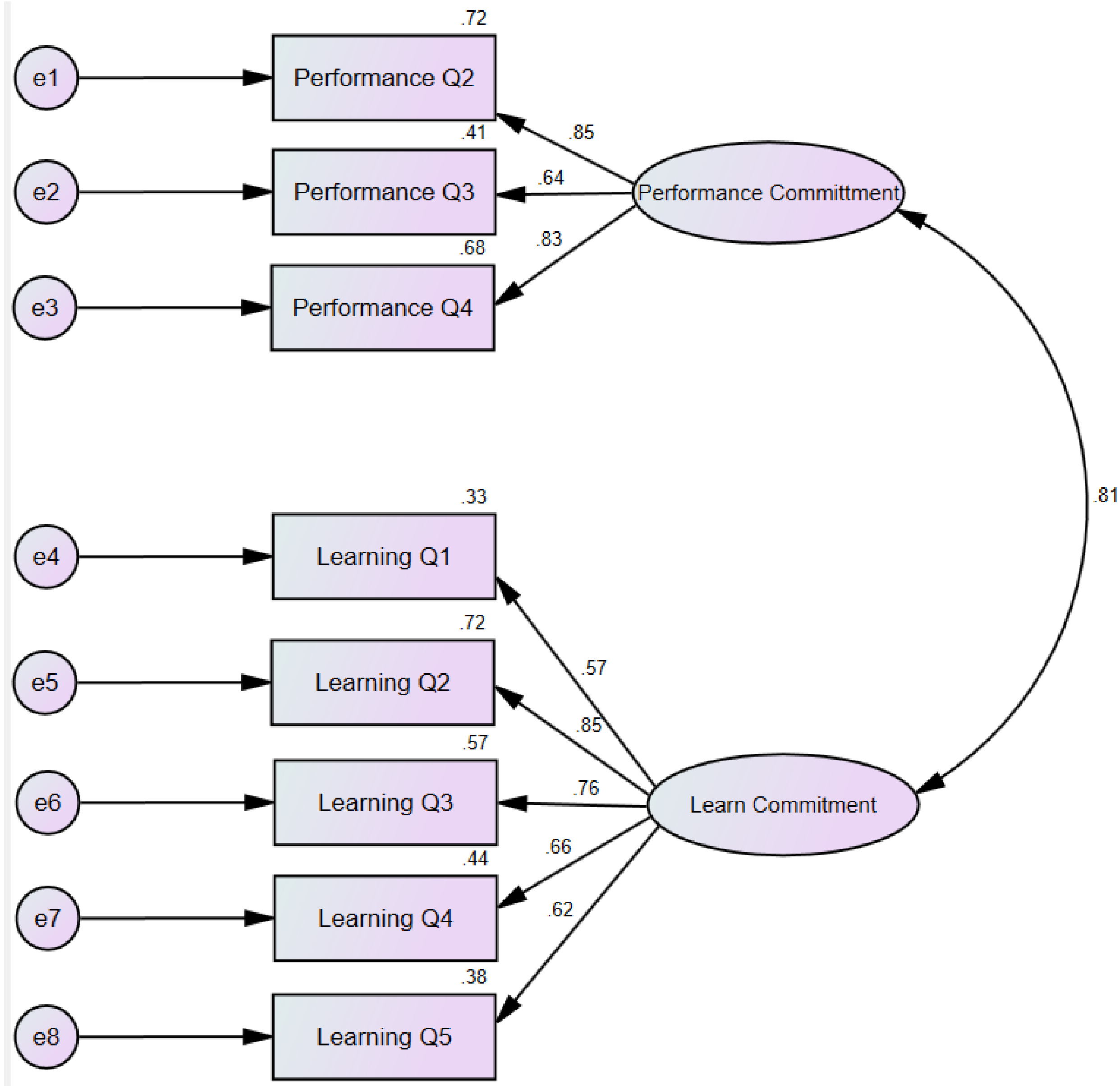
Across pages, the answers count up by one. Specifically, the answer to Box six, Page one is 3; Box six, Page two is 4, Page three is 5; etc.

[a] This figure is taken verbatim from Figure 2 (p. 1,444) of Webb et al. (2013)

Figure 4

Goal Commitment[a] Confirmatory Factor Analysis[b]

CFI = .907 RMSEA = .108



[a] Performance goal commitment is determined by questions two, three, and four in appendix item 4 and learning goal commitment is determined by questions one through five in appendix item 3.
[b] This model yields a CFI of .907, which is greater than the .90 cutoff suggested by Hu and Bentler (1999) and therefore suggests adequate model fit. RMSEA is .108, which is greater than the .06 cutoff suggested by Hu and Bentler (1999) and may indicate poor model fit. Reported values in the figure reflect standardized estimates.

Table 1
Moderator and Covariate Descriptive Statistics (Phase 1)

Means (Standard Deviations) for Moderators and Covariates in Phase 1

	Performance Goal	**Learning Goal**	**Average**
Performance Goal[a]	.46	N/A	.46
Commitment Measure	1.37		(1.37)
	n = 22		
Alternative	.65	N/A	.65
Performance Goal	(1.57)		(1.57)
Commitment Measure[b]	n = 22		
Learning Goal	N/A	.71	.71
Commitment[c]		(1.47)	(1.47)
		n = 21	
Self-Efficacy[d]	.96	.65	.81
	(.60)	(.80)	(.70)
	n = 22	n = 21	
Task Attractiveness[e]	4.19	4.37	4.28
	(.87)	(.94)	(.90)
	n = 22	n = 21	
Analytical Reasoning[f]	3.41	3.10	3.26
	(1.47)	(1.34)	(1.40)
	n = 22	n = 21	
Task Complexity[g]	.09	-.19	-.05
	(2.14)	(2.27)	(2.21)
	n = 22	n = 21	
Shortcut Complexity[h]	1.00	.57	.79
	(1.51)	(1.94)	(1.72)
	n = 22	n = 21	

[a] Performance goal commitment is a composite measure consisting of five questions each on a 9-point Likert scale ranging from -4 to 4. Questions are located in appendix item 4. Means are unadjusted for factor loadings.
[b] Exploratory factor analysis of pilot data suggested that using only three of the five questions in the above measure may be appropriate. This alternative specification is also included. Means are unadjusted for factor loadings.
[c] Learning goal commitment is a composite measure consisting of five questions each on a 9-point Likert scale ranging from -4 to 4. Questions are located in appendix item 3. Means are unadjusted for factor loadings.
[d] Self-efficacy is measured as participants' average responses to four questions asking participants about their perceptions of goal difficulty as well as their confidence in their ability to perform. Questions are located in appendix item 5.
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7.
[g] Task complexity is the agreement with statement "I found this task to be complicated" on a 9-point Likert scale ranging from -4 to 4. This statement is located in appendix item 6.
[h] Shortcut complexity is the agreement with the statement "Finding shortcuts was complicated" on a 9-point Likert scale ranging from -4 to 4. This statement is located in appendix item 6.

Table 2
Moderator and Covariate Descriptive Statistics (Phase 2)

Means (Standard Deviations) Moderators and Covariates in Phase 2

	Performance Goal	Learning Goal	Simultaneous Goals	Sequential Goals	Average
Performance Goal[a] Commitment Measure	.60 (1.22) n = 18	N/A	.35 .93 n = 25	.57 (1.44) n = 25	.49 (1.20)
Alternative Performance Goal Commitment Measure[b]	.86 (1.47) n = 18	N/A	.65 (1.21) n = 25	.72 (1.66) n = 25	.73 (1.44)
Learning Goal Commitment[c]	N/A	.50 (1.36) n = 25	.93 (1.03) n = 25	1.17 (1.12) n = 25	.87 (1.20)
Self-Efficacy[d]	.40 (1.17) n = 18	.41 (1.17) n = 25	.32 (1.21) n = 25	.40 (1.12) n = 25	.38 (1.17)
Task Attractiveness[e]	3.81 (1.04) n = 18	4.31 (.92) n = 25	4.45 (1.03) n = 25	4.04 (.96) n = 25	4.19 (1.00)
Analytical Reasoning[f]	3.78 (1.56) n = 18	3.52 (1.56) n = 25	3.16 (1.57) n = 25	3.12 (1.54) n = 25	3.37 (1.55)
Task Complexity[g]	.22 (2.13) n = 18	-.76 (1.74) n = 25	-.08 (2.06) n = 25	-.04 (2.03) n = 25	-.19 (1.99)
Shortcut Complexity[h]	1.28 (1.97) n = 18	.28 (1.46) n = 25	.60 (1.76) n = 25	.64 (1.89) n = 25	.66 (1.77)

[a] Performance goal commitment is a composite measure consisting of five questions each on a 9-point Likert scale ranging from -4 to 4. Questions are located in appendix item 4. Means are unadjusted for factor loadings.
[b] Exploratory factor analysis of pilot data suggested that using only three of the five questions in the above measure may be appropriate. This alternative specification is also included. Means are unadjusted for factor loadings.
[c] Learning goal commitment is a composite measure consisting of five questions each on a 9-point Likert scale ranging from -4 to 4. Questions are located in appendix item 3. Means are unadjusted for factor loadings.
[d] Self-efficacy is measured as participants' average responses to four questions asking participants about their perceptions of goal difficulty as well as their confidence in their ability to perform. Questions are located in appendix item 5.
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7.
[g] Task complexity is the agreement with statement "I found this task to be complicated" on a 9-point Likert scale ranging from -4 to 4. This statement is located in appendix item 6.
[h] Shortcut complexity is the agreement with the statement "Finding shortcuts was complicated" on a 9-point Likert scale ranging from -4 to 4. This statement is located in appendix item 6.

Table 3
The Effect of Single Goal Type on Total Shortcuts[a] Discovered (Phases 1 & 2)

Panel A: Number and Percentage of Participants Discovering each Shortcut

	Participants Who Discovered	
Shortcut	**Number**	**%**
1	81	87.1
2	76	81.7
3	64	68.8
4	2	2.2
5	26	28.0
6	59	63.4

Panel B: Means (Standard Deviations) for Total Shortcuts Discovered Across all Periods[b] (n = 86)

	Learning Goal	**Performance Goal**	**Average**
Number of Shortcuts	3.76	3.45	3.62
	(.74)	(1.41)	(1.11)
	n = 46	n = 40	

Panel C: Analysis of Covariance (Shortcuts Discovered)

Factor	**df**	**Sum of Squares**	**F**	**p-value[c]**
GOAL TYPE[d]	1	2.428	1.964	**.088**
PHASE[e]	1	.088	.071	.790
GOAL TYPE X PHASE	1	1.583	1.281	.261
TASK ATTRACTIVENESS[f]	1	.451	.364	.548
ANALYTICAL REASONING[g]	1	.697	.564	.455
Error	80			

[a] For a complete list of shortcuts please refer to Figure 3.
[b] This is the sum of shortcuts discovered in each individual period.
[c] Reported p-values are two-tailed unless testing a one-tailed prediction as signified by bold.
[d] Goal Type: 0 = performance goal, 1 = learning goal
[e] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[f] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[g] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 4
The Effect of Single Goal Type on Shortcuts[a] Discovered in Period 1 (Phases 1 & 2)

Panel A: Means (Standard Deviations) for Shortcuts Discovered[b] (n = 86)

	Learning Goal	**Performance Goal**	**Average**
Number of Shortcuts	1.59	1.63	1.60
	(1.19)	(1.46)	(1.31)
	n = 46	n = 40	

Panel B: Analysis of Covariance (Shortcuts Discovered)

Factor	**df**	**Sum of Squares**	**F**	**p-value[c]**
GOAL TYPE[d]	1	.212	.132	.717
PHASE[e]	1	4.790	2.997	.087
GOAL TYPE X PHASE	1	5.909	3.698	.058
TASK ATTRACTIVENESS[f]	1	2.450	1.533	.219
ANALYTICAL REASONING[g]	1	4.037	2.526	.116
Error	80			

[a] For a complete list of shortcuts please refer to Figure 3.
[b] Total number of shortcuts discovered in period 1 only.
[c] Reported p-values are two-tailed.
[d] Goal Type: 0 = performance goal, 1 = learning goal
[e] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[f] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[g] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 5
The Effect Single of Goal Type on Shortcuts[a] Discovered in Period 2 (Phases 1 & 2)

Panel A: Means (Standard Deviations) for Shortcuts Discovered[b] (n = 86)

	Learning Goal	Performance Goal	Average
Number of Shortcuts	1.59 (1.22) n=46	1.38 (1.35) n=40	1.49 (1.28)

Panel B: Analysis of Covariance (Shortcuts Discovered)

Factor	df	Sum of Squares	F	p-value[c]
GOAL TYPE[d]	1	.857	.525	.471
PHASE[e]	1	.471	.288	.593
GOAL TYPE X PHASE	1	5.838	3.576	.062
TASK ATTRACTIVENESS[f]	1	.516	.316	.576
ANALYTICAL REASONING[g]	1	1.596	.978	.326
Error	80			

[a] For a complete list of shortcuts please refer to Figure 3.
[b] Total number of shortcuts discovered in period 2 only.
[c] Reported p-values are two-tailed.
[d] Goal Type: 0 = performance goal, 1 = learning goal
[e] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[f] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[g] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 6
The Effect of Single Goal Type on Shortcuts[a] Discovered in Period 3 (Phases 1 & 2)

Panel A: Means (Standard Deviations) for Shortcuts Discovered[b] (n = 86)

	Learning Goal	Performance Goal	Average
Number of Shortcuts	.59 (.60) n = 46	.45 (.75) n = 40	.52 (.75)

Panel B: Analysis of Covariance (Shortcuts Discovered)

Factor	df	Sum of Squares	F	p-value[c]
GOAL TYPE[d]	1	.030	.058	.810
PHASE[e]	1	3.238	6.365	.014
GOAL TYPE X PHASE	1	1.547	3.040	.085
TASK ATTRACTIVENESS[f]	1	2.599	5.109	.027
ANALYTICAL REASONING[g]	1	.008	.016	.901
Error	80			

[a] For a complete list of shortcuts please refer to Figure 3.
[b] Total number of shortcuts discovered in period 3 only.
[c] Reported p-values are two-tailed.
[d] Goal Type: 0 = performance goal, 1 = learning goal
[e] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[f] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[g] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 7
The Effect of Single Goal Type on Time Spent Learning (Phases 1 & 2)

Panel A: Means (Standard Deviations) Time Spent Searching For Shortcuts[a] (n = 86)

	Learning Goal	Performance Goal	Average
Period 1	6.0	5.0	5.5
	(3.6)	(3.5)	(3.6)
	n = 46	n = 40	
Period 2	7.2	6.6	6.9
	(2.7)	(2.9)	(2.8)
	n = 46	n = 40	
Period 3	7.0	6.6	6.8
	(3.3)	(3.4)	(3.3)
	n = 46	n = 40	
Average	6.7	6.1	6.4
	(2.4)	(2.6)	(2.6)

Panel B: Analysis of Variance (Time Spent Searching for Shortcuts in Period 1)

Factor	df	Sum of Squares	F	p-value[b]
Goal Type[c]	1	1751.912	1.383	.127
Error	85			

Panel C: Analysis of Variance (Time Spent Searching for Shortcuts in Period 2)

Factor	df	Sum of Squares	F	p-value
Goal Type	1	719.470	.935	.168
Error	85			

Panel D: Analysis of Variance (Time Spent Searching for Shortcuts in Period 3)

Factor	df	Sum of Squares	F	p-value
Goal Type	1	342.326	.303	.292
Error	85			

Panel E: Analysis of Variance (Time Spent Searching for Shortcuts on Average)

Factor	df	Sum of Squares	F	p-value
Goal Type	1	844.499	1.260	.133
Error	85			

[a] Self-reported measure of the proportion of each 10-minute round spent searching for shortcuts converted into minutes. This measure is found in appendix item 6.
[b] Reported p-values are one-tailed
[c] Goal Type: 0 = performance goal, 1 = learning goal

Table 8
The Effect of Single Goal Type on Period 3 Performance (Phases 1 & 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 86)

	Learning Goal	Performance Goal	Average
Performance	72.4	76.2	74.2
	(26.8)	(26.0)	(26.3)
	n = 46	n = 40	

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	104.208	.146	.703
PHASE[d]	1	722.427	1.015	.317
GOAL TYPE X PHASE	1	163.033	.229	.633
TASK ATTRACTIVENESS[e]	1	86.522	.121	.730
ANALYTICAL REASONING[f]	1	131.625	.184	.670
Error	80			

[a] Performance is operationalized as number of correct answers entered in period three.
[b] Reported p-values are two-tailed.
[c] Goal Type: 0 = performance goal, 1 = learning goal
[d] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 9
The Effect of Single Goal Type on Period 1 Performance (Phases 1 & 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 86)

	Learning Goal	Performance Goal	Average
Performance	33.7	33.9	33.8
	(20.6)	(21.1)	(20.7)
	n = 46	n = 40	

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	.013	.000	.996
PHASE[d]	1	8.645	.020	.889
GOAL TYPE X PHASE	1	242.630	.775	.381
TASK ATTRACTIVENESS[d]	1	130.597	.296	.588
ANALYTICAL REASONING[e]	1	792.890	1.794	.184
Error	80			

[a] Performance is operationalized as number of correct answers entered in period 1.
[b] Reported p-values are two-tailed.
[c] Goal Type: 0 = performance goal, 1 = learning goal
[d] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 10
The Effect of Single Goal Type on Period 2 Performance (Phases 1 & 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 86)

	Learning Goal	Performance Goal	Average
Performance	57.3	61.9	59.5
	(25.6)	(24.6)	(25.1)
	n = 46	n = 40	

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	260.018	.408	.525
PHASE[d]	1	831.537	1.304	.257
GOAL TYPE X PHASE	1	9.431	.015	.904
TASK ATTRACTIVENESS[e]	1	78.202	.123	.727
ANALYTICAL REASONING[f]	1	1422.283	2.230	.139
Error	80			

[a] Performance is operationalized as number of correct answers entered in period 2.
[b] Reported p-values are two-tailed.
[c] Goal Type: 0 = performance goal, 1 = learning goal
[d] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 11
The Effect of Single Goal Type on Total Performance (Phases 1 & 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 86)

	Learning Goal	Performance Goal	Average
Performance	163.5	172.0	167.5
	(60.8)	(59.6)	(60.0)
	n = 46	n = 40	

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	699.410	.191	.663
PHASE[d]	1	3440.369	.940	.335
GOAL TYPE X PHASE	1	1179.899	.323	.572
TASK ATTRACTIVENESS[e]	1	39.204	.011	.918
ANALYTICAL REASONING[f]	1	8298.418	2.268	.136
Error	80			

[a] Performance is operationalized as number of correct answers entered across all three periods.
[b] Reported p-values are two-tailed.
[c] Goal Type: 0 = performance goal, 1 = learning goal
[d] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 12

The Effect of Single Goal Type on Effort Intensity in Period 3 (Phases 1 & 2)

Panel A: Means (Standard Deviations) For Performance Per Shortcut Found[a] (n = 84)

	Learning Goal	Performance Goal	Average
Performance	19.2	23.7	21.3
	(5.8)	(10.9)	(8.7)
	n = 46	n = 38	

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	313.416	4.420	**.020**
PHASE[d]	1	278.681	3.930	.051
GOAL TYPE X PHASE	1	155.589	2.194	.143
TASK ATTRACTIVENESS[e]	1	34.709	.299	.587
ANALYTICAL REASONING[f]	1	2.263	.020	.890
Error	78			

[a] Performance per shortcut found is operationalized as number of correct answers entered in period three divided by the total number of shortcuts found across all periods.
[b] Reported p-values are two-tailed unless testing a one-tailed prediction as signified by bold.
[c] Goal Type: 0 = performance goal, 1 = learning goal
[d] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 13
The Effect of Single Goal Type on Effort Intensity in Period 1 (Phases 1 & 2)
Panel A: Means (Standard Deviations) For Performance Per Shortcut Found[a] (n = 61)

	Learning Goal	**Performance Goal**	**Average**
Performance	20.4	21.3	20.8
	(9.8)	(15.1)	(12.3)
	n = 34	n = 27	

Panel B: Analysis of Covariance (Performance)

Factor	**df**	**Sum of Squares**	**F**	**p-value[b]**
GOAL TYPE[c]	1	313.416	4.420	**.020**
PHASE[d]	1	278.681	3.930	.051
GOAL TYPE X PHASE	1	155.589	2.194	.143
TASK ATTRACTIVENESS[e]	1	34.709	.299	.587
ANALYTICAL REASONING[f]	1	2.263	.020	.890
Error	55			

[a] Performance per shortcut found is operationalized as number of correct answers entered in period one divided by the number of shortcuts found in period 1.
[b] Reported p-values are two-tailed unless testing a one-tailed prediction as signified by bold.
[c] Goal Type: 0 = performance goal, 1 = learning goal
[d] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 14
The Effect of Single Goal Type on Effort Intensity in Period 2 (Phases 1 & 2)
Panel A: Means (Standard Deviations) For Performance Per Shortcut Found[a] (n = 84)

	Learning Goal	Performance Goal	Average
Performance	18.8	22.6	20.5
	(8.3)	(12.0)	(10.2)
	n = 46	n = 38	

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	376.532	3.702	**.029**
PHASE[d]	1	18.364	.181	.672
GOAL TYPE X PHASE	1	89.831	.883	.350
TASK ATTRACTIVENESS[e]	1	300.544	2.955	.090
ANALYTICAL REASONING[f]	1	21.901	.215	.644
Error	78			

[a] Performance per shortcut found is operationalized as number of correct answers entered in period two divided by the total number of shortcuts found across the first two periods.
[b] Reported p-values are two-tailed unless testing a one-tailed prediction as signified by bold.
[c] Goal Type: 0 = performance goal, 1 = learning goal
[d] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 15
The Effect of Single Goal Type on Effort Intensity in Total (Phases 1 & 2)
Panel A: Means (Standard Deviations) For Performance Per Shortcut Found[a] (n = 84)

	Learning Goal	Performance Goal	Average
Performance	35.4	42.4	38.6
	(14.5)	(24.7)	(20.0)
	n = 46	n = 38	

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	1478.465	4.030	**.024**
PHASE[d]	1	2574.894	7.019	.010
GOAL TYPE X PHASE	1	396.939	1.082	.301
TASK ATTRACTIVENESS[e]	1	197.282	.538	.466
ANALYTICAL REASONING[f]	1	14.117	.038	.845
Error	78			

[a] Performance per shortcut found is operationalized as number of correct answers across all periods divided by the total number of shortcuts found across all periods.
[b] Reported p-values are two-tailed unless testing a one-tailed prediction as signified by bold.
[c] Goal Type: 0 = performance goal, 1 = learning goal
[d] Phase: 0 = phase 1 of data collection, 1 = phase 2 of data collection
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 16
The Effect Simultaneous Goal Assignment on Total Shortcuts[a] Discovered (Phase 2)

Panel A: Means (Standard Deviations) for Shortcuts Discovered[b] (n = 50)

	Learning Goal	**Simultaneous Goals**	**Average**
Number of Shortcuts	3.68 (.75) n=25	3.60 (1.16) n=25	3.64 (.96)

Panel B: Analysis of Covariance (Shortcuts Discovered)

Factor	**df**	**Sum of Squares**	**F**	**p-value[c]**
GOAL TYPE[d]	1	.002	.002	**.484**
TASK ATTRACTIVENESS[e]	1	.043	.048	.827
ANALYTICAL REASONING[f]	1	4.649	5.268	.026
Error	46			

[a] For a complete list of shortcuts please refer to Figure 3.
[b] This is the sum of shortcuts discovered in each individual period.
[c] Reported p-values are two-tailed unless testing a one-tailed prediction as signified by bold.
[d] Goal Type: 0 = learning goal, 1 = simultaneous goals
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 17
The Effect Simultaneous Goal Assignment on Shortcuts[a] Discovered in Period 1 (Phase 2)

Panel A: Means (Standard Deviations) for Shortcuts Discovered[b] (n = 50)

	Learning Goal	**Simultaneous Goals**	**Average**
Number of Shortcuts	1.16 (1.18) n=25	1.40 (1.26) n=25	1.28 (1.21)

Panel B: Analysis of Covariance (Shortcuts Discovered)

Factor	**df**	**Sum of Squares**	**F**	**p-value[c]**
GOAL TYPE[d]	1	1.465	1.057	.309
TASK ATTRACTIVENESS[e]	1	2.180	1.573	.216
ANALYTICAL REASONING[f]	1	3.255	2.350	.132
Error	46			

[a] For a complete list of shortcuts please refer to Figure 3.
[b] Total number of shortcuts discovered in period 1.
[c] Reported p-values are two-tailed.
[d] Goal Type: 0 = learning goal, 1 = simultaneous goals
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 18
The Effect Simultaneous Goal Assignment on Shortcuts[a] Discovered in Period 2 (Phase 2)

Panel A: Means (Standard Deviations) for Shortcuts Discovered[b] (n = 50)

	Learning Goal	Simultaneous Goals	Average
Number of Shortcuts	1.88	1.52	1.70
	(1.39)	(1.64)	(1.52)
	n=25	n=25	

Panel B: Analysis of Covariance (Shortcuts Discovered)

Factor	df	Sum of Squares	F	p-value[c]
GOAL TYPE[d]	1	1.581	.656	.422
TASK ATTRACTIVENESS[e]	1	.020	.008	.928
ANALYTICAL REASONING[f]	1	.008	.003	.956
Error	46			

[a] For a complete list of shortcuts please refer to Figure 3.
[b] Total number of shortcuts discovered in period 2.
[c] Reported p-values are two-tailed.
[d] Goal Type: 0 = learning goal, 1 = simultaneous goals
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 19
The Effect Simultaneous Goal Assignment on Shortcuts[a] Discovered in Period 3 (Phase 2)

Panel A: Means (Standard Deviations) for Shortcuts Discovered[b] (n = 50)

	Learning Goal	Simultaneous Goals	Average
Number of Shortcuts	.64	.68	.66
	(.86)	(.85)	(.85)
	n=25	n=25	

Panel B: Analysis of Covariance (Shortcuts Discovered)

Factor	df	Sum of Squares	F	p-value[c]
GOAL TYPE[d]	1	.001	.000	.992
TASK ATTRACTIVENESS[e]	1	3.327	4.803	.034
ANALYTICAL REASONING[f]	1	.193	.278	.600
Error	46			

[a] For a complete list of shortcuts please refer to Figure 3.
[b] Total number of shortcuts discovered in period 3.
[c] Reported p-values are two-tailed.
[d] Goal Type: 0 = learning goal, 1 = simultaneous goals
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 20
The Effect of Single Goal Type on Time Spent Learning (Phase 2)

Panel A: Means (Standard Deviations) Time Spent Searching For Shortcuts[a] (n = 50)

	Learning Goal	Simultaneous Goals	Average
Period 1	5.7	4.3	5.0
	(3.7)	(3.1)	(3.5)
	n = 25	n = 25	
Period 2	7.5	5.8	6.7
	(2.8)	(3.4)	(3.2)
	n = 25	n = 25	
Period 3	7.1	6.3	6.7
	(3.4)	(3.4)	(3.4)
	n = 25	n = 25	
Average	6.7	5.5	6.1
	(2.7)	(3.0)	(2.9)

Panel B: Analysis of Variance (Time Spent Searching for Shortcuts in Period 1)

Factor	df	Sum of Squares	F	p-value[b]
Goal Type[c]	1	2312.000	1.946	.089
Error	49			

Panel C: Analysis of Variance (Time Spent Searching for Shortcuts in Period 2)

Factor	df	Sum of Squares	F	p-value
Goal Type	1	3872.000	3.967	.026
Error	49			

Panel D: Analysis of Variance (Time Spent Searching for Shortcuts in Period 3)

Factor	df	Sum of Squares	F	p-value
Goal Type	1	760.500	.667	.209
Error	49			

Panel E: Analysis of Variance (Time Spent Searching for Shortcuts on Average)

Factor	df	Sum of Squares	F	p-value
Goal Type	1	2112.500	2.630	.056
Error	49			

[a] Self-reported measure of the proportion of each 10-minute round spent searching for shortcuts converted into minutes. This measure is found in appendix item 6.
[b] Reported p-values are one-tailed
[c] Goal Type: 0 = performance goal, 1 = learning goal

Table 21

The Effect of Simultaneous Goals on Period 3 Performance (Phase 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 50)

	Learning Goal	Simultaneous Goals	Average
Performance	68.8 (25.6) n = 25	80.8 (20.0) n = 25	74.8 (23.6)

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	2424.544	5.026	.030
TASK ATTRACTIVENESS[d]	1	226.396	.469	.497
ANALYTICAL REASONING[e]	1	2280.180	4.726	.035
Error	46			

[a] Performance is operationalized as number of correct answers entered in period 3.
[b] Reported p-values are two-tailed.
[c] Goal Type: 0 = learning goal, 1 = simultaneous goals
[d] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[e] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 22
The Effect of Simultaneous Goals on Period 1 Performance (Phase 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 50)

	Learning Goal	Simultaneous Goals	Average
Performance	32.0 (20.4) n = 25	32.4 (18.2) n = 25	32.1 (19.2)

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	62.301	.182	.671
TASK ATTRACTIVENESS[d]	1	671.761	1.965	.168
ANALYTICAL REASONING[e]	1	934.136	2.733	.105
Error	46			

[a] Performance is operationalized as number of correct answers entered in period 1.
[b] Reported p-values are two-tailed.
[c] Goal Type: 0 = learning goal, 1 = simultaneous goals
[d] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[e] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 23
The Effect of Simultaneous Goals on Period 2 Performance (Phase 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 50)

	Learning Goal	Simultaneous Goals	Average
Performance	54.7	59.4	57.1
	(23.8)	(24.7)	(24.1)
	n = 25	n = 25	

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	536.667	.963	.332
TASK ATTRACTIVENESS[d]	1	1199.380	2.152	.149
ANALYTICAL REASONING[e]	1	653.022	1.172	.285
Error	46			

[a] Performance is operationalized as number of correct answers entered in period 2.
[b] Reported p-values are two-tailed.
[c] Goal Type: 0 = learning goal, 1 = simultaneous goals
[d] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[e] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 24
The Effect of Simultaneous Goals on Total Performance

Panel A: Means (Standard Deviations) For Performance[a] (n = 50)

	Learning Goal	Simultaneous Goals	Average
Performance	155.5	172.6	164.1
	(55.2)	(50.6)	(53.2)
	n = 25	n = 25	

Panel B: Analysis of Covariance (Performance)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	6447.901	2.654	.110
TASK ATTRACTIVENESS[d]	1	5714.886	2.352	.132
ANALYTICAL REASONING[e]	1	10788.803	4.440	.041
Error	46			

[a] Performance is operationalized as number of correct answers entered across all three periods.
[b] Reported p-values are two-tailed.
[c] Goal Type: 0 = learning goal, 1 = simultaneous goals
[d] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[e] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 25
The Effect of Sequential Goals on Period 3 Performance (Phase 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 50)

	Learning Goal	Sequential Goals	Average
Performance	68.8	79.2	74.0
	(25.6)	(20.5)	(23.6)
	n = 25	n = 25	

Panel B: Analysis of Covariance (Productivity)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	1214.369	2.236	**.071**
TASK ATTRACTIVENESS[d]	1	498.247	.917	.343
ANALYTICAL REASONING[e]	1	289.495	.533	.469
Error	46			

[a] Performance is operationalized as number of correct answers entered in period three.
[b] Reported p-values are two-tailed unless testing a one-tailed prediction as signified by bold.
[c] Goal Type: 0 = learning goal, 1 = sequential goals
[d] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[e] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 26
The Effect of Sequential Goals on Period 3 Performance (Phase 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 45)

	Learning Goal	Sequential Goals	Average
Performance	69.7	86.0	77.3
	(25.9)	(10.2)	(21.6)
	n = 24	n = 21	

Panel B: Analysis of Covariance (Productivity)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	2807.430	7.210	**.005**
TASK ATTRACTIVENESS[d]	1	824.557	2.118	.153
ANALYTICAL REASONING[e]	1	383.611	.985	.327
Error	41			

[a] Performance is operationalized as number of correct answers entered in period three.
[b] Reported p-values are two-tailed unless testing a one-tailed prediction as signified by bold.
[c] Goal Type: 0 = learning goal, 1 = sequential goals
[d] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[e] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 27
The Effect of Sequential Goals on Period 3 Performance (Phase 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 35)

	Learning Goal	Sequential Goals	Average
Performance	70.3	87.8	78.8
	(26.2)	(10.4)	(21.8)
	n = 18	n = 17	

Panel B: Analysis of Covariance (Productivity)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	2782.039	6.673	**.008**
TASK ATTRACTIVENESS[d]	1	267.781	.642	.429
ANALYTICAL REASONING[e]	1	191.286	.459	.503
Error	31			

[a] Performance is operationalized as number of correct answers entered in period three.
[b] Reported p-values are two-tailed unless testing a one-tailed prediction as signified by bold.
[c] Goal Type: 0 = learning goal, 1 = sequential goals
[d] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[e] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 28
Comparing The Effects of Combined Goals on Total Shortcuts[a] Discovered (Phase 2)

Panel A: Means (Standard Deviations) for Shortcuts Discovered[b] (n = 50)

	Simultaneous Goals	Simultaneous Goals	Average
Number of Shortcuts	3.60	3.68	3.64
	(1.16)	(1.21)	(1.17)
	n=25	n=25	

Panel B: Analysis of Covariance (Shortcuts Discovered)

Factor	df	Sum of Squares	F	p-value[c]
GOAL TYPE[d]	1	.097	.068	.795
TASK ATTRACTIVENESS[e]	1	.005	.004	.952
ANALYTICAL REASONING[f]	1	2.362	1.670	.203
Error	46			

[a] For a complete list of shortcuts please refer to Figure 3.
[b] This is the sum of shortcuts discovered in each individual period.
[c] Reported p-values are two-tailed.
[d] Goal Type: 0 = learning goal, 1 = simultaneous goals
[e] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[f] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

Table 29

Comparing The Effects of Combined Goals on Period 3 Performance (Phase 2)

Panel A: Means (Standard Deviations) For Performance[a] (n = 50)

	Simultaneous Goals	Sequential Goals	Average
Performance	80.8	79.2	80.0
	(20.0)	(20.5)	(20.1)
	n = 25	n = 25	

Panel B: Analysis of Covariance (Productivity)

Factor	df	Sum of Squares	F	p-value[b]
GOAL TYPE[c]	1	33.668	.087	.769
TASK ATTRACTIVENESS[d]	1	13.513	.035	.853
ANALYTICAL REASONING[e]	1	1792.327	4.629	.037
Error	46			

[a] Performance is operationalized as number of correct answers entered in period three.
[b] Reported p-values are two-tailed.
[c] Goal Type: 0 = learning goal, 1 = sequential goals
[d] Task attractiveness is a composite measure based on seven questions located in appendix item 2 and is included as a covariate.
[e] Analytical reasoning is a composite measure based on six questions located in appendix item 7 and is included as a covariate.

APPENDIX

1. Letter Search Sample

1 .																**R**	
E	M	T	J	K	O	K	S	U	C	S	B	L	Z	Z	N	X	N
O	F	Q	U	Y	W	O	Q	A	A	S	Z	G	P	B	C	S	V
K	E	B	T	F	T	G	J	N	S	T	U	Y	F	L	T	S	B
B	B	D	G	Z	I	M	L	B	Q	W	O	O	C	U	C	B	N
G	S	A	K	A	O	B	J	V	X	Y	Z	W	X	T	S	C	L
N	N	D	Z	V	F	X	X	L	K	L	S	L	I	I	U	T	C
R	G	E	K	T	U	M	L	H	J	Z	S	M	Y	V	G	D	M
2 .																**V**	
D	Z	V	K	V	W	A	V	M	W	E	V	Z	V	L	V	B	V
V	R	V	C	X	M	V	S	K	O	T	N	I	W	N	Q	V	R
V	I	V	L	B	J	F	V	V	V	V	V	A	V	Z	V	L	V
I	Q	V	K	U	V	R	I	A	E	E	M	W	V	D	V	Q	V
V	B	V	W	M	V	O	V	A	S	V	A	N	V	R	V	O	V
V	C	G	M	I	V	G	U	V	E	S	E	Z	V	Y	Z	Y	I
P	J	A	C	V	R	F	V	A	L	W	D	P	K	J	Q	Z	B
3 .																**Z**	
Z	Z	G	Z	Z	O	W	Z	J	Z	B	Z	D	O	A	D	Z	Z
X	O	G	C	L	E	J	Z	X	K	D	D	T	Q	Z	K	G	Z
Z	Z	E	Z	M	Z	L	Z	I	Z	U	Z	Z	K	Z	R	X	V
X	W	O	S	G	W	F	Z	C	Z	Z	B	Z	Z	A	R	B	Z
Z	I	Z	Y	Z	Z	K	Z	T	T	V	Y	X	X	Z	G	F	Z
Z	N	U	Y	I	M	O	Z	E	Z	Q	J	Z	S	R	E	M	U
U	Z	T	V	Z	P	Z	I	Y	J	V	U	E	J	S	A	L	X
4 .																**B**	
I	H	V	L	B	F	A	H	G	F	X	X	X	X	X	X	X	X
K	A	L	R	G	K	G	L	L	B	M	N	A	B	H	I	D	B
P	P	R	V	B	H	B	T	B	T	F	B	J	X	O	Q	Y	I
T	O	G	I	Y	C	R	G	F	Y	V	Z	F	X	X	W	O	B
S	G	Y	A	S	O	F	D	X	J	Y	W	R	Y	K	B	P	H
B	L	G	O	A	E	L	Q	U	U	X	I	O	C	F	T	V	U
G	R	C	E	Z	U	U	J	P	J	E	Y	F	H	O	F	G	R
5 .																**Z**	
R	Z	Z	U	G	Y	Y	U	V	L	Y	X	G	M	H	T	A	E
Z	W	J	J	R	M	T	W	C	Q	V	A	R	F	U	T	U	N
L	M	W	O	A	H	R	E	U	C	D	E	R	W	Z	I	U	V
T	J	D	T	E	E	T	E	O	A	R	Z	Z	C	X	E	Z	S
C	S	H	O	O	H	M	Q	V	B	I	R	D	Z	A	R	Z	C
R	S	F	G	L	J	C	N	S	Z	S	D	S	A	Z	H	Q	L
K	I	U	K	A	V	V	P	B	Z	U	X	L	R	B	B	J	T
6 .																**F**	
R	F	F	K	A	R	U	W	L	P	E	J	N	Q	Y	T	T	A
Q	C	L	K	B	X	A	Q	I	T	V	L	I	D	I	S	Q	Y
Y	L	H	P	V	Q	K	S	G	O	C	M	Z	G	Z	K	V	A
Q	W	P	M	P	Y	A	I	D	S	P	H	M	C	Y	D	S	I
C	I	E	C	B	M	L	H	M	S	L	H	J	R	K	W	F	I
B	H	B	D	R	K	V	D	B	U	X	V	Y	O	G	I	K	C
P	I	I	R	Q	X	K	X	C	X	N	N	W	R	V	H	N	V

Appendix continued

2. Task Attractiveness Questions

How would you describe this task?

Attractive ←---→Repulsive	○ Extremely ○ Quite ○ Slightly ○ Neither ○ Slightly ○ Quite ○ Extremely
Dull ←---→Exciting	○ Extremely ○ Quite ○ Slightly ○ Neither ○ Slightly ○ Quite ○ Extremely
Good ←---→Bad	○ Extremely ○ Quite ○ Slightly ○ Neither ○ Slightly ○ Quite ○ Extremely
Boring ←---→Interesting	○ Extremely ○ Quite ○ Slightly ○ Neither ○ Slightly ○ Quite ○ Extremely
Superior ←---→Inferior	○ Extremely ○ Quite ○ Slightly ○ Neither ○ Slightly ○ Quite ○ Extremely
Unwholesome ←---→Wholesome	○ Extremely ○ Quite ○ Slightly ○ Neither ○ Slightly ○ Quite ○ Extremely
Fun ←---→Tedious	○ Extremely ○ Quite ○ Slightly ○ Neither ○ Slightly ○ Quite ○ Extremely

Appendix continued

3. Learning Goal Commitment Questions

1. It's hard to take the assigned goal of learning 3 shortcuts seriously.

○	○	○	○	○	○	○	○	○
-4	-3	-2	-1	0	1	2	3	4
Strongly disagree		Moderately Disagree		Neutral		Moderately Agree		Strongly agree

2. I don't care if I achieve the assigned goal of learning a total of 3 shortcuts.

○	○	○	○	○	○	○	○	○
-4	-3	-2	-1	0	1	2	3	4
Strongly disagree		Moderately Disagree		Neutral		Moderately Agree		Strongly agree

3. I am strongly committed to the goal of learning a total of 3 shortcuts

○	○	○	○	○	○	○	○	○
-4	-3	-2	-1	0	1	2	3	4
Strongly disagree		Moderately Disagree		Neutral		Moderately Agree		Strongly agree

4. It wouldn't take much to get me to abandon the assigned goal of learning a total of 3 shortcuts.

○	○	○	○	○	○	○	○	○
-4	-3	-2	-1	0	1	2	3	4
Strongly disagree		Moderately Disagree		Neutral		Moderately Agree		Strongly agree

5. I think the assigned goal of learning a total of 3 shortcuts is a good goal to shoot for.

○	○	○	○	○	○	○	○	○
-4	-3	-2	-1	0	1	2	3	4
Strongly disagree		Moderately Disagree		Neutral		Moderately Agree		Strongly agree

Appendix continued

4. Performance Goal Commitment Questions

1. It's hard to take the assigned goal of entering 90 correct answers seriously. ○ ○ ○ ○ ○ ○ ○ ○ ○ -4 -3 -2 -1 0 1 2 3 4 Strongly disagree, Moderately Disagree, Neutral, Moderately Agree, Strongly agree
2. I don't care if I achieve the assigned goal of entering 90 correct answers. ○ ○ ○ ○ ○ ○ ○ ○ ○ -4 -3 -2 -1 0 1 2 3 4 Strongly disagree, Moderately Disagree, Neutral, Moderately Agree, Strongly agree
3. I am strongly committed to the goal of entering 90 correct answers. ○ ○ ○ ○ ○ ○ ○ ○ ○ -4 -3 -2 -1 0 1 2 3 4 Strongly disagree, Moderately Disagree, Neutral, Moderately Agree, Strongly agree
4. It wouldn't take much to get me to abandon the assigned goal of entering 90 correct answers. ○ ○ ○ ○ ○ ○ ○ ○ ○ -4 -3 -2 -1 0 1 2 3 4 Strongly disagree, Moderately Disagree, Neutral, Moderately Agree, Strongly agree
5. I think the assigned goal of entering 90 correct answers is a good goal to shoot for. ○ ○ ○ ○ ○ ○ ○ ○ ○ -4 -3 -2 -1 0 1 2 3 4 Strongly disagree, Moderately Disagree, Neutral, Moderately Agree, Strongly agree

Appendix continued

5. Self-Efficacy Questions

I am confident in my ability to find correct answers.

-4	-3	-2	-1	0	1	2	3	4
○	○	○	○	○	○	○	○	○

Strongly disagree · Moderately Disagree · Neutral · Moderately Agree · Strongly agree

Using the scale below, please rate the difficulty of entering 90 correct answers.

1	2	3	4	5	6	7
○	○	○	○	○	○	○

Low difficulty · Moderate difficulty · High Difficulty

I am confident in my ability to discover shortcuts

-4	-3	-2	-1	0	1	2	3	4
○	○	○	○	○	○	○	○	○

Strongly disagree · Moderately Disagree · Neutral · Moderately Agree · Strongly agree

Using the scale below, please rate the difficulty of learning a total of 3 shortcuts.

1	2	3	4	5	6	7
○	○	○	○	○	○	○

Low difficulty · Moderate difficulty · High Difficulty

Appendix continued

6. Post-Experimental Questionnaire

The requirements of the task were easy to understand.

○ ○ ○ ○ ○ ○ ○ ○ ○

-4 -3 -2 -1 0 1 2 3 4

Strongly disagree Moderately Disagree Neutral Moderately Agree Strongly agree

I enjoyed working on the task.

○ ○ ○ ○ ○ ○ ○ ○ ○

-4 -3 -2 -1 0 1 2 3 4

Strongly disagree Moderately Disagree Neutral Moderately Agree Strongly agree

I worked hard on the task.

○ ○ ○ ○ ○ ○ ○ ○ ○

-4 -3 -2 -1 0 1 2 3 4

Strongly disagree Moderately Disagree Neutral Moderately Agree Strongly agree

I found the task to be complicated.

○ ○ ○ ○ ○ ○ ○ ○ ○

-4 -3 -2 -1 0 1 2 3 4

Strongly disagree Moderately Disagree Neutral Moderately Agree Strongly agree

Finding shortcuts was complicated.

○ ○ ○ ○ ○ ○ ○ ○ ○

-4 -3 -2 -1 0 1 2 3 4

Strongly disagree Moderately Disagree Neutral Moderately Agree Strongly agree

I thought I could achieve my goal of 90 correct answers.

○ ○ ○ ○ ○ ○ ○ ○ ○

-4 -3 -2 -1 0 1 2 3 4

Strongly disagree Moderately Disagree Neutral Moderately Agree Strongly agree

I wanted to achieve my goal of 90 correct answers

○ ○ ○ ○ ○ ○ ○ ○ ○

-4 -3 -2 -1 0 1 2 3 4

Strongly disagree Moderately Disagree Neutral Moderately Agree Strongly agree

I thought I could achieve my goal of finding at least 3 shortcuts.

○ ○ ○ ○ ○ ○ ○ ○ ○

-4 -3 -2 -1 0 1 2 3 4

Strongly disagree Moderately Disagree Neutral Moderately Agree Strongly agree

I wanted to achieve my goal of finding at least 3 shortcuts.

○ ○ ○ ○ ○ ○ ○ ○ ○

-4 -3 -2 -1 0 1 2 3 4

Strongly disagree Moderately Disagree Neutral Moderately Agree Strongly agree

Appendix continued

6. Post-Experimental Questionnaire Continued

Please describe the shortcuts you discovered below and when you discovered them

Box	Shortcut	Period Discovered
1		
2		
3		
4		
5		
6		

Approximately what percentage of your time did you spend searching for shortcuts?

Period	Percentage of time spent searching for shortcuts	
1		%
2		%
3		%

Gender

○ Male ○ Female

Age:

[ ] years

Year in school:

○ 1 ○ 2 ○ 3 ○ 4 ○ 5+

Appendix continued

7. Analytical Reasoning Questions

The FOLLOWING INFORMATION APPLIES TO THE NEXT THREE QUESTIONS.

P, Q, R, S, and T are the computers in five overseas offices of a large multi-national company. The computers are linked in an unusual manner in order to provide increased security to the main offices. Data can be DIRECTLY requested only:

From P by Q	From Q by P	From S by Q	From T by R
From P by T	From R by P	From S by T	

1. Which of the following CANNOT request data from any of the other four computers?
- ○ Q
- ○ R
- ○ S
- ○ T

2. If computers Q, R, S, and T are the only ones operating, which of the following requests can be made either directly or indirectly through one or more of the operating computers?
- ○ a request by Q for data from T
- ○ a request by T for data from R
- ○ a request by R for data from S
- ○ a request by R for data from Q

3. Which of the following is a complete and accurate list of computers that can request data from S through exactly one other computer?
- ○ P and Q
- ○ P and R
- ○ Q and R
- ○ R and T

Appendix continued

7. Analytical Reasoning Questions Continued

THE FOLLOWING INFORMATION APPLIES TO THE NEXT THREE QUESTIONS.

Last week's total hours worked and hourly wages for the cashiers of Market X.

Cashier	Hourly Wage	Total Hours Worked
P	$4.25	40
Q	$4.75	32
R	$5.00	26
S	$5.50	25
T	$5.50	22

Note: Last week no more than two cashiers worked at any one time, no cashier worked more than 12 hours on the same day, and on each day each cashier worked continuously.

1. If Market X is open 96 hours per week, for how many hours last week were two cashiers working at the same time?

- ○ 49
- ○ 48
- ○ 36
- ○ 24

2. What was the average (arithmetic mean) number of hours that the five cashiers worked last week?

- ○ 25
- ○ 27
- ○ 29
- ○ 30

3. On Saturday of last week, Market X was open for 15 hours and exactly four cashiers worked. What was the greatest possible amount that Market X could have paid in cashier's wages for that day?

- ○ $132.00
- ○ $157.50
- ○ $161.25
- ○ $163.00