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Multi-Task Setting Involving Simple and Complex Tasks: An Exploratory Study of Employee Motivation

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by

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DEDICATION

I would like to dedicate this dissertation to my husband, my sister, and my parents. Andras, thank you for your support in my pursuit of happiness. Thank you for your love, patience, and guidance. You are my inspiration in life. I would have never been able to go through this process without you by my side.

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ABSTRACT

In this study, employees are given autonomy in effort allocation across two tasks – complex and simple tasks, where the return to the organization is significantly higher for the complex task requiring high skill than for the simple task requiring low skill. An unavoidable feature of multi-task settings is that effort expended on one task detracts from effort that can be expended on another task. This effort trade-off among tasks becomes problematic when the returns from different tasks are unequal, with important consequences for a firm's overall performance. The design of management accounting control systems in such multi-task setting is difficult because organizations have to achieve multiple objectives: to improve productivity on both simple and complex tasks (i.e., performance) and to direct employee effort to more complex tasks given that the complex tasks are more valuable to firms (i.e., effort allocation). In a laboratory experiment, I examine the effects of two motivational mechanisms, financial compensation and relative performance information (RPI), on employee performance and effort allocation between simple and complex tasks. I find that the effects of RPI and financial compensation are independent such that each motivational mechanism affects performance and effort allocation separately. In addition, I find that the effects of RPI or financial compensation depend on whether a worker is a top performer or a bottom performer. Also, findings demonstrate that the effects of these motivational mechanisms on employee effort allocation and performance depend on the complexity of the task. Future research studies and managers who design incentive systems should consider the implementation of different types of incentives for

different performer levels. Organizations should consider the degree of complexity of the tasks that workers must perform in multi-task settings.

1.0 INTRODUCTION

Most jobs in contemporary organizations require employees to perform multiple tasks (Ichniowski and Shaw 2003; Laux 2001; Lindbeck and Snower 1996; Holmstrom and Milgrom 1990).[1] For example, General Electric recently started a wave of production efficiency changes for the development of its commercial engines by cross-training their workforce (Norris 2011). "Employees who would formerly be specialized at specific tasks such as rotor grinding or stacking rotors are now empowered to perform multiple tasks and work together on one engine serial number from start to finish" (Norris 2011, p.41). The tasks performed by an employee often vary in the degree of skill required and in their importance to the organization. Although all required tasks must be performed, tasks requiring higher (lower) skill usually result in higher (lower) returns to the firm. Organizations expect employees to not only take on multiple tasks, but also to focus their efforts on tasks that have a higher return potential for the firm.[2]

An employee must allocate his or her effort among the multiple tasks to be performed. In many organizations employees are allowed to decide how much effort to allocate among multiple tasks (Langfred and Moye 2004). Providing employees with such autonomy enhances employee productivity (Amabile 1996). Choice gives individuals a sense of personal control

[1] Lindbeck and Snower (1996) suggest that the organizational structure of manufacturing and service companies has started to change. Among some of the described changes is that workers now engage in multiple tasks. They attribute the restructuring process to technological advances (i.e., transmission of information) and improvements in physical and human capital (i.e., knowledge disseminated through the educational systems has allowed workers to become increasingly capable of performing multiple tasks). Ichniowski and Shaw (2003) provide examples of workers performing a range of tasks: engineers work on developing better production methods and also work on maintaining existing production equipment; professors teach and conduct research.

[2] For example, an employee in a professional service firm might provide bookkeeping services to clients and also prepare clients' corporate tax returns. The bookkeeping services generate a smaller contribution margin than the preparation of tax returns for the professional service firm.

resulting in increased employee morale, greater organizational commitment, and lower turnover (Chua and Iyengar 2006). Empowering employees with autonomy in effort allocation, however, can be problematic when multiple tasks must be performed, because insufficient effort towards some tasks could inhibit achievement of organizational goals.

An unavoidable feature of multi-task settings is that effort expended on one task detracts from effort that can be expended on another task. This effort trade-off among tasks becomes problematic when the returns from different tasks are unequal, with important consequences for a firm's overall performance. Therefore, studying allocation of effort is important because if employees are motivated to allocate their effort across tasks in a manner preferred by the organization (i.e., firm-preferred effort allocation), the overall organization's productivity would increase leading to increases in the firm's profit.

In this study, employees are given autonomy in effort allocation across two tasks requiring varying levels of skill. I examine a multi-task setting in which employees must perform both simple and complex tasks, where the return to the organization is significantly higher for complex tasks requiring high skill than for simple tasks requiring low skill. In such a setting, the organization has two objectives: to improve productivity on both simple and complex tasks and to direct employee effort to more complex tasks given that the complex tasks are more valuable to the firm. Such a setting is important to examine because, given a choice, most effort-averse employees would allocate effort to the simple task in the absence of differential rewards on the tasks.

In a multi-task setting, most effort-averse employees will allocate effort toward the task they feel more capable of performing, which is the simple task. Recognizing that employees would prefer to allocate effort to simple tasks, organizations desirous of directing effort towards complex tasks can provide greater financial incentives (rewards) for performance on the complex task. Management accounting control systems include tools such as financial incentives used to steer employees towards an organization's strategic objectives (Chenhall 2003). Prior research has demonstrated that the efficacy of financial incentives decreases as the task becomes more complex because the effort-to-performance connection[3] is more uncertain compared to that of simple tasks (Bonner, Hastie, Sprinkle and Young 2000). Since the effort-to-performance connection is often tenuous for complex tasks (Bailey and Fessler 2011; Bonner and Sprinkle 2002; Bonner et al. 2000; Vroom 1964),[4] it is unclear whether simply providing financial incentives will accomplish the firm's objective of having employees direct greater effort towards the complex task. Thus, it is unclear whether employees will still prefer to perform the simple task if the complex task is rewarded more than the simple task.

Apart from financial incentives, social factors can also have a motivational effect on employees (e.g.,Tafkov 2013; Murthy and Schafer 2011; Kachelmeier and Towry 2002; Towry 2003). Examples of social factors include providing relative performance information (RPI), nonfinancial incentives, and fairness. RPI is information provided by the accounting system to a person regarding some aspect of peer performance (Sprinkle 2000). Workers can obtain RPI from the accounting information systems of the firm or from informal methods, such as from mutual monitoring (e.g., Towry 2003). Providing relative performance information (RPI) fosters social comparisons and can positively impact performance (Murthy and Schafer 2011; Tafkov

[3] In a simple task, greater effort allocation can directly affect performance. In a complex task, however, effort allocation does not have a direct or strong impact on performance because simply expending additional effort without any change in task strategy is unlikely to improve performance on the complex task.

[4] Task complexity affects the relationship between effort and performance. The link between effort and performance for complex tasks is weaker than for less complex tasks because individual characteristics such as expertise and experience could also influence performance of complex tasks (Bailey and Fessler 2011). Bonner and Sprinkle (2002) call for research that examines the effect of effort as a mediator of the relationship between financial incentives and performance.

2013). Prior research has established the effectiveness of RPI in a single task-setting (Tafkov 2013; Young, Fisher and Lindquist 1993; Hannan, Krishnan and Newman 2008; Frederickson 1992; Murthy and Schafer 2011). There is no evidence in the literature regarding the efficacy of RPI in a multi-task setting where individuals must perform both simple tasks requiring less skill and complex tasks requiring greater skill.

I examine a setting in which a worker who is paid under flat-wage or goal-based compensation and is either provided with RPI or not chooses the level of effort to allocate across low-return simple and high-return complex tasks. Both RPI and financial incentives are motivational mechanisms that affect worker performance. On the one hand, RPI has the effect of inducing workers to engage in social comparison (Festinger 1954). When comparing their performance to that of others, in order to maintain a positive self-image, workers become competitive and are motivated to perform better than their peers. On the other hand, financial incentives link individual performance to pay leading to motivated workers who strive to maximize their rewards. It is unknown how the presence of multiple motivational mechanisms—one financial and one social—will affect workers' effort allocation and performance across the multiple-tasks they must perform. Including financial incentives based on individual performance and RPI creates multiple incentives for participants to allocate effort as they consider both their utility for wealth and their utility for social distinction. Thus, it is important to examine the combined motivational effects of RPI and financial incentives on worker performance and effort allocation in a multi-task setting.

Firms often compensate employees with financial incentives such as bonuses for reaching a goal (Halzack 2012), and they often disseminate RPI to their employees (Anderson et al. 1982; Nordstrom et al. 1990; Wikoff et al. 1982). Prior research has documented that RPI does not lead to firm-preferred effort allocation in the absence of financial incentives (e.g., Hannan et al. 2013) and financial incentives do not improve performance on a complex task (e.g., Bonner et al. 2000). I examine whether in a multi-task setting combining RPI and financial incentives will lead to an interactive effect. Evidence of such an interactive effect of these two motivational mechanisms in a multi-task setting could be informative to organizations who are interested in designing effective management accounting control systems. Accountants and managers strive to design effective information, compensation, and incentive systems as part of their control function in the organization (Indejejikian 1999; Atkinson et al. 2001; Bonner and Sprinkle 2002). RPI and financial incentives are important factors to be considered in the design of the overall management accounting control system.

I investigate the effects of RPI and financial compensation on employee performance and effort allocation in a multi-task environment by conducting an experiment that uses a 2 x 2 between-subjects design. I vary RPI at two levels: present or absent. I also vary the type of financial compensation participants receive: goal-based pay that is based on individual performance or flat-wage pay. The two tasks are structured to reflect varying complexity: simple and complex tasks. The dependent variables are effort allocation and performance efficiency (i.e,, productivity). I find that the effects of RPI and financial compensation are independent such that each motivational mechanism affects performance and effort allocation separately. In addition, I find that the effects of RPI or financial compensation depend on whether a worker is a top performer or a bottom performer.

This study contributes to the literature on multiple tasks, RPI, and financial incentives and also contributes to practice. Financial incentives and RPI are crucial aspects of organizational design (Eriksson, Poulsen, and Villeval 2009). Prior literature has established that, in a single task setting, RPI can have a positive effect on performance when employees are compensated with a piece-rate financial incentive (e.g., Tafkov 2013) and a negative effect on performance when employees are compensated with a tournament incentive (Hannan et al. 2008). I examine the interactive effects of RPI and goal-based incentives in a multi-task setting and provide evidence beyond the Hannan et al. (2013) study, which documents that RPI, in the absence of financial incentives based on individual performance, has a negative effect on effort allocation and performance.

In a multi-task environment organizations experience greater difficulty in designing incentive systems because the firm has to achieve multiple objectives: to motivate a desired level of effort and to foster optimal effort allocation across tasks. This study investigates whether financial incentives and social factors can work together to foster firm-preferred effort allocation and high performance across tasks. First, I examine whether goal-based compensation (financial incentives) interacts with RPI (a social factor) to affect employee effort allocation and performance on (low-return) simple and (high-return) complex tasks. Post-hoc analyses demonstrate that the effects of feedback and monetary incentives depend on whether a worker is a top performer or a bottom performer on the task. What these analyses reveal should be informative to managers who strive to overcome the challenges of designing effective incentive systems in multi-task settings. This study also provides empirical evidence beyond Bonner et al. (2000) by providing evidence of the efficacy of financial incentives in a multi-task setting comprising simple and complex tasks that differ in their degree of payoffs and hence return to the firm. Despite the reality that employees often work on more than one task, few studies have examined effort allocation across multiple tasks (Sprinkle 2003).

In the remainder of this dissertation, I discuss the background literature and present the research questions (Section 2), explain the research method (Section 3), present the results of the experiment (Section 4), discuss the results, limitation of the study, future research, and provide a summary (Section 5).

2.0 LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1 Multi-Task Setting

Multi-task settings are increasingly important and common (Lindbeck and Snower 2000). Lindbeck and Snower (1996, 2000) describe a shift in the organization of work within companies from an environment characterized by specialization by tasks to a work environment characterized by cross-training, integration of tasks, and job rotation. Recent technological advancements have allowed employees to communicate more freely within an organization leading to the integration of tasks and job rotation (Lindbeck and Snower 1996; 2000). Thus, the concept of a multi-task setting is not new to organizations; however, the multi-task setting literature is sparse (Sprinkle 2003). Despite the proliferation of multi-task settings, however, little is known about how incentive systems can be designed to motivate effort and performance in such settings.

Employees are increasingly being asked to perform a range of tasks with varying complexity. For example, AES Corporation, a producer and seller of electricity to public utilities, gives plant technicians the authority to budget and purchase supplies (Markels 1995). Plant engineers are also asked to arrange financing for new plants and negotiate multimillion-dollar contracts while still performing their routine tasks (Markels 1995). Firms want employees to not only take on multiple tasks but also to focus their efforts on tasks that have higher returns potential for the firm. An example of an industry in which an employee performs both low-return simple and high-return complex tasks is the financial services industry. Bankers perform routine, simple tasks such as monitoring deposits and withdrawals for clients, in addition to more complex tasks such as analyzing the financial statements of business owners who request bank loans. It is reasonable to assume that making new business loans is a more valuable and complex task to a bank than monitoring withdrawals and deposits in accounts, as new business loans can significantly impact a bank's profitability. Although organizations seek to direct employees' efforts towards complex tasks given that they are more valuable[5], the efficient and successful completion of simple tasks is still important.

If employees allocate their effort across tasks as desired by the organization (i.e., firm-preferred effort allocation),[6] the organization's overall productivity would increase leading to increases in firms' profits. In other words, employees are required to perform well on simple and complex tasks and at the same time to allocate more effort towards the complex tasks. For example, a bank would encourage its employees to focus their efforts on making new business loans because such a task is more valuable to the bank and insufficient employee effort on this task can have a detrimental effect on the bank's performance. However, the bank employees are also asked to be efficient and productive when they are performing simple tasks such as monitoring customers' deposits and withdrawals. One reason firms want their employees to focus their effort toward the high-return complex task while staying productive on low-return simple tasks is that in order to succeed in the current competitive and technologically advanced economy firms must generate creative solutions without sacrificing productivity on routine tasks (Chang and Birkett 2004).

[5] An assumption of this study is that higher (lower) skilled tasks such as complex (simple) tasks bring higher (lower) profit to an organization. Thus, complex tasks are more valuable to an organization.
[6] Firm-preferred effort allocation occurs when employees allocate effort according to the organization's desires. In this study, employees' interests are aligned with those of their employer when employees allocate more effort towards the complex task while allocating the minimum required effort towards the simple task.

In a multi-task setting, however, employees can shift effort among tasks according to their preference and not that of the firm. The occurrence of shifting effort among tasks according to workers' preferences could be explained by self-affirmation theory. Self-affirmation theory (Steele 1988) suggests that when individuals' self-image is threatened in one area, individuals will choose to maintain their positive self-image by affirming their competence in another area. With a more nebulous effort-to-performance connection for the complex task,[7] employees will be uncertain whether expending more effort on the complex task will lead to an increase in performance. However, with a more certain effort-to-performance connection for the simple task, employees could direct effort to the simple task in order to maintain a positive self-image. Thus, in a multi-task setting where an employee perceives that he can perform better on a simple task than on a complex task, he may be motivated to allocate disproportionate effort to the task on which he feels more capable (i.e., the simple task).

Recognizing that employees would prefer to allocate effort to low-return simple tasks, organizations desirous of directing effort towards high-return complex task can provide higher payoffs for performance on the complex task. It is unclear whether giving employees such an incentive will result in a preference for the more complex task over the simple task. On the one hand, agency theory predicts that workers seek to maximize wealth (Baiman 1982), suggesting that employees would prefer to allocate effort towards the complex task which provides higher payoffs. On the other hand, expectancy theory predicts that workers assess the likelihood that increased effort will yield better task performance leading to desired rewards and will allocate effort accordingly (Vroom 1964). Although the complex task provides higher payoffs, since

[7] As discussed in a later section, performance on complex tasks is mostly driven by cognitive ability and strategy rather than effort.

workers would be unsure whether increasing effort on the complex task would lead to improvements in performance, they could prefer the simple task. Not only is it unclear whether employees will choose to allocate more effort towards a high-return complex task, but it is also an open question whether employees will subsequently increase their performance on the complex task given that prior literature has shown that financial incentives do not result in improved performance for such tasks (e.g., Bonner et al. 2000).

2.1.1 The Effects of Financial Incentives in a Multi-Task Setting

Financial incentive schemes are tools used by management to steer employees towards an organization's strategic objectives (Chenhall 2003). The design of management accounting control systems is influenced by the efficacy of financial incentives. Bonner et al. (2000) demonstrates that the efficacy of financial incentives depends on task complexity (i.e., simple versus complex tasks). Given that financial incentives are present in most organizations, their efficacy in motivating effort and performance has been studied extensively in accounting (Bonner and Sprinkle 2002). I examine the efficacy of financial incentives such as goal-based compensation in a multi-task setting in which a worker has a choice of allocating effort between a simple low value task and a complex high value task.

Previous multi-task studies have examined more easily measured and less easily measured tasks (e.g., Brugger and Moers 2007) and problem-solving tasks (e.g., Hannan et al. 2013). Bruggen and Moers (2007) investigate the effects of social pressures on financial incentives in a multi-task setting. Economic theory suggests that in a multi-task environment, when tasks are substitutes and some tasks are less easily measured than others, incentive compensation can have detrimental effects on performance (Holmstrom and Milgrom 1991). In a multi-task setting, if one task is more difficult to measure than another, workers have a tendency to allocate effort to the more easily measured task (Holmstrom and Milgrom 1991). Holmstrom and Milgrom (1991) also suggest that workers will direct their effort towards tasks that are directly measured and rewarded, to the detriment of other tasks that may not be directly measured and rewarded. This type of multi-task setting is the focus of the Bruggen and Moers' (2007) study, in which they examine the effect of social pressure and financial incentives provided only on the easily measured task on effort in a multi-task environment.

Unlike the Bruggen and Moers study, which does not examine the effects of RPI, the current study examines the effects of RPI on tasks that are both easy to measure, vary in task complexity, and differ in their relative value to the firm. In addition, I measure performance using real-effort tasks involving decoding of numbers to letters and solving anagrams, in contrast to the Bruggen and Moers (2007) abstract tasks of simply choosing an effort level. The generalizability of the results of studies in which participants simply choose a number for effort is limited because the participants are not exerting actual effort and effort is measured in an abstract way. In this study I ask participants to exert actual effort by performing the two tasks so that they can become committed to the tasks and experience the cost of effort. It is important for participants in this study to exert actual effort in order to form expectancies of the effort-to-performance connection of the simple and complex tasks. Thus, it is worth examining the effect of financial incentives on effort allocation across low-return simple and high-return complex tasks and performance when participants are required to exert actual effort.

Further, in the current study I examine goal-based compensation scheme while Bruggen and Moers investigate the effects of a piece-rate scheme on the task that is easy to measure and no financial incentives on the task that is difficult to measure. Piece rate pay provided on a measurable task directs employee attention to this task and away from the unmeasurable task, thus resulting in effort allocation that is inconsistent with firm preference.

In the current study, I examine whether effort allocation that is inconsistent with firm-preferred effort allocation is caused by the motivational effect of financial incentives or by social comparison induced by RPI. My prediction is that when RPI is coupled with flat-wage compensation, RPI will lead employees to distort their effort allocations away from the firm-preferred effort allocation. When RPI is coupled with a goal-based compensation as opposed to flat-wage, it is unclear whether employees' effort allocation will be consistent with firm-preferred effort allocation and employee performance will increase. Thus, I examine the effects of goal-based compensation and RPI on effort allocation and subsequent performance in a multi-task setting.

In the Bruggen and Moers' (2007) study, firm-preferred effort allocation is represented by an equal allocation of effort between one easy to measure task and one unmeasurable task. In Hannan et al. (2013), firm-preferred effort allocation is represented by an equal allocation of effort between two problem-solving tasks, math and verbal. However, in reality tasks vary in the degree of skill required and in their importance to the organization. Although all required tasks must be performed, tasks requiring high (low) skill are complex (simple) tasks resulting in higher (lower) returns to the firm. In the current study, I examine a setting in which employees are asked to allocate more effort towards a high-return complex task that is more valuable to the organization and minimum amount of effort towards a low-return simple task.

2.2 Task Complexity

It is important to study task complexity because tasks can vary in complexity, and complexity has been shown to be one of the determinants of performance in accounting settings (Bonner 1994). Broadly defined by Bonner and Sprinkle (2002), task complexity refers to the amount of attention or processing required by a task as well as the amount of structure a task provides. Wood (1986) defines complex tasks as having a greater number of distinct subtasks and information cues, and suggests that there are multiple ways of converting task inputs into outputs in a complex task. Wood (1986) presents a theoretical model of tasks in which the three essential components of all tasks are outputs, required acts, and information cues. The required acts and information cues are important task inputs that affect task performance (Wood 1986). Bonner et al. (2000) classify complex tasks as problem-solving tasks that can be completed in a number of ways. The common thread in these definitions is that a complex task requires individuals to determine the best way to achieve a certain goal when a solution is unclear.

In a review of literature, task complexity is described as a function of both task characteristics and cognitive processes of the individual (Campbell 1988; Bonner et al. 2000). Campbell (1988) considers not only tasks characteristics (i.e., task inputs and outputs) but also defines task complexity in terms of the cognitive demands placed on the individual. He describes several task characteristics that contribute to task complexity: the presence of multiple potential ways (i.e., paths) to arrive at a desired task output, the presence of multiple desired outcomes to be attained, and the presence of uncertain links among paths and outcomes.

In the current study, task complexity is operationalized at two levels – lower level complexity is referred to as a simple task and higher level complexity is referred to as a complex task. The simple task is a letter decoding task that has been extensively used in prior research

(Chow 1983; Webb 2002; Murthy and Schafer 2011). The decoding task requires individuals to notice and respond to a stimulus by looking up a number in the decoding key and entering the corresponding letter. The central subtask is selective attention (Bonner et al. 2000). Prior studies describe the letter decoding task as a simple and mechanical task, which allows participants to readily develop performance expectations (Webb 2002, p. 368).[8]

The complex task involves solving anagrams in which participants are presented with a word and instructed to create as many words as they can by rearranging the letters in the given word (e.g., Schweitzer, Ordonez, and Douma 2004; Hannan et al. 2013). Prior studies indicate that solving anagrams is a cognitive task (Schweitzer et al. 2004). The complexity of solving anagrams can be varied depending on the length of given words. The longer the words, the more letters there are for individuals to consider. There is more uncertainty involved in this task than the simple task because individuals will have to evaluate different potential ways of generating words to reach a desired outcome. There are also multiple desired outcomes to be achieved as individuals will be instructed to create as many words as they can. An increase in the number of possible ways to arrive at multiple desired task outcomes increases information load, which, in turn, increases complexity. For these reasons, the task of solving anagrams is a complex task.

A final reason the task of solving anagrams is complex is because it contains an element of creativity. There are various task strategies that individuals can use to create new words. For example, rather than using a permutation approach to solve anagrams, which consists of pairing each letter with a new letter until a new word is formed, individuals can use several more efficient task strategies in order to increase task performance. One task strategy is for individuals

[8] Since performance on the letter decoding task requires only effort and not ability, I can attribute participants' performance to their effort and not their abilities.

to categorize the letters into two groups—vowels and consonants so the individual can see the distribution of each group —and then consider creating new words. Another approach is to rearrange the letters in the given anagram into a circle, which can help individuals recognize the relationship of one letter to another in a different order to create new words. A third task strategy is to arrange the letters in alphabetical order to determine what words can be created. Regardless of the strategy used, participants will be creating new words, and although there will be some overlap, the created words will be different and original. The creativity element of this task is the process of generating multiple answers (words) to a set problem. The creativity element of task performance raises uncertainty since individuals will not know whether choosing to spend more time on the task of solving anagrams will necessarily increase their performance leading to higher compensation.

The task of solving anagrams is chosen in this study because it contains an element of creativity and because the task is measurable allowing me to determine overall performance in a multi-task setting.[9] The task of solving anagrams serves as an experimental analog to real-world settings involving the creation of ideas and processes. Just as solving anagrams involves working with a set of letters and creatively rearranging them to create new words, many white collar jobs also involve recombining elements of existing tasks and processes to offer new and innovative solutions to problems. Such settings are representative of tasks performed at a range of professional service firms (Chang and Birkett 2004).

Chang and Birkett (2004) examine how professional service firms (PSFs) use competency standards to manage the paradoxical challenge of balancing the need for

[9] I acknowledge that the task of solving anagrams does not involve the same level of creativity as the task of solving puzzles; for example see Kachelmeier and Williamson (2010).

professional creativity and productivity. “Creativity and productivity place different types of cognitive demand on professionals in PSFs: on the one hand, they are required to do things differently; on the other hand, they are required to do the same things better” (Chang and Birkett 2004, p. 9). Productivity is advanced through the efficient use of professional time. For example, non-client service related use of time is detrimental to productivity (i.e., administrative routine tasks) and conversely, client-related time generates profits for the organization (i.e., preparation of a client’s tax return). In such a setting, the firm wants its professionals to work efficiently on the non-client service tasks while still focusing effort on the client-related service tasks. Chang and Birkett (2004) explain that professionals have to make the trade-off between productivity and creativity as they progress up the hierarchy from novice towards expert levels. Professionals are increasingly required to perform more complex tasks, providing them with opportunities to be creative (Chang and Birkett 2004).

Simple tasks have few required acts (inputs) and the relation between inputs and outputs does not vary. In complex tasks, however, there usually are a number of subtasks and uncertainty surrounds the relation between inputs and outputs. Thus, simple tasks preclude major individual differences in developing task strategies. However, individuals recognize that for good performance complex tasks require complicated task strategies (Locke and Latham 1990). People change cognitive strategies quite frequently in order to find an appropriate task strategy, thereby often employing task strategies that are not appropriate (e.g., Naylor and Clark 1968). Performance on a complex task is affected more by using the appropriate task strategies (i.e., cognitive ability and mental effort) than by effort (Locke and Latham 1990); therefore, the effort-to-performance connection is uncertain for a complex task that requires cognitive ability.

In this study, participants could increase their performance on the complex task by attempting one of the efficient task strategies such as rearranging the letters into a circle, grouping them into vowels and consonants, or arranging the letters in alphabetical order. The inefficient task strategy is to randomly match letters until a new word is created. Although I do not hypothesize about the effects of using a task strategy on the performance of a complex task, the research design of the experiment allows me to explore whether RPI and financial incentives motivate individuals to use task strategies for the complex task, whether individuals frequently switch strategies, and whether using these strategies improves individual performance on the complex task.

Task complexity interacts with financial incentives in affecting performance (Bonner et al. 2000). I examine a setting in which a worker who is paid under flat-wage or goal-based compensation chooses the level of effort to allocate across low-return simple and high-return complex tasks. I extend the Bonner et al. (2000) study by investigating the effect of financial incentives on individual performance when individuals have to perform both simple and complex tasks and choose how to allocate effort between them.

2.3 Financial Compensation Schemes

Management accounting has an important role in a firm's compensation system design by providing information for worker rewards and evaluation (Fessler 2003). I examine the effects of two types of financial compensation schemes: financial incentives such as goal-based pay, which is based on individual performance and financial compensation scheme, which is not based on performance, flat-wage. A fundamental prediction of economic theory is that financial incentives tied to individual performance will motivate workers towards greater task engagement and effort than when flat-wage compensation is employed (Bonner et al. 2000; Sprinkle 2003). Effort-averse individuals derive disutility rather than utility from working. Agency theory suggests that individuals attempt to minimize the effort necessary to achieve the rewards offered (Bonner and Sprinkle 2002). In order to ensure that employees work towards maximizing firm wealth, firms provide financial incentives (Baiman 1982), such as goal-based compensation.

Bonner and Sprinkle (2002) present a model of the relation between financial incentives and effort and performance. They describe effort as a four-dimensional construct. Effort can be direction, duration, intensity, and effort directed toward learning. Effort towards learning focuses on improving performance in the future, whereas the other three dimensions of effort refer to improving performance in the current period. Effort intensity is measured by assessing individual performance on a task involving fixed time limit while effort direction is constrained. Effort direction refers to the task in which the individual chooses to engage. Effort duration refers to the amount of time an individual works on a task. In this study, effort allocation consists of both effort duration and effort direction because individuals choose the amount of time they want to spend working on a task of their choice.

The relation between financial incentives and effort is mediated by cognitive and motivational mechanisms and moderated by person, task, environmental and incentive scheme variables (Bonner and Sprinkle 2002). Two environmental variables that interact with financial incentives are assigned goals and disseminating RPI, which are the variables examined in the current study. Bonner and Sprinkle (2002) describe expectancy and goals as two of the cognitive and motivational mechanisms of financial incentives.

2.3.1 Expectancy Theory

Expectancies and goals are cognitive mechanisms that mediate the relationship between financial incentives and effort (Bonner and Sprinkle 2002). Expectancy theory suggests that individuals behave in a way that will maximize expected satisfaction with outcomes (Bonner and Sprinkle 2002). Expectancy theory (Vroom 1964) predicts that individuals who have a high expectancy that their actions will lead to a desired outcome will be more likely to undertake the actions than individuals with lower expectancy. Incentives that fail to generate a belief that a worker's efforts will result in a performance level that qualifies for the reward (expectancy) will fail to motivate effort (Steel and Konig 2006). Firms favor financial incentives based on the understanding that incentives can cause people to focus on performance and make effort changes in their attempts to maximize rewards.

Expectancy theory suggests that people have expectancies concerning whether or not they will actually accomplish a task goal if they expend additional effort; that is, an individual makes a subjective probability estimate concerning his chances for reaching a goal given a particular situation. Goals are important because they establish firm's views of a desirable goal (outcome) and establish the value of the monetary reward after attaining that goal. Goals interact with expectancy by influencing perceived difficulty of accomplishing the task (Bonner and Sprinkle 2002). When individuals commit to a goal provided by the financial incentive, they align their personal goals with the goals of the incentive scheme, that is, the goals of the organization. Aligning personal goals with the expectancy that they can accomplish the goals increases effort (Locke and Latham 1990), indicating that goals can have a positive effect on effort and performance and firms should use goal-based contracts.

2.3.2. The Effects of Goals on Effort and Performance

In the current study, financial incentives, such as goal-based compensation, refer to an extrinsic motivator in which pay is linked to individual performance. Goal-based compensation (i.e., individuals receive a bonus once they achieve a set goal) links pay to overall performance[10] and incorporates a goal, making this type of pay effective in improving performance. Prior studies provide evidence that financial incentives such as piece-rate and goal-based compensation lead to increased effort resulting in improved performance in a single and simple task environment (Bonner et al. 2000). Increases in effort lead to increased performance when performance is linked to pay via financial incentives (Bonner and Sprinkle 2002). This effect occurs for simple tasks in which the connection between effort and performance is strong.

Increased task complexity, however, reduces the correlation between effort and performance (Bonner and Sprinkle 2002). Bonner and Sprinkle (2002) explain that as task complexity increases, the risk of not achieving the goal increases, and individuals struggle to determine whether their efforts will result in a reward. Task complexity leads to uncertainty and the connection between effort and performance becomes more difficult to predict. Thus, individuals require greater rewards to perform more uncertain tasks (Bonner and Sprinkle 2002).[11]

The efficacy of financial incentives depends on the task complexity, the relation between the tasks, and the extent to which these tasks are measurable (Holmstrom and Milgrom 1991). In the current study, both tasks are measurable and are independent of each other. In other words,

[10] Overall performance in this study is measured as the sum of points earned on the simple task divided by the time allocated to the simple task and the points earned on performing the complex task divided by the time allocated to the complex task (i.e., performance efficiency).
[11] In this study, participants can earn a greater number of points by performing the complex task than the simple task. Thus, they can increase the likelihood of reaching the targeted number of points (i.e., the goal) by allocating more time towards the complex. Reaching the goal, in turn, allows them to receive a bonus.

performance on the simple task will not improve or detract from the performance on the complex task and vice versa; thus, the tasks are unrelated. However, task complexity affects the efficacy of the financial incentives. Bonner et al. (2000) indicate that task complexity interacts with financial incentives in affecting the efficacy of financial incentives. As the task becomes more complex, the effectiveness of financial incentives decreases because individuals do not perceive a strong relation between their effort, task performance, and pay (i.e., the effort-to-performance connection). In a simple task, additional effort can directly affect performance. In a complex task, effort does not have a direct or strong impact on performance because simply expending additional effort without any change in task strategy is unlikely to improve performance.

The reason individuals perceive the effort-to-performance connection of a complex task as nebulous is that a complex task requires the use of an appropriate task strategy. People recognize that complex tasks require complicated task strategies for good performance (Locke and Latham 1990). Locke and Latham (1990) suggest that performance on complex tasks is affected more by cognitive strategies than by effort. Performing well on a complex task requires strategies that are peculiar to the domain of that task, while performing well on a simple task, such as recalling words, may require only the use of general mnemonic skill or the exertion of additional effort. Individuals performing a complex task will engage in more strategy development than they would in simple tasks (Bonner and Sprinkle 2002). However, the effort directed toward developing task strategies could actually decrease performance in the short run because individuals change approaches fairly frequently to find an appropriate strategy (e.g., Naylor and Dickinson 1969).

As task complexity increases, it is less likely that most financial incentives such as goal-based compensation improve performance (Bonner et al. 2000). Challenging but attainable goals improve performance on a simple task because they require higher performance in order for the individual to feel a sense of self-satisfaction and they motivate the individual to expend more effort (Locke and Latham 1990). However, challenging goals on a complex task can lead to tunnel vision because the focus will be on the desire to get immediate results rather than on learning the best way of performing the task (e.g., Wood, Bandura and Bailey 1990). Shapira (1976) and Pittman et al. (1982) show that individuals focus narrowly on the achievement of the goal in order to receive their performance-based compensation. When assigned challenging goals on a complex task, individuals might focus on the outcome and its consequences and fail to devote sufficient attention to strategy development (Locke and Latham 1990).

The pressure of meeting or beating a challenging goal makes the time spent searching for production efficiencies less effective (Webb et al. 2012). For example, when the task is difficult, setting a difficult goal lowers performance (Huber 1985). Huber (1985) shows that the decrease in performance was attributed to the variation in performance strategies employed by participants. Cognitive psychology theory suggests that individuals faced with the pressure of challenging goals may not be successful in searching for and developing task strategies because difficult goals induce stress and anxiety decreasing working memory, which hinders individuals' ability to systematically generate and test the hypotheses necessary to identify more efficient task strategies (Markman et al. 2006). Locke and Latham (1990) suggest that in a complex task challenging goals may create a level of arousal that interferes with the cognitive processes involved in selection and development of task strategies, leading to the misdirection of attention and effort. For example, Ashton (1990) shows that additional effort induced by the incentives may result in high pressure and arousal, which has a detrimental effect on performance.

Although prior literature has focused on the effects of challenging goals on performance, practice has not necessarily followed suit. Merchant and Manzoni (1989) describe the differences between theory and practice of goal setting. They report the findings of a field study of 54 profit centers. The study reports that in 11 of the 12 firms that were investigated, managers are paid extra bonuses for exceeding budgeted levels of performance. Contrary to goal-setting theory, the budget goals for the profit centers are set at low and achievable levels in order to reduce the risk of managers giving up on a goal that becomes too difficult to attain when managers face unforeseen negative circumstances. Managers of profit centers operate under conditions of high uncertainty and complexity (Merchant and Manzoni 1989). Easy and achievable budget goals protect them against possible exogenous influences.

Wood et al. (1997) suggest that easily attainable goals provide individuals with flexibility (slack) to search for production efficiencies or improved task-related strategies. Setting easy goals gives individuals the flexibility to spend time searching for and using different task strategies (Sprinkle et al. 2008). Not having the pressure induced by very challenging goals, individuals who are assigned moderately challenging goals will have the ability to identify more appropriate task strategies. The current study examines the effect of challenging but attainable goals on individual performance in a multi-task setting.[12]

Although financial incentives result in poor performance on complex tasks, Bonner et al. (2000) conclude that goal-based compensation is more effective in increasing performance on a complex task than is piece-rate compensation, because of the motivational effect of incorporating goals. Thus, the current study focuses on the effects of goal-based compensation on employee

[12] Consistent with definitions in the literature, easy goal is achievable almost 100 percent of the time and a challenging goal is achievable 25 percent of the time (Locke and Latham 1990). I choose to investigate an attainable but challenging goal which is achievable 25 percent of the time. The appropriate level of the goal in this study was determined during the pre-test of the tasks and two pilot studies as described in the method section.

effort allocations and performance. Goal-based and flat-wage compensation schemes are also chosen in the current study because they are common in managerial accounting literature and are representative of practice (Bailey et al. 1998; Hannan et al. 2013). According to a recent article in the Washington Post, a lump-sum bonus to an individual for reaching a goal is called a “spot bonus” (Halzack 2012, A12). The increased use of variable pay including spot bonuses or other financial incentives has been attributed to the recent sluggish economy as suggested by Halzack (2012). She further explains that in the uncertain economic times more firms use bonuses as a strategy to retain high performers without creating additional fixed costs.

In this study, flat-wage compensation is not only included as a baseline, for the purpose of comparison to goal-based compensation, but also is included because flat-wage compensation is commonly used in practice. Because of the complexity of the multi-task setting, it is inherently more difficult for organizations to provide incentives that will not only motivate appropriate levels of effort but also appropriate effort allocation (Holmstrom and Milgrom 1991). Some of the complexity in designing an appropriate incentive system in such a multi-task setting revolves around whether the organization should include only objective performance measures or both objective and subjective performance measures (e.g., Bol et al. 2010; Bol 2011). The banking industry is one example of an industry in which most bank officers are paid with flat-wage compensation. For example, a bank officer who provides customer service by maintaining customers’ deposits and withdrawals also analyzes financial statements of customers who are requesting business loans. Bank officers are primarily paid with a fixed salary regardless of the number of customers they service or the type of task they perform.

This study seeks to provide insights into how organizations can benefit from improving the efficacy of financial incentives when effort expended on a simple task may detract from effort on a complex task in a setting in which the organization desires employees to allocate more effort towards the complex task because it is more profitable for the organization. Prior research shows that non-economic factors are also relevant in decision-making and control (Ashton 1990; Libby and Lipe 1992; Bonner and Sprinkle 2002). Social factors such as providing RPI can positively impact performance, which prior research has established in a single task-setting (Tafkov 2013; Young et al. 1993; Hannan et al. 2008; Frederickson 1992; Murthy and Schafer 2011). I suggest that when organizations provide RPI in addition to the financial incentives in a multi-task setting, prior research findings do not generalize to individual performance and effort allocation.

2.4 Relative Performance Information

Research examining the effects of RPI on performance and effort allocation is important because RPI is information provided to a person regarding some aspect of peer performance and such information has a fundamental role in facilitating individual and organizational learning (Atkinson et al. 2001; Sprinkle 2000, 2001). Employees can obtain RPI in an informal way by mutually monitoring each other (e.g., Towry 2003) or the organization can formally disseminate RPI to employees (e.g., Tafkov 2013; Hannan et al. 2013), which is the focus of the current study. The accounting information systems of firms become critical in the process of aligning employees and firms interests since the accounting system can be designed to disseminate RPI to employees. RPI is a type of feedback that has an integral role to performance reporting and distribution of rewards; thus, both financial incentives and RPI have a major role in motivating performance. Research on how to structure financial incentives and the feedback provided by accounting information systems to best align employees' interest with those of the firm is important.

Recent studies (e.g., Tafkov 2013; Hannan et al. 2013) examine two different types of RPI: private and public. When private RPI is provided, each employee's relative performance rank is known only by that individual. When public RPI is provided, each employee's relative performance rank is known by that individual and all peers. The reason I examine public RPI is that public RPI has a stronger effect on performance than private RPI because public RPI allows for greater involvement in social comparison (e.g., Smith 2000; Tafkov 2013; Hannan et al. 2013). For example, Hannan et al. (2013) demonstrate that public RPI has a more detrimental effect on performance than private RPI does in a multi-task setting where no financial incentives are present. Tafkov (2013), on the other hand, demonstrates that public RPI has a more positive effect on performance than private RPI in a single-task setting when employees are compensated with a piece-rate.

2.4.1 Social Comparison Theory

RPI is information that allows individuals to engage in social comparison. Individuals have a drive to evaluate their abilities in order to have an accurate view of their abilities (Festinger 1954). The need to reduce uncertainty about their abilities (Festinger 1954) and to enhance self-image and self-esteem (Wheeler 1966) motivate individuals to seek out information about their own abilities. Abilities are manifested only through performance. Thus, if an individual is evaluating his ability, he will do so by comparing his performance on a task to that of others on the same task (Suls and Wheeler 2000). The goal of evaluating abilities is to predict one's performance on a task. Information such as RPI about others' task performances helps in evaluating abilities via social comparison.

Festinger (1954) predicts that individuals who are provided with RPI will engage in social comparison and will take action to reduce discrepancies in group performance by trying to do slightly better than others in the group. Employees who are ranked based on relative performance will try to improve their performance when it is below the average. Festinger (1954) suggests that individuals whose performance is higher than the average performance will be pressured to maintain their level of high performance. Performing better than others leads to positive feelings about self-image, while performing worse than others leads to negative feelings such as shame (Tafkov 2013). Every individual strives to perform at least slightly better than others, leading individuals to behave competitively. During the social comparison process, individuals become competitive because they experience pressure to do better than others (Festinger 1954). This pressure can have motivational or detrimental effects on effort and performance.

Economic theory predicts that RPI will positively affect performance only when compensation is tied to that of peers because team members have an incentive to monitor and punish each other leading to peer pressure and increased performance. Prior research has focused on examining the effect of RPI on effort and performance in a single task environment when employee compensation is based on peer performance (e.g., Kandel and Lazear 1992). In the presence of peer pressure, compensation based on peer performance can reduce a free-rider problem in organizations (Kandel and Lazear 1992).

However, social comparison theory (Festinger 1954) predicts that providing RPI will affect task performance even in cases where compensation is *not* linked to peer performance.

Individuals seek to compare themselves with others in terms of their performance in order to judge their own abilities and how they are doing. Individuals' perceptions of their abilities compared to those of others affect their self-image. People are motivated to maintain positive self-image and competence (Beach and Tesser 1995; Tesser 1988). To maintain positive self-image, when individuals are able to compare their performance to that of others, they want to perform better than others leading them to exhibit competitive behavior (Festinger 1954). Festinger (1954) suggests that the consequence of social comparison is that individuals change their behavior to be more like that of the comparison group.

Firms often provide RPI to workers even if RPI is not linked to peer performance (Nordstrom et al. 1990). For example, some bank managers disclose to their tellers the number of new accounts opened by each employee and the total funds in these accounts although bank tellers' pay is not based on peer performance (Tafkov 2013). In professional service firms, managers provide tax preparers with the number of billable hours worked during the week and the number of newly acquired clients; however, tax preparers are not compensated based on peer performance.

Recent studies have investigated the effect of RPI on performance in a single task (e.g., Hannan et al. 2008; Tafkov 2013; Murthy and Schafer 2011) and multi-tasks environments (e.g., Hannan et al. 2013) when employee compensation is not based on peer performance. In a single-task setting, RPI positively affects performance when compensation is based on individual performance (e.g., piece-rate pay) (Murthy and Schafer 2011; Tafkov 2013), but negatively affects performance when compensation is tournament-based (Hannan et al. 2008). In a multi-task setting, in the absence of financial incentives, RPI positively affects performance when workers are not given a choice in effort allocations between two tasks of equal value, and RPI negatively affects performance when workers are given a choice in effort allocations (Hannan et al. 2013).

I, however, examine the effects of RPI and financial incentives on performance when employees are given a choice in effort allocations between simple and complex tasks. Although Hannan et al. (2013) document that RPI negatively influences performance in the absence of financial incentives, I investigate whether RPI could positively affect performance when workers are compensated with a goal-based pay or flat-wage. Such a finding should be informative to organizations that try to align employee interests with those of the firm in a multi-task setting.

2.4.2 Self-Affirmation Theory

In both single- and multi-task settings, workers who are provided with RPI will engage in social comparison, and in turn, in competitive behavior. However, only in a multi-task setting will workers also engage in self-affirmation behavior. The premise of self-affirmation theory is that individuals often compensate for failures in one aspect of their lives by emphasizing successes in other domains (Sherman and Cohen 2006). Steele's (1988) self-affirmation theory suggests that individuals are motivated to maintain their positive self-image or self-integrity. Integrity can be defined as the sense that an individual is a good and appropriate person (Sherman and Cohen 2006). The self is composed of different domains, which include an individual's roles, such as being a student, and individual's goals such as succeeding in school or at work (Sherman and Cohen 2006). The theory predicts that when individuals perceive a threat to their self-image, they will cope with it by affirming an unrelated aspect of the self. Steele describes self-affirmation as a "general ego-protective system, one function of which is to affirm an overall self-concept of worth after is has been threatened" (Steele 1988, p. 266).

Steele (1988) explains that cognitions that threaten the perceived integrity of self-image arouse a motive to reaffirm the self. The threatening cognitions arise from a number of sources, such as information in the environment and behavior of others. Individuals can respond to threats using psychological adaptation of affirming alternative self-resources unrelated to the provoking threat or engaging in activity that makes salient important values unconnected to the threatening event (Sherman and Cohen 2006). Sherman and Cohen (2006) further explain that by re-asserting their self-integrity (i.e., self-image) in a different area, individuals realize that their self-worth does not hinge on the evaluative implications of the immediate situation.

2.5 Development of Hypotheses and Research Questions

2.5.1 Effort Allocation Predictions

In a multi-task setting, RPI provided to employees can be a threat to their positive self-image. Self-affirmation theory (Steele 1988) suggests that individuals will deal with such a threat to their image in one area by attempting to affirm their competence in another area. Therefore, theory suggests that employees who receive RPI will maintain their competence by shifting their effort to the task on which they can affirm their competence. They will shift effort in a way to allow them to outperform peers in at least one area, enhancing their social distinction (Frey 2007).[13] Thus, RPI can motivate employees to adjust their effort allocations away from firm-preferred allocation so that employees perform well on one task even if it means that they perform worse on another task for the detriment of the organization.

[13] Individuals have an innate desire to achieve positive social distinction (Frey 2007).

It is important to investigate effort allocations across multiple tasks because workers can shift effort across tasks according to their preferences and not those of the organizations, resulting in employee effort allocation that is inconsistent to firm-preferred effort allocation. Individuals will feel more capable of increasing performance on the simple task because simple tasks require fewer inputs and the relation between inputs and task outputs does not vary, whereas, in complex tasks there are a greater number of subtasks and uncertainty that surrounds the relationship between inputs and outputs. Complex tasks are, by their nature, difficult (Campbell 1988). Campbell (1988) states that task complexity and task difficulty can sometimes be used interchangeably, but not always. All complex tasks are difficult, but not all difficult tasks are complex (Cambpell 1988).[14] Thus, in a multi-task setting where an individual perceives that he can perform better on one task than the other, he may be motivated to allocate disproportionate effort to the task on which he feels more capable (i.e., the simple task).

The effect of disproportional allocation of effort towards the low-return simple task will be amplified when workers are provided with RPI. Although some degree of disproportional allocation of effort towards the low-return simple task may occur without providing RPI to employees, I predict that the provision of RPI will exacerbate the degree of disproportionate effort allocation towards the simple task. When employees are given RPI, they will have a greater tendency to allocate more effort to the simple task because RPI allows individuals to engage in social comparison leading to competitive behavior. Social comparison theory suggests that workers compare themselves to others in order to evaluate their own abilities which affect

[14] Liu and Li (2000) define task difficulty as the amount of effort individuals have to exert in performing the task. For example, a simple task such as letter decoding can be transformed to a more difficult simple task by increasing the number of letters to decode at the same time. In this case the letter decoding task is still a simple task, but it is more difficult.

their self-image. In both single-task and multi-task environments workers can exert more effort to improve performance beyond that of their peers.

In a multi-task environment workers can *shift* effort among tasks in order to maintain positive self-image. This preference stems from the fact that individuals want to maintain a positive self-image when they compare themselves to others (i.e., when RPI is provided). Self-affirmation theory (Steele 1988) suggests that when their self-image is threatened, individuals can maintain their positive self-image and competence by affirming their competence in another area. It is important to note that employees' self-image will be threatened in situations when they receive RPI about how their performance compares to that of others. Since the effort-to-performance connection for a complex task is uncertain and less clear, individuals will be unsure whether their performance will increase when they increase effort levels on a complex task. However, with a more certain effort-to-performance connection for the simple task, employees could direct effort to the simple task in order to re-affirm a positive self-image.

2.5.1.1 The effect of flat-wage and RPI on effort allocation

The design of incentives systems in organizations desirous of directing effort towards high-return complex tasks is complicated. I examine how employees effort allocations will change when they are compensated with a flat-wage or goal-based pay. It is important to examine the effects of RPI and financial incentives in a multi-task setting because Hannan et al. (2013) show that RPI has a negative effect on effort allocation and subsequent performance when workers are *compensated based on their effort allocation choices* and are provided with RPI. Therefore, it is an open question as to how RPI affects effort allocation and performance in a multi-task setting when workers are compensated based on individual performance (i.e., goal-based contracts). Thus, unlike Hannan et al. (2013), I investigate a setting in which RPI can have a positive effect on effort allocation and performance when provided along with *pay based on individual performance such as goal-based compensation or flat-wage compensation.*

Hannan et al. (2013) find that when participants can choose their effort allocations and are paid based on their *effort allocations*, they distort their effort allocations from the firm-preferred equal effort allocation only when provided with RPI. I predict that a distortion of effort allocations induced by RPI could be also observed when workers are paid with flat-wage. When employees are paid under a flat-wage scheme, prior literature has established that employees are not motivated to work hard because their pay is not affected by their levels of effort (Baiman 1982). Flat-wage compensation does not motivate improvements in levels of effort or firm-preferred effort allocation because pay is not linked to effort. Since employees' pay is not impacted by their effort allocation and effort levels, effort-averse employees will allocate effort toward the task they feel more capable of performing, which is the simple task. Providing RPI to employees who are paid under a flat-wage contract will further amplify the effect of effort allocation towards the simple task because employees will engage in social comparison and shift effort allocations even more towards the simple task in order to affirm their competency and positive self-image on the simple task, even if it means that they do less well on the complex task. My first hypothesis, formally stated, is:

H1: Under a flat-wage compensation scheme, individuals will allocate more effort towards the simple task than the complex task when individuals are provided with relative performance information than when they are not provided with relative performance information.

One of the differences between the Hannan et al. (2013) study and the current study is that individuals in the Hannan et al. study receive a payment based on effort *allocation* and not *actual effort.* This design choice allowed the behavioral effects of RPI to be isolated from the motivational effects of financial incentives. They find that employees distort their effort allocations across two relatively complex tasks in order to affirm their positive self-image. Additionally, in the Hannan et al. (2013) study, firm-preferred effort allocation is an equal effort allocation between two relatively complex tasks (i.e., verbal and math problems). In the current study, firm-preferred effort allocation represents greater effort allocation towards a high-return complex task and minimal effort allocation towards a low-return simple task because I examine a setting in which complex tasks are more valuable to organizations. Unlike Hannan et al. (2013), I examine the effect of RPI on effort allocation *and* performance across simple and complex tasks when workers are paid based on their *individual performance* in a setting where they receive higher rewards for performance on the complex task. Because workers receive RPI and financial incentives, I will be able to examine the trade-off between behavioral and financial incentives, which represents a contribution to the literature beyond the Hannan et al. (2013) study.

When given a choice, employees who are provided with RPI will be able to maintain their positive self-image by exerting more effort on the simple task because individuals perceive a stronger effort-to-performance connection for the simple task than for the complex task. As suggested by Expectancy theory individuals behave in a way that will maximize expected satisfaction with outcomes (Bonner and Sprinkle 2002). Workers perceive a stronger connection between effort and performance on the simple task such that they will expect that increases in their effort on the simple task will improve outcomes. Thus, individuals whose self-image is threatened by negative feedback from RPI will allocate more time to the simple task in order to raise their performance on that task and thus re-affirm their positive self-image on at least one task.

However, in many multi-task settings, the organization prefers that employees allocate greater effort to complex tasks because such tasks are usually associated with higher contribution margins for the firm. It is reasonable to assume that any organization that wants to direct effort to the complex task will provide greater reward for performance on the complex task to make the firm's effort allocation and effort level preferences salient to workers and to incentivize workers to direct effort towards complex tasks. Thus, it is unclear whether employees will still prefer the simple task given a choice between a simple and a complex task when the complex task is rewarded more than the simple task.

Given that more complex tasks generate higher contribution margins, the organization's objective is to motivate employees to allocate more effort towards the complex task while allocating the minimum amount of effort to the simple task. On the one hand, I expect that when workers are provided with RPI, they will allocate more effort towards the complex task when they are paid under goal-based compensation because they will be motivated to maximize their wealth by receiving greater rewards for improved performance on the complex task. On the other hand, employees who receive both RPI and goal-based compensation can experience increased performance pressure leading to an increased level of psychological arousal, which worsens performance. In this case, workers who do not expect to reach the goal will experience a threat to their self-image. I expect that individuals shift their effort allocations towards the simple task in order to re-affirm their positive self-image. Thus, there are two competing effects as explained in the following paragraphs — one suggesting that the combination of RPI and goal-based compensation will cause improved performance on the complex task, and the other suggesting the opposite effect of combining RPI and goal-based compensation. Because theory does not provide a clear basis for predicting which effect will dominate in affecting employee effort allocation choices, rather than a directional prediction, I pose a non-directional research question.

The following two sections examine the positive and negative effects of the combination of two motivational mechanisms (financial incentives and RPI) on effort allocation.

2.5.1.2 The positive effect of financial incentives and RPI on effort allocation

Providing higher rewards on the complex task will direct workers' efforts towards the complex task as desired by the organization. In order for individuals to improve their performance on the complex task, they will need more time to think of creative solutions to the task while using efficient task strategies. It is only when workers' performance on the complex task is improved that they will be able to maximize their total compensation. Along with the goal-based compensation, organizations can provide workers with RPI to reduce the uncertainty of the effort-to-performance connection on the complex task. Social comparison induced by RPI highlights incorrect decisions, increases awareness about attainable performance levels and increases cognitive activity (Briers et al. 1999).

Expectancy theory suggests that people have expectancies concerning whether they will actually accomplish a task goal if they expend additional effort on it. When making subjective probability estimates concerning their chances of reaching a goal, individuals can use feedback to form more accurate expectations. RPI is a type of feedback that allows individuals to make inferences about the task complexity, their own abilities, and the abilities of others in the group. A major determinant of forming these expectancies is the individual's perception of his own abilities (Atkinson 1964). RPI facilitates social comparisons and allows workers to learn more about their abilities by comparing their task performance to that of others. RPI is provided on the simple task and on the complex task separately, thus informing workers about their relative ability on each task. Knowledge of their relative ability on each task should help them better assess their likelihood of reaching the assigned goal.

Goals represent the firm's expected standard of performance. Goals will direct workers attention to the complex task, the high payoff task, because workers who perform the complex task can earn more points than those who perform the simple task (i.e., the complex task earns participants more points than the simple task). Working exclusively on the simple task will not allow workers to achieve the goal. Thus, goals provided in addition to RPI allow workers to infer their likelihood of success on the complex task because RPI on the complex task allows workers to learn about their relative ability and the goal allows them to learn about the desired performance.[15] If workers possess the necessary high skill level to perform a complex task, then workers will be able to increase their expectancy belief of reaching the goal. This belief about the likelihood of achieving the desired performance is a major determinant of individual behavior (Carver and Scheier 1981). Because providing RPI should increase workers' expectancy of reaching the goal, they will make more informed effort allocation decisions. Expectancy theory suggests that increased expectancy of reaching a goal motivates individuals to improve performance. In order to improve overall performance, workers must allocate more time to the complex task. Thus, I predict that workers operating under a goal-based compensation scheme provided with RPI will allocate effort according to their organization's preferences, that is, they will allocate more effort towards the complex task. In this setting, workers will use the additional information provided from RPI to increase their chances of improving expected performance on the complex task in order to maximize their compensation. Since effort allocations across tasks impacts performance, workers will allocate more time to the complex task to increase their chances of doing well on the complex task.

[15] Undergraduate student participants in this study possess the necessary skill to work on the complex task (solving anagrams).

2.5.1.3 The negative effect of financial incentives and RPI on effort allocation

The provision of RPI in addition to compensating workers with goal-based pay can increase the performance pressure on a decision maker. RPI allows individuals to engage in social comparison in order to evaluate their abilities. During the social comparison process, individuals become competitive because they experience pressure to do better than others (Festinger 1954). In a meta-analysis, Kluger and DeNisi (1996) find that feedback does not increase performance in over 33 percent of the examined studies. The researchers suggest that the effectiveness of feedback decreases as individuals focus more on themselves and away from the task. Feedback has the capability to alter the locus of attention (Kluger and DeNisi 1996). Goal-based pay provided to an individual who performs a complex task can also increase performance pressure (Lock and Latham 1990). Increased pressure can harm performance. Ashton (1990) provides a pressure-arousal-performance framework that provides insights into the effects of incentives, feedback, justification, and decision aid on decision-making.

Ashton's framework is consistent with the Yerkes-Dodson Law, which describes the relation between arousal and performance as an inverted U-shaped graph (e.g., Ashton 1990; Yerkes and Dodson 1908). The Yerkes-Dodson Law (1908) predicts that performance pressure increases motivational arousal, which in turn increases performance. At some level of pressure, however, additional pressure causes anxiety and reduces effort and performance. Low levels of arousal as induced by goal-based compensation or performance feedback lead to an increase in performance. As the level of arousal increases to a moderate level, goal-based compensation or performance feedback can motivate the greatest improvements in performance; however, excessively high levels of pressure results in low performance. Increasing pressure can lead to an increased level of psychological arousal which results in worse performance (Ashton 1990).

Anxiety is heightened by performance feedback and goal-based pay, especially when the task complexity increases.

As task complexity increases, performance pressure should also increase because of the uncertainty in the connection between effort and task outcome. Yerkes and Dodson (1908) also suggest that the optimum level of arousal for complex tasks is lower than the optimum level of arousal for simple tasks. Because both RPI and goal-based compensation have a motivational effect on individuals, they will jointly create high levels of performance pressure. The law has important implications because workers will be less likely to prefer the complex task under the pressures induced by the two motivational mechanisms of RPI (pressure to do better than others) and financial incentives (pressure to reach the goal).

Numerous psychology studies have examined the effect of stress on cognitive processes. These studies find that stress has a negative effect on individuals' cognitive processes by narrowing their focus of attention (Hockey 1970). Janis (1982) shows that individuals under stress scan information and alternatives hastily. In the current study, the complex task requires cognitive effort suggesting that increased performance stress can lead workers to make incorrect choices and effort allocation decisions that are inconsistent with firm-preferred allocations.

If they feel psychological anxiety and performance pressure to reach a goal in order to maximize their compensation, especially given that their performance will be compared to that of others in the group, workers will perceive RPI as a threat to their positive self-image and competence. Self-affirmation theory suggests that when individuals' self-worth is threatened, people will shift their effort to a different task in order to affirm their positive self-image. In order to maintain their positive self-image and competence, workers provided with RPI who are paid under goal-based compensation will allocate more time to the simple task in an attempt to maintain their social standing by performing well on one of the two tasks, even if it is at the expense of not reaching the performance goal. In this case, if individuals allocate more time to the simple task than to the complex task forgoing their opportunity to maximize pay, the evidence would be consistent with the notion that the behavioral motivation effect of RPI is stronger than the financial motivation effect of goal-based pay. Because theory suggests that RPI and financial incentives can have competing effects on employee effort allocation, I have no theoretical basis for predicting which effect will dominate. Formally, this expectation is stated in the following research question:

RQ1: What is the effect of financial compensation and relative performance information on employee effort allocation between simple and complex tasks in a multi-task setting?

2.5.2 Performance Predictions

2.5.2.1 The negative effect of financial incentives and RPI on performance

I now consider how RPI affects performance when employees can alter their effort allocations between simple and complex tasks under goal-based compensation. I examine worker performance efficiency, or productivity, in order to account for the time allocated to each task and to compare individual performance between tasks.[16] Worker performance efficiency (i.e., productivity) is measured as the output generated from working on each task scaled by the time allocated to each task. It is unclear how performance efficiency will change because performance output is impacted by workers' effort allocations between the two tasks, and it is an open

[16] Performance efficiency is a productivity measure that accounts for the varying degree of task complexity (e.g., more points are earned when working on the complex task than simple task). In order to sum the performance of the simple and complex tasks, task output has to be the same (i.e., points earned per second). For example, the performance efficiency of a participant who earned 100 points working on the complex task for four minutes is not the same as the performance of a participant who earned 100 points working on the complex task for two minutes. The second participant is more efficient on the task.

question whether RPI in addition to goal-based compensation will lead to firm-preferred effort allocation. Goal-based financial incentives can direct employee attention to the complex task because they can earn higher compensation. However, behavioral research has shown that financial incentives do not improve employee performance on a complex task (Bonner et al. 2000). The more complex the task, the less effective is a goal-based financial incentive in motivating high performance. As task complexity increases, uncertainty surrounding worker's task performance also increases because in a complex task there are many paths to a desired outcome. Thus, workers do not perceive a direct relationship between their pay and each individual output.

Expectancy theory (Vroom 1964) suggests that the motivational power of pay in producing high performance is a function of the belief that high performance can be attained, the belief that high performance will lead to outcomes, and the degree to which those outcomes are valued. In other words, workers have an expectancy regarding whether they will achieve a task goal if they expend effort. In order to reach the goal and the reward, performance on the complex task must be improved. However, employees might not expect that an increase in effort duration on the complex task will lead to increased performance. Uncertainty about the effort-to-performance connection on the complex task can lead to uncertainty about goal-based pay. Therefore, goal-based pay provided to workers who perform not only simple but also complex tasks can increase uncertainty in individuals' beliefs about reaching the desired task performance, leading to increased anxiety and performance pressure.

In the presence of the second motivational mechanism, RPI, goal-based pay can further increase worker performance pressure, exacerbating the deterioration in performance. RPI facilitates social comparisons among peers. Workers, in turn, want to perform a little bit better than their peers and become competitive, as suggested by social comparison theory. Pfeffer and Sutton (1999) suggest that internal competition (i.e., within peers) is destructive for their performance. The authors suggests that workers performing cognitive tasks perform better when they do not work under close scrutiny and they do not feel constantly assessed and evaluated, which can occur when working in the presence of competitors. When employees focus their attention too heavily on what their peers are doing and their peer's reactions, internal competition (i.e., among peers) can be destructive.

The presence of both motivational mechanisms, RPI and goal-based compensation, can lead to heightened anxiety. The motivation to maximize wealth by improving performance on a complex task and the motivation to affirm self-worth by comparing their performance to that of peers on a complex task can harm employee performance. Thus, even if employees allocate more time to the complex task, they might not observe an increase in their performance.

2.5.2.2 The positive effect of financial incentives and RPI on performance

The motivational effects of RPI and goal-based compensation could be complementary, such that RPI and goal-based pay both improve individual performance. Alternatively, the two factors could be substitutes for one another, such that each factor could individually improve performance but both factors together create performance pressure and anxiety. Providing goal-based compensation with RPI can result in increased overall performance because goal-based pay draws individuals' attention to information about the outcome of the task and RPI provides feedback to individuals about their relative ability on each task. Setting goals provides workers with information about what type or level of performance is needed to be attained. However, feedback such as RPI allows workers to further evaluate their performance and that of coworkers.

Locke and Latham (1990) explain that goals have an initial effect on performance by informing workers of the desired task outcome. Once feedback has been provided, individuals are able to track their performance and their performance in relation to their goals so that adjustments in effort, direction, and strategy can be made as needed. RPI is a type of feedback that can be used as an intervention to improve the effect of goals on performance on a complex task and overall individual performance. RPI is provided for the simple and complex task separately allowing individuals to learn about their relative ability on each task. Per social comparison theory (Festinger 1954), RPI should foster competition inducing individuals to outperform their peers. Thus, RPI is a type of feedback that allows workers to increase their expectancy of reaching a desired goal. Individuals who believe that they can reach the goal (i.e., increased expectancy) will be more motivated to improve their performance as suggested by expectancy theory (Vroom 1964). Overall performance is measured as the sum of the performance on the simple task and the complex task divided by the time allocated to each task in order to be able to truly compare improvements in performance. I formally state the research question below:

> **RQ2:** What are the effects of financial compensation and relative performance information on employee overall performance in a multi-task setting?

2.5.2.3 The positive effect of RPI on performance under financial incentives

Prior research has established that RPI and piece-rate pay interact to positively affect performance in a *single-task* setting (Tafkov 2013), although when RPI is provided with tournament incentive schemes in a single-task setting performance does not improve (Hannan et al. 2008). In a multi-task setting, without considering the effects of financial incentives, RPI could have a positive or a negative effect on performance depending on whether employees are given autonomy over the tasks (Hannan et al. 2013). More specifically, when employees are not allowed to choose their effort allocation across multiple tasks and when they are not paid with individual performance-based compensation, RPI has a motivational and positive effect on performance. However, when employees are allowed to choose their effort allocation across multiple tasks and when they are not compensated with individual performance-based pay, RPI has a detrimental effect on performance (Hannan et al. 2013).

Hannan et al. (2013) demonstrate that RPI can have a negative effect on performance when the firm is not able to control effort allocations. Hannan et al. (2013) calls for research examining the interplay between financial incentives and behavioral factors effects on effort allocations in multi-task environments. I add to this growing stream of literature by investigating whether when employees are given autonomy and are compensated with a bonus-based compensation, RPI can have a positive effect on effort allocation across multiple tasks and subsequent performance.

Tafkov (2013) describes and tests a causal model predicting that the positive effect of RPI on performance will be stronger under an individual performance-based contract than under a flat-wage contract in a *single-task* environment. When the accounting system disseminates RPI to employees, individuals are more confident that their ability is superior to that of another person if they are reasonably sure that the person failed to outperform them after trying hard to do so (Martin 2000). Tafkov (2013) finds that under a piece-rate compensation relative to a flat-wage compensation, employees are more inclined to attribute differences in performance to differences in abilities because the piece-rate pay motivates individuals to exert more effort than a flat-wage contract (Baiman 1982). Since employees can make better inferences about others' performance, employees engage in more social comparison when they are compensated with piece-rate pay relative to flat-wage compensation. Thus, the positive effect of social comparison is stronger under an individual performance-based contract (i.e., piece-rate pay) in a single-task setting (Tafkov 2013).

Tafkov's (2013) causal model will also be applicable in a *multi-task* setting in which workers have a choice of allocating effort across a low-return simple task and a high-return complex task. Performance comparisons with others are useful in forming beliefs about one's own ability when performance is impacted by task complexity that is common to all employees. In turn, beliefs affect effort and subsequent performance (Suls and Wheeler 2000). When performance depends both on task complexity and individual's ability, learning how well others perform is useful for separating the effects of the two factors in the inference process (Suls and Wheeler 2000).

Individuals who receive RPI are able to observe their ranked performance in comparison with others' ranks. Under a flat-wage compensation scheme, individuals cannot use the feedback provided by RPI to analyze whether the overall performance of others is different because of (1) exerting additional effort on the simple task or the complex task, (2) lack of additional effort exerted by some employees, or (3) differences in abilities on the simple and complex tasks. Thus, in a multi-task setting under a flat-wage compensation scheme, receiving RPI does not help employees to engage in social comparisons that could yield improvements in performance.

RPI is useful to workers because it provides feedback about their abilities and how their abilities compare to those of others. Understanding others' abilities is important when workers engage in social comparison (Festinger 1954). Under goal-based compensation, workers can draw clearer inferences about their abilities and those of others than inferences made under flat-wage compensation (Tafkov 2013). Under flat-wage compensation a worker would not be able to learn about whether the difference in relative performance is due to differences in workers' abilities or/and differences in effort. Financial incentives motivate workers to exert effort (Baiman 1982; Vroom 1964), reducing the probability that differences in relative performance among workers is due to differences in effort. Thus, RPI interacts with financial incentives allowing individuals to draw clearer inferences about effort and abilities, allowing workers to learn more about their task performance and the task at hand.

2.5.2.4 The negative effect of RPI on performance under financial incentives

A flat-wage compensation scheme might lead to greater performance than goal-based compensation when individuals are provided with RPI because of the increased performance pressure of two motivational mechanisms--RPI and goal-based pay. As explained in the previous section, task complexity decreases the correlation between effort and performance (i.e., weak effort-to-performance connection) and increases uncertainty regarding whether exerting higher effort will result in improved task performance. In order to evaluate their abilities, individuals engage in social comparison when they are provided with RPI. Thus, RPI provided regarding the performance on a complex task should reduce uncertainty leading to increased expectancy and a perceived stronger connection between effort and performance. Providing RPI to workers can reduce this perceived uncertainty of the connection of effort-to-performance on a complex task, thus leading to increased performance in the absence of goal-based compensation. However, when goal-based compensation is provided and RPI is disseminated to workers, jointly they can create high levels of performance pressure leading to lower overall performance.

RQ3: What is the effect of relative performance information on employee overall performance under different financial compensation schemes in a multi-task setting?

2.5.3 The Effect of Top and Bottom Performers

Social comparison theory predicts that individuals will strive to perform at least slightly better than others when provided with relative performance information. Individuals who perform better than average will want to maintain their high performance rank, while individuals who perform worse than average will want to improve performance in order to outperform at least some of their peers. During the social comparison process, individuals become competitive because they experience pressure to do better than others (Festinger 1954). This performance pressure can have a positive or a negative effect on performance efficiency. For high performers, RPI should lead to positive feelings about self-image, while for low performers it could lead to negative feelings such as shame (Tafkov 2013). Specifically, workers who receive feedback that they rank low in comparison with their peers might be discouraged and decrease their expectancy of reaching the goal, thereby leading to deterioration in their subsequent performance. The reduction in the performance efficiency by the bottom performers might be lower, greater, or equal to the effect of the increased performance by top performers. I examine whether the effort allocation and performance efficiency effects of top (high) performers are greater than the potential negative effects of RPI on the bottom (low) performers. In post-hoc analyses, I split the data into top (individuals ranked 1 and 2), average (individual ranked 3) and bottom (individuals ranked 4 and 5) performers and separately examine the effects of financial incentives on effort allocation and performance efficiency for high versus low performers.

> **RQ4**: In a multi-task setting what are the effects of relative performance information and financial compensation schemes on effort allocation and overall performance of employees of different performance levels?

3.0 METHOD

3.1 Research Design

The experimental design is a 2 x 2 between-subjects design. The first between-subjects factor is financial incentives varied at two levels: flat-wage or goal-based compensation. The second between-subjects factor is public RPI: present or absent. To test the research hypotheses, upper-level accounting students are recruited to participate in an experiment. Participants are randomly assigned to one of four treatment conditions: 1) RPI-Flat wage, 2) RPI-Goal-based compensation, 3) No RPI-Flat wage, and 4) No RPI-Goal-based compensation. Each experimental session is conducted with five[17,18] participants and lasts for three rounds: one training round, one round in which participants expect to receive RPI or not, and one main round after RPI has been provided or not. Each participant performs two tasks with varying task complexity: letter-decoding--a simple task, and solving anagrams--a complex task.

3.2 Tasks

Participants perform two tasks using a web-based application. The simple task consists of decoding numbers into letters of the alphabet and the complex task consists of solving anagrams. Both tasks have to be performed without using any calculators or paper and pencil in the training and main rounds. To mitigate any vocabulary differences across participants, the chosen

[17] I use a group size of five participants in order to have a clear delineation of top performers and bottom performance as well as an average performer who is ranked number 3. Prior studies have also used a size group of five participants (Hannan et al. 2013; Tafkov 2013).
[18] There were nine sessions in which four students participated.

anagrams consist of common English words. Participants' verbal ability is also measured with several practice SAT verbal questions, which are used to control for any verbal ability group differences in the statistical analyses. The two tasks were pre-tested to ensure that the difficulty level of each anagram is similar and to obtain participants' average task performance. Once participants choose the number of seconds they wish to perform each of the tasks, they perform the tasks for the chosen amount of time.

Appendix A shows the experimental manipulations for two treatments. Participants are also provided with descriptions of both tasks. The letter decoding task consists of two frames. The top frame shows the decoding key, which is randomized each round. The bottom frame is the input window, which shows a random number between 1 and 42. The decoding task involves looking up the decoding key and entering the corresponding number into the input window. Participants are also provided with a description of the solving anagrams task. Participants are instructed to rearrange the letters of the word presented at the top of their computer screens into new words; immediately below the given word, there are three task strategies available to participants. Participants are not instructed to use the strategies. They are only told that there are three different approaches available to them. The first task strategy, "circle" rearranges the letters into a circle; the second approach, "vowels," consists of grouping the letters into vowels and consonants; the third task strategy rearranges the letters in alphabetical order, "alphabet." By clicking on each strategy button, participants could actually see the letters rearranged according to the strategy. Appendix B shows how the strategy buttons work. Performance on a complex task usually improves through learning over longer periods of time. Thus, participants are given the opportunity to use any or all of the suggested task strategies if they wish in order to improve their performance on the task over the training round and Round 1.

3.3 Pre-Test of Tasks and Two Pilot Studies

A pre-test of the tasks was conducted in order to establish participants' average performance on the letters decoding task and the task of solving anagrams. Sixty students participated in the pre-test. For their participation students were compensated on average $16 and received course credit.[19] Participants were asked to perform the letter decoding task and the task of solving anagrams for six rounds total: three rounds of each task. In the post-experimental questionnaire I asked participants to what extent they agree or disagree that solving anagrams is a complex task. I asked participants the same question regarding the letter decoding task. Participants perceived the letter decoding task as less complex than the task of solving anagrams (4.433 vs. 9.783, respectively; 1- being strongly agree and 13 - being strongly disagree; paired t-test = 11.09, $p<.0001$). Participants were also asked about their perception of the difficulty of each task on a scale of 1 to 13, where 1 is extremely easy and 13 is extremely difficult. The mean for the task of solving anagrams is 8.13 and the mean for letter decoding is 2.95 (paired t-test = 14.69, $p<.0001$). Thus, participants correctly perceived the letter decoding task as an easier task to perform. To the question about which task they perceived as more cognitively demanding (i.e., required more mental effort), 96.67 percent of participants responded that the task of solving anagrams took more cognitive effort.

To verify that the effort to performance connection for the simple letter-decoding task is stronger than that for the complex anagram task, I asked participants the same question about each task: "To what extent do you agree that the more time you spend on the decoding task

[19] They were paid with flat-wage or piece-rate pay. There were no group differences in performance and pay, thus, I am using the entire sample of the pre-test.

(solving anagrams), the more letters you can decode (the more words you can create)?" On average, participants agreed that the more time spent on the simple task, the higher the output (3.70); however, participants did not agree as strongly with the statement that the more time spent on the complex task, the higher the output (5.50, where 1 is strongly agree, and 13 is strongly disagree; paired t-test = 3.44, p = .0011).

One of the reasons for conducting the pre-test was to establish average performance on each task in order to set a moderately difficult goal and to set the points that could be earned by working on each task. Participants were able to correctly decode 23.9 letters per minute and were able to create 1.93 four-letter words per minute, 1.36 three-letter words per minute, and 0.544 five-letter words per minute, on average.[20] I used several criteria to set the goal in term of points for the goal-based compensation conditions. First, I assigned one point to a correctly decoded letter, five points for a correct two-letter word, ten points for a correct three-letter word, fifteen points for a correct four-letter word, and twenty-five points for a correct five-letter word.

There was a varying degree of complexity within the complex task because participants could choose to create several five-letter words to reach the goal or they could choose to create more two- and three-letter words. The process of reaching the goal was not important for the hypothetical firm as long as workers reach the goal. Second, the points assigned to the complex task are much higher than the points assigned to the simple task because the complex task entails higher risk. Third, I ensured that participants who decide to allocate all allotted time to the letter decoding task will not be able to earn enough points to reach the goal. As established in the pre-test, the highest performance on the letter decoding task for the allotted time was 155. Thus, the goal set for the pilot test should be at least greater than 155. Further, I calculated the average

[20] Unlike the pilot, the pre-test did not allow participants to create two-letter words.

points per minute earned on both tasks: 23.9 points for the letter decoding task and 71.05 for solving anagrams.[21] Based on this information I set the goal at 250 points for the goal-based compensation used in the first pilot study because it is easily achievable goal when participants allocate three or four minutes to the complex task.

There were two pilot studies conducted with undergraduate accounting student participants from a university in the Southeastern United States. They had not previously participated in this experiment. There were no statistically significant differences in the demographic characteristics among student participants from the pre-test and the pilot studies. The main purpose of the pilot studies was to ensure that the experimental manipulations were well understood by student participants as well as to ensure that the goal of 250 points for the goal-based compensation was perceived as a challenging but achievable goal. Based on the results of the pilot studies, the goal of 250 points was increased to 270 points.

3.4 Participants

Festinger (1954) states that individuals tend to evaluate their abilities in comparison with others who have similar level of abilities in order to obtain a more accurate view of their own abilities. In order to facilitate social comparison when RPI is provided, I use student participants who represent a homogenous group of individuals who possess similar abilities and knowledge. Student participants will choose to engage in social comparison of their abilities with other students who possess similar level of abilities.

Participants are recruited from undergraduate accounting classes at a large southeastern university. Individuals who participated in the pre-test and the two pilot studies are not

[21] I used an estimated average performance for two-letter words to be 3 words per minute.

significantly different in terms of demographic and other characteristics from the individuals who participated in the main experiment. The four groups of participants are drawn from the same accounting program. Gibbs and Salterio (1996) recognize that an important element of any experimental design is to appropriately match participants to the tasks. Although, the tasks in this study do not have a real-world analog, they are appropriate for testing the underlying theory because the tasks are well understood by student participants, and they should have the ability to perform the tasks. Thus, student participants and the tasks in this study are appropriately matched. Also, participants are trained on both tasks before they begin Round 1 ensuring that they can perform and understand the tasks.[22] I also follow prior literature and use student participants as proxies for workers (e. g., Murthy and Schafer 2011; Hannan et al. 2013; Tafkov 2013).

3.5 Manipulation of Relative Performance Information

In all conditions participants receive individual performance information at the end of each round showing how many letters were correctly and incorrectly decoded and how many valid and incorrect words were generated. Participants in the No-RPI condition receive no additional performance information. Participants in the RPI condition receive the relative performance rank separately for the letter decoding and the task of solving anagrams for Round 1 and Round 2. The rank is based on the relative performance of the five participants in each

[22] The training round consists of performing both tasks for 5 minutes each. In Round 1 participants may take some time to get used to the tasks. Also, in Round 1 participants expect to receive RPI once they finish performing the tasks. Thus, the dependent variables are measured in Round 2, after participants receive RPI (so that the effect of RPI can be evident). The effect of RPI on effort allocations and overall performance can be truly observed in Round 2.

session.[23] Participants learn their own rank and the ranks of each of the other four participants (i.e., public RPI). Also, in order to manipulate RPI as *public* RPI, participants are instructed to introduce themselves by saying "Hello. I am participant number ___." They are also told to introduce themselves and to say what accounting classes they are currently enrolled. In all experimental conditions, each participant introduced himself/herself by reading the participant number displayed on the top of their computer screen. The purpose of this introduction was to remove performance rank anonymity.

Before starting Round 1 participants in the RPI condition are told that "At the end of Round 1 and 2, your performance on each task will be ranked relative to the other four participants in the group. Your ranking on each task will be based on the points you earn on that task relative to the points earned by the other participants on the task. For example, you will be ranked #1 on a task if you earn more points on that task than any of the other four participants. Everyone in the group will see their own rank and the ranks of the others on each task." Immediately below this statement participants are provided with a picture example of the relative ranks. Participants in the No-RPI condition do not receive this statement and do not receive a picture example of the ranks.

The participants in the RPI present condition know their relative performance on both tasks in terms of points, but they will not receive performance distribution information (i.e., range, frequencies, averages). Providing detailed feedback could result in the participants forming a standard of performance which allows participants to simply conform to the standard.

[23] The size of the group was chosen based on prior studies, which used the same group size of five individuals (e.g., Tafkov 2013 and Hannan et al. 2013).

Thus, providing detailed performance information is not provided since it would introduce a confound variable in the experiment.

3.6 Manipulation of Financial Compensation Scheme

Participants in the goal-based compensation condition are paid based on their individual performance such that they maximize compensation by increasing their performance on the complex task (i.e., create more new words). In the goal-based compensation condition, participants are paid $15 fixed pay in addition to a bonus of $7.50 for earning 270 points in each round.[24] Appendix A provides a screenshot of the information participants read in the RPI-Goal-based condition. Participants in the goal-based compensation condition are told the following: "Your compensation is based on the number of points you earn. Your firm will pay you for your performance on both rounds with a $15 fixed payment plus a bonus of $7.50 for Round 1 plus a bonus of $7.50 for Round 2, which depends on your performance on the tasks (i.e. how many points you earn. You can earn a bonus of $7.50 in Round 1 if you earn a total of 270 points by performing the tasks. You can earn a second bonus of $7.50 in Round 2 by performing the tasks. Thus, your total pay could be $30 ($15 fixed + $7.50 bonus for Round 1 + $7.50 bonus for Round 2)."

Participants in the flat-wage compensation condition are told that "Your compensation is not based on the number of points you earn. Your firm will pay you for your performance on both rounds with a $15 fixed payment regardless of the number of points you earn."

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[24] Bonus payment in this study is a lump sum of $7.50 for each round for reaching a goal, and thus, some individuals might not be motivated to improve their performance once they reach the goal. Any improvements in performance beyond the goal will be due to the motivational effect of RPI. To conclude that RPI has motivational effect on performance beyond the effect of a goal-based pay, I compare the performance mean for participants who are paid with a goal-based compensation to the mean of participants who are paid with goal-based pay and receive RPI.

3.7 Dependent Variables

The two main dependent variables of interest are effort allocation and performance efficiency. Total number of seconds presented to participants is 300 (5 minutes). Participants are told that they need to work on the simple task for minimum of 1 minute and to keep high productivity on both tasks. Therefore, the total seconds available to participants to allocate is 240 seconds (4 minutes). The first dependent variable, effort allocation, is measured as the number of seconds spent working on the complex task out of the 240 seconds available to allocate for that task.

The firm-preferred effort allocation is to perform 1 minute on the low-return simple task as required and 4 minutes on the high-return complex task. To emphasize the firm-preference to participants, in all experimental conditions they are told that the task of solving anagrams brings more profit to the firm, and is, thus, more important to their organization; their firm prefers employees to focus their attention to the task of solving anagrams.

The second dependent variable is performance efficiency. Overall performance is calculated as the points earned on the decoding task in Round 2 divided by the number of seconds allocated to the decoding task (including the 60 required seconds) in Round 2 plus the points earned on the anagrams in Round 2 divided by the number of seconds allocated to the anagram task in Round 2. This overall performance variable captures efficiency and is represented as number of points earned per second. It allows me to compare true performance scaled by allocated time.

The output produced from working on the simple task is the number of correctly decoded letters and the output produced from working on the complex task is the number of valid two, three, four and five letter words. In order to equate the units of output of both tasks, points are assigned to correctly decoded letters and to valid new words. The point system was established based on the pre-test of the tasks and the two pilot studies as described in the previous section.

3.8 Experimental Procedures

I conducted separate sessions for each of the four experimental conditions. Five participants who were randomly signed up for an experimental session via Experimetrix entered the computer lab and were instructed to access a website. Each session began by providing participants with an informed consent form and general description of the study. Participants completed a pre-experimental questionnaire to obtain information about their demographic characteristics, risk preferences, self-esteem, and their verbal abilities. Next, participants were given a detailed description and screenshots of the two tasks. Before training with the tasks, participants had to pass an instruction quiz asking about the total number of rounds in the study, number of possible letter-combinations for the anagram task, different approaches available to solve anagrams, and correct description of the decoding task. If participants selected the wrong answer to any one question, the web-based application re-routed them back to the instruction page.

Next, participants practiced performing the two tasks in order to gauge their capabilities. They had the opportunity to train on each task for five minutes. Each participant chose the order of tasks in the training session. I tracked the order of the tasks and controlled for order effects in the analyses. After they completed the training session, individuals were provided with feedback about the maximum number of words that could be formed during the training session and the maximum number of correctly decoded letters from prior studies. It is only in the training session that participants are provided with feedback about the maximum number of words that could be formed and decoded letters. The purpose of providing this feedback is to allow participants to more accurately gauge their capabilities on the tasks.

Once they complete the training round, participants answered task attractiveness and intrinsic motivation questions. Next, participants were asked to assume the role of a worker, and they were presented with the manipulated information as shown in Appendix A. Participants were also informed that the organization required them to allocate a minimum of 60 seconds towards the letter decoding task, and the remaining 240 seconds of work time could be allocated as they desired. On the same page, participants were asked to make their effort allocation decision by choosing the number of seconds they would like to spend performing each task (out of 240 seconds available).

Before participants made their effort allocation decision, on the same screen they were reminded of their performance on the training round. Participants were informed about the number of correctly decoded letters and correctly created two-, three-, four-, and five-letter words during the training round in order for them to make an informed effort allocation decision.

Once they made their effort allocation choice, participants performed the two tasks for the number of seconds they have chosen (Round 1). A clock was displayed on the computer screen so that participants could monitor the amount of time spent on each task. Once time expired, participants in the RPI condition were able to see relative ranks for each task. All participants saw their total points earned for the round. A screenshot of the relative performance ranks is included in Appendix B. On the same page, participants were asked to allocate 240 seconds for Round 2. Participants performed the tasks in Round 2 and were shown relative ranking information at the end of Round 2 if they were in the RPI condition.

Next, participants answered manipulation check questions and post-experimental questions. The two manipulation check questions were measured on a 13-point Likert scale where 1 equals strongly disagree and 13 equals strongly agree. Participants indicated the degree to which they agreed or disagreed with the following two statements: 1) The more points I earned, the more money I made, and 2) I learned my relative performance rank as well as that of the other participants in the group. Among other questions such as perceptions of task complexity in the post-experimental questionnaire, I included questions that measure the degree of social comparison and performance pressure. Once participants were finished answering all questions, they were paid and dismissed.

3.8.1 Control Variables

In order to control for participants verbal ability, the verbal questions used in this study are actual SAT practice questions provided by the College Board, which is the organization that scores the SAT exams. These questions can be found on the following web site: www.sat.collegeboard.org.[25] There were three multiple-choice verbal questions that are labeled medium difficulty by the College Board. I pre-tested the SAT questions with student participants. Eighty-four percent of participants identified the correct answer to all three SAT questions. Two additional questions that are asked before participants are provided with the case materials are whether English is their first language (i.e., the language they grew up speaking) and how many college-level English classes they have taken.

Prior literature suggests that self-esteem may affect how individuals engage and respond to social comparison (Gibbons and McCoy 1991). I adapted three self-esteem questions from

[25] Source: Copyright © 2012. The College Board. www.collegeboard.org. Reproduced with permission.

Hannan et al. (2013) that measure participant confidence in their scholastic abilities, the extent to which they feel respected by peers, and the extent to which they are concerned about the impressions they make. The self-esteem questions are asked before participants are exposed to the experimental manipulations.

Also, I include five questions that are adapted from Weber et al. (2002) study to measure risk preferences in investment and gambling domains. Participants are asked to indicate their likelihood on a five-point Likert scale of engaging in each activity: 1) betting a day's income at the horse races, 2) investing 5% of their annual income in a very speculative stock, 3) betting a day's income on the outcome of a sporting event, and 4) investing 5% of their annual income in a conservative stock (i.e., stock from a well-established company operating in a mature sector of the economy). The risk preference scale is included before the experimental manipulations to capture participants' innate risk preferences that are not changed based on the experimental treatments.

Prior research suggests that task performance may be affected by individual's perception of task attractiveness (Fessler 2003). Task attractiveness is defined as an individual's attitude toward that task and is accompanied by a high degree of intrinsic motivation (Fessler 2003). I measured task attractiveness using Fessler's (2003) seven-question scale. I create a composite task attractiveness measure by averaging the responses on all questions into one variable. The task attractiveness scales for each task are included before and after the experimental manipulations to measure any differences after participants are exposed to their experimental condition.

Further, I include a scale measuring individuals' intrinsic motivation because prior studies in psychology demonstrate that in the absence of external motivators, individuals choose to work longer on tasks for which they receive more satisfaction (Ryan and Deci 2000). Intrinsic motivation relates to activities one undertakes for one's own sake (Deci 1971). Intrinsic motivation is defined as the doing of an activity for its inherent satisfaction rather than for some outcome or consequence (Ryan and Deci 2000). I adapt Dermer (1975) scale. For the decoding and the anagrams tasks, the scale consists of three statements with which participants agree or disagree on a five-point Likert scale. The three items are: 1) performing well on the letter decoding task (solving anagrams) contributes to my personal growth and development, 2) performing well on the letter decoding task (solving anagrams) gives me a feeling of accomplishment, and 3) I feel a great sense of personal satisfaction when I perform well on the letter decoding task (solving anagrams). I calculate Cronbach's alpha and use an average score from the three items to include in the models. The intrinsic motivation scale is given to students immediately after their training with both tasks and before the manipulations of the independent variables. The reason for the inclusion of this measure before as opposed to after the experimental treatments is that intrinsic motivation is defined as the individual's innate preference to work on a task after the removal of external contingencies.

4.0 RESULTS

4.1 Participants Demographics

The participants for the main study were drawn from the same student population of a southeast university as the participants from the pre-test of the tasks and the two pilot studies. Participants were recruited from an undergraduate accounting program. For their participation, they were rewarded course credit. Also, on average, participants were paid $18.39 across all conditions for approximately one hour of their time. The experiment took on average 53.72 minutes to complete. Participants in the flat-wage conditions were paid $15, whereas participants in the RPI – Goal-based condition earned an average of $22.65 and participants in the No RPI – Goal-based condition earned an average of $21.39. There is no statistically significant difference between earnings by participants in the RPI group versus those in the No RPI group (t-value = 1.49, p=0.14). However, the monetary reward of $15 earned by participants in the flat-wage group is significantly different from the reward of $22.03 earned by participants in the goal-based condition (t-value=10.81, p<0.001), which is by design.

In total, 199 students participated. The mean age of the participants was 25.13. There were 92 male (46.23 percent) and 107 female (53.77 percent) participants. Students were similar on background characteristics such as age, education, and work experience. On average, they had taken 3.51 accounting classes and had 60.96 months (5.08 years) of work experience. Participants reported on average 19.11 months (1.59 years) of professional work experience. Students' self-reported GPA averaged 3.34. Participants had taken 3.03 college-level English classes, on average. Seventy-five percent of participants reported that English is their first language (i.e., the language they grew up speaking). Sixty-three percent of participants had solved anagrams, and 55 percent of students responded that they solved anagrams at least once a year.

Participants were also asked to indicate their primary motivation for working hard on a scale of 1 to 10, where 1 equaled "how co-workers perceived my work" and where 10 equaled "the amount of money I received". On average, students responded 5.63. I also conducted a one-way ANOVA in which the dependent variable was the primary motivation for working hard and the independent variable was the four experimental treatments. There were no statistically significant differences across treatments (F-value = 0.41, p=0.75) suggesting that participants' motivation to work hard did not differ across conditions prior to exposure to the experimental treatments.

4.2 Manipulation Checks

Participants were asked two manipulation check questions after Round 2. They were asked to agree or disagree on a scale of 1 to 13 (1-strongly disagree; 13-strongly agree) with the following statements: 1) The more points I earned, the more money I made, and 2) I learned <u>my</u> relative performance rank as well as that of the <u>other participants</u> in the group. The average responses on the first statement for participants in the flat-wage and goal-based experimental conditions were 7.48 (n=96) and 8.27 (n=103) respectively; the difference in responses is not statistically significant (t-value=1.17, p=0.25).[26] On the second question, the average responses

[26] I also tested the statistical difference between the mean response of Flat-wage and the mid-point 7 and the mean response of Goal-based pay group and the mid-point 7 (7=neither agree nor disagree with statement). The mean of

for participants in the RPI and no-RPI were 9.24 (n=104) and 6.95 (n=95) respectively; the difference in responses between these two experimental treatments is statistically significant (t-value=3.84, p=0.0002).[27] The mean responses on the RPI manipulation check question are significantly different between conditions, suggesting that participants correctly understood the RPI manipulation.

Within each round when participants finished performing the first task, they were provided with individual feedback regarding the number of points they earned on that task. In the flat-wage condition, there was also a message stating that their compensation was a fixed $15 regardless of the number of points they earned. Surprisingly, participants in the flat-wage pay condition answered 7.48 on average to the first manipulation check statement suggesting that they neither agree nor disagree with the statement that "the more points I earned, the more money I made". Since participants were reminded of their compensation scheme several times during Rounds 1 and 2, I believe that participants understood the compensation manipulation; however, they might have not understood the manipulation check statement. Participants might have overly focused on the point system in the experiment.

4.3 Understanding of Tasks Quiz

After participants were given detailed description of the two tasks, they were asked to take a short quiz to ensure that they understood the tasks. The quiz asked participants the number of combinations they could generate in the anagrams task, to choose the correct description of

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Goal-based pay group of 8.27 is statistically different from the mid-point 7 (t-value=2.80, p=0.006) and the mean of Flat-wage pay group of 7.48 is not statistically different from the mid-point 7 (t-value=0.99, p=0.33).

[27] I also tested the statistical difference between the mean response of RPI group and the mid-point 7 and the mean response of No-RPI group and mid-point 7 (7=neither agree nor disagree with statement). The mean of No-RPI group of 6.95 is not statistically different from the mid-point 7 (t-value=0.10, p=0.92); however, the mean of RPI group of 9.24 is statistically different from the mid-point 7 (t=5.46, p<.0001).

the decoding task, to indicate the different approaches available for solving anagrams (i.e., strategies), and to indicate whether a statement identifying the number of rounds was true or false. If participants selected one wrong answer choice, they were re-directed back to the screen describing the study and the tasks. Seventy percent of participants answered correctly the first time; twenty-one percent were re-directed once. There were five individual who were re-directed more than three times. I examined the responses of these participants. No participants were dropped from the dataset because they appeared as legitimate data points. The statistical analyses did not change substantially when these five participants were excluded; thus, I left them in the dataset.

4.4 Test of Hypothesis and Research Questions

Hypothesis 1 (H1) predicts that employees paid under flat-wage scheme will allocate more effort towards the simple task when they are provided with RPI than when they are not provided with RPI. Research question 1 (RQ1) examines how the presence or absence of RPI will affect effort allocation when employees work under goal-based compensation scheme. I test H1 and answer RQ1 using ANOVA.[28] RQ2 examines the effect of RPI (present or absent) on performance efficiency in the presence of goal-based pay, and RQ3 examines the effect of financial compensation schemes (flat-wage or goal-based pay) on performance efficiency in the presence of RPI. The dependent variable used in the first ANOVA model testing H1 and RQ1 is effort allocation. The second dependent variable used in the second ANOVA model testing RQ2 and RQ3 is performance efficiency.

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[28] I also test the hypothesis and research questions by conducting ANCOVA models in which I included all of the covariate variables in this study (e.g., demographics, risk preference, task attractiveness, self-esteem, intrinsic motivation etc.) The covariates were not statistically significant in the analyses.

I first test the assumptions underlying ANOVA analysis. I conduct a Bartlett's test examining the equality of variances across groups for both dependent variables; the test for effort allocation is not statistically significant suggesting that there are equal variances across experimental groups (p=0.93). The test of equality of variances for performance efficiency is not statistically significant at alpha level 0.01 (p=0.05). I also conduct a normality test (e.g., Shapiro-Wilk's test) for each of the dependent variables. The test of normality for effort allocation for three out of the four group are not statistically significant at alpha level 0.01 (p = 0.08) and significant at p=0.003 for the goal-based pay/RPI group suggesting that the data for that group to some extent are not normally distributed. The test for normality of the second dependent variable, performance efficiency, is not statistically significant for any groups (untabulated). ANOVA models are robust to moderate deviations from assumptions of equal variances and normal error if the group sample sizes are equal or near equal and the sample is large (Larson 2008; Norman 2010). The sample size for the RPI – flat-wage group is 45, RPI – Goal-based pay is 50, No RPI – flat-wage group is 58, and No-RPI – Goal-based pay is 46. The total number of participants used in the statistical analyses is 199.

The first dependent variable, effort allocation, is measured as the number of seconds participants allocated towards the complex task. The two independent variables in the models are RPI and financial compensation schemes. The ANOVA model is not statistically significant at alpha level of 0.05 (F-value=1.21, p=0.3). The second dependent variable is performance efficiency. Performance efficiency is measured as the sum of total points earned by performing the decoding task divided by the seconds allocated towards that task in Round 2 and total points earned by performing the task of solving anagrams divided by the seconds allocated towards that task in Round 2. The ANOVA model is not statistically significant suggesting no group mean differences across experimental conditions (F-value=0.51, p=0.67).

Because the statistical analyses for effort allocation and performance efficiency are not statistically significant, I conjecture that the effect of the top performers and the effect of the bottom performance on effort allocation and performance efficiency might be canceling each other out, resulting in statistically insignificant effects. Thus, I examine the effects of top and bottom performers in the next section.

4.4.1 The Effect of Top and Bottom Performers

The reduction in the performance efficiency by the bottom performers might be lower, greater, or equal to the effect of the increased performance by top performers. I examine whether the effort allocation and performance efficiency effects of top performers are greater than the potential negative effects of the bottom performers. In post-hoc analyses, I create two variables. The first variable equals 1 when the participants are ranked 1 and 2 in Round 2[29] on the solving anagrams task (i.e., top performers), equals 2 when the participants are ranked 4 and 5 on the same task (i.e., bottom performers), and the variable equals 0 when the participants are ranked number 3 (i.e., average performers). The second variable equals 1 when the participants are ranked 1 and 2 in Round 2 on letter decoding task (i.e., top performers), equals 2 when the participants are ranked 4 and 5 on the same task (i.e., bottom performers), and the variable equals

[29] I specifically examine individual ranks in Round 2 because the ranking is cumulative. It is based on individual performance (points) of Round 1 plus Round 2. Because of the cumulative nature of the ranking it is possible that two individuals earn the same number of points over the two rounds. The ranking in this study allowed participants to have the same rank (e.g., two individuals can be ranked number 1).

0 when the participants are ranked number 3 (i.e., average performers).[30] The group size of five individuals allows me to delineate the performance of top, bottom, and average performers.[31]

Overall, there are 46 individuals (23.13 percent) who are classified as top performers on both tasks (ranked either 1 or 2); there are 14 individuals (7.04 percent) who are classified as bottom performers on both tasks (ranked 4 and 5). One hundred thirty-nine individuals (69.85 percent) are classified as average performers on both tasks or they are top performers on one task and bottom or average performers on the other task.

Next, I re-examine the assumptions underlying ANOVA analysis when the ANOVA models include the two variables for top/bottom performers on the simple or complex task. In order to test the assumptions underlying ANOVA analysis, I create a variable called group. The group variable has twelve levels representing the interaction of the three independent variables: RPI (Absent or Present), financial compensation (Flat-wage or Goal-based pay), and top/bottom performer (Top, Bottom, or Average), thus, the 2 x 2 x 3 design results in twelve experimental groups. I conduct a Bartlett's test examining the equality of variances across all twelve groups for both dependent variables; the test for effort allocation of top/bottom performers on the complex task is not statistically significant suggesting that there are equal variances across experimental groups (p=0.61). The tests for effort allocation and performance of top/bottom performers on the simple task as well as the test for performance of top/bottom performers on the complex task are statistically significant at alpha level of 0.05 suggesting that there are unequal variances across experimental groups. ANOVA models are robust to moderate deviations from

[30] The two variables are measured at three levels (0=average performers, 1=top performers, and 2=bottom performers). Thus, in the ANOVA models the base level is the average performers, and the models reflect two degrees of freedom for these variables.

[31] Although the participants in the No RPI treatments did not receive relative rank information during the experiment, the web-based system tracked and recorded their relative ranks. Thus, my further analyses of the rankings include participants in all four experimental treatments.

the assumption of equal variances when the sample is large (Larson 2008; Norman 2010). The sample size in this study is 199.

I also conduct a normality test (e.g., Shapiro-Wilk's test) for each of the dependent variables when the top/bottom performer variables are also included in the models. I test for the normality assumption across all twelve experimental groups. The tests of normality for effort allocation for all groups are not statistically significant at alpha level of 0.05 with the exception of the following groups. The Shapiro-Wilk's test for the following groups is statistically significant at alpha level of 0.05: 1) for the effort allocation dependent variable: bottom performers of the simple task who do not receive RPI and are paid with goal-based pay and average performers of the simple task who do not receive RPI and are paid with a flat-wage pay, and the average and top performers of the complex task who receive RPI and are paid with goal-based pay, and 2) for the performance efficiency dependent variable: bottom performers on the simple task who receive RPI and are paid with goal-based pay. This result suggests that the data for that group to some extent are not normally distributed. ANOVA models are robust to moderate deviations from assumptions of equal variances and normal error if the group sample sizes are equal or near equal and the sample is large (Larson 2008; Norman 2010). The sample size for the RPI – flat-wage group is 45, RPI – Goal-based pay is 50, No RPI – flat-wage group is 58, and No-RPI – Goal-based pay is 46. The total number of participants used in the statistical analyses is 199.

I conduct two ANOVA models in which the dependent variables are effort allocation towards the complex task and overall performance efficiency. The independent variables in these models are RPI, financial compensation, and top/bottom performers on the *complex* tasks. Next, re-examining the research questions, I conduct additional two ANOVA models in which the dependent variables are effort allocation towards the complex task and overall performance efficiency. The independent variables in these models are RPI, financial compensation, and top/bottom performers on the *simple* task. The ANOVA models and the results are displayed in Tables 1 Panel C, Table 2 Panel B, Table 3 Panel C, and Table 4 Panel C.

4.4.2 The Effect of Top and Bottom Performers on the Complex Task

Next, I examine the effects of RPI and financial compensation schemes on top and bottom performers' effort allocation choices and performance efficiency separately for each task.

4.4.2.1 Effort allocation

RQ1 examines the effect of motivational mechanisms, RPI and financial compensation, on employee effort allocation between simple and complex tasks. I conduct ANOVA analysis for top and bottom performer of the complex task in order to understand their effort allocation choices. The dependent variable is effort allocation measured as the number of seconds allocated towards the complex task (out of 240 available seconds). I initially include a three-way interaction term in the model for the three independent variables of interest: RPI, financial compensation, and top/bottom performers. The three-way interaction term is not statistically significant (F-value=0.48, p=0.62); thus, I drop it out of the model. The interaction term of RPI and financial compensation is also not statistically significant (F-value=0.08, p=0.77). This result suggests that the effect of the two motivational mechanisms, RPI and financial compensation schemes, is additive such that RPI and financial compensation affect individual effort allocation separately. The ANOVA model is presented in Table 1, Panel C.

Table 1 – The Effect of RPI and Financial Compensation Schemes on Effort Allocation of Top and Bottom Performers on the Complex Task

PANEL A: Treatment Descriptive Statistics

Treatment group	N	Mean	Standard Deviation
RPI - Top Performer	76	165.56	47.82
RPI - Bottom Performer	15	134.73	50.12
No RPI - Top Performer	48	158.72	40.02
No RPI - Bottom Performer	31	145.34	49.66

PANEL B: Treatment Descriptive Statistics

Treatment group	N	Mean	Standard Deviation
Goal-based pay - Top Performer	62	158.31	47.88
Goal-based pay - Bottom Performer	20	142.09	38.31
Flat-wage - Top Performer	62	165.97	41.74
Flat-wage - Bottom Performer	26	137.98	57.3

Dependent variable:
Effort allocation is measured as the number of seconds participants allocated towards the complex task (out of 240 available seconds). The means in Panel A and B represent number of seconds allocated to the complex task.
Independent variables:
RPI is manipulated as present (=1) or absent (=2).
Financial compensation scheme is manipulated as goal-based compensation (=1) or flat-wage compensation (=2).
Post-hoc I determined whether a participant is a top, bottom, or average performer on the complex task. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the complex task.

Table 1 – The Effect of RPI and Financial Compensation Schemes on Effort Allocation of Top and Bottom Performers on the Complex Task Cont'd.

PANEL C: ANOVA Model and Significance

Analysis of variance source of variation	Degrees of freedom	Sum of Squares	Mean Square	F-value	Significance
RPI	1	14350.00	14350.00	6.47	0.01
FIN	1	13021.00	13021.00	5.87	0.02
RPI*FIN	1	182.96	182.96	0.08	0.77
HIGHLOW_COMPLEX	2	35939.13	17969.56	8.10	0.00
RPI*HIGHLOW_COMPLEX	2	21735.98	10867.99	4.90	0.01
FIN*HIGHLOW_COMPLEX	2	16784.42	8392.21	3.78	0.02

Model's p-value = 0.0024

Dependent variable: effort allocation to the complex task

PANEL D: Contrast Tests

Treatment group comparisons	Significance	95% Confidence Interval
RPI - Top Performer VS. No RPI - Top Performer	0.43	-10.34 – 24.01
RPI - Bottom Performer VS. No RPI - Bottom Performer	0.47	-39.89 – 18.68
RPI - Bottom Performer VS. RPI - Top Performer	0.02	4.54 – 57.11
No RPI - Bottom Performer VS. No RPI - Top Performer	0.22	-8.14 – 34.92
RPI - Top Performer VS. No RPI - Bottom Performer	0.05	0.28 – 40.16
RPI – Top Performer VS. RPI – Average Performer	0.00	25.44 – 123.16
RPI – Bottom Performer VS. RPI – Average Performer	0.00	51.63 – 158.62
No RPI – Top Performer VS. No RPI – Average Performer	0.38	-13.83 – 36.52
No RPI – Bottom Performer VS. No RPI – Average Performer	0.86	-25.07 – 20.99

Dependent variable:
Effort allocation is the dependent variable in the ANOVA model. Effort allocation is measured as the number of seconds participants allocated towards the complex task (out of 240 available seconds).
Independent variables:
RPI is manipulated as present (=1) or absent (=2).
FIN is manipulated as goal-based compensation (=1) or flat-wage compensation (=2).
HIGHLOW_COMPLEX is a measured variable, which is created post-hoc. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the complex task. HIGHLOW_COMPLEX = 1 if Top performer, =2 if Bottom Performer, and =0 if Average performer.

Table 1 – The Effect of RPI and Financial Compensation Schemes on Effort Allocation of Top and Bottom Performers on the Complex Task Cont'd.

PANEL E: Contrast Tests

Treatment group comparisons	Significance	95% Confidence Interval
Goal-based pay - Top Performer VS. Flat-wage - Top Performer	0.38	-24.70 – 9.38
Goal-based pay - Bottom Performer VS. Flat-wage - Bottom Performer	0.77	-23.97 – 32.20
Goal-based pay - Bottom Performer VS. Goal-based pay - Top Performer	0.19	-8.62 – 41.05
Flat-wage - Bottom Performer VS. Flat-wage - Top Performer	0.02	5.24 – 50.75
Flat-wage - Top Performer VS. Goal-based pay - Bottom Performer	0.05	-48.24 – 0.48
Goal-based pay - Top Performer VS. Goal-based pay - Avrg Performer	0.48	-20.28 – 42.85
Goal-based pay - Bottom Performer VS. Goal-based pay - Avrg Performer	0.13	-8.30 – 63.30
Flat-wage - Bottom Performer VS. Flat-wage - Avrg Performer	0.00	50.59 – 127.35
Flat-wage - Top Performer VS. Flat-wage - Avrg Performer	0.00	24.78 – 97.17

Dependent variable:
Effort allocation is the dependent variable in the ANOVA model. Effort allocation is measured as the number of seconds participants allocated towards the complex task (out of 240 available seconds).
Independent variables:
RPI is manipulated as present (=1) or absent (=2).
FIN is manipulated as goal-based compensation (=1) or flat-wage compensation (=2).
HIGHLOW_COMPLEX is a measured variable, which is created post-hoc. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the complex task. HIGHLOW_COMPLEX = 1 if Top performer, =2 if Bottom Performer, and =0 if Average performer.

The analysis reveals a two-way interaction between RPI and top/bottom performers (F-value=4.90, p=0.01) suggesting that the effect of RPI on effort allocation choices depends on whether an employee is a top or bottom performer of the complex task. The two-way interaction between financial compensation and top/bottom performers is also statistically significant (F-value=3.78, p=0.03) suggesting that the effect of financial compensation scheme depends on whether the employee is a top or bottom performer of the complex task.

RPI induces the top performers on the complex task to allocate more effort towards the complex task than the bottom performers. As shown in Table 1, Panel A, on average, top performers who received RPI allocated 165.56 seconds to the complex task out of 240 available seconds versus bottom performers who also received RPI but allocated 134.73 seconds towards the complex task. However, when top and bottom performers are not provided with RPI (158.72 vs. 145.34, respectively), their allocation of effort towards the complex task does not differ. This result is graphically depicted on Figure 1. When top performers on the complex task receive RPI, they allocate more effort to the complex task than the low performers, regardless whether the low performers received RPI or not. These results suggest that RPI has stronger effect on top performers than on bottom performers.

I further examine the interactive effects of financial compensation scheme and top/bottom performers. The descriptive statistics are displayed on Table 1, Panel B. Table 1, Panel C shows no statistically significant difference between top and bottom performers' effort allocation choices (158.31 vs. 142.09, respectively) when individuals are compensated with goal-based pay. However, when employees are compensated with flat-wage, top performers on the complex task allocate significantly more effort to the complex task than bottom performers (165.97 vs. 137.98, respectively). Top performers paid with flat-wage allocated more time towards the complex task than low performers paid with goal-based pay, which pays out greater rewards for performing better on the complex task (165.97 vs. 142.09, respectively). The contrast testing is displayed on Table 1, Panel E (p=0.05). These results are graphically depicted on Figure 2.

4.4.2.2 Performance efficiency

Next, I examine whether the top performers on the complex task who allocated more time towards the complex task actually increase their overall performance on both tasks. I investigate whether allocating more effort towards the complex task translates into an improved total performance on both tasks. In this section, I examine RQ2 and RQ3 for top and bottom performers on the complex task. RQ2 and RQ3 together investigate the effect of RPI and financial compensation schemes on individual performance.

I conduct ANOVA analysis for top and bottom performers on the complex task in order to examine their performance. The dependent variable in Table 2, Panel B is performance efficiency measured as the sum of points earned performing the simple task divided by the number of seconds allocated to this task and the points earned performing the complex task divided by the number of seconds allocated to the complex task. I initially include a three-way interaction term in the model for the three independent variables of interest: RPI, financial compensation, and top/bottom performers. The two-way interaction terms between RPI and top/bottom performer and financial schemes and top/bottom performers as well as the three-way interaction are not statistically significant at alpha level = 0.05; thus, I drop these terms from the model.

Table 2 – The Effect of RPI and Financial Compensation Schemes on Performance Efficiency of Top and Bottom Performers on the Complex Task

PANEL A: Treatment Descriptive Statistics

Treatment group	N	Mean	Standard Deviation
RPI	95	1.32	0.36
No RPI	104	1.5	0.46

PANEL B: ANOVA Model and Significance

Analysis of variance source of variation	Degrees of freedom	Sum of Squares	Mean Square	F-value	Significance
RPI	1	1.42	1.42	10.91	0.00
FIN	1	0.05	0.05	0.37	0.54
RPI*FIN	1	0.23	0.23	1.80	0.18
HIGHLOW_COMPLEX	2	8.71	4.36	33.43	0.00

Model's p-value< 0.0001

Dependent variable: performance efficiency

Dependent variable:
Total performance efficiency is the dependent variable in the ANOVA model. Performance efficiency is measured as the sum of the points earned working on the simple task divided by the number of seconds allocated to the simple task (including the 60 required seconds) and the points earned working on the complex task divided by the number of seconds allocated to the complex task.
Independent variables:
RPI is manipulated as present (=1) or absent (=2).
FIN is manipulated as goal-based compensation (=1) or flat-wage compensation (=2).
HIGHLOW_COMPLEX is a measured variable, which is created post-hoc. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the complex task. HIGHLOW_COMPLEX = 1 if Top performer, =2 if Bottom Performer, and =0 if Average performer.

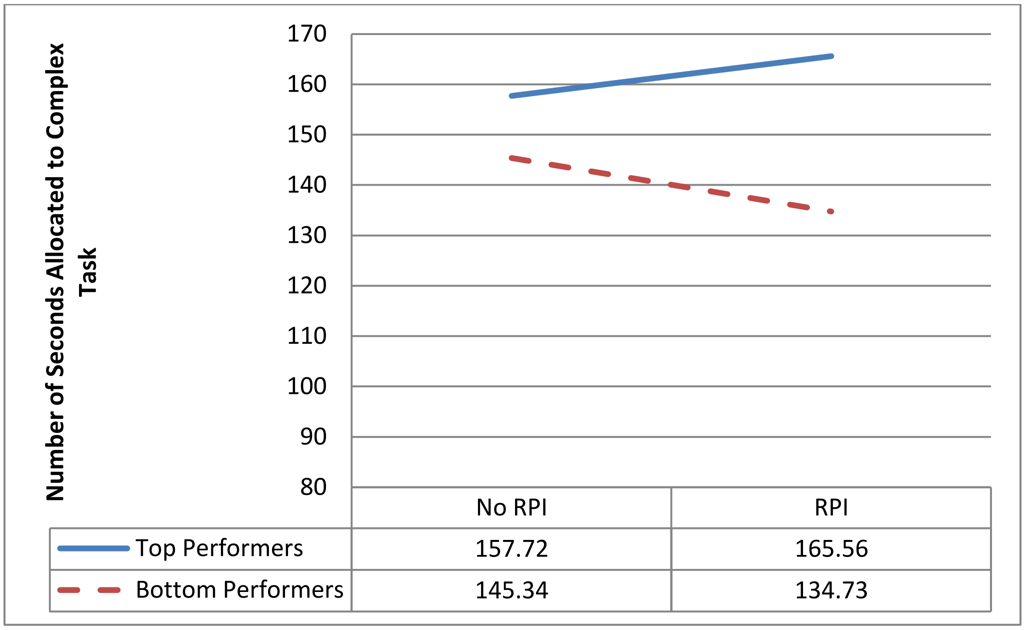

Figure 1- The Effects of RPI and Top/Bottom Performers of Complex Task on Effort Allocation

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Dependent variable:
Effort allocation is measured as the number of seconds participants allocated towards the complex task (out of 240 available seconds).
Independent variables:
RPI is manipulated as present (=1) or absent (=2).
Top/Bottom performer is a measured variable, which is created post-hoc. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the complex task.

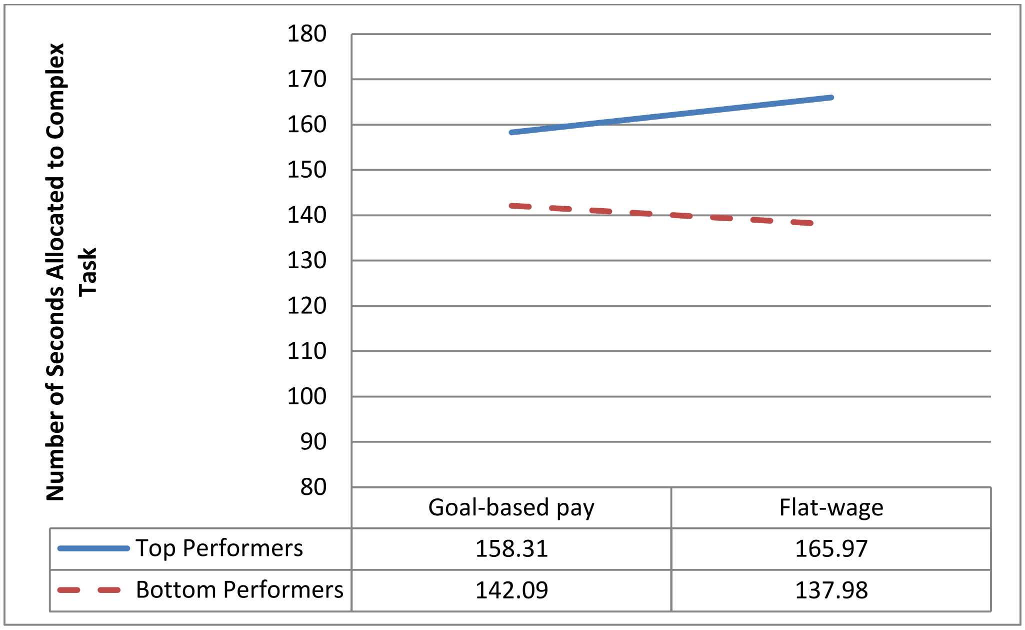

Figure 2 - The Effects of Financial Compensation and Top/Bottom Performers of Complex Task on Effort Allocation

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Dependent variable:
Effort allocation is measured as the number of seconds participants allocated towards the complex task (out of 240 available seconds).
Independent variables:
Financial compensation scheme is manipulated as goal-based compensation (=1) or flat-wage compensation (=2).
Top/bottom performer is a measured variable, which is created post-hoc. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the complex task.

The ANOVA model shows a significant main effect for top and bottom performers, where the top performers on the complex task achieve mean performance efficiency of 1.72, whereas the bottom performers achieve a mean performance efficiency of 1.28. The difference in means is statistically significant ($p<0.0001$). The interaction term of RPI and financial compensation scheme is not statistically significant (F-value=1.80, $p=0.18$) implying that the effect of RPI on efficiency does not depend on the type of financial compensation. This result also implies that the motivational effects of RPI and financial schemes are independent such that financial compensation and RPI affect performance efficiency separately.

Further, the main effect for financial compensation scheme is not statistically significant (F-value=0.37, $p=0.54$). Although flat-wage compensation motivates top performers to allocate more effort towards the complex task, flat-wage compensation does not motivate performers to improve their efficiency. However, the main effect for RPI is statistically significant (F-value=10.91, $p=0.0001$) and the main effect for top/bottom performers is significant (F-value=33.43, $p<0.0001$). I perform contrast testing to detect mean group differences. Individuals who are provided with RPI perform less efficiently than those not provided with RPI (1.32 vs. 1.5, respectively). This result suggests that RPI can have a negative effect on performance when employees perform both simple and complex tasks.

These findings together indicate that RPI drives top performers to allocate more time to the complex task as desired by the firm; however, this effect does not translate into improved performance efficiency. When paid with a flat-wage scheme top performers on the complex task also allocate more effort towards the complex task than bottom performers, achieving the first firm objective of focusing effort on the complex tasks; however, both top and bottom performers paid with a flat-wage scheme are not more efficient than performers paid with a goal-based scheme. Summarizing the findings for top and bottom performers on the complex tasks, the results show that the flat-wage compensation scheme or the presence of RPI positively affects individual effort allocation choices by motivating them to allocate more effort towards the complex task. However, flat-wage compensation does not motivate top or bottom performers on the complex task to improve their performance, and RPI negatively impacts performance efficiency when workers have to perform both simple and complex tasks.

4.4.3 The Effect of Top and Bottom Performers on the Simple Task

Next, I examine the effects of RPI and financial compensation schemes on top and bottom performers' effort allocation choices and performance efficiency on the simple task. The results of the analyses of top and bottom performers of the simple task are displayed in Tables 3 and 4.

4.4.3.1 Effort allocation

I re-examine RQ1 by conducting an ANOVA analysis for top and bottom performer on the *simple* task in order to understand their effort allocation choices. The dependent variable is effort allocation measured by the number of seconds allocated towards the complex task.[32] I initially include a three-way interaction term in the model for the three independent variables of interest: RPI, financial compensation, and top/bottom performers on the simple task. The three-way interaction term is not statistically significant (F-value=1.84, p=0.16); thus, I drop it out of the model. This result suggests that the effect of financial compensation schemes does not

[32] If the dependent variable is measured as the number of seconds allocated to the simple task, instead, the results do not change because the number of seconds allocated to the simple task plus the number of seconds allocated to the complex task always equal 240 seconds. I chose to measure effort allocation as the number of seconds allocated to the complex task in order for the interpretation of the results to be in terms of the complex task, which is the more valuable task in this multi-task setting.

depend on the effects of RPI and whether an individual is a top or bottom performer on a simple task. The interaction term of RPI and financial compensation is also not statistically significant (F-value=0.35, p=0.55) suggesting that the effects of RPI and financial compensation on effort allocation are independent.

Table 3, Panel C reveals a statistically significant two-way interaction between financial compensation schemes and top/bottom performers (F-value=5.64, p=0.001), suggesting that the effect of the type of financial compensation on effort allocation choices depends on whether an employee is a top or bottom performer on the simple task. I further conduct contrast testing to examine differences in group means. The results reveal that no group differences exist between goal-based pay and flat-wage pay and top and bottom performers on the simple task. Additional contrast tests show that the type of financial compensation motivates only the average performers (i.e., ranked as number 3) to allocate more effort towards the complex task (results untabulated). The descriptive statistics are displayed on Table 3, Panel B. The main effect of financial compensation further shows that individuals who are compensated with a flat-wage scheme allocate more effort towards the complex task (164.96) than individual paid with a goal-based scheme (148.49) (p=0.02).

4.4.3.2 Performance efficiency

Next, I examine whether the top and bottom performers on the simple task achieve improved performance efficiency, despite the finding that financial compensation schemes motivate only the average performers to allocate more effort towards the complex task. I investigate whether allocating more effort towards the complex task translates into an improved total performance on both tasks. In this section, I examine RQ2 and RQ3 for top and bottom performers on the simple task.

Table 3 – The Effect of RPI and Financial Compensation Schemes on Effort Allocation of Top and Bottom Performers on the Simple Task

PANEL A: Treatment Descriptive Statistics

Treatment group	N	Mean	Standard Deviation
Goal-based pay	96	148.49	48.88
Flat-wage pay	103	164.96	49.27

PANEL B: Treatment Descriptive Statistics

Treatment group	N	Mean	Standard Deviation
Goal-based pay - Top Performer	62	168.1	47.88
Goal-based pay - Bottom Performer	20	155.08	38.3
Flat-wage - Top Performer	62	156.65	41.74
Flat-wage - Bottom Performer	26	167.36	57.3

Dependent variable:
Effort allocation is measured as the number of seconds participants allocated towards the complex task (out of 240 available seconds). The means in Panel A and B represent number of seconds allocated to the complex task.
Independent variables:
Financial compensation scheme is manipulated as goal-based compensation (=1) or flat-wage compensation (=2). Post-hoc I determined whether a participant is a top, bottom, or average performer. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the simple task.

Table 3 - The Effect of RPI and Financial Compensation Schemes on Effort Allocation of Top and Bottom Performers on the Simple Task Cont'd.

PANEL C: ANOVA Model and Significance

Analysis of variance source of variation	Degrees of freedom	Sum of Squares	Mean Square	F-value	Significance
RPI	1	4484.28	4484.28	1.95	0.16
FIN	1	12255.16	12255.16	5.32	0.02
RPI*FIN	1	814.83	814.83	0.35	0.55
HIGHLOW_SIMPLE	2	779.22	3899.61	1.69	0.19
RPI*HIGHLOW_SIMPLE	2	955.98	477.99	0.21	0.81
FIN*HIGHLOW_SIMPLE	2	25980.61	12990.30	5.64	0.00

Model's p-value = 0.03

Dependent variable: effort allocation to the complex task

PANEL D: Contrast Tests

Treatment group comparisons	Significance	95% Confidence Interval
Goal-based pay - Top Performer VS. Flat-wage - Top Performer	0.27	-8.96 – 31.86
Goal-based pay - Bottom Performer VS. Flat-wage - Bottom Performer	0.3	-35.44 – 10.86
Goal-based pay - Bottom Performer VS. Goal-based pay - Top Performer	0.25	-9.41 – 35.45
Flat-wage - Bottom Performer VS. Flat-wage - Top Performer	0.32	-31.95 – 10.52
Flat-wage - Top Performer VS. Goal-based pay - Bottom Performer	0.89	-23.85 – 20.71
Goal-based pay - Top Performer VS. Goal-based - Average Performer	0.00	-71.03 – (-20.57)
Goal-based pay - Bottom Performer VS. Goal-based - Average Performer	0.02	-59.63 – (-5.93)
Flat-wage - Bottom Performer VS. Flat-wage - Average Performer	0.79	-22.14 – 29.17
Flat-wage - Top Performer VS. Flat-wage - Average Performer	0.26	-10.70 – 39.18

Dependent variable:
Effort allocation is the dependent variable in the ANOVA model. Effort allocation is measured as the number of seconds participants allocated towards the complex task (out of 240 available seconds).
Independent variables:
RPI is manipulated as present (=1) or absent (=2).
FIN is manipulated as goal-based compensation (=1) or flat-wage compensation (=2).
HIGHLOW_SIMPLE is a measured variable, which is created post-hoc. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the simple task. HIGHLOW_SIMPLE = 1 if Top performer, =2 if Bottom Performer, and =0 if Average performer.

I conduct ANOVA analysis for top and bottom performers on the simple task in order to examine their performance. The dependent variable is overall performance efficiency measured as the sum of points earned performing the simple task divided by the number of seconds allocated to this task and the points earned performing the complex task divided by the number of seconds allocated to the complex task. I include a three-way interaction term in the model for the three independent variables of interest: RPI, financial compensation, and top/bottom performers. The three-way interaction term is not statistically significant at alpha level of 0.05 (F-value = 2.38, p=0.0958). The two way interaction of RPI and financial compensation is not statistically significant (F-value=0.11, p=0.74). This result implies that the motivational effects of RPI and financial schemes are independent such that financial compensation and RPI affect performance efficiency separately. Thus, I focus on the two-way interaction terms in the model as shown in Table 4, Panel C.

I conduct contrast tests to examine the group means of the significant two-way interaction between top/bottom performers and the type of financial compensation. The results show that the significant interaction is driven by the average performers. Similar to the effect on effort allocation, financial compensation schemes do not affect top or bottom performers to improve performance efficiency on the tasks. Further, the main effect of financial compensation scheme is not statistically significant (F-value=0.37, p=0.54).

Table 4 – The Effect of RPI and Financial Compensation Schemes on Performance Efficiency of Top and Bottom Performers on the Simple Task

PANEL A: Treatment Descriptive Statistics

Treatment group	N	Mean	Standard Deviation
Goal-based pay - Top Performer	43	1.51	0.36
Goal-based pay - Bottom Performer	32	1.59	0.38
Flat-wage - Top Performer	44	1.54	0.48
Flat-wage - Bottom Performer	37	1.49	0.32

PANEL B: Treatment Descriptive Statistics

Treatment group	N	Mean	Standard Deviation
RPI - Top Performer	38	1.43	0.27
RPI - Bottom Performer	38	1.63	0.31
No RPI - Top Performer	49	1.62	0.5
No RPI - Bottom Performer	31	1.48	0.38

Dependent variable:
Total performance efficiency is the dependent variable in the ANOVA model. Performance efficiency is measured as the sum of the points earned working on the simple task divided by the number of seconds allocated to the simple task (including the 60 required seconds) and the points earned working on the complex task divided by the number of seconds allocated to the complex task. The means displayed in Panel A and B show the performance efficiency for different treatment groups.
Independent variables:
RPI is manipulated as present (=1) or absent (=2).
Financial compensation scheme is manipulated as goal-based compensation (=1) or flat-wage compensation (=2).
Post-hoc I determined whether a participants is a top, bottom, or an average performer on the simple task. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the simple task.

Table 4 – The Effect of RPI and Financial Compensation Schemes on Performance Efficiency of Top and Bottom Performers on the Simple Task Cont'd.

PANEL C: ANOVA Model and Significance

Analysis of variance source of variation	Degrees of freedom	Sum of Squares	Mean Square	F-value	Significance
RPI	1	0.01	0.01	0.06	0.81
FIN	1	0.20	0.20	1.22	0.27
RPI*FIN	1	0.02	0.02	0.11	0.74
HIGHLOW_SIMPLE	2	0.11	0.06	0.33	0.72
RPI*HIGHLOW_SIMPLE	2	1.25	0.62	3.79	0.02
FIN*HIGHLOW_SIMPLE	2	0.96	0.48	2.92	0.06
RPI*FIN*HIGHLOW_SIMPLE	2	0.78	0.39	2.38	0.096

Model's p-value = 0.05

Dependent variable: performance efficiency

PANEL D: Contrast Tests

Treatment group comparisons	Significance	95% Confidence Interval
RPI - Top Performer VS. No RPI - Top Performer	0.04	-0.36 – (-0.01)
RPI - Bottom Performer VS. No RPI - Bottom Performer	0.07	-0.01 – 0.38
RPI - Bottom Performer VS. RPI - Top Performer	0.04	-0.38 – (-0.01)
No RPI - Bottom Performer VS. No RPI - Top Performer	0.08	-0.02 – 0.35
RPI - Top Performer VS. No RPI - Bottom Performer	0.89	-0.21 – 0.18
RPI - Top Performer VS. RPI - Average Performer	0.25	-0.09 – 0.37
RPI - Bottom Performer VS. RPI - Average Performer	0.57	0.29 – 0.16
No RPI - Top Performer VS. No RPI - Average Performer	0.94	-0.21 – 0.19
No RPI - Bottom Performer VS. No RPI - Average Performer	0.15	-0.06 – 0.38

Dependent variable:
Total performance efficiency is the dependent variable in the ANOVA model. Performance efficiency is measured as the sum of the points earned working on the simple task divided by the number of seconds allocated to the simple task (including the 60 required seconds) and the points earned working on the complex task divided by the number of seconds allocated to the complex task.
Independent variables:
RPI is manipulated as present (=1) or absent (=2).
FIN is manipulated as goal-based compensation (=1) or flat-wage compensation (=2).
HIGHLOW_SIMPLE is a measured variable, which is created post-hoc. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the simple task. HIGHLOW_SIMPLE = 1 if Top performer, =2 if Bottom Performer, and =0 if Average performer.

I conduct contrast tests to examine any group differences in means for the interaction of RPI and top/bottom performers (Table 4, Panel D). The results are graphically depicted on Figure 3. As described in the previous section, RPI has a negative impact on the performance efficiency of top or bottom performers on a complex task. Similarly, RPI has a negative impact on the performance efficiency of *top* performers on a simple task; however, RPI has a positive impact on the performance efficiency of *bottom* performers on a simple task. RPI motivates bottom performers to improve their performance efficiency more than top performers of a simple task (1.63 vs. 1.43, respectively; p=0.04). However, without providing RPI to individuals, the top performers are more efficient than the bottom performers (p=0.08).

On average, performance efficiency of bottom performers of the simple task in the RPI treatment is 1.63 compared to that of bottom performers in the No RPI treatment of 1.45. The difference in group means is statistically significant (p=0.07) suggesting that RPI has a positive effect on bottom performers' efficiency (Table 4, Panel D). On average performance efficiency of top performers in the RPI treatment is 1.43 compared to that of top performers in the No RPI treatment of 1.62. The difference in group means is statistically significant (p=0.04) suggesting that RPI has a negative impact on top performer efficiency. [33]

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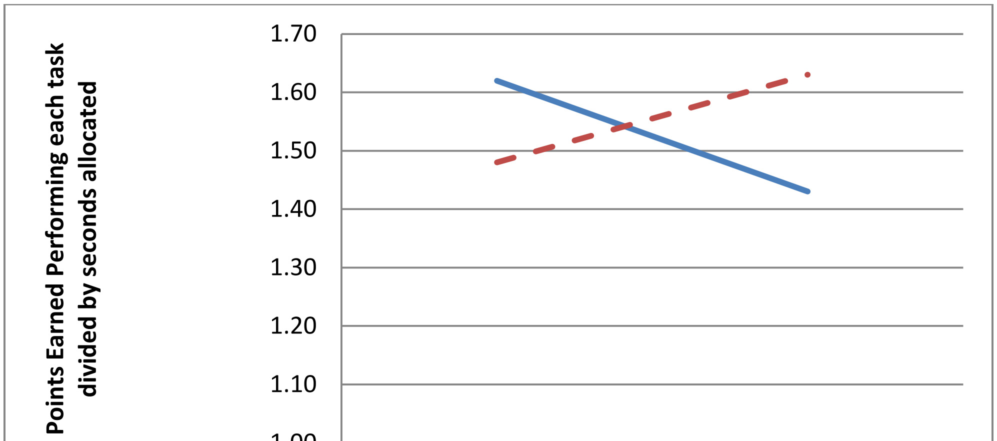
[33] Additionally, I examine the performance efficiency effect on each task separately. I conduct two ANOVAs – one model in which the dependent variable is performance efficiency of the simple task and a second model in which the dependent variable is performance efficiency of the complex task. The results when the dependent variable is performance efficiency on the complex task are qualitatively unchanged as the results when the dependent variable is overall performance efficiency in a multi-task setting. However, when the dependent variable is performance efficiency on the simple task, the two interaction terms for financial compensation and top/bottom and RPI and top/bottom are not significant. This analysis suggests that the overall performance efficiency in a multi-task setting is driven by the complex task.



	No RPI	RPI
Top performer	1.62	1.43
Bottom performer	1.48	1.63

Figure 3 - The Effects of RPI and Top/Bottom Performers of Simple Task on Performance Efficiency

Dependent variable:
Performance efficiency is measured as the sum of the points earned working on the simple task divided by the number of seconds allocated to the simple task (including the 60 required seconds) and the points earned working on the complex task divided by the number of seconds allocated to the complex task.
Independent variables:
RPI is manipulated as present (=1) or absent (=2).
Top/bottom performer is a measured variable, which is created post-hoc. Bottom performers are classified as those participants who ranked 4 and 5, Average performers are participants who ranked 3, and Top performers were ranked number 1 and 2 when performing the simple task.

4.4.4 Summary of Top and Bottom Performer Effects

The findings show that RPI and the type of financial compensation scheme affect separately effort allocation and performance efficiency. I examine whether the effects of RPI and financial compensation depend on the effect of top and bottom performers on the complex and simple tasks. The results indicate that flat-wage pay motivates top performers to allocate more time towards the complex task than goal-based pay does, in a setting in which individuals have to perform both simple and complex tasks. However, flat-wage pay does not motivate individuals to improve their performance efficiency.

The effects of RPI on effort allocation and performance efficiency depend on whether individuals are sorted as top or bottom performers. RPI positively impacts effort allocation by motivating top performers to allocate effort towards the complex task; however, RPI negatively impacts their performance efficiency. Top performers who are provided with RPI perform much worse than those top performers who are not provided with RPI. RPI has a positive effect on performance efficiency only for bottom performers on a simple task. Bottom performers on a simple task perform much better than top performers when individuals are provided with RPI.

4.5 Social Comparison Post-Experimental Question

RPI is a type of feedback that provides workers with more information about their ability and that of their co-workers. In a single-task setting when individuals receive RPI they are able to reduce the perceived noise in the effort-to-performance relationship and hence are able to make more informed inferences about their ability and the ability of others in their session. It is unknown whether this finding will apply in a multi-task setting in which workers have to perform tasks of varying complexity.

In the post-experimental questionnaire, I asked participants whether the differences in performance in their session were mainly due to differences in individual effort levels or due to differences in individual ability. The answer to the question was measured on a scale of 1 representing entirely due to differences in effort and 13 representing entirely due to differences in ability. I compared mean response differences between the RPI-Flat-wage and RPI-Goal-based compensation conditions. The individuals in the flat-wage group would not be able to discern whether any performance differences are due to effort or ability because all five individuals in a group are compensated with flat-wage. I examine whether when individuals are compensated with performance-based pay such as goal-based compensation, they can distinguish between effort and ability. Individuals performing only one task presume that since they are all paid under performance-based pay, all individuals in the group will exert high effort. Thus, any individual performance differences must be due to differences in ability (e.g., Tafkov 2013). Participants in this study perform both simple and complex tasks. To the question regarding whether observed differences were due to effort or ability, participants on average answered 7.39 in the RPI-Flat-wage condition versus 7.26 in the RPI-Goal-based condition; the mean difference is not statistically significant ($p=0.77$) suggesting that findings from a single-task setting research may not necessarily generalize to a multi-task setting research.

Tafkov (2013) demonstrates that in a single-task setting the positive effect of social comparison is stronger under individual performance-based contract than flat-wage pay. I find that Tafkov’s (2013) finding does not generalize to a multi-task setting because individuals cannot discern the effects of effort and ability when they perform multiple tasks of varying complexity. When performance depends both on task complexity and individual's ability, individuals have difficulty separating the effects of the two factors in the inference process. Task complexity decreases the correlation between effort and performance and increases uncertainty regarding whether exerting higher effort will result in improved task performance. Workers paid with goal-based incentives will be unsure whether their peers will exert high effort when performing the complex task.

4.6 Goal Achievement

I further examine whether individuals across conditions reached or did not reach the goal of 270 points in the second round. Seventy-one, 56, 66, and 67 percent of participants in the RPI-Flat wage, RPI – Goal-based pay, No RPI – Flat wage, and No RPI/Goal-based groups, respectively, achieved the set goal. Seventy-one percent of participants in the RPI – Flat-wage group reached the goal when they were not explicitly told about the goal of 270 points, whereas the group of individuals who worked under goal-based pay and also received RPI reached the goal only 56 percent of the time in Round 2. This difference is statistically significant (Chi-square=5.56, p=0.02).

In the RPI condition 63 percent of participants reached the goal, and in the No RPI condition 66 percent achieved the goal of earning 270 points in round 2. I test the difference in percentage with a chi-square test, which shows that there is no statistically significant difference in the proportion reaching the goal in the RPI and No RPI groups (Chi-Sq=0.45, p=0.50). This result suggests that RPI did not have a motivational effect on performance. Although in the flat-wage condition participants were not told about the goal, I examine the number of participants that attained the goal. In the flat-wage condition, 68 percent of participants attained the goal and

62 percent of participants achieved the goal in the goal-based compensation condition (Chi-Sq=1.84, p=0.18) suggesting that the type of financial compensation did not have a motivational effect on performance. These findings indicate that the combination of RPI and type of financial compensation schemes impact performance. When the two motivational mechanisms are provided to workers who are performing simple and complex tasks, RPI and goal-based pay simultaneously have a negative impact on individual performance (56 percent reached goal); however, when individual pay is not tied to the goal they are not aware about the goal, and when they are provided with RPI 76 percent of individuals reached the goal.

In the post-experimental questionnaire, I asked participants in the goal-based experimental conditions whether the goal of 270 points was attainable or too difficult on a scale of 1 equals “goal was attainable” and 13 equals “goal was too difficult.” The mean response to this question was 5.81 suggesting that participants perceived the goal for earning a bonus of $7.50 per round as moderately challenging but still attainable.

4.7 Use of Strategies

I also examine whether individuals used different strategies when performing the complex task. Participants are told that three task approaches are available but are not required to be used. In the post-experiment questionnaire I asked participants about the extent to which their strategy of working on the tasks changed during the study (1 equals not at all and 13 equals to a great extent). On average, participants indicated that their strategy on complex task (6.66) changed to a greater extent than their strategy on the simple task (5.68) (paired t-value=3.42, $p<0.001$). This finding is not surprising given that the letter decoding task does not allow individuals to use various strategies; however, the solving anagrams task allows for various strategies. I conjecture that the negative effect of RPI on performance efficiency could be due to individuals who attempt various strategies.

To examine whether RPI has an effect on individual use of strategy on the complex task, I conduct a t-test. Participants in the RPI treatment reported that on average the extent to which their strategy on the complex task changed during the study was 7.18, whereas individuals who were not provided with RPI indicated 6.18 (t-value=2.08, p=0.04). This result suggests that RPI induces individuals to keep changing strategies when performing the complex task in attempt to improve their performance; however, the results reported earlier indicate that providing RPI to individuals has a negative impact on their performance efficiency. I also conduct a t-test to examine whether the type of financial compensation schemes motivate individuals to change strategies on a complex task. The financial compensation does not affect the extent to which individuals change strategies (t-value=0.38, p=0.70).

Prior research has established that meeting or beating a challenging goal makes the time spent searching for production efficiencies less effective (Webb et al. 2012), and individuals make more mistakes when the goals are more difficult than when they are easy (Sales 1977). Thus, I examine whether participants in the goal-based versus those in the flat-wage conditions made more mistakes when solving anagrams. There is no statistically significant difference in the mean number of incorrectly created words between goal-based and flat-wage conditions (p=0.86). This finding suggests that the individuals working under financial incentives (i.e., goal-based pay) did not perceive the goal as difficult compared to those working under a flat-wage scheme.

4.8 Control Variables

Based on the findings of prior research, I collect data on a number of covariates that have been shown to affect individual effort allocation or performance. [34]

4.8.1 Task Order Effects

Participants undergo training on the two tasks in order to gauge their capabilities. They have the opportunity to train on each task for five minutes. Each participant chooses the order of tasks in the training session. I track the order of the tasks and control for order effects in the analyses.

4.8.2 Self-Esteem

In this section I present the descriptive statistics for control variables collected during the main study. First, I adapt three self-esteem questions from Hannan et al. (2013). The self-esteem questionnaire is placed before participants are exposed to the manipulations of the study. On average, students' confidence in their scholastic abilities is 5.77, the extent to which they feel respected by peers is 5.32, and the extent to which they are concerned about the impressions they make is 5.48 where all three questions are measured on a 7-point Likert scale (1 equals not at all, 7 equals to a great extent or very confident). These results suggest that students are concerned about the impressions they make and are confident in their academic abilities, on average. I create a new variable called overallesteem which is calculated by averaging the responses to the

[34] I conduct ANOVA analyses in which the dependent variables are the covariates in order to analyze whether randomization worked in the experiment (i.e., no group differences before individuals are exposed to the manipulations). All ANOVA models are not statistically significant.

three questions into one composite score. Overallesteem variable is included in statistical models as a covariate.

4.8.3 Risk Preferences

Participants are also asked to indicate their risk preferences. The risk preference scale is adapted from Weber et al. (2002) and is provided to participants before the manipulations. Participants are asked to indicate their likelihood of engaging in each activity on a five-point Likert scale where 1 represents "very unlikely" and 5 represents "very likely": 1) betting a day's income at the horse races, 2) investing 5 percent of their annual income in a very speculative stock, 3) betting a day's income on the outcome of a sporting event, and 4) investing 5 percent of their annual income in a conservative stock. The mean responses that are collected before the treatment manipulations are averaged to create a composite score of 2.40. I include the composite score risk measure as a covariate in statistical analyses.

4.8.4 Verbal Ability

I control for participants' verbal ability by including three actual SAT multiple choice questions in which students are required to find the error in a sentence or to choose the appropriate words to fill in blanks in an incomplete sentence. At least eighty-two percent of participants are able to identify the correct answer choice in all three SAT questions. I also control for participants' verbal ability by including two additional covariates in the statistical models. The first variable is the number of English college-level classes and the second variable is whether English is the language participants grew up speaking.

4.8.5 Task Attractiveness

Prior research suggests that task performance may be affected by an individual's perception of task attractiveness (Fessler 2003). Task attractiveness is defined as an individual's attitude toward that task and is accompanied by a high degree of intrinsic motivation (Fessler 2003). I measure task attractiveness using Fessler's (2003) seven-question scale. Cronbach's alpha for task attractiveness of the letter decoding task (alpha=0.932) and of solving anagrams (alpha =0.925) yield a high measure of internal reliability. I then conduct a factor analysis to confirm that responses on all seven questions load on one factor. I create a composite task attractiveness measure by averaging the responses on all seven questions into one variable.

Task attractiveness was measured immediately after participants completed training on both tasks (scale: 1-attractive, 7-repulsive). The mean attractiveness scores for the letter decoding task are 3.64, 3.93, 3.57, and 3.85 for RPI-Flat-wage, RPI-Goal-based, No RPI-Flat-wage, and No RPI-Goal-based conditions respectively. The mean attractiveness scores for the task of solving anagrams are 3.20, 3.01, 3.03, and 3.25 for RPI-Flat-wage, RPI-Goal-based, No RPI-Flat-wage, and No RPI-Goal-based conditions respectively. I test for differences between the attractiveness of the two tasks with paired t-tests. The overall mean across all conditions for task attractiveness of the letter decoding task is 3.75 and overall mean for task attractiveness of the solving anagrams is 3.12.[35] The difference in overall means for both tasks are statistically significant (paired t-test = 5.21, p<0.0001) suggesting that participants perceived the letter

[35] I further test whether these means are significantly different from the mid-point 4. The mean of the letter decoding task of 3.75 is statistically different from the mid-point 4 (t-value=2.53, p=0.012) and the mean of the solving anagrams task of 3.12 is statistically different from the mid-point 4 (t-value=10.59, p<0.0001).

decoding (simple) task as more attractive and interesting than the solving anagrams (complex) task.[36]

The task attractiveness scale was also measured after the manipulations. I examine for differences between the perceptions of task attractiveness before and after the experimental treatments because Fessler (2003) suggests that performance-contingent compensation may turn "play" into "work" by reducing task attractiveness. Unlike Fessler (2003), I find that task attractiveness of the simple task increased after the manipulations (paired t-test = 1.86, p=0.065). Similarly, participants' perceptions of task attractiveness of the complex task also increased after the manipulations (paired t-test = 5.04, p<0.0001).

4.8.6 Intrinsic Motivation

In light of these findings, and that attractive tasks could be accompanied by a high degree of intrinsic motivation on the part of the workers, I include an intrinsic motivation scale adapted by Dermer (1975) and used in prior accounting studies (e.g., Merchant 1981). Participants agree or disagree on a 5-point Likert scale with the following statements: 1) performing well on the letter decoding (solving anagrams) task contributes to my personal growth and development, 2) performing well on the letter decoding (solving anagrams) task gives me a feeling of accomplishment, and 3) I feel a great sense of personal satisfaction when I perform well on the letter decoding (solving anagrams) task. These statements were provided to participants before

[36] I include both composite scores of task attractiveness, for the simple and for the complex task, in the statistical models as covariates. Perceptions of task attractiveness of the simple task is a statistically significant covariate (p=0.01) in a model in which the dependent variable is effort allocation. The results do not change when the covariates are included in the models.

the manipulations.[37] Cronbach's alpha for intrinsic motivation of the letter decoding task (alpha=0.837) and of solving anagrams (alpha =0.891) yield a high measure of internal reliability. I create a composite intrinsic motivation measure by averaging the responses on all three questions into one variable for each of the tasks. The mean of the composite score of intrinsic motivation for the letter decoding task is 3.59 and 3.12 for the task of solving anagrams. I test for differences in means of intrinsic motivation with a paired t-test. Participants report higher intrinsic motivation when performing the complex task than when performing the simple task (paired t-test=6.96, $p<0.0001$). [38]

4.9 Perceptions of Task Complexity

In the post-experimental questionnaire, I asked participants additional questions about their perceptions of the tasks. All questions were asked on a 13-point Likert scale where 1 represents strongly agree and 13 represents strongly disagree. Participants were asked to what extent they agree that the decoding task (solving anagrams) requires mechanical skills (i.e., not cognitive skills). On average, participants indicated 4.94 for the decoding task and 7.91 for solving the anagrams task (paired t-value =8.47, $p<0.0001$) suggesting that participants correctly perceived that the decoding task is a more routine and mechanical task than the complex task of solving anagrams. Eighty-eight percent of participants indicated that the task of solving anagrams was more cognitively demanding.

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[37] Measuring individuals' intrinsic motivation after the treatments are introduced will be a noisy measure capturing changes due to the treatment effects; thus, I measure intrinsic motivation before the manipulations.

[38] I include both composite scores of intrinsic motivation, for the simple and complex tasks, in all statistical models. Intrinsic motivation of the complex task is a statistically significant covariate in a model in which the dependent variable is overall performance efficiency.

I also asked participants about whether they agree or disagree that the decoding task (solving anagrams) is a complex task. On average, participants agreed more with the statement that solving anagrams is a complex task (4.93) than with the statement that decoding is a complex task (9.06). The difference in mean perception of task complexity is statistically significant (paired t-value=13.05, $p<.0001$).

Campbell (1988) defines task complexity in terms of the cognitive demands placed on the individual. He describes several task characteristics that contribute to task complexity: the presence of multiple potential ways (i.e., paths) to arrive at a desired task output, the presence of multiple desired outcomes to be attained, and the presence of uncertain links among paths and outcomes. In order to ensure that participants perceived the complex task to possess the characteristics described by Campbell (1988) I include a question in the post-experimental questionnaire which asks participants to what extent they agree or disagree that the letter decoding (solving anagrams) task possesses the following characteristics: 1) there are multiple potential approaches to solve the task, 2) there are multiple solutions to the tasks, and 3) there are uncertain links among potential approaches to solve the task and task solutions. All three statements are measured on Likert scale of 1 (strongly agree) to 13 (strongly disagree). Then, I test with a paired t-test for differences in means of perceptions of task complexity based on the three statements between the letter decoding task (simple) and solving anagrams task (complex). Participants agreed more strongly that the complex task has multiple potential approaches to solve the task (2.71) than the simple task (7.32) (paired t-test=14.50, $p<0.0001$). Participants also agreed more strongly that the complex task has multiple solutions to the task (2.75) than the simple task (9.97) (paired t-test=21.24, $p<0.0001$). Also, participants correctly identified that the complex task has more uncertain links among potential approached to solve the task (5.13) than the simple task (8.12) (paired t-test=9.24, p<0.0001).

Further, on a scale of 1 to 13, where 13 is extremely difficult, participants were asked about the difficulty level of the decoding task (solving anagrams). They indicated that the decoding task is relatively easy on average (4.06), whereas solving anagrams is perceived as much more difficult (6.69). The means are significantly different (paired t-value=10.58, p<.0001). Also, seventy-eight percent of all participants indicated correctly that the letter decoding task was easier to perform (i.e., simple task).

Task complexity affects the perceived relationship between effort and performance. Since the effort-to-performance connection is tenuous for complex tasks (Bailey and Fessler 2011; Bonner and Sprinkle 2002; Bonner et al. 2000; Vroom 1964), participants will believe that allocating additional time towards the task of solving anagrams may not result in increased performance. Participants were asked about the extent to which they agree that the more time they spend on the decoding task (solving anagrams), the more letters (words) they can decode (create). The mean agreement for the letter decoding task is 3.55 and 4.27 for the task of solving anagrams. As theory predicts, there is a statistically significant difference between perceptions of the effort-to-performance connection for the simple and complex tasks (paired t-test =2.28, p=0.02) suggesting that participants correctly recognized the more tenuous link between effort and performance for the complex task.

5.0 SUMMARY

In multi-task settings comprising both low-return simple and high-return complex tasks, organizations have two objectives: (1) to achieve desirable effort allocation in which employees allocate effort according to the organization’s preferences, and (2) to motivate high overall performance. In a multi-task setting, employees will allocate effort to the task they feel more capable of performing, which is the simple task. This study examines whether in a setting where complex tasks are more valuable to the organization and employees have control over the amount of effort they can allocate between simple and complex tasks, firms can achieve their strategic objectives by providing RPI and/or financial incentives. Halzack (2012) suggests that in the current economic climate an increasing number of firms are using bonuses for retaining top-performing workers and to avoid creating additional fixed costs. In addition to paying workers with financial incentives, disseminating RPI could further increase their productivity without additional financial outlays.

RPI and financial incentives are important factors to be considered in the design of the overall management accounting control system. Paying workers with financial incentives based on individual performance and providing them with RPI creates multiple incentives for participants to allocate effort as they consider both their utility for wealth and their utility for social distinction. Thus, “it is unclear whether feedback has additive or interactive effects with monetary incentives” (Bonner and Sprinkle 2002, p.329). By including both RPI and financial incentives in a laboratory experiment, the results of this study shed light on this issue. The findings demonstrate that RPI and financial compensation schemes have separate effects on effort allocation and performance efficiency. I also find that in certain cases the effects of RPI and financial compensation depend on whether a worker is a top or a bottom performer.

Financial compensation schemes such as goal-based pay and flat-wage pay are common in practice and in managerial accounting literature (Bailey et al. 1998; Hannan et al. 2013). Firms also often disseminate RPI to their employees (Anderson et al. 1982; Nordstrom et al. 1990; Wikoff et al. 1982). Holmstrom and Milgrom (1991) suggest that in multi-task settings financial incentives can not only motivate workers but also can direct the allocation of effort among the tasks (Holmstrom and Milgrom 1991). Firms desirous of directing effort towards complex task can provide greater financial incentives (rewards) for performance on the complex task. However, prior research demonstrates that the efficacy of financial incentives decreases as the task becomes more complex (Bonner et al. 2000). Thus, it is unclear whether simply paying workers with financial incentives such as goal-based pay will accomplish firms' objective of having employees direct greater effort towards the complex task.

The results of the experiment show that the effect of the financial compensation scheme depends on whether the employee is a top or bottom performer. The results demonstrate that financial incentives such as goal-based pay, in the absence of RPI, are not an effective tool to motivate firm-preferred effort allocation and improved performance in a multi-task setting consisting of tasks with varying degrees of complexity. It appears that workers focus narrowly on the reward and reaching the goal rather than on how to improve their performance. Although financial incentives would provide employees with greater rewards for allocating more time towards the complex task and subsequently reaching the performance target, financial incentives do not appear to be an effective motivational mechanism for firm-preferred effort allocation and improved performance in a multi-task setting.

Bonner et al. (2000) demonstrate that the efficacy of financial incentives decreases as the task becomes more complex because the effort-to-performance connection is more uncertain compared to that of simple tasks. In a multi-task setting it is unclear whether simply providing financial incentives will accomplish the firm's objective of having workers direct greater attention to the complex task. The current study finds that financial incentives are not effective at directing effort or in improving performance in a multi-task setting, in which workers perform both complex and simple tasks. This finding suggests that the financial incentives in this study failed to generate a belief that a worker's effort will result in the performance level that qualifies for the reward (bonus), thus, failing to motivate higher effort. Expectancy theory suggests that as the perceived probability (expectancy) of winning the bonus decreases due to the uncertain effort-to-performance connection on the complex task, effort reduces; thus, workers paid under goal-based pay are discouraged from pursuing the goal (target) even before they actually do the tasks.

The results indicate that workers paid under flat-wage scheme allocate more effort towards the complex task than workers paid under goal-based scheme. Specifically, top performers on the complex task who are paid under flat-wage scheme allocate more effort towards the complex task than poor performers on the complex task who are also compensated with a flat-wage scheme. Although flat-wage pay has a positive effect on top and bottom performers of both tasks in terms of effort allocation choices, flat-wage pay does not motivate top and bottom performers to improve performance. These findings provide evidence beyond Bonner et al. (2000) who suggest that financial incentives do not motivate high effort on a complex task. This study demonstrates that the efficacy of financial incentives is reduced when workers have to perform simple and complex tasks in a multi-task setting.

The second motivational mechanism examined in this study is RPI. Prior studies show that providing RPI fosters social comparisons and positively impacts performance in a single-task setting (e.g., Murthy and Schafer 2011; Tafkov 2013). The current study provides evidence of the effectiveness of RPI in a multi-task setting where workers must perform both simple requiring less skill and complex task requiring greater skill. The current study provides evidence beyond Hannan et al. (2013). Unlike Hannan et al. (2013) who examine the effect of RPI on effort allocation between two relatively complex tasks, I examine the effect of RPI on effort allocation between simple and complex tasks. I find that RPI has a positive impact on effort allocation by motivating bottom performers on the simple task to direct their effort allocation towards the complex task, which is more valuable to the firm. However, similar to Hannan et al. (2013), I also find that RPI can have a negative impact on performance efficiency. The only setting in which RPI has a positive impact on performance is when the employee is sorted as a bottom performer on a simple task. Similarly to prior studies (e.g., Murthy and Schafer 2011), RPI has a positive impact on the performance of a simple task.

Prior research has documented that RPI does not lead to firm-preferred effort allocation when employees are compensated based on their effort allocation choices and they perform two relatively complex tasks (Hannan et al. 2013). However, prior research does not provide evidence regarding the effectiveness of RPI in a multi-task setting where individuals must perform both simple and complex tasks. The current study demonstrates that overall RPI has a negative impact on both effort allocation and performance efficiency. The only setting in which RPI has a positive impact on performance is for the bottom performers of the simple task.

I also provide evidence beyond Hannan et al. (2013) by examining whether the inclusion of financial incentives helps to improve the negative impact of RPI on effort allocation and performance. The current study examines the trade-off between the behavioral incentives of RPI and financial incentives of goal-based pay in a multi-task setting. In a multi-task setting the motivational effects of RPI and goal-based compensation could be complementary, such that RPI and goal-based pay both improve individual performance. Alternatively, the two factors together can create performance pressure and anxiety. I find that each motivational mechanism separately does not improve performance; however, flat-wage pay has a positive impact on effort allocation but does not lead to improved performance.

Prior literature suggests that workers performing cognitive tasks perform better when they do not work under close scrutiny and they do not feel constantly assessed and evaluated, which can occur when working in the presence of competitors (Pfeffer and Sutton 1999). During the social comparison process, workers will experience pressure to do better than others (Festinger 1954). The findings of this study suggest that performance pressure has a negative effect on performance. Top performers on the simple task who strive to perform slightly better than others and who want to maintain their high performance rank perform worse than the bottom performers. Top and bottom performers on the complex task perform worse than those performers who do not receive RPI. The bottom performers on the complex task do not improve their overall performance on both tasks when they are provided with RPI; however, the bottom performers on the simple task improve their performance when they receive RPI. This finding is explained by the uncertain connection of effort-to-performance on the complex task. Bottom performers on the complex task who receive feedback that they rank low in comparison with their peers are discouraged and decrease their expectancy of reaching the goal, leading to deterioration in performance. Bottom performers on the simple task who receive feedback that they rank low in comparison with their peers are encouraged to work harder to outperform at least some of their peers since they have form the expectancy that additional effort will lead to improved performance on the simple task.

Although RPI has a negative impact on performance efficiency, RPI has a positive impact on effort allocation choices. The study finds that RPI motivates top performers on the complex task to allocate more effort towards the complex task as desired by the organization, thus, achieving the organization’s objective. RPI is a type of feedback that allows workers to make more informed effort allocation decisions. RPI allows workers to infer their likelihood of success on the complex task because the feedback on the complex task allows workers to learn about their relative ability. RPI induces bottom performers on the complex task to allocate less time to the complex task because bottom performers want to re-affirm their positive self-image by being successful at least on one of the two tasks – the simple task. Thus, depending on whether workers are top or bottom performers, RPI can be informative to some workers (i.e., top performers) or RPI can be perceived as a threat to their positive self-image (i.e., bottom performers).

These findings have implications for theory by providing evidence beyond Bonner et al. (2000) and Hannan et al. (2013) and have implications for managers. These results are important to firms that strive to design appropriate management accounting control systems to achieve firm objectives of firm-preferred. The study finds that the effects of financial incentives on effort allocation and performance do not depend on the presence or absence of RPI. The findings suggest that the effects of these motivational mechanisms are separate rather than combined. Thus, I suggest that when organizations provide RPI in addition to financial incentives in a multi-task setting comprising simple and complex tasks, prior research findings do not generalize to individual performance and effort allocation. These findings should be informative to managers who are interested in designing effective management accounting control systems. The findings also inform managers of the benefits and costs of providing RPI. The findings should also inform managers that they need to consider the complexity of the tasks when designing incentives systems.

Further, the study shows that the motivational effects of RPI depend on whether an employee is a top or a bottom performer. This finding has implications for practice. Firms may consider providing different incentives to top and bottom performers in their firms. A future research question may arise as to why firms should keep their bottom performing employees. The current study finds that bottom performers on a simple task who are provided with RPI perform equally well as the top performers on the simple task who are not provided with RPI and perform better than top performers on the simple task who are provided with RPI. Thus, bottom performers have to be motivated by different incentives than those for top performers and they could contribute to the achievement of firm objectives. Future research could also investigate whether grouping the task into two simple versus two complex tasks in a multi-task setting would achieve both firm objectives.

As with most studies, this study is subject to several limitations. The two experimental tasks (letter decoding and solving anagrams) were selected because they varied in complexity, but they do not have any direct real-world analog. Still, the task of decoding letters is similar to a routine job in which workers use mechanical skills to complete projects. Just as solving anagrams involves creatively rearranging letters to create new words, many white collar jobs also involve recombining ideas to provide innovative solutions to problems. Further, the size of the bonus may affect individual motivation. The results may change if the size of the bonus changes. Also, the participants in this study perform the tasks in two rounds; however, the effects of RPI and financial incentives in a multi-task setting may change if the study were extended to multiple additional rounds. Workers may need additional time to learn the strategies on a complex task. Future research can examine these effects in a longitudinal study consisting of multiple rounds. This study does not consider long-term considerations such as career concerns, promotion, and job security, which are concerns most workers experience in a real-world setting. Future research can examine the effects of promotion concerns in a multi-task setting.

Many prior studies examine the effects of different motivational mechanisms on performance in a single-task setting (e.g., Hannan et al. 2008; Murthy and Schafer 2011; Tafkov 2013); however, in reality workers are asked to perform multiple tasks. This study contributes to the scarce literature on multi-task settings by examining the effects of RPI and financial incentives on performance and effort allocation when workers must perform simple and complex tasks. Designing effective management accounting control systems in a multi-task setting is challenging. Thus, constant re-evaluation of the efficacy of firms' current incentive system is needed (Hannan et al. 2008). Future research can examine the effects of hybrid incentives schemes containing both flat-wage pay and subjective (discretionary) bonus payments, which do not require the achievement of a pre-specified goal.

In this study participants are provided with two rankings on each task. Future research could examine the effects of the content of RPI on performance when individuals are provided with one overall rank for both tasks. Future research could also examine the effects of providing detailed information about worker performance on individual performance and effort allocation. Also, in this study RPI is provided in terms of individual ranking based on relative performance. Future research can examine the effect of a different type of RPI (e.g., percentile standing) on performance and effort allocation in a multi-task setting. Workers can be provided with feedback about how their peers allocated their time to different tasks. Instead of providing RPI based on performance, firms can disseminate RPI based on effort allocation.

This study contributes to the literature and practice in several ways. The study contributes to the management accounting control literature by showing that the effects of incentive systems depends on whether an employee is a top or a bottom performer. Prior studies have not considered the effects of incentives on the performance and effort allocation of top and bottom performers. Future research studies and managers who design incentive systems should consider the implementation of different types of incentives for different performer levels. Also, the findings indicate that organizations should consider the degree of complexity of the tasks that workers must perform in a multi-task setting. This paper shows the importance of considering task complexity when designing incentive systems in multi-task settings.

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APPENDIX A – EXPERIMENTAL INSTRUMENT

TRAINING ROUND

Now you can perform both tasks in training mode, just click on the task to start the training session. You will have to perform each task for 5 minutes.

SOLVING ANAGRAMS TASK

LETTER DECODING TASK

{only after participants train on both tasks are they able to see the “continue” button}

CONTINUE

Group 1: No RPI – Goal-based Pay

Please read these instructions very carefully. You will need to understand these instructions. Also, you will be required to complete a quiz to demonstrate that you have a complete and accurate understanding of these instructions.

Tasks

During the main session, you will perform the tasks for 2 rounds. Although the tasks are abstract, the skills needed to perform the tasks can be applied in a real-life work environment and in your coursework. The other participants in your session are given the same tasks.

Please assume the role of an employee working in a hypothetical firm where you work on these two tasks and you are being financially compensated for your work as described below.

You are given a time limit of **5 minutes per round (i.e., 300 seconds) to perform both tasks.** One minute out of the 5 allotted minutes will be allocated to the decoding task as required by your firm. **Your firm asks you to choose how to allocate the remaining 4 minutes (240 seconds) between the two tasks.**

Your firm provides you with additional information about your job:
1) the task of solving anagrams brings **more profit** to the firm and is thus, more important to your organization. Your firm prefers employees to focus their attention to the task of solving anagrams.
2) your firm allows you to **choose how to allocate the 4 minutes** between the two tasks,
3) your firm requires you to allocate **at a minimum 1 minute** to the letter decoding task. **The allocation of the remaining 4 minutes (240 seconds) is your choice.**

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Your Compensation - Performance-based

You earn points by performing the tasks. **Your compensation is based on the number of points you earn.** Each correctly decoded letter earns you **1 point** in the *letter decoding task*. In the *task of solving anagrams*, you can earn points depending on the length of the created words. Creating a two-letter word earns you 5 points, a three-letter word earns you 10 **points**, a four-letter word is worth **15 points,** and a five-letter word is worth **25 points.**

Task	**Points**
Correctly decoded letter	1
Two-letter word	5
Three-letter word	10
Four-letter word	15
Five-letter word	25

Your firm will pay you for your performance on <u>both rounds</u> with a **$15 fixed payment plus a bonus of $7.50 for Round 1 plus a bonus of $7.50 for Round 2, which depends on your performance on the tasks (i.e. how many points you earn). You can earn a bonus of $7.50 in Round 1 if you earn a total of 270 points by performing the tasks. You can earn a**

second bonus of $7.50 in Round 2 by performing the tasks. Thus, your total pay could be $30 ($15 fixed + $7.50 bonus for Round 1 + $7.50 bonus for Round 2).

Your total compensation will be paid to you in cash upon completion of the study.

You are allotted 5 minutes (300 seconds) and you need to perform the letter decoding task for 1 minute (60 seconds). The remaining 4 minutes (240 seconds) you can allocate between the letter decoding task and the task of solving anagrams as you choose. Once you make your decision below, you will perform the two tasks for the amount of time you have chosen. Please make your allocation of seconds below (must add up to 240 seconds).

During the 5-minute training session of letter decoding, you correctly decoded ___ letters.

During the 5-minute training session of solving anagrams, you correctly created __ two-letter words, __ three-letter words, __ four-letter words, and __ five-letter words.

Letter Decoding Task

[ ] Seconds

Solving Anagrams

[ ] Seconds

* Sum of allocated time must equals 240.

Group 4: RPI – Flat-wage

Please read these instructions very carefully. You will need to understand these instructions. Also, you will be required to complete a quiz to demonstrate that you have a complete and accurate understanding of these instructions.

Tasks

During the main session, you will perform the tasks for 2 rounds. Although the tasks are abstract, the skills needed to perform the tasks can be applied in a real-life work environment and in your coursework. The other participants in your session are given the same tasks.

Please assume the role of an employee working in a hypothetical firm where you work on these two tasks and you are being financially compensated for your work as described below.

You are given a time limit of **5 minutes per round (i.e., 300 seconds) to perform both tasks.** One minute out of the 5 allotted minutes will be allocated to the decoding task as required by your firm. **Your firm asks you to choose how to allocate the remaining 4 minutes (240 seconds) between the two tasks.**

Your firm provides you with additional information about your job:
1) the task of solving anagrams brings **more profit** to the firm and is thus, more important to your organization. Your firm prefers employees to focus their attention to the task of solving anagrams.
2) your firm allows you to **choose how to allocate the 4 minutes** between the two tasks,
3) your firm requires you to allocate **at a minimum 1 minute** to the letter decoding task. **The allocation of the remaining 4 minutes (240 seconds) is your choice.**

---PAGE BREAK ---

Your Compensation-Fixed Pay

You earn points by performing the tasks. **Your compensation is <u>not</u> based on the number of points you earn.** Each correctly decoded letter earns you **1 point** in the *letter decoding task*. In the *task of solving anagrams*, you can earn points depending on the length of the created words. Creating a two-letter word earns you 5 points, a three-letter word earns you 10 **points**, a four-letter word is worth **15 points,** and a five-letter word is worth **25 points.**

Task	**Points**
Correctly decoded letter	1
Two-letter word	5
Three-letter word	10
Four-letter word	15
Five-letter word	25

Your firm will pay you for your performance on <u>both rounds</u> with a **$15 fixed payment <u>regardless</u> of the number of points you earn.**

Your total compensation will be paid to you in cash upon completion of the study.

Relative Rank Based on Points Earned on Each Task

At the end of Round 1 and 2, your performance on each task will be ranked relative to the other four participants in the group. Your ranking on each task will be based on the points you earn on that task relative to the points earned by the other participants on that task. For example, you will be ranked #1 on a task if you earn more points on that task than any of the other four participants. Everyone in the group will see their own rank and the ranks of the others on each task.

An example of the relative ranking follows below:

Relative Ranks

Letter Decoding Task		Solving Anagrams	
Participant No.	Relative Rank	Participant No.	Relative Rank
3	1	3	1
2	2	2	2
1	3	4	3
5	3	5	3
4	4	1	3

During the 5-minute training session of letter decoding, you correctly decoded ___ letters.

During the 5-minute training session of solving anagrams, you correctly created __ two-letter words, __ three-letter words, __ four-letter words, and __ five-letter words.

Letter Decoding Task

[   ] Seconds

Solving Anagrams

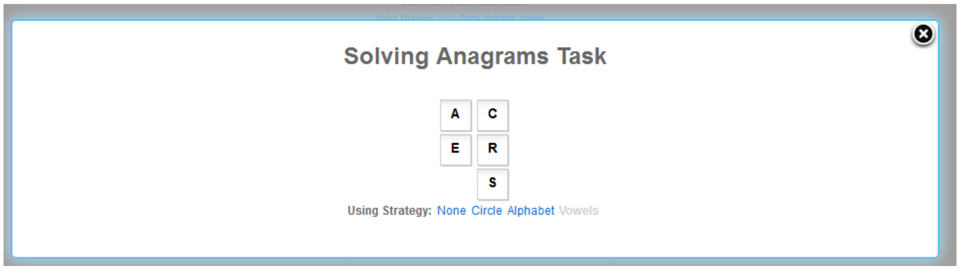
[   ] Seconds

* Sum of allocated time must equals 240.

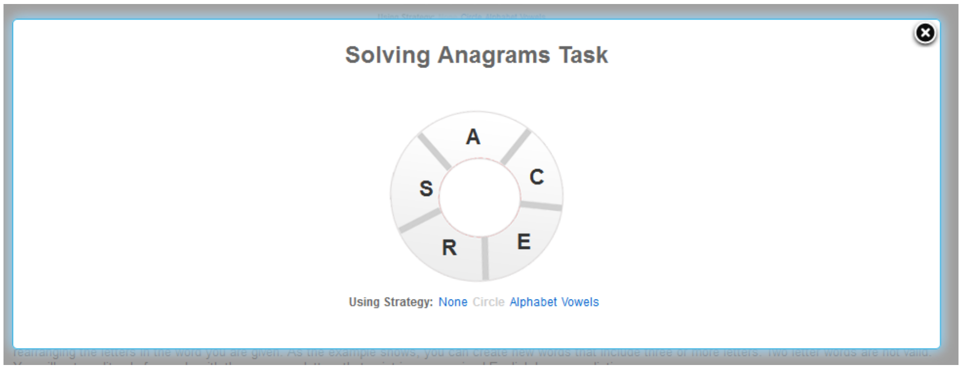
APPENDIX B – SCREENSHOTS OF EXPERIMENTAL MATERIALS

1. Screenshot of Task Strategies for Solving Anagrams

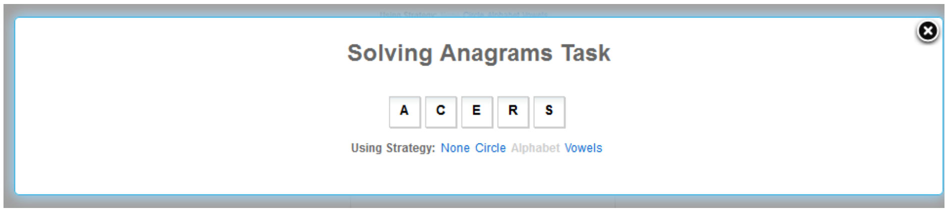
1) "Vowels" strategy



2) "Circle" strategy



3) "Alphabet" strategy



2. Screenshot of Relative Performance Information in Round 1

Total Points Earned

Letter Decoding Task Points:

1

Anagrams Task Points:

0

Total Points Earned:

1

Relative Ranks

Letter Decoding Task		Solving Anagrams	
Participant No.	Relative Rank	Participant No.	Relative Rank
3	1	3	1
2	2	2	2
1	3	4	3
5	3	5	3
4	4	1	3

You are about to begin round 2:

You are allotted 5 minutes (300 seconds) and you need to perform the letter decoding task for 1 minute (60 seconds). The remaining 4 minutes (240 seconds) you can allocate between the letter decoding task and the task of solving anagrams as you choose. Once you make your decision below, you will perform the two tasks for the amount of time you have chosen. Please make your allocation of seconds below (must add up to 240 seconds).

Letter Decoding Task Seconds

Solving Anagrams Seconds

* Sum of allocated time must equals 240.

APPENDIX C – IRB APPROVAL LETTER

USF
UNIVERSITY OF SOUTH FLORIDA

DIVISION OF RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • FAX (813) 974-5618

August 17, 2012

Maia Farkas
School of Accountancy
4202 East Fowler Ave., BSN 3403
Tampa, FL 33620

RE: **Exempt Certification** for IRB#: Pro00009383
Title: The individual and separate effects of financial incentives and social factors on effort allocation and performance when employees must perform both simple and complex tasks

Dear Ms. Farkas:

On 8/16/2012 the Institutional Review Board (IRB) determined that your research meets USF requirements and Federal Exemption criteria as outlined in the federal regulations at 45CFR46.101(b):

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:
(i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

As the principal investigator for this study, it is your responsibility to ensure that this research is conducted as outlined in your application and consistent with the ethical principles outlined in the Belmont Report and with USF IRB policies and procedures. Please note that changes to this protocol may disqualify it from exempt status. Please note that you are responsible for notifying the IRB prior to implementing any changes to the currently approved protocol.

The Institutional Review Board will maintain your exemption application for a period of five years from the date of this letter or for three years after a Final Progress Report is received, whichever is longer. If you wish to continue this protocol beyond five years, you will need to submit a new application. When your study is completed, either prior to, or at the end of the five-year period, you must submit a Final Report to close this study.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John A. Schinka, Ph.D., Chairperson
USF Institutional Review Board

APPENDIX D – THE COLLEGE BOARD APPROVAL LETTER

RE: Permission Request Form - University of South Florida

permission [permission@collegeboard.org]

Sent: Wednesday, November 14, 2012 4:02 PM

To: Farkas, Maia

Maia,

Thank you for using our online permissions request form. Your request to use the below referenced material in your forthcoming research is APPROVED. Permission is granted on a one-time, non-exclusive, and nontransferable basis provided you include, where relevant, the following copyright citations exactly as written below:

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Please keep in mind however, that when administering the questions, you make clear that the administration is for research purposes only and you are not acting as an agent of SAT or the College Board.

Please also send us a copy of the research product when you have completed it.

Best,

Robert Marko
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Ph. (212) 649-8421
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-----Original Message-----
From: collegeboard@collegeboard.com [mailto:collegeboard@collegeboard.com]
Sent: Wednesday, October 24, 2012 9:02 PM
To: permission
Subject: Permission Request Form - University of South Florida

Copyright & Trademark Permission Request Form
****

First Name: Maia
Last Name: Farkas
Organization: University of South Florida

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Address: 4202 E. Fowler Ave, School of Accountancy
City: Tampa
State: FL
Country: usa
Zip/Postal Code: 33620
Phone Number: 619-204-6068
Fax Number:
Email Address: maia@usf.edu

Step 2: Project Information (Please provide as much information as possible)

What type of request are you making? (For the publication/media section we must make selection of at least one of the subcategories mandatory.)
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TEST QUESTION REQUEST:

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Exam/Publication Year: not clear
Exam/Publication Subject: 5 SAT verbal question with moderate difficulty published online on your web site
Page Number(s):
Question Number(s):
College Board URL: www.sat.collegeboard.org

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Title of Your Project: Dissertation
Author: Maia Farkas
Format: Print
Other:
Distribution Territory: United States
Quantity/Circulation: 200
Publication Distribution Date: 12/01/12
Price: I am not selling anything. These questions are used as part of my dissertation.
Other Information About Project:
The practice online SAT questions that I have selected will be used in my dissertation. I am a P.h.D. candidate at the University of South Florida, and I will be asking students to answer the selected verbal SAT questions below in order to assess their verbal performance. Students' answers will be anonymous; the results may be mentioned in my dissertation.

Proper acknowledgement and copyright date will be given.

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evaluate your request.
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