The Effects of Performance Incentives and Creativity Training on Creative Problem Solving Performance

by

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AUTHOR'S DECLARATION

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

I understand that my thesis may be made electronically available to the public.

Abstract

I investigate the effect of different incentive schemes on employees' effort and performance in a creative problem-solving task because current literature is divided on the effect of performance-based incentives on creative problem solving. Using an experiment, I compare two types of performance-based incentives (piece-rate pay and fixed wage plus recognition) with fixed wage alone and examine whether creativity training can moderate the relationship between performance-based incentives and creative problem-solving performance. Extending the theoretical predictions from Bonner and Sprinkle's (2002) incentive-effort-performance model to creative tasks, I predict that the effect of performance-based incentives on creative problem-solving performance will be more positive in the presence of creativity training than in its absence.

One hundred and twenty participants attempted to solve six creative insight problems under time constraint. Creative problem-solving performance is measured as the number of insight problems solved. As predicted, significant performance incentive by creativity training interactions are found for both the piece-rate pay and the fixed wage plus recognition. Without training, piece-rate pay produces lower performance than fixed wage alone. With training, however, performance is higher under piece-rate pay than under fixed wage alone. Relative to fixed wage alone, fixed wage plus recognition has no effect on performance without training, but fixed wage plus recognition generates higher performance with training. Supplemental analysis reveals that individuals receiving performance-based incentives (piece-rate pay or fixed wage plus recognition) and training spent less time solving each problem than those receiving performance-based incentives and no training, suggesting that the combination of performance-based incentives and training increases individual efficiency. Further, regardless of incentive scheme, individuals display a similarly high level of interest in the task, suggesting that intrinsic motivation was not negatively affected by tying incentives to task performance. Findings from this study have implications for organizations that seek to motivate creative performance using either monetary or non-monetary incentives.

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Dedication

This thesis is dedicated to my family. To your health and happiness.

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Chapter 1 Introduction

Researchers and management consultants often suggest that firms can use incentive compensation to improve employee performance (Abbott, Johnson, King, & Turner, 2010; Prendergast, 1999; Quast, 2011). Performance incentives have the potential to increase employee output by directing attention to the rewarded performance dimension and by encouraging employees to expend greater effort on the rewarded task (Bonner & Sprinkle, 2002). Evidence from the field suggests that firms that regularly rely on creativity to solve business problems are also more likely to use performance incentives (Grabner, 2014). However, incentives can fail as often as succeed to increase employee performance on more complex tasks (Bonner, Hastie, Sprinkle, & Young, 2000). In particular, prior research shows that, in tasks that require creativity, individuals paid fixed wages perform at least as well as those who receive performance incentives (Kachelmeier, Reichert, & Williamson, 2008; Webb, Williamson, & Zhang, 2013).

It is not clear if and how performance incentives affect individuals' creative performance, but employees often have the opportunity to learn and to search for additional information in order to tackle the problems they face (Sprinkle, 2008). Employer-provided creativity training represents one such opportunity (Clapham, 1997). Therefore, it is possible that the role of performance incentives in a creative problem-solving task is not only to motivate higher effort but also to encourage employees to apply what they learn from training. This study examines how performance incentives and creativity training interact to affect creative problem-solving performance.

An understanding of the determinants of creative problem-solving performance is important because creativity is the first step of innovation, which organizations need to survive in an increasing complex and competitive environment (Forrester, 2014; IBM, 2010). Further, this study contributes to theories on incentives because creative problem-solving tasks are complex and incentives often fail to increase performance on complex tasks (Amabile, 1996; Bonner et al., 2000). Bonner and Sprinkle (2002) suggest that the dearth of positive effects noted in empirical research does not mean that incentives do not matter, rather, incentivized employees also need sufficient skill to solve complex problems. Creativity training can improve employees' creativity-relevant skills (Amabile, 1996; Clapham, 1997; Puccio, Cabra, Fox, & Cahen, 2010; Scott, Leritz, & Mumford, 2004).

The creative training and consulting industry is large. In a survey study, Solomon (1990) reports that 25% of the organizations surveyed with more than 100 employees use some type of creativity training. One firm that provides creativity training, The Creativity Workshop, operates in multiple countries and boasts of clients from industry, arts/education, and government ("The creativity workshop," 2015). Interestingly, firms often consider creativity training and performance incentives as separate tools to affect creative performance, rather than as two parts of a coherent strategy for increasing innovation (Burroughs, Dahl, Moreau, Chattopadhyay, & Gorn, 2011). Bonner and Sprinkle (2002) suggest that training and incentives may act as complements but point out a lack of empirical evidence that supports their hypothesis. This study addresses this gap in the literature as well as informs practitioners about the possible synergies of combining creativity training and performance incentives to impact creative performance.

In my study, individuals are asked to solve insight problems. Achieving insight is commonly associated with the "Aha!" experience, with the proverbial light bulb going on over one's head (Dominowski & Dallob, 1995).[1] Most importantly, insight is considered a key aspect of creativity by many creativity theorists (Baas, De Dreu, & Nijstad, 2008; Hennessey & Amabile, 2010; Mednick, 1962; Wallas, 1926; Weisberg, 2006). Like other creative tasks, insight problems demand that problem solvers possess a certain level of skill because performance is often not commensurate to increases in effort duration;[2] rather, individuals must be able to re-direct their effort and consider less obvious problem-solving methods (Amabile, 1996; Knoblich, Ohlsson, Haider, & Rhenius, 1999). Specifically, individuals often need to re-structure a problem and to re-code existing information to achieve insight (Schilling, 2005). Prior research has shown that training and experience can increase performance on insight problems (Cunningham & MacGregor, 2008; Scott et al., 2004). Extending prior research, I examine how creativity training interacts with two different types of performance-based incentives (monetary and non-monetary) to affect creative (insight) problem-solving performance.[3]

The first type of performance incentive that I examine is piece-rate pay. Piece-rate pay allows individuals to increase their total pay in proportion to additional output and is

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[1] A widely cited example of an insight problem is the Duncker (1945) candle problem. Details of this and other insight problems used in this study are provided in Appendix A.

[2] Bonner and Sprinkle (2002) break down effort into four dimensions: effort intensity, effort duration, effort direction, and strategy development which is associated with learning. My study specifically focuses on effort duration which represents how long individuals stay on a task.

[3] Focusing on insight problems limits the generalizability of my findings because insight problems do not represent the full spectrum of creative performance. However, in view of the limited available research, insight problems are useful because performance on insight problems can be objectively measured and a viable training method has already been developed. Measurement precision is useful in an experimental setting because participants are shielded from outcome uncertainty which could cause them to discount the incentives and exert less effort (Sprinkle 2008).

seen as an effective way of increasing employee effort and performance for many tasks (Bonner et al., 2000). Therefore, I expect individuals receiving piece-rate pay to exert effort for longer than those receiving fixed wages. However, despite the increased effort, individuals receiving piece-rate pay may not generate higher performance than those receiving fixed wages because solving creative problems, such as the insight problems in my study, relies on the ability to make associations of seemingly unrelated, or remote, objects (McCaffrey, 2012a; Schilling, 2005; Thagard, 2012). Without creativity training, individuals typically make remote associations via subconscious processing, an unpredictable and, often, uncontrollable process. Incentives tend to generate performance pressure which motivates people to try to control this process, but such efforts tend to be directed toward more common associations rather than toward remote associations; therefore, creative performance is not enhanced (McGraw & McCullers, 1979). In other words, without the proper skills, the motivation to obtain a creative solution may actually hinder an individual's creative performance.[4]

The second type of performance incentive that I examine is recognition. In my thesis, I refer to recognition as the provision of performance information about the top performers in a public forum. Specifically, top performers are recognized in front of all employees, thus allowing employees to compare their own performances with those at the top.[5] Recognition is non-monetary and an alternative means to motivate employees (Nelson & Spitzer, 2003; Stajkovic & Luthans, 2003). Recognition can increase effort because it provides a platform

[4] For the sake of brevity, I often refer to creative problem-solving performance as simply *performance*.
[5] Unlike public relative performance information (cf. Tafkov, 2013), recognition is asymmetrical as poor performance information is not made public.

for social comparison. Social comparison theory suggests that individuals often use relative performance information to assess their own abilities and, as a result, are motivated to perform better than others in order to maintain a positive self-image (Festinger, 1954; Hannan, McPhee, Newman, & Tafkov, 2013; Suls & Wheeler, 2000; Tafkov, 2013). I expect that individuals receiving fixed wages plus recognition will expend higher raw effort than those receiving only fixed wages. However, the desire to do better than others and to avoid being worse than others can also generate performance pressure (Murayama & Elliot, 2012). Therefore, I also expect that individuals receiving fixed wage plus recognition without the appropriate skills will not be able to increase their creative problem-solving performance.

The introduction of creativity training is expected to mitigate the problem that incentives do not lead to better performance. Through training, individuals acquire creativity-relevant skills to manage the complexity of insight problems. In my study, individuals undertake creativity training, i.e., instructions and practice, about the Generic Parts Technique (GPT; McCaffrey 2011). Individuals are taught to mentally decompose objects into various parts and to define these parts according to their physical attributes, and not their original intended uses. Learning about the GPT allows individuals to gain the skill to overcome the functional fixedness problem, which often blocks creative thinking in design problems (Duncker, 1945; McCaffrey & Krishnamurty, 2014). In essence, knowledge of the GPT can enable individuals to direct their effort towards breaking down a complex problem into smaller and less cognitively demanding components, thus allowing them to convert their effort into results despite performance pressure.

To test my predictions, I designed an experiment in which participants attempted to solve six insight problems. Performance was measured as the number of insight problems solved. I manipulated incentive scheme (fixed wage, piece-rate pay, fixed pay plus recognition) and training (creativity training or no creativity training). In the fixed wage condition, participants were paid $15 regardless of their performance. In the piece-rate condition, participants received a base wage of $6 and earned $3 additionally for each problem solved.[6] In the fixed wage plus recognition condition, those in the top quartile were publicly recognized and their performance scores were communicated to other participants in the same experimental condition. I predicted that neither piece-rate pay nor fixed wage plus recognition would increase performance compared to fixed wage alone in the absence of creativity training. With creativity training, I predicted that the individuals receiving piece-rate pay and fixed wage plus recognition would outperform those receiving only a fixed wage.

Results indicate that the effect of performance incentives (both piece-rate pay and fixed pay plus recognition) depends on training. In the absence of creativity training, piece-rate pay resulted in lower performance than fixed wage alone. In the presence of training, however, piece-rate pay led to higher performance than fixed wage alone. Fixed wage plus recognition, relative to fixed wage alone, had no positive effect on performance in the absence of training. However, similar to piece-rate pay, fixed wage plus recognition helped to generate higher performance than fixed wage alone when training was provided. In both

[6] An earlier pilot study determined that the average number of problems solved by participants in the training / piece-rate pay condition is three, so at $3 per problem solved plus the $6 base wage, the expected average pay in the piece-rate condition equals that of the fixed pay condition.

performance incentives conditions, participants exerted more effort (measured as time spent) on the problems than those in the fixed pay alone condition. These results suggest that spending more time on the task may not overcome the negative effects of using performance incentives. Unless individuals who receive performance incentives can direct their effort toward more effective problem solving processes, which training provides, their performance would not be higher than those receiving only fixed wages.

This study has several implications for research and practice. First, I replicate prior findings that, without creativity training, performance incentives have no effect, or have negative effects on performance on creative tasks (Burroughs et al., 2011; Kachelmeier et al., 2008; Webb et al., 2013). I show that these result holds for creative insight tasks, which have received less attention than divergent thinking tasks from accounting research. My results indicate that, in a one-period setting, incentives may increase an individual's willingness to expend effort but may also generate sufficient pressure to nullify any potential benefits of working longer at the task.

Second, this is one of the first studies to show that a piece-rate pay scheme can have a positive effect on performance over an economically equivalent fixed wage scheme if piece-rate pay is combined with creativity training. Specifically, individuals with high creativity skills were less likely to be adversely affected by performance pressure. This finding may partly explain why performance incentives are commonly found in creative work settings (Grabner, 2014). This result informs practice by suggesting that incentives can increase performance if firms train employees on creativity-relevant skills. Although training is common in practice, prior accounting research has not incorporated it into research designs and creativity training has not generally been linked with incentives in practice.

Third, this study also provides new evidence to the literature that non-monetary incentives, such as recognition, can interact with creativity training and increase creative problem-solving performance. Practitioners have argued that recognition is an inexpensive and yet effective means of increasing employee performance (Nelson 1995; 2012). My results suggest that recognition worked as well as, or even better than, piece-rate pay because individuals were motivated by the opportunity to appear competent in front of their peers. However, it is important to recognize that recognition may increase performance only when employees possess, or have the opportunity to acquire, relevant creativity skills.

The remainder of this thesis is organized as follows. In Chapter 2, I review the literature on the definitions of creative performance and performance incentives, and discuss the features of piece-rate pay and recognition. Then I review the literature on creativity training. In Chapter 3, I develop hypotheses regarding how performance incentives and creativity training affect individual effort and creative problem-solving performance. In Chapter 4, I describe my experimental method and design. Chapter 5 presents results and related discussions. Finally, Chapter 6 concludes.

Chapter 2 Literature Review

2.1 Introduction

In this chapter, I review existing psychology and accounting literature to examine how performance incentives and creativity training might affect performance in creative problem solving. This chapter is organized as follows. In Section 2.2, I define creative performance and creative problem solving. In Section 2.3, I separately introduce piece-rate pay and recognition as two types of performance incentives and discuss how incentives affect performance and, in particular, how incentives affect creative problem-solving performance. In Section 2.4, I review the research on creativity training and the joint application of creativity training and performance incentives. I conclude in Section 2.5.

2.2 Creative Performance and Creative Problem Solving

Creative performance refers to the development of a novel product, idea, or problem solution that serves as the basis for innovation by individuals, organizations, and society (Hennessey & Amabile, 2010; Shalley & Gilson, 2004). Though creativity and innovation are closely-related concepts, scholars have made the distinction such that creativity involves the generation of ideas, whereas innovation involves the implementation of ideas at the individual, group, or organizational level (Shalley & Gilson, 2004). Therefore, studies about creative performance have largely focused on idea generation rather than implementation. In addition, creative ideas must have two separate qualities. First, ideas will not be considered creative if they are not new or unusual, and second, ideas must be sufficiently practical so that they can be implemented. In other words, considerations of feasibility separate creative solutions from those that are merely bizarre (Rietzschel, Nijstad, & Stroebe, 2010).

The literature on creativity is vast, and various research paradigms have evolved over time. Baas, De Dreu, and Nijstad (2008) summarize three main approaches used to measure the level of creativity. Below, I discuss the differences and similarities of these three approaches. The first approach to measuring creativity uses open-ended divergent thinking and ideation tasks, in which performance is broken down into fluency, cognitive flexibility, and originality (Almeida, Prieto, Ferrando, Oliveira, & Ferrándiz, 2008). For example, individuals may be asked to think of alternative uses for bricks or to design a new household product for university students (Girotra, Terwiesch, & Ulrich, 2010; Torrance, 1974). Fluency refers to the number of unique ideas generated. Flexibility refers to the number of distinct categories the solutions can be divided into. Originality refers to the subjective infrequency of an idea. Creative performance is often an aggregate score of these three dimensions. Measuring flexibility and originality requires knowledgeable and experienced jurors. Evaluation is typically done using rating scales.

The second approach to measuring creativity is a variant of the divergent thinking test and is called the product-based measurement approach (Amabile, 1996). In the product-based approach, individuals are asked to generate an idea or solution for a context-rich problem (e.g., how to solve a human resource problem in a steel factory), and independent experts (or jurors) are asked to provide an overall rating of creativity (Amabile, 1979; Kachelmeier et al., 2008; Shalley, 1995). The logic behind this approach is that experts will understand contextual boundaries of their respective domains; as a result, they are in the best position to decide what is original and appropriate and what level of performance can be expected from the idea generators. In summary, performance measurement relies on consensus subjective evaluations of third-party observers.

The third approach to measuring creativity uses performance on insight problems (Weisberg, 2006). In contrast to using open-ended divergent thinking tasks, insight problems typically require an individual to solve a pre-defined problem that has only one solution. These problems are often abstract and remove considerations regarding context.[7] Insight problems are sometimes favoured over divergent thinking tasks because researchers can target specific cognitive mechanisms and examine how individuals process certain information. A famous example is Duncker's (1945) candle problem, in which the functional fixedness problem is highlighted (see Appendix A, Problem 3). Two key features of insight problems are that people's initial or dominant responses are usually incorrect and that they often feel stuck until they find a way to re-structure the problem or re-code existing information; therefore, the discovery of an insight often feels refreshing and unexpected (Dominowski & Dallob, 1995; Knoblich et al., 1999). To assess creative performance, researchers usually measure individuals' speed at solving problems and their relative success rates (Ansburg & Dominowski, 2000; Glucksberg, 1962).

Although open-ended divergent thinking tasks and closed-ended insight problems appear quite distinct, the inner cognitive processes are similar. Thagard (2014) separates the

[7] Some researchers have argued that creativity is culturally and historically bound (Hennessey & Amabile, 2010; Thagard, 2013). I do not argue against this proposition. However, historical and cultural considerations complicate the assessment of creative performance. Using abstract problems to assess creative performance reduces the scope of the study, but increases measurement precision.

concept of creation into two cognitive processes: association and analogy. Association occurs when the recall of one mental representation activates, or spreads, to others (Collins & Loftus, 1975). Analogy occurs when a particular case is used as inspiration for another, leading to the mapping of high-level concepts while bypassing problem-specific minutiae (Schilling, 2005; Weisberg, 2006). Thagard (2012) performs a historical study and concludes that almost every important scientific invention in the past 100 years involved the combination or adaptation of previously known, but seemingly unrelated, ideas. In many ways, divergent-thinking tasks measure creativity using remote associations because idea evaluators are asked to assess the extent to which individuals combine different pieces of knowledge in a surprising, yet enlightening, fashion (Amabile, 1996). In insight problems, however, remote associations are built into the solutions of insight tasks by design, and performance is measured by the likelihood and the speed at which individuals find these associations. In other words, divergent-thinking tasks test for clever combinations in a more unconstrained, context-rich setting, whereas insight problems do so in a controlled, relatively context-impoverished setting.

Additional support for the similarity of the cognitive mechanism underlying divergent thinking and insight problems comes from the neuroscience literature. Jung-Beeman et al. (2004) find that just prior to solving a verbal insight problem, increased activity is found in the right temporal cortex of the human brain, which is also the region responsible for retrieval of more remote, or weaker, associations needed for divergent thought (Jung-Beeman, 2005). In contrast, retrieval of close or strong associations is more likely to be preceded by increased activity in the left temporal cortex (Subramaniam, Kounios, Parrish, & Jung-Beeman, 2009).

Similar evidence has been found in research on the hippocampus. The hippocampal region performs crucial functions for memory formation and retrieval (Hodges, 1995). Duff, Kurczek, Rubin, Cohen, and Tranel (2013) predicted that the hippocampus contributes to creativity through "the rapid generation, combination, and recombination of existing mental representations to create novel ideas and ways of thinking" (p. 1143). They found that individuals with lesions of the hippocampus perform significantly worse than healthy individuals on the Torrance Tests of Creative Thinking, which include a variety of divergent thinking exercises. In a fMRI study, Luo and Niki (2003) found increased activity in the hippocampal regions of participants' brains just before the participants discovered solutions to insight problems.[8] Although no single region of the brain is solely responsible for the formation of creative ideas, the above evidence suggests that insight and divergent thinking tasks often activate the same regions of the brain.

There are various advantages and disadvantages of using insight problems to measure creativity. An advantage of using insight problems is that they provide more precise measures of performance. In contrast, open-ended divergent-thinking problems suffer from significant measurement noise from using subjective evaluations. A disadvantage of using insight problems is that they allow only one correct solution so that researchers cannot examine creativity at different levels. Unlike open-ended problems, insight problems cannot be used to assess whether an idea is incrementally or radically creative. In conclusion, creative performance is complex, and each research paradigm presents its own challenges. I use insight problems as my measurement tool because I want to study a setting in which

[8] Luo and Niki (2003) used a series of Japanese riddles as their instrument.

multiple problems requiring creative solutions exist and it is possible to incentivize employees by the number of problems solved (Gibbs, Neckermann, & Siemroth, 2014). As such, I opt for higher measurement precision over the ability to distinguish incremental and radical creativity.

2.3 Performance Incentives, Skill, and Creative Performance

In this section, I first introduce performance incentives in general and discuss the two types of incentive schemes, piece-rate pay and recognition, that will be investigated in this study. Then, I discuss how performance incentives can affect task performance, and how skill affects that relationship. Finally, I discuss how the current literature on performance incentives and general task performance can inform our understanding of the creative problem-solving task setting, and review recent studies in accounting on incentive schemes and creative performance.

2.3.1 Performance Incentives

I define performance incentives as rewards that are contingent on employee output. Examples of performance incentives include piece-rate schemes, quota schemes, and tournament schemes (Bonner et al., 2000).[9] Implications of this definition are that performance is measurable (in number of units or the degree of quality) and that high and

[9] Engagement and completion dependent schemes are also found in the literature studying creativity (Byron & Khazanchi, 2012; Deci, Ryan, & Koestner, 1999). These schemes, however, do not adhere to my definition of performance incentives because rewards do not depend on the level of output. If an employee is paid merely to complete a task or to start a task without any concerns about performance quantity or quality, the scheme resembles a fixed wage rather than pay for performance.

low performers are separable. In my setting, employees have knowledge of this performance contingency before they start work.

The first type of incentive scheme I investigate in this study is piece-rate pay. Piece-rate pay refers to a pre-defined amount paid to employees for each unit of output that can be measured. Piece-rate pay is used in many industries, including firms that employ creative workers. For example, some firms provide bonuses to scientists for successfully obtaining patents (Burroughs et al., 2011; Sauermann & Cohen, 2010). Others, such as consulting firms use reward programs whereby employees can earn points for contributing ideas and then redeem those points for tangible goods such as bicycles and televisions (Gibbs et al., 2014). Even universities periodically adjust professors' research stipends to reflect research output in quantity as well as quality. Although in most cases piece-rate pay is a minor portion of the overall compensation packages of these creative workers, the portion that consists of piece-rate pay is still important because research has shown that employees' behaviors are often driven by how they are paid rather than by the amount of payment (Jensen & Murphy, 1990).

The second type of incentive I investigate is recognition which is an alternative performance incentive and is non-monetary. Recognition has been cited in the management literature as an effective reward for motivating effort on a wide variety of tasks (Nelson & Spitzer, 2003). More specifically, recognition refers to the public disclosure of performance information of high performing employees, and the intention is to give pride to those recognized and motivate those who witness the action of recognition. Recognition can be formal as well as informal. An example of formal recognition is "product of the year" awards at annual banquets and dinners with companies' executives (Burroughs et al., 2011; Terwiesch & Ulrich, 2009). Another example occurs in the advertising industry where creative directors spend a lot of energy working on commercials that can help them win competitive awards such as One Show and Clio (Kilgour, Sasser, & Koslow, 2013). Informal recognition can also be effective; Cools, Stouthuysen, and Van den Abbeele (2014) find that furniture designers mention that the approval of colleagues at their place of work as well as that of industry colleagues motivates them to demonstrate feats of creativity, e.g., finding innovative ways to complete a project on a tight budget.[10]

2.3.2 Performance Incentives, Skill, and Task Performance

Contrary to the belief that incentives are beneficial to performance on all tasks, research shows that performance incentives do not always lead to higher performance compared to fixed pay (Bonner et al., 2000; Camerer & Hogarth, 1999). In a review of 131 experimental studies, Bonner et al. (2000) find that financial incentives often generate no positive effects in more complex tasks such as judgment and problem-solving tasks. Given these results, Bonner et al. conclude the characteristics of the task and incentive schemes must be jointly considered when firms employ performance incentives.

In a separate review article, Bonner and Sprinkle (2002) present a conceptual model and suggest that incentives mainly affect performance through their effects on employee

[10] I do not tie recognition to financial rewards in my study because I want to isolate the effect of recognition. Even so, recognition in practice may be tied to either explicit or implicit financial rewards. For example, creative directors in advertising agencies may work hard to cultivate a reputation for creativity in order to increase their market value or just to receive appreciation and approval from colleagues and superiors. In practice, financial rewards and social rewards may co-exist. An experiment, however, allows me to disentangle the effect of financial rewards from the effect of social rewards.

effort, and they break down effort into four dimensions: effort duration, effort intensity, effort direction, and strategy development. Effort duration and intensity refer to the length of time and the amount of attention during that time that an individual devotes to an activity respectively. Effort direction refers to the choice an individual makes to spend time on an activity or to split time among several activities. Strategy development refers to effort directed specifically toward planning, learning and developing a skill. In general, performance incentives entice individuals to exert greater effort (duration and intensity) toward the rewarded task. Incentives may also direct attention toward (away from) the rewarded (unrewarded) task in a multi-task environment.[11] In summary, Bonner and Sprinkle's model reconciles with the extant empirical results by proposing that task characteristics need to be matched with the appropriate effort dimension to realize a positive effect between effort and performance.

Bonner and Sprinkle (2002) hypothesize that the effect of incentives on performance will be moderated by personal variables such as individual skill. Skill is defined as the possession of task-relevant knowledge as well as knowledge organization, mental representation, and hypothesis generation capabilities (Bonner & Sprinkle, 2002). In some instances, a surplus of effort can make up for a deficit in skill and vice versa; that is, effort and skill may act as substitutes for each other. In other instances, effort and skill may act as complements. For example, the lack of skill can attenuate the positive effect of effort on performance; that is, despite working harder and for longer, individuals cannot increase

[11] Bonner and Sprinkle (2002) rely on several theories such as expectancy theory, agency theory, and goal theory to make this general claim. Because these theories make similar predictions, their differences are not discussed here.

performance if they lack the key skill that allows for effort to be converted into performance. If individuals realize that increases in effort cannot ensure higher performance, they may also withdraw effort since the marginal benefit of working harder may be lower than the marginal cost. It is also possible that individuals who realize that their performance cannot be raised without additional skills may direct effort toward learning and skill-development in the short term in order to raise performance in the long term.

Empirical research about the above questions is relatively sparse, and the question of whether skill and effort act as complements or substitutes may depend on the nature of the task (Bonner & Sprinkle, 2002). Awasthi and Pratt (1990) use a task that involves cognitively challenging questions on probability, sample size, and sunk cost decisions; they show that performance incentives increase individual effort irrespective of skill, but only more skilled individuals perform better in response to incentives. These results suggest that, in a problem-solving setting, effort and skill are complements as the lack of skill attenuates the positive relationship between incentives and performance.[12] Sprinkle (2000) uses a multi-period Bayesian task and finds that performance incentives increase effort toward skill development, thus contributing to higher performance.[13] Sprinkle's (2000) results show that, in a task

[12] Awasthi and Pratt's (1990) results suggest that individuals do not withdraw effort even though they have low skills and the probability of obtaining the incentive is low. I provide two potential interpretations of why individuals do not withdraw effort. First, the degree to which individuals withdraw effort depends on the timeliness and precision of feedback. In tasks where individuals do not find out that they have not made progress, they may continue to exert effort until the task ends. Second, associating incentives with task performance may increase the perceived importance of the task; therefore, individuals may frame the task as a challenge, which increases intrinsic motivation. Intrinsically motivated individuals derive enjoyment from doing the task itself and are less deterred by minor setbacks (Eisenberger, Rhoades, & Cameron, 1999).

[13] In Sprinkle's (2000) study, effort toward learning and skill development is monetized and is measured as the number of times individuals access performance feedback information. Each time an individual accesses performance feedback information, he/she pays a small amount of money to the experimenter.

setting where skill development is possible, individuals receiving performance incentives direct their effort toward learning. Further, the performance discrepancy between incentivized and non-incentivized individuals increases over time. Libby and Lipe (1992) use a task that first involves frequency learning, and then recognition and recall of the information during the learning phase. They find that performance incentives increase the effort directed at frequency learning and increase performance during recall, but incentives do not improve performance during recognition, which is simpler than recall. These results suggest that skill and effort are less complementary in simpler tasks that involve automatic cognitive processes such as frequency learning (Bonner & Sprinkle, 2002). Because the literature predicts a range of possible effects given the nature of the task, it is important to understand whether effort and skill are complements in the creative problem-solving task setting.

2.3.3 Performance Incentives, Skill, and Performance in Creative Problem Solving

Creative problem-solving tasks differ from routine tasks in several aspects. First, creative problems have no known solution paths; i.e., individuals cannot follow an established algorithm to obtain the solution as they can for known math problems. Amabile (1996) claims that solving creative problems requires heuristic responses and that solving routine problems requires algorithmic responses. For example, an artist is considered to be working on an algorithmic task if he/she creates a painting using an existing template (e.g., children with large sad eyes, using dark-toned backgrounds). However, if the artist actually creates the template, he/she is working on a heuristic task.[14] Second, individuals often have to engage in a prolonged trial-and-error process because there will seem to be many potential paths, though most will lead to dead-ends. For example, finding the solutions to insight problems involves the difficult skill of constraint relaxation (Knoblich et al., 1999).[15] This skill is difficult because many cannot consciously control it; that is, individuals often have no recollection of how they reached a solution, except that they experience a flash of illumination after a period of focused and/or de-focused thinking. Finally, due to the complexity and challenge presented by such problems, individuals may actually enjoy doing them because they gain a sense of accomplishment derived from generating something new. Contrary to the economic perspective that individuals are effort averse and incentives are needed to get them to apply effort (Kunz & Pfaff, 2002), a view from psychology research is that individuals may voluntarily expend effort if they find the work intrinsically interesting and challenging (Deci, 1971; Nakamura & Csikszentmihalyi, 2002).

[14] Amabile (1996) also suggests that the determination of an algorithmic or heuristic task depends on the knowledge level of the individual. If a student is able to work out a mathematical theorem without knowing that this theorem exists, then the solution is considered to be creative even though the theorem might have been known by the scientific community for hundreds of years. Insight problems can fit this definition of a heuristic task. Although the solutions for insight problems are pre-defined and known by a number of people, those who see these problems for the first time are engaged in a creative process because they must find their own way toward the solution.

[15] Knoblich et al. (1999) suggest that impasses during problem solving are caused by an overly constrained solution space that is inconsistent with the goal state. Hence, relaxing of the inappropriate constraints leads to the problem solution. For example, solving the Duncker candle problem requires individuals to mentally separate the form and function of the thumbtack box, seeing it at as a paper platform rather than a container. The candle problem also helps to explain the effect of chunking. Familiarity with a class of objects can lead to pattern formation, or chunks, which reduces cognitive load. Because individuals retrieve knowledge chunks relatively automatically, pre-existing chunks can pose inappropriate constraints and cause problem-solving impasses. For example, the thumb tacks and the tack box form one chunk and this chunk needs to be decomposed before the appropriate solution can be identified.

Due to these differences between creative problem-solving tasks and routine tasks, performance incentives may impact performance on creative problems differently than on routine tasks. First, firms may find it difficult to use incentives to direct employee effort; thus, although individuals are motivated to do "something" to earn their reward, it will not be clear to them what to do to earn it. Second, the high complexity of creative problems means that a higher level of skill is needed. Without sufficient skill, individuals may not be able to translate incentive-induced effort into results. In fact, the presence of salient performance incentives may reduce performance because incentives may hurt the individual's ability to relax constraints as the process appears to involve the subconscious (McGraw & McCullers, 1979). Third, if intrinsic motivation is the key input for the creative process, then changes in the level of performance incentives may not have significant effects on performance because incentives are more likely to affect extrinsic motivation. Further, it has been suggested that the presence of performance incentives can interfere with people's innate interest in the task, that is, crowd out intrinsic motivation. As a result, performance may fall (Deci, 1971; Frey & Jegen, 2001).[16]

[16] Although some theories suggest that incentives would decrease intrinsic motivation by reducing individual self-determination (Ryan & Deci, 2000), empirical evidence often fails to show that performance incentives crowd out intrinsic motivation (Byron & Khazanchi, 2012; Deci et al., 1999; Gibbs et al., 2014). Supporters of the learned industriousness theory even predict and find that performance incentives increase intrinsic motivation (Eisenberger et al., 1999). The intricacies of this debate often lie within operational details of studies such as whether creativity is explicitly asked of participants and whether the incentive contract is framed positively, i.e., as bonuses and tools of encouragement, or negatively, i.e., as bribes and tools of punishment. Given my focus on creativity is from a cognitive perspective and my description of incentives is in a neutral setting, crowding out of intrinsic motivation is unlikely to be observed in my setting.

Several recent studies in accounting provide insight into the above opinions.[17] Kachelmeier, Reichert, and Williamson (2008; KRW) used designing Rebus puzzles, an open-ended task, to test how various forms of performance incentives affect individual creative performance. They compared fixed wage, quantity-based pay, average creativity-based pay, and weighted creativity-based pay. They found that people tend to trade off quantity for average quality; that is, when the reward was contingent on average creativity rating, fewer puzzles were submitted but the average creativity ratings were higher. However, making pay contingent on being highly creative (i.e., average creativity-based pay) did not lead to more highly creative ideas. Specifically, participants who received creativity-based pay (both average creativity-based pay and the weighted creativity-based pay) produced the same number of highly creative ideas (ideas ranked in the top-quartile of creativity) as those who received fixed pay or quantity-based pay. Therefore, the higher average creativity rating achieved by those in the average creativity-based pay condition was likely due to censoring of less creative ideas.[18] KRW also showed that attempts to direct effort through incentives may be counterproductive. Participants receiving the weighted creativity-based pay, which is the product of average creativity rating and the number of ideas generated, produced fewer ideas in total but the same number of highly-creative ideas as participants in the quantity-

[17] I focus on accounting studies mainly because they make the distinction between the size of incentives and the way incentives are paid. Prior studies, mostly in psychology, often confound these relationships by comparing conditions with no incentive to conditions with various performance incentives (e.g., Amabile, 1982; Burroughs et al., 2011; Glucksberg, 1962; McGraw & McCullers, 1979).

[18] KRW also compared the performance of those receiving quantity-based pay with the performance of those receiving fixed pay. They found that although individuals receiving quantity-based pay produced a much higher number of ideas than those receiving fixed pay, the number of highly creative ideas was not different between the two conditions.

based pay condition produced. Therefore, total productivity was lower when incentives were based on two equally important aspects of performance.

In another study, Kachelmeier and Williamson (2010; KW) found that individuals may self-select into different incentive schemes based on perceived performance potential; however, initial self-assessments did not reflect final outcomes. KW asked individuals to practice the Rebus puzzle design task and then to select between the quantity-based and the weighted-creativity-based incentive scheme. Those who performed well in the practice period selected the creativity-weighted incentive scheme more often and performed better than those who selected the quantity-based scheme in the initial stages of the experiment. KW observed that those in the quantity-based pay condition eventually caught up to the other group. From these results, KW opine that less talented individuals may level the playing field if they do not spend too much energy worrying about quality and just keep working to produce a higher quantity of output.

Following up on earlier results, Kachelmeier, Wang, and Williamson (2014; KWW) examined the long-term effect of performance incentives and compared it to that of fixed pay. They initially asked participants to do the same Rebus puzzle task as KRW's study under fixed wage or quantity-based pay schemes. In contrast to KRW, KWW asked the same participants to generate a few more puzzles ten days later when they came to pick up their remuneration. Hence, KWW's study is separated into period one and two. KWW found that participants receiving quantity-based pay generated a greater number of highly-creative ideas than those receiving fixed pay only in period two. It should be noted that participants in KWW did not know about period two during period one, so any additional thought they put into the task after the performance period was voluntary. Based on their results, KWW suggest that firms need to be cognizant that there may be an effect delay between when the incentives are introduced and when the benefits, in performance, of incentives are realized. KWW's conclusions advanced the literature by adding to KRW's findings; that is, although creative performance does not improve when people try harder in the short term as a result of incentives, it does improve in the long term as a result of incentives. A surprising result was that the long-term (period two) positive effect of performance incentives was only observed among individuals who received quantity-based pay in period one. In contrast, those who received creativity-based pay (i.e., pay for generating puzzles ranked in the top quartile of creativity ratings) in period one exhibited no more creativity in period two than individuals who received fixed pay. KWW conclude that the long-term effect is conditional on whether individuals achieve sufficient initial progress and that more progress can be obtained if individuals simply focus on being productive rather than on being creative.[19]

Webb, Williamson, and Zhang (2013; WWZ) found that goal-based incentives can reduce the individuals' ability to generate insights. In WWZ's experiment, participants could increase performance by either manually counting letters in a block of text or find out "shortcuts" which are complex patterns that allow the participants to derive the number of letters without counting. WWZ measured both the number of shortcuts found as well as efficiency which is the average number of minutes spent on searching for shortcuts. They gave participants either difficult or easy goals which had incentives attached and found that

[19] KWW also acknowledge that motivation crowding did not occur in their task setting. They suggest that performance incentives have the potential to make people tired, and tiredness contributed to the apparent "lack of interest" in the free-task period researchers have used to measure intrinsic motivation.

participants who received more difficult goals perceived that it was important to locate shortcuts. In contrast, those who received easier goals devoted more time toward counting to make sure that they hit their goals at the cost of fewer shortcuts found. Individuals who received difficult incentivized goals found more shortcuts than those who received easy incentivized goals, but were less efficient at finding shortcut. It should be noted that the highest efficiency was found among participants who were paid fixed wages and had easy production targets. From these results, WWZ conclude that incentives tied to difficult performance goals can amplify performance pressure and reduce cognitive capacity devoted to problem solving, thus reducing individuals' ability to recognize difficult, unusual patterns.

The research by Kachelmeier, Williamson, and colleagues is highlighted because they controlled for the level of pay while manipulating the way individuals are paid. Collectively, the evidence paints an interesting, but incomplete picture regarding performance incentives and creative performance. Their studies largely confirm that tying incentives to creative problem-solving performance does not generate a significant increase in output in the short term. However, if the incentives are tied to a task dimension that is easier to control (e.g., production quantity), then individuals will work harder at that more easily controlled dimension. For example, KRW's participants generated more Rebus puzzles overall when incentives were tied to quantity than when wages were fixed. Effort directed toward increasing quantity in prior periods can produce different spillover effects on creativity. On one hand, in KWW, a higher number of ideas contributed positively to the number of highly creative ideas, although only for period two. On the other hand, in WWZ, effort devoted to increasing quantity through conventional means contributed negatively to the identification of insights. These diverging effects are caused by differences in task characteristics.

KW and KWW offer glimpses of skill related effects of incentives on creative performance. KW shows that initial assessment of creativity skills can be misleading. In KW, participants likely performed an initial memory search and processing, and those who generated more ideas perceived that they had high personal ability. However, the participants might have ignored the possibility that dedicated effort to increase production could lead to new discoveries. It is possible that, with experience, individuals who are incentivized to improve can become better at solving creative problems if they develop skills as predicted by Bonner and Sprinkle's (2002) incentives to strategy development hypothesis. However, it is not clear whether participants in the quantity-based pay condition developed skills which could be applied to related problems because neither study provides direct evidence of learning.[20] In addition to considering the role of strategy and skill development, it is worthwhile to investigate avenues for training since training can provide skills faster than employees can learn from experience alone.

2.4 Creativity Training and Creative Problem Solving

In this section, I first explain the theory regarding the nature of creativity training and related empirical evidence. Then I discuss how the provision of creativity training may affect the relationship between performance incentives and creative problem-solving performance.

[20] KWW collected self-reports from participants in the quantity-based pay condition. These participants admitted to thinking more about the task during the resting period. But KWW admit that the data is too noisy for path analysis.

2.4.1 Creativity Training

Creativity training consists of attempts to raise individuals' creative skills through instruction and practice. Amabile (1996) outlines three main determinants of creative outcomes: domain skill, creativity skill, and task motivation. Domain skill refers to the knowledge and technical skills regarding the subject matter, whereas creativity skill refers to general cognitive styles, heuristics, and work processes that impact the retrieval and combination of useful information. Amabile suggests that creativity skills can be learned through experience as well as instruction, and that, once learned, creativity skills can be applied across a variety of domains.

Creativity training provides an attractive solution to organizations that desire greater creative output from their employees. Solomon's (1990) survey finds that 25% of organizations with over 100 employees implement some form of creativity training.[21] Over time, the number of creativity training programs and consulting service providers has proliferated (Birdi, 2005; Scott et al., 2004). Scott et al. (2004) broadly categorize existing research on training into divergent thinking training and problem-solving / insight training, consistent with the two measurement paradigms found in creativity research. Further, depending on the type and number of cognitive and affective processes involved, creativity training can be long or short (cf. Clapham, 1997; Isaksen & Treffinger, 2004). Although researchers generally assume that an individual's skills, such as math and verbal communication, tend to remain stable and develop slowly over time (Bonner & Sprinkle, 2002), some creativity skills may be learned faster because they involve changing

[21] Some of the companies cited in the study include Frito Lay, Du Pont, and Texas Instruments.

information processing styles rather than memorizing additional content (Chrysikou, 2006; McCaffrey, 2012a). However, not all creativity training programs are effective or effective to equal extents; in their meta-analysis, Scott et al. (2004) find that programs that apply cognitive models generate the most positive effects among both divergent thinking and problem-solving tasks. Other techniques such as motivation and attitude change training generate insignificant, even negative, effects.

In addition to providing skills, creativity training may also increase creative performance through a positive effect on self-efficacy. Tierney and Farmer (2002) define creative self-efficacy as the belief that one has the ability to generate creative outcomes. In general, elevated self-efficacy has been found to increase information search, memory recall, and cognitive processing capacity (Tierney & Farmer, 2002). In particular, individuals with higher creative self-efficacy may be better at coping with the uncertainties inherent within creative endeavors (Tierney & Farmer, 2011). Since individuals' perceptions of their personal ability (or skill) and task difficulty are two key determinants of self-efficacy (Gist & Mitchell, 1992), training may provide employees with new skills which then increases perceived ability and self-efficacy. Moreover, it is possible that training leads to not only discernible increases in skill, but also increases in creative problem-solving performance through higher optimism (Rego, Sousa, Marques, & Cunha, 2012).[22] By extension, if individuals fail to grasp new skills, then self-efficacy may not increase. In a field experiment, Gist (1989) finds that cognitive-modeling training enhances creative self-efficacy on an idea

[22] It should be noted that Scott et al. (2004) found that attitude change training can be less effective than cognitive and problem-solving training at improving creative performance. Scott et al. failed to find a net positive effect for attitude training in their meta-analysis.

generation task more than lecture-based training that delivers similar content. Another possibility is that insights into a task through training may lead to the realization that the problem is more complex than initially thought, thus reducing self-efficacy.[23] In summary, skill acquisition may increase creative self-efficacy, thus enhancing creative problem-solving performance.

2.4.2 Creativity Training and Performance Incentives

The effect of the interaction between training and incentives may be similar to that between skills and incentives; that is, if training increases skill and, as long as skill serves as a complement to effort, individuals will be motivated to use the new skill toward the task in order to acquire the reward (Bonner & Sprinkle, 2002). Then the effect of performance incentives on creative problem-solving performance may increase as creativity training increases. However, Bonner and Sprinkle assert that most existing studies show that training does not increase the effect incentives have on performance (cf. Arkes, Dawes, & Christensen, 1986; Gigerenzer, Hoffrage, & Kleinbölting, 1991). To better examine this issue, Bonner and Sprinkle suggest that future research should better align the skill provided by the training and the skill required by the task; otherwise, individuals may not respond to incentives by applying knowledge from training. Bonner and Sprinkle also indicate that, in experimental studies, the researchers should make sure that participants actually acquire the skill in the time allowed.

[23] Cervone and Peake (1986) showed that individuals who focus on the more difficult aspects of a task have lower self-efficacy than those who focus on the easier aspects of the same task.

The human resources literature has identified that, despite organizations spending significant money and time on training of various kinds, the percentage of employees not applying what they learned from training may be as high as 50% (Burke & Hutchins, 2007). Therefore, researchers have been interested in the determinants of employees' motivation to transfer training from the classroom to real work (Facteau, Dobbins, Russell, Ladd, & Kudisch, 1995; Seyler, Holton III, Bates, Burnett, & Carvalho, 1998). In a meta-analytic study, Taylor, Russ-Eft, and Chan (2005) found that when training transfer is included in performance reviews, employees' have significantly higher motivation to apply what they learned. However, some organizations may not have the means to keep track of whether individual employees apply what they learn from training. Moreover, such incentives can reduce critical thinking among employees because they are incentivized to apply trained techniques even in situations that do not require them.

An alternative to forcing employees to apply training is to incentivize job performance irrespective of training transfer while presenting training as an opportunity to improve job performance. Facteau et al. (1995) found that employees were attracted to training programs which enable them to become more effective on their current jobs.[24] Yamnill and McLean (2001) suggest that the motivation to transfer training can be tied to employees' expectancies about job related outcomes; that is, if an individual expects to be

[24] Facteau et al. (1995) surveyed state government employees in the U.S. and reported that extrinsic motivators do not encourage employees to engage in training as much as intrinsic motivators. However, they define extrinsic motivation as the desire to seek employment outside of the state government and intrinsic motivation as the desire to improve current job performance, and it is not clear whether motivation to improve current job performance in order to obtain bonuses and promotions is classified as intrinsic or extrinsic. As a result, these results present weak evidence against using performance incentives with training.

rewarded for high job performance and training transfer leads to higher job performance, then the individual will be motivated to undertake and transfer training even though he or she is not explicitly incented to do so. In this case, the organization can avoid the cost of measuring training transfer and prevent employees from applying trained techniques irrespective of the situation.

Studies that incorporate both performance incentives and creativity training are sparse. In one such study, Eisenberger, Armeli, and Pretz (1998) trained school children by priming divergent thinking using an unusual uses task. In this task, participants received incremental pay based on training performance and were told that they either had correct (unusual) or incorrect (usual) responses. The researchers found that training using the divergent thinking task increased the degree of originality participants demonstrated on a subsequent task, during which everyone was promised the same fixed completion-contingent reward. The same effect was not observed among those who did not receive divergent thinking training. This study demonstrates that training can help mold individual behaviour toward being more original and that compensating people for training performance does not necessarily crowd out creative performance in a subsequent uncompensated task. However, organizations may be wary of adopting such behaviour-modification training because employees may try to be too creative and start impractical projects that end up hurting profitability (Busco, Frigo, Giovannoni, & Maraghini, 2012; Grabner, 2014). In addition, because Armeli et al. did not give participants creativity-contingent performance incentives for doing the subsequent task, it is unknown whether the training effect would have remained if they were given incentives to be creative in the subsequent task.

Burroughs et al. (2011) investigated the effect of using the combination of creativity training and performance incentives in the new product development setting. Participants were university students taking an engineering and design course and were given divergent thinking training that involved visualization techniques. In this study, half of the participants received training about the visualization technique and the other half received no training. Further, participants either received no pay or a tournament incentive in which the top three performers received monetary prizes. The researchers observed that tournament incentives interacted with training; specifically, the tournament incentive / training condition showed significantly higher creative performance than the control condition with neither incentive nor training. Compared to the control condition with no pay or training, neither the training alone condition nor the incentive alone condition improved performance.[25] Although Burroughs et al. investigated a research question similar to mine, there is an important distinction between the two. Specifically, Burroughs et al. compared their training and incentive conditions against a control condition that had no pay and no training rather than against a control condition with a fixed wage, generating two issues. First, the performance of the incentivized and trained individuals relative to individuals working under fixed wage is unknown.[26] Second, because Burroughs et al. used a tournament scheme to introduce rewards, one cannot tell whether the positive effect was caused by the higher expected pay or because participants were put in a competitive situation. To address these issues, this

[25] It is not apparent why training alone did not have a direct positive impact on performance given that the authors report that training led to higher use of visualization. It is possible that those who were trained but not incentivized submitted ideas that were original but less practical; thus, performance did not improve on average.
[26] It is possible that had individuals received fixed wage rather than no pay, they would have exerted adequate effort on the task and had similar levels of creative performance as those who had the opportunity to earn some remuneration.

question must be examined in a setting where average expected pay between conditions is equal (i.e., one group receives fixed pay while the other receives performance incentives[27]) and where competition is separated from pay (i.e., individuals compete for a non-monetary incentive such as recognition and compare their performance to those paid under fixed pay alone).

In summary, creativity training has often been used as a tool to increase employee creativity skills, but the potential interaction between creativity training and performance incentives remains under-investigated. Bonner and Sprinkle (2002) suggest that the effectiveness of performance incentives can be enhanced when accompanied by training, but few studies had directly tested this conjecture, and fewer still had done so in the creative problem-solving setting.

2.5 Conclusion

This chapter reviews the accounting, economics, and psychology literature on creative problem solving, performance incentives, and creativity training. I find that although creative problem solving has been defined and measured in various ways, the ability to establish connections among remote pieces of knowledge underlies good performance in all situations. Despite the commonality in the cognitive process involved, the relationship between performance incentives and creative problem solving is complex, and its significance often depends on an individual's skill level. I identify creativity training as a

[27] Using a pilot test with participants from the same demographic group, I calibrated expected pay between fixed wage and piece-rate pay conditions. I used the average performance and earnings of individuals who received piece-rate rate and creativity training to set the pay for those in fixed wage and fixed wage plus recognition conditions. Hence, differences in expected pay are less likely to explain differences in performance.

way to modify individual skill and improve the effectiveness of performance incentives. In Chapter 3, I develop predictions regarding the effect of performance incentives and creativity training on creative problem-solving performance given my choice of using insight problems as measurement tools.

Chapter 3 Hypothesis Development

3.1 The Effect of Performance Incentives on Effort during Creative Problem Solving

In this chapter, I will discuss how piece-rate pay and fixed wage plus recognition, as alternatives to fixed wages alone, can affect performance on creative problem-solving tasks. I first discuss how effort is affected by the introduction of performance incentives, and then discuss why incentivized effort may not positively impact creative performance. In Section 2.3.2, I review that effort has four dimensions, according to Bonner and Sprinkle (2002). In this section, I focus my discussion on effort duration and effort direction because effort intensity is difficult to measure and it is strongly correlated with effort duration. I do not examine strategy development since it is defined as a long-term response to incentives and, thus, is unlikely to occur in a one-period experimental study.

3.1.1 Piece-rate Pay and Effort Duration

Compared to fixed wages, a piece-rate incentive scheme can increase employee effort duration because it provides the most direct link between performance and reward. This prediction is supported by expectancy theory, which states that individual motivation is determined by the combination of expectancy, instrumentality, and valence of reward (Vroom 1965). Expectancy refers to the belief that effort will translate into performance results, instrumentality refers to the belief that performance increases will earn additional rewards, and valence refers to the personal utility of the reward being offered. Assuming that valence and expectancy are positive, increases in instrumentality will increase employee motivation. A piece-rate pay scheme boosts instrumentality because every measurable increment of performance is tied to additional rewards. Therefore, whenever performance can be measured precisely and objectively, piece-rate pay can motivate employees more than a fixed wage can (Prendergast, 1999). Given the above reasoning, my first hypothesis is stated as follows.

> H1: Individuals receiving piece-rate pay contingent on creative problem-solving performance will exert higher effort by working longer on the task than individuals receiving fixed wage alone.

The above prediction is limited to the effect on effort duration because it is less clear how piece-rate facilitates changes in other dimensions of effort such as effort direction.[28] McGraw & McCullers (1979) found that individuals receiving piece-rate pay displayed fixation toward one type of problem solving method, i.e., the one that worked. But when a new problem emerged and required a shift in the way problems were solved, those receiving piece-rate pay were slower to shift their problem-solving approach than unpaid individuals. These results suggest that piece-rate pay may impede effort direction changes and thus is not conducive to solving creative problems in different settings.

3.1.2 Recognition and Effort Duration

A different way organizations can motivate employees to exert effort is by promising to recognize high performers. Recognition may occur in public or in private. As discussed

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[28] Bonner et al. (2000) find that piece-rate pay often produces a positive effect on performance in production and clerical tasks (i.e., when performance is sensitive to effort intensity and duration). However, the positive effect of piece-rate pay on performance weakens when judgment and puzzle-solving tasks are used.

in Section 2.3.1, this study focuses on recognition that is public in nature.[29] Employees can also be recognized for high absolute or relative performance. For tasks, such as ones used in this study, where there are no standard benchmarks of performance, recognition of high relative performance may be more motivating than absolute performance because the common environmental risks are removed (Lazear & Rosen, 1981). In summary, the recognition examined in my study is public and reveals relative performance information.

Kosfeld and Neckermann (2011) found that temporary employees in a non-government organization worked harder for a prize of only symbolic value. At the beginning of each session, the managing director displayed thank-you cards that were to be distributed to the two employees who did the best work. At the end of each session, the organization's database displayed the names of the award winners to everyone in that respective session. Kosfeld and Neckermann attribute this extra motivation to the fact that individuals have utility for social standing and public recognition, and that a public disclosure of the names of the winners confers such recognition. Because the nature of the reward is social, individuals derive utility from knowing, and having other people know, about their individual performance relative to others.

There are two potential alternative explanations for the positive effect of recognition rewards on performance in Kosfeld and Neckermann's (2011) study. One explanation is that there was a demand effect generated by the presence of the managing director, who endorsed

[29] Private recognition is also used in organizations. For example, a manager may individually praise an employee for a job well-done. This form of recognition, however, does not allow employees to find out or to compare performance information of other employees.

the thank-you cards and made the task appear more important. To address this concern, the researchers introduced a separate experimental condition in which the thank-you cards were signed by the session administrator rather than the managing director. Workers in this condition exerted the same level of effort as those in the condition that had the managing director sign the thank-you cards. Another potential explanation is that workers merely wanted acknowledgement for their hard work, and they were not particularly interested in being compared with others. But, if that was the case, then it would be expected that total effort and performance would have been even greater if thank-you cards were delivered to everyone in the session. I contend that this result is possible but unlikely because workers may infer how well the reward represented true hard work from the exclusivity of the reward; thus, indiscriminant distribution of recognition rewards can dilute their perceived value.

Social comparison theory provides an explanation for why people desire to be recognized for performance that is superior compared to others. Social comparison theory postulates that individuals strive to assess their own ability and that they will use relative performance information (RPI), in absence of normative ability benchmarks, to make those assessments (Festinger, 1954). Festinger (1954) also states that, in order make an accurate assessment, individuals are more likely to compare themselves against those who are considered to be peers rather than superiors. Comparisons, however, generate the possibility that ability discrepancies among the workers will be observed. Whereas positive RPI suggests that one's ability is high and helps employees maintain a positive self-image, negative RPI is undesirable because it creates a conflict between one's desire for a positive self-image and actual performance results (Hannan et al., 2013; Suls & Wheeler, 2000; Tessor, 1985).[30]

If recognition reveals RPI, I predict the expectation of recognition will affect employee effort. For example, Tafkov (2013) found that, when individuals received assessment on a skill of personal importance, positive (negative) RPI was associated with greater pride (shame) when the information was disclosed in public versus in private. In addition, individuals considered RPI to be more accurate and more reflective of personal ability when performance incentives were provided because the presence of incentives ensured that everyone tried hard during the task. Finally, Tafkov showed that individuals were able to anticipate the benefits of performing well on a task that provided RPI and competed harder in order to protect their self-esteem. I expect that the prospect of receiving recognition will increase the effort individuals exert on a creative problem-solving task.[31] Since recognition resembles public RPI because the other employees will learn about the performance information of the top performers, fixed wage plus recognition will encourage more competition and hard work than fixed wage alone. I state my hypothesis 2 as follows.

[30] Research shows that, when confronted with negative RPI, individuals may dissociate themselves from the task in order to stop the comparison (Hannan et al., 2013). Moreover, individuals may stop identifying with the referent group in order to protect their self-esteem (Festinger, 1954).

[31] The research setting facilitates social comparison. First, creative problem-solving ability is important because students see it as a valuable skill in academics as well as in professional employment (Bryant, Stone, & Wier, 2011; Ford & Gioia, 2000). Second, a group of students from the same program provides the relevant peer group. Students regularly compete against each other for scholarship, internship, and jobs for graduates; therefore, they are motivated to assess their abilities and to protect their positive self-images.

H2: Individuals receiving recognition for higher relative performance in addition to fixed wage will exert higher effort by working longer on the task than those receiving fixed wage alone.

H2 is also limited to the prediction of higher effort duration because it is unclear how recognition affects effort direction. Using recognition to activate social comparison should increase the anxiety level of the individual and, similar to piece-rate pay, generate a narrow-minded approach that prevents changing effort direction in a creative problem-solving task (Amabile, 1982; Shalley & Oldham, 1997). Tafkov (2013) showed that individuals who received private or public RPI felt more nervous than those who did not receive RPI. However, recognition in my study is different than public RPI in Tafkov's (2013) study because in my study only the top performers' performance information is revealed and those at the bottom do not find out how they are ranked, nor do others. Murayama and Elliot (2012) posit that competition simultaneously activates performance-approach and performance-avoidance goals and these goals can have opposite effects on performance. Individuals with performance-approach goals try to do well relative to others and exhibit challenge-based behaviors such as eagerness, task-absorption, and persistence. Individuals with performance-avoidance goals try to avoid doing poorly compared to others and exhibit threat-based behaviors such as worry, task distraction, and self-handicapping. Compared to public RPI, public recognition based on relative performance can reduce the anxiety that would have been caused by full public disclosure of RPI. Such recognition emphasizes performance-approach goals rather than performance-avoidance goals by highlighting only good performance and hiding poor performance. Therefore, I expect recognition to motivate higher task persistence which should lead to higher effort duration, but it is not clear whether individuals will be better at changing effort direction if they receive recognition.

3.2 The Effect of Incentivized Effort on Creative Problem-solving Performance in the Absence of Creativity Training

Although individuals receiving piece-rate pay or fixed wage plus recognition will exhibit higher effort duration than those receiving a fixed wage alone, those who fail to steer their effort in the appropriate direction may not increase their performance on creative problem-solving tasks. In Section 2.3.3, I pointed out that the key difference between creative tasks and routine tasks is that individuals need to identify a non-obvious solution path to solve creative problems. In the case of insight problems, individuals must be able to re-structure problems and/or re-code existing information, a process commonly referred to as breaking set or thinking outside-the-box (Weisberg, 2006). Conversely, those who cannot think outside the box are considered to be functionally fixated. Functional fixation is a common problem among individuals working in engineering and design. Those who are fixated often fail to see simple alternative uses of objects and end up using elaborate and costly methods to solve problems when much simpler solutions exist.[32] I consider the ability to avoid functional fixation a skill which requires cognitive flexibility.

Whether individuals become trapped by functional fixation or are able to break set depends on the individual's skill and frame of mind. Incentivized individuals are more likely to succumb to functional fixation due to the phenomenon called choking under pressure

[32] For example, most people will see a plastic patio chair as a thing to sit on rather than something to paddle with (McCaffrey, 2012b). A common illustration of the functional fixedness problem is the Duncker candle problem, which is frequently used as a creativity assessment tool (Weisberg, 2006).

(Baumeister, 1984; Beilock & Carr, 2001). Choking occurs when an individual performs more poorly than expected given his or her skill level (Beilock & Carr, 2001). Baumeister (1984) documented evidence that various forms of pressure inducers, such as money, competition, and presence of an audience, cause choking. Baumeister's results imply that the presence of performance pressure encourages individuals to consciously monitor their behaviours to make sure that actions are executed correctly. Paradoxically, when the needed skill cannot be consciously controlled, monitoring hurts rather than helps performance. For example, well-learned sensorimotor actions such as putting in golf and shooting free throws in basketball often suffer when individuals try "too hard" to control the complex series of movements involved in their performance. This occurs because individuals have limited working memory which cannot hold and process all the needed actions. Baumeister also found that those who are on the verge of obtaining or losing an incentive are more likely to forcibly monitor their actions, and thus are more susceptible to choking.

Overcoming functional fixation requires breaking set. Set breaking is thought of as the culmination of an incubation period, i.e., a series of remote associations are made in the mental background and some emerge as insights (Schilling, 2005; Wallas, 1926). To individuals, the discovery of these insights appear as serendipity rather than as products of careful analysis (Gilhooly, Georgiou, & Devery, 2013; Knoblich et al., 1999). Therefore, performance incentives are not likely to help with set breaking because they are more likely to induce conscious monitoring which directs individual attention to the common associations rather than the uncommon ones. To elaborate, suppose human cognitive capacity is fixed and is allocated among conscious and subconscious processing; then, mental resources devoted to one type of processing will take away resources available to the other type. Therefore, individuals are better able to generate remote associations when they allocate a significant portion of their processing capacity to the subconscious process, even though they cannot really control the results of this process. The incentives affect individuals by forcing them to allocate most or all of their mental capacity to the conscious process and that hurts creativity. Therefore, potentially useful subconscious processing is replaced by less helpful conscious processing.

Performance incentives may also interfere with set breaking by adding performance pressure and cognitive distraction. One stream of literature states that incentive-induced pressure causes individuals to have distracting thoughts (e.g., about the consequences of obtaining and losing the incentive) which reduce working memory available for actual problem-solving (Beilock & Carr, 2005; Beilock, Kulp, Holt, & Carr, 2004; Webb et al., 2013). Unlike the choking under pressure hypothesis which focuses on how incentives can hurt performance by increasing unhelpful conscious monitoring, the cognitive distraction hypothesis suggests that incentives can hurt performance by reducing conscious analytical processing capabilities. However, the negative cognitive distraction effect is likely limited to activities that use a high level of cognitive resources. Beilock and Carr (2005) tested and found that pressure reduced performance more on difficult math problems that demanded high levels of working memory than on easy math problems. Beilock et al. (2004) conclude that although both choking and distraction can have negative effects on performance, the extent to which one has the primary effect depends on the task. If the task relies greatly on working memory capacity, then distraction is more harmful; if proceduralized and subconscious processes are more crucial, then choking is more harmful. Because set breaking, and thus subconscious processing, is key to creative problem solving, I make the following null predictions for piece-rate pay and fixed wage plus recognition in comparison to fixed wage alone.

H3 (null): Despite working on the task for longer, individuals receiving piece-rate pay will not have higher performance on the creative problem-solving task than those receiving fixed wage alone.

H4 (null): Despite working on the task for longer, individuals receiving fixed wage plus recognition will not have higher performance on the creative problem-solving task than those receiving fixed wage alone.

Further, to the extent that individuals experience different levels of performance pressure between receiving piece-rate pay and fixed wage plus recognition, creative problem-solving performance can differ between these two incentive schemes. The fixed wage plus recognition incentive scheme should boost the self-esteem of the recognized high performers and allow low performers to retain some anonymity and avoid public embarrassment. Therefore, although fixed wage plus recognition may activate performance-avoidance goals to a lesser extent than public RPI, it is unclear whether fixed wage plus recognition will generate more or less performance pressure compared to the piece-rate pay. Since there is no strong theoretically justified directional prediction, I ask the following research question.

RQ1: What is the difference in creative problem-solving performance between individuals receiving piece-rate pay and those receiving fixed wage plus recognition?

3.3 The Effect of Creativity Training on Creative Problem-solving Performance

Training is expected to increase performance in creative problem-solving by providing individuals with creativity-relevant skills as well as boosting self-efficacy. As I discuss in Section 2.4, training can exist in many forms. In my study, I examine the Generic Parts Technique (GPT), a form of cognitive modelling training developed by McCaffrey (2012b). McCaffrey's training provides individuals with a systematic approach to information processing and re-coding and is designed to help them overcome the functional fixedness problem.

The GPT prompts individuals to mentally break down an object to its basic elements and then to define each element according to its shape, size, and material without using words that imply use. For example, the shaft of an arrow is described as a long wooden cylinder. By re-coding the shaft, individuals become more aware of its alternative uses that take advantage of its shape (e.g., use as a poker, hanger, roller, spindle, etc.) and material (e.g., for burning, insulating, etc.) If this re-coding does not occur, many potential uses will not be found because individuals might be fixated on the shaft's current function. The concept behind the GPT is not new. Chrysikou (2006) used an alternative categories task, i.e., asking people to list as many different uses of objects as possible, to prime a similar mindset, which helped individuals solve insight problems similar to the ones used in McCaffrey (2012b). In fact, the alternative uses task, developed by E. P. Torrance, is one of the most popular tests of creativity (Baas et al., 2008). The advantage of GPT is that, among its peers, it most closely resembles a training program because it possesses both a theory component as well as a practice component (Appendix B).

The importance of subconscious processing for creativity decreases as individuals acquire more creativity skills through training. Although I stated that subconscious processing is important for creativity because it helps individuals generate remote associations, subconscious activities are, by nature, difficult to control and results are unpredictable. Techniques introduced by training such as the GPT do not speed up the subconscious mental process; rather, they help individuals process information systematically using a conscious approach. Without training, people may end up exhausting all common associations before being able to think 'outside-the-box'. For example, in the candle problem, an individual may generate many ways to use the thumb tacks to hold the candle to the wall, realize that none work, and only then consider using other things to hold the candle. If the individual has received the GPT training, she may survey all items in the scenario, break them down into basic elements, and look for the most efficient and effective solution. The individual may spend more time thinking 'outside-the-box' and increase her probability of generating insights. In summary, creativity training increases the effectiveness of conscious efforts toward creative problem solving so that individuals can exercise more control over the process and can increase performance by increasing effort. I predict that, when individuals receive fixed wages, those who receive creativity training will have higher performance than those who do not receive creativity training.

> H5: In the fixed wage condition, individuals who receive GPT training will have higher creative problem-solving performance than individuals who do not receive GPT training.

H5 is not without tension. The success of the training program depends on the motivation of individuals to learn and to apply what they have learned and the degree to which they believe that the training is useful. Although the GPT helps individuals to re-code existing information, it also increases the amount of information individuals need to process to solve a problem. Individuals applying the GPT will be breaking down various objects in the problem, but not everyone will solve every problem; as the number of objects increases, an individual's workload as it relates to the GPT also multiplies. If individuals are not motivated, the positive effect of training will not be significant. For example, Burroughs et al. (2011) found that creativity training did not increase creative performance among uncompensated participants.

3.4 The Interactive Effects of Performance Incentives and Creativity Training on Creative Problem-solving Performance

Although performance incentives are not expected to increase creative problem-solving performance on their own, incentives may become more beneficial when individuals receive creativity training. In the previous section, I contend that performance incentives tend to increase effort duration, but also cause higher performance pressure and choking under pressure. If performance pressure arising from performance incentives causes individuals to consciously monitor their thought processes too closely, their mental flexibility and thus their creative problem-solving performance may suffer. With creativity training, however, performance pressure becomes less detrimental. Training such as the GPT is able to help prevent individuals from fixating on common associations and break set. Therefore, the conscious monitoring of thought processes under training becomes a boon, rather than a hindrance for insight generation. Consistent with the above argument, I expect effort and skill in my task setting to act more as complements, especially since the GPT requires individuals to invest effort in problem restructuring and information recoding so that they can generate more potential solutions.[33] This prediction is consistent with the belief that, in a creative problem-solving setting, skill and effort are complements. As individuals acquire better skills from training, the positive effect incentivized effort has on performance increases.

Performance incentives may provide the added benefit of encouraging individuals to learn from training sessions and to use trained techniques. The human resources literature reports that, despite organizations spending significant money and time on training, the percentage of employees not applying what they learned from training may be as high as 50% (Burke & Hutchins, 2007). Anderson (1982) suggests that self-monitoring effort increases the rate of skill acquisition, especially among novices. Yamnill and McLean (2001) suggest that the motivation to transfer training can be tied to employees' expectancy about job related outcomes; that is, if an individual expects to be rewarded for high job performance and training transfer leads to higher job performance, then the individual will be motivated to undertake and to transfer training even though he or she not explicitly incented to do so. Therefore, if the default reaction toward training is to ignore it (perhaps individuals like to avoid the effort of trying something new), then performance incentives can encourage greater uptake for the training techniques, thus leading to higher performance.

[33] Thomas Edison was quoted as saying that genius is about 2% inspiration and 98% perspiration (Simonds, 1934). Though it is difficult to verify the actual proportions of the inputs, the difference between the two numbers speaks to the importance of hard work to innovation.

In summary, compared to no creativity training, training will allow individuals receiving performance incentives to increase performance on creative problem solving because they can benefit from effort spent on conscious processing. In addition, performance will be boosted because individuals expecting to receive performance incentives will be more likely to use training techniques.

> H6: In the presence of creativity training, those receiving piece-rate pay will have higher creative problem-solving performance than those receiving fixed wage alone.
>
> H7: In the presence of creativity training, those receiving fixed wage plus recognition will have higher creative problem-solving performance than those receiving fixed wage alone.

Given these hypotheses rely on the theory that creativity training such as the GPT makes a heuristic task more analytical and, thus, more responsive to increases in conscious processing (monitoring), one would expect that effort duration will partially mediate the relationship between performance incentives and creative problem-solving performance in the presence of GPT training. Because effort duration represents a dimension of monitoring efforts, e.g., a student who needs to check over his answers on an exam will typically spend more time in the exam room. I make the following prediction.

> H8: In the presence of creativity training, those receiving performance incentives (piece-rate pay, fixed wage plus recognition) will have higher creative performance than those receiving fixed wage alone, and this effect is partially mediated by effort duration on the task.

Finally, one might wonder whether piece-rate pay will generate higher performance than fixed wage with recognition, or vice versa. This comparison may depend on which performance incentive motivates higher effort, which I cannot predict a priori. Therefore, I pose the following research question.

> RQ2: In the presence of creativity training, what is the difference in creative problem-solving performance between those receiving piece-rate pay and those receiving fixed wage plus recognition?

Chapter 4 Research Method

4.1 Overview

I employed a 3 x 2 factorial laboratory experiment with *Incentive Scheme* (three levels: Fixed Wage, Piece-rate Pay, and Fixed Wage plus Recognition) and *Training* (two levels: creativity training and no creativity training) as between subject factors (see Figure 1, Panel A). In this and subsequent sections, *Performance Incentive* refers to both *Piece-rate Pay* and *Fixed Wage plus Recognition* conditions In this experiment, participants completed a computer-based insight problem-solving task which presented six problems used in McCaffrey (2012b). My dependent variables include the duration of effort (*Effort Duration*) exerted by participants and their creative problem-solving performance (*Performance)*.

The chapter is organized as follows. Section 4.2 describes the task and provides details of the participants. Section 4.3 describes the experimental procedures used. Section 4.4 describes the independent variables that were manipulated. Section 4.5 describes the dependent variables and various process measures taken. This chapter concludes in Section 4.6.

4.2 Task Details and Participants

4.2.1 Task Details

Prior studies on creativity have used many different types of creative problem-solving tasks. Amabile (1996) argue that creative tasks should not appear to have obvious solution paths initially and individuals must come up with ideas that are original (at least to them) and appropriate. In Section 2.2, I contend that insight problems such as the Duncker candle problem satisfy these requirements and allow performance to be measured with precision. The problems used in this study were taken from McCaffrey (2012) and include the Duncker candle problem among others; similar problems have been used in past research on insight generation (e.g., Ansburg & Dominowski, 2000; Chrysikou, 2006; Dominowski & Dallob, 1995).[34] See Appendix A for detailed descriptions of all six problems.

The task required participants to read the descriptions of the problems and type their responses in textboxes on their computer screens. Participants were given seven minutes per question for a total of 42 minutes. It should be noted that, based on McCaffrey's (2012b) data and pilot testing, seven minutes was determined as adequate time for individuals to come up with multiple conjectures and type out the answers. In any case, the presence of time restrictions works against my hypotheses 6, 7, and 8 because it reduces the ability of incentivized individuals to prolong their work time. Another reason for instituting a strict time limit was to make sure that all participants saw and responded to all the problems.[35] Participants, however, were not obligated to spend the full seven minutes on each question and could move on if they felt that the solution had been found or if they had given up looking for the solution. Participants were also told that they could submit multiple (up to five) textual responses and that they would be given credit if one of their responses was correct

[34] I sincerely thank Anthony McCaffrey, who provided not only his dissertation but also the detailed performance statistics for each problem.

[35] For practical reasons, each experimental session could not extend beyond 80 minutes. Therefore, if an individual spent a long time on one of the earlier problems, she would feel rushed at the end and would not read the question properly. Because the six problems have varying degrees of difficulty, differences in problem selection behaviour such as being slow at the beginning but rushing at the end would introduce noise in the dependent measure.

irrespective of order.[36] Appendix C shows the instructions participants saw when attempting these problems.

4.2.2 Participants

It is important to appropriately match participants with the experiment task (Bonner et al., 2000). Amabile's (1996) model suggests that individuals in creativity studies need to have sufficient domain knowledge to produce creative solutions and to achieve meaningful variation in performance. Age and work experience do not present significant obstacles; children as young as seven years old have been used in published academic studies on creativity (e.g., Amabile, 1982). The key is to provide participants with an activity that is appropriate for their knowledge level. In the case of Amabile (1982), elementary school children were asked to make collages, which school children in the U.S. had learned how to do at an even younger age. The insight problems used in this study involved objects such as candles, trucks, watches, ropes, and desk lamps, and I expected university students to have working knowledge of such everyday objects. Prior studies used similar tasks and found university students to be appropriate participants even though students were a convenient population from which to sample (Chrysikou, 2006).

One hundred and twenty undergraduate students from a large Canadian public university participated in separate sessions over the course of two weeks (eight weekdays).

[36] This design choice was made to prevent floor effects because participants do not receive contemporaneous feedback. Prior studies allowed participants to check with the administrator whether their solutions were correct, and if not correct, which part of their current solution was wrong. I do not allow individuals to check their answers because performance incentives may increase feedback seeking behaviour; I do not focus on feedback in this study and extra feedback may increase creative problem-solving performance.

Participants were recruited from first and second year accounting and management science classes, although not everyone was majoring in these two subjects. Participants came from different academic programs; 67 were accounting and finance majors, 19 were undertaking double-degrees with one of the degrees being accounting and finance, 19 were math majors, and 15 were from other programs such as science and engineering. The average age among participants was 18.5 years. The number (percentage) of female students was 70 (58%).

The double-degree students solved more problems than other students. There was a significant positive correlation between *Performance* and *Accounting Double Degree* ($r = .24$, $p = .002$, two-tailed).[37] Ceteris paribus, I expected those who had superior domain knowledge to be better at solving the insight problems represented. Although I could not measure individual differences in domain knowledge, it is possible that the double-degree students had higher domain knowledge as a result of the quantity and diversity of courses they had taken. Since double-degree program admissions standards were generally higher than single-degree programs, double-degree students were more likely to have higher intelligence. *Gender* did not affect *Performance* ($r = -.05$, $p = .242$, two-tailed).[38] *Age* had a marginally significant effect on *Performance ($r = -.15$, $p = .091$, two-tailed)*, although the weak relationship may be due to a lack of variation in the *Age* variable. The oldest participant

[37] The significant effect remains even in a multi-variate regression after controlling for performance incentive, training, and other demographic variables.

[38] Although this appears to be in contrast with results of Chen, Williamson, and Zhou (2012) who found that women were more creative than men, Chen et al.'s (2012) study involved computer-mediated collaboration which men used to a lesser degree than women. My study does not require group collaboration, so gender differences are not expected to be significant.

was aged 23, and the youngest was 17.[39] No demographic variable was significantly correlated with the manipulated variables, suggesting that random assignment was successful.

4.3 Experimental Procedures

Participants were recruited via course websites, class email lists, and Facebook groups. To register, individuals had to take a survey hosted on Qualtrics, in which they consented to participate in the study and selected an experimental session to attend. They also completed a short exercise which allowed me to collect data for a few individual difference variables. These variables are discussed in detail in Section 4.5.2. Upon receiving the registration list, I confirmed the experimental session schedules with each participant and sent reminders to them the day before their sessions.

Upon arrival for their scheduled sessions, participants consented again to have their in-lab responses made available for research. They were then randomly assigned to one of six experimental conditions. First, they learned about their respective incentive schemes. The instructions can be found in Appendix D. They were asked several manipulation check questions and had to answer all questions correctly before they could advance. If they submitted a wrong answer, the program would generate an error message, ask them to read the instructions again, and select a different answer. Participants then entered the training phase. Based on pilot testing, it was determined that the GPT training would take 10 minutes on average to complete; therefore, those who did not receive GPT training performed a word

[39] In a pilot test using participants recruited from Amazon MTurk, I found evidence that age was strongly and positively correlated with the number of problems solved ($r = .37$, $p = .002$, two-tailed). In the pilot, the average age was 33 years old, with the youngest participant being 20 and the oldest 68.

association exercise of equal duration. Afterwards, participants performed a practice problem similar to the ones they were about to see in the main task; they were given seven minutes to generate and submit solutions and then reviewed the correct solution.

Before the start of the main task, participants answered questions regarding self-efficacy and set goals for the number of problems they wanted to solve (see Appendix E). Self-efficacy and personal goals have been found to mediate the relationship between the performance incentive and subsequent effort (Wright & Kacmar, 1995). The participants received the six insight problems in the same order, had seven minutes to solve each problem, and were not allowed to go back to previous problems.[40] After each problem, participants responded to two questions about whether they had seen the problem before and how confident they were that they had found the ideal solution. Some problems, such as the candle problem and the truck problem, were more popular; thus, a number of individuals reported having seen them before. In response, I either controlled for or removed their responses from my analyses (see Section 4.5.1). I used participants' confidence about their solutions (from 0 to 100) as self-assessments of probability of success because participants did not receive formal feedback regarding their performance until the experiment was finished. After they submitted solutions to all six problems, participants responded to a post-experiment questionnaire (see Section 4.4.2 and Appendix E). The solutions were released

[40] In a pilot, I compared performance of individuals who were given the problems in the current order with performance of those who were given the problems in random order. Order did not affect performance, nor the interaction of order and training. Participants were not allowed to go back to a previous problem because I would not be able to measure time spent on each problem. However, some participants commented after the experimental session that they were able to figure out a previous problem when attempting a subsequent problem. Although this design feature possibly suppressed the overall performance of the participants, it likely biased against me finding results because incentivized individuals are more likely to have lingering thoughts about previous unsolved problems and solve them later if allowed to do so.

once all the experimental sessions concluded, and payments were made in the following week. Figure 1, Panel B exhibits a flowchart that demonstrates all the stages of this experiment.

4.4 Independent Variables and Process Measures

4.4.1 Independent Variables

I manipulated two variables between participant groups: *Incentive Scheme* (fixed wage, piece-rate pay, or fixed wage plus recognition) and *Training* (creativity training or no creativity training). Using Qualtrics, participants were randomly assigned to one of six conditions after they provided their consent. Everyone remained in the same condition throughout the study. Because the *Fixed Wage plus Recognition* condition involved competition, participants were made aware that they would be competing against only others in the same condition; that is, individuals who received training did not compete for recognition against those who did not receive training.

Incentive Scheme

Exactly one third of 120 total participants were assigned to each incentive condition. Those in the *Fixed Wage* condition received $15 as remuneration for attending the laboratory session of the study. They were told that, regardless of their performance on the problem solving task, they would be guaranteed that amount. Participants who were assigned to the *Piece-rate Pay* condition were guaranteed $6 for attending the laboratory session.[41] In addition, they learned that they could earn $3 for each problem solved and up to $18 if they solved all six problems. Therefore, the maximum pay in this condition was $24. If

[41] The fixed payment was deemed necessary to encourage sufficient participation. This is similar to prior studies that examined piece-rates or competitive pay (cf. Kachelmeier et al., 2008; Kachelmeier & Williamson, 2010).

participants solved three problems on average, their pay would be $15.[42] Finally, participants who received *Fixed Wage plus Recognition* were told that their pay for attending the session was $15, and if they performed well and placed in the top-quartile in their respective group, they would be recognized in an email the experimenter would send to everyone in that group. In addition, each individual would be able to compare his/her performance against the published performance scores of the top performers.[43] Detailed descriptions of the compensation information can be found in Appendix D. By experimentally controlling the expected pay at $15, I minimize the potential problem that performance differences could be caused by differences in expected pay amount; thus, differences in performance between the *Fixed Pay plus Recognition* condition and the *Fixed Wage* condition could then be attributed to the effect of recognition (Wright & Kacmar, 1995).

Training

My second manipulated variable was the presence of creativity training. In the *Creativity Training* condition, participants were trained using the Generic Parts Technique (GPT). First, participants were given an overview of the GPT. Second, participants were provided a comprehensive example of the GPT consisting of a tree diagram and explanations. Third, participants were asked to practice the GPT using the tree diagram approach. Standard feedback was provided after each exercise to reinforce understanding. The average time to

[42] A separate study was conducted to calibrate the amount of fixed pay so that the fixed pay would equal the average pay of the *Piece-rate Pay / Creativity Training* condition. This procedure made the pay equal across the three incentive scheme conditions when participants performed at the average level of the *Piece-rate Pay / Creativity Training* condition.

[43] Due to ethical concerns, I gave the participants the option of not allowing their names to be sent in the congratulatory email, but none had a problem with having their names released.

complete the training was just over nine minutes. Appendix B displays the actual training instrument. At the conclusion of training, all participants attempted one insight problem (the circuit problem) as practice. After they submitted their responses, the correct solution was displayed. Those in the *Creativity Training* condition read a statement about how the GPT applied to the problem they attempted. This statement was not present in the *No Creativity Training* condition.

In the *No Creativity Training* condition, participants were asked to work on the Word Association (WA) task which was designed to take the same time to complete as the GPT training. Participants in this condition were asked to rapidly type the first word they thought of after seeing a stimulus word. The WA task was developed by Christensen and Guilford (1958) and was shown not to impact creativity on subsequent insight problems (Chrysikou, 2006; McCaffrey, 2012a). Providing such 'placebo training' was superior to having the participants do nothing because this approach controlled for the possibility that any type of training / exercise, rather than creativity training in particular, could increase performance as a result of individuals gaining confidence at the task (Chrysikou, 2006; Clapham, 1997).[44] In addition, having both groups work on a mentally stimulating task helped to equalize the energy level of the participants when they advanced to the next stage of the experiment.

[44] In the post-experiment questionnaire, I measured the perceived usefulness of training by averaging questions 1 to 3 in Appendix B. Results suggest that participants in the *Creativity Training* condition thought the training was more useful than those in the *No Creativity Training* condition ($F = 73.57$, $p < .001$). Further, perceived training usefulness is positively correlated with performance in the *Creativity Training* condition ($r = .42$, $p = .001$), but not in the *No Creativity Training* condition ($r = .07$, *ns*). Combined, these results suggest that the training manipulation was successful.

4.4.2 Process Measures

Theory suggests that personal goals (*Goal*) and self-efficacy (*Efficacy*) mediate the relationship between incentives and effort.[45] To gain a better understanding of whether these intermediate processes respond to changes in *Incentive Scheme* or *Training*, and whether they help to predict changes in *Effort Duration* and *Performance*, I asked participants to respond to a series of questions. To measure *Goal*, the program prompted individuals to set a goal, from zero to six, about how many problems they committed to solving, and to respond to four questions about goal commitment (*Commitment*; adopted from Hollenbeck, Williams, & Klein, 1989). To measure *Efficacy*, I used Bandura's (2006) self-efficacy scale for problem-solving tasks. Participants responded to six statements about their confidence level (from 1 to 100) to solve different numbers of problems (from 6 to 1), respectively. My results show that *Efficacy* and *Goals* were closely related, but neither was significantly associated with *Effort Duration* or *Performance*. The difference between my study and the previous studies that have found these process measures to be important (i.e., Wright & Kacmar, 1995) is that performance feedback is not given to individuals in my study. Consistent performance feedback allows individuals to understand what they are or are not doing properly. If the person experiences success, self-efficacy will rise and help raise performance in subsequent periods.

[45] However, prior research does not agree on whether self-efficacy precedes goal setting or vice versa (cf. Bandura & Cervone, 1983; Lerner & Locke, 1995). Further, there is disagreement about whether goals or self-efficacy partially or completely mediate the relationship between incentives and effort (Wright & Kacmar, 1995).

4.5 Dependent Variables and Covariates

4.5.1 Dependent Variables

The two dependent variables in this study were participants' *Effort Duration* and *Creative Problem-Solving Performance*, shortened to *Performance*, at the creative problem-solving task. Following prior literature which also used time spent as a proxy for effort (e.g., Sprinkle 2000; Hannan et al. 2008; Hecht et al. 2012; Tafkov 2013), I assumed that individuals had utility for leisure (in this case, leisure represented the time not spent on the task and the opportunity to leave early).[46] Hence, *Effort Duration* was measured as the average time spent on each unsolved problem from when a participant started reading a problem to when he/she clicked the 'next' button. Average time spent on unsolved problems represented a better measure of effort than the overall average because those who solved the problem would proceed to the next problem quickly, leading to lower average time. Hence, individual persistence was more precisely measured on unsolved problems because individuals faced the choice of giving up or keep working until the seven minutes expired.[47] Bonner and Sprinkle's (2002) model suggests that *Effort Duration* is not the only variable that can affect *Performance*. In a creative problem-solving task such as mine, "working smart" is arguably more important than "working hard"; that is, effort directed at applying the training techniques is more valuable than effort that lacks direction or is misdirected.

[46] Prior research in accounting has often used a time bonus for finishing earlier to proxy for disutility of high effort (e.g., Hannan et al. 2008; Tafkov 2013). However, in these studies, participants could not leave early if they finished because the experiments contained multiple rounds and those who finished had to wait for the slowest participants to be done.

[47] Thanks to Jeremy Douthit and Steve Kaplan for raising this point.

However, I was unable to directly observe effort direction because even those participants who claimed to have used the GPT responded that they applied the technique in their minds rather than drawing tree diagrams on paper.

Performance is measured as a person's ability to generate solutions for new creative problems. Participants' past experiences with some problems confounds this measure because, with prior experience, problem solving is no longer confined to new problems. In my study, I dealt with this problem in two ways. First, I constructed a variable (*Prior Experience*) by counting the number of problems participants reported they had previously seen and used the variable as a control in a multivariate regression. Second, for my *Performance* variable, I computed a ratio of solved problems over eligible problems and removed the number of previously-seen problems from both the numerator and the denominator. Subsequent testing shows that my results remain similar regardless of the method of controlling for *Prior Experience*.[48] For remuneration purposes, however, participants were not penalized for having prior experience with the problems. To assess whether participants solved the problems, written responses were compared against the standard answers to these insight problems. To receive credit, an answer had to match the standard answer or be as good as the standard answer as subjectively determined by the raters. Two independent raters who were unaware of the experimental conditions, along with myself, coded these responses.[49] The aggregate agreement percentages between rater A and

[48] The way *Performance* is measured does, however, affect the type of statistical testing that can be done. More details are provided in Chapter 5 Results.
[49] Note that my coding was done after I scrambled the order of the participants, so I did not have the names of the participants nor did I know which condition they were in during coding. Consensus tests show that my coding had a high level of agreement with each independent rater.

experimenter, rater B and experimenter, and rater A and rater B were 96%, 95%, and 94%, respectively, suggesting a high level of consensus.[50] All differences in coding were resolved through discussion.

4.5.2 Covariates

To control for individual differences in creative problem-solving ability, I measured individual *Cognitive Ability* and *Cognitive Flexibility*. Barr, Pennycook, Stolz, and Fugelsang (2014) show that cognitive ability and cognitive flexibility are positively associated with performance on insight as well as divergent thought tasks. *Cognitive Ability* is defined as general intelligence and analytical reasoning skills and is measured using the Wordsum task of Huang and Hauser (1996). The Wordsum task is a vocabulary test that has been found to be highly correlated with full-scale intelligence tests (Barr et al., 2014). *Cognitive Flexibility* is the ability to connect cognitively distant concepts (i.e., make remote associations) and is measured by the cumulative score of three remote associations test (RAT) questions (selected from Bowden and Jung-Beeman 2003). The RAT is a popular measure of cognitive flexibility and has been used in many creativity research studies (e.g., Friedman and Förster 2005). Both *Cognitive Ability* and *Cognitive Flexibility* were positively correlated with *Performance* ($r = .19$, $p = .039$ for Cognitive Ability; $r = .19$, $p = .036$ for Cognitive Flexibility).[51] In addition to individual ability, I also measured individual intrinsic

[50] The consensus measure was used because the data is nominal in nature and simple agreement percentage allows for easy interpretation. As shown, the actual degree of consensus is significantly higher than the chance percentage of 50%. For completeness, I also calculate and show that there was a high level of initial inter-rater consistency (Cronbach's $\alpha = .975$).
[51] The ratio of unknown problems solved was used to calculate the correlations among *Performance, Cognitive Ability*, and *Cognitive Flexibility*.

motivation because theory suggests that creative performance may be low if individuals have low intrinsic motivation (Amabile, 1996). I asked participants about their level of interest (*Interest*) toward the task in the post-experiment questionnaire because interest forms a significant part of intrinsic motivation. I asked questions selected from the Intrinsic Motivation Inventory (www.selfdeterminationtheory.org). Overall, interest in the task was high (4.06 out of 5 on a Likert Scale) and was positively correlated with *Performance* ($r= .25$, $p= .007$). See questions in the post-experiment questionnaire in Appendix E.

Chapter 5 Results

5.1 Introduction

This chapter provides the results of the experiment described in Chapter 4. The effects of *Incentive Schemes* on *Effort Duration*, that is, whether *Piece-rate Pay* and *Fixed Wage plus Recognition* produce higher work motivation over *Fixed Wage* (Hypotheses 1 and 2), are tested in Section 5.2. The null effects of *Incentive Schemes* on *Performance* in absence of *Creativity Training* (i.e., Hypotheses 3 and 4) and the comparison between the effectiveness of *Piece-rate Pay* and *Fixed Wage plus Recognition* in the absence of *Creativity Trainin*g (i.e., Research Question 1) are tested in Section 5.3. Section 5.4 tests the effectiveness of *Creativity Training* on *Performance* (i.e., Hypothesis 5). Section 5.5 examines the interactive effects of *Incentive Schemes* and *Training*, and compares the relative effect of *Piece-rate Pay* and *Fixed Wage plus Recognition* (i.e., Hypotheses 6 and 7 and Research Question 2). I examine the potential mediation of the interactive effect by *Effort Duration* (i.e., Hypothesis 8) in Section 5.6. Supplemental analysis is discussed in Section 5.7. This chapter concludes in Section 5.8.

5.2 The Effects of Incentive Scheme on Effort Duration

For Hypotheses 1 and 2, *Effort Duration* is the dependent variable of my tests. Table 1 provides descriptive results for *Effort Duration* by experimental condition. Table 2 provides the results of an ANOVA with *Incentive Scheme* and *Training* as independent variables, and *Effort Duration* as the dependent variable. Results showed that *Incentive Scheme* had a significant effect on *Effort Duration* (Table 2 Panel A: $F = 4.49$, $p = .013$).

Training did not impact *Effort Duration* (Table 2 Panel A: F = 1.07, p = .304), nor did the interaction of *Training* and *Incentive Scheme* (Table 2 Panel A: F = .09, p = .914). Panel B of Table 2 shows the results of planned contrasts between *Performance Incentives* and *Fixed Wage* conditions. In support of Hypotheses 1 and 2, I found that *Piece-rate Pay* increased *Effort Duration* over *Fixed Wage* alone (Table 2 Panel B: Contrast = 43.49, p = .009 one-tailed), and so did *Fixed Wage plus Recognition* (Table 2 Panel B: Contrast = 49.42, p = .004 one-tailed). The direction of the results held regardless of the presence of *Creativity Training*.[52] These results are consistent with the belief that tying incentives to performance increases individuals' willingness to exert effort; in my study, participants worked longer even on problems that they were ultimately unsuccessful at solving.

The contrast between *Piece-rate Pay* and *Fixed Wage plus Recognition* showed no significant differences in *Effort Duration* (Table 2 Panel B: Contrast = -5.93, p = .759). This result suggests that promising recognition to top performers can motivate similar levels of effort as providing variable monetary compensation. However, this result only provides a preliminary understanding of the effect of social rewards such as recognition because I only manipulated recognition at one level. One might argue that the recognition provided in my study was fairly unremarkable because individuals received only an email rather than a more visible symbol of achievement such as a plaque or a trophy. It is possible that recognition rewards with greater "fanfare" such as a trophy handed out at a company gala may motivate

[52] Untabulated contrast results show that when there was no Creativity Training, Effort Duration increased by 43.71 seconds (p = .040, one-tailed) and by 43.29 (p = .043, one-tailed) seconds when comparing Fixed Wage with Piece-rate Pay and Fixed Wage plus Recognition, respectively. When there was Creativity Training, Effort Duration increased by 43.55 seconds (p = .054, one-tailed) and by 56.92 (p = .021, one-tailed) seconds when comparing Fixed Wage with Piece-rate Pay and Fixed Wage plus Recognition, respectively.

greater effort than an email would. It is also possible that I used a group of participants who were already highly competitive because most participants were from the same program and would likely be competing against one another for internship opportunities as well as graduate positions. I contend that since most participants were freshmen and they might not know each other well, their desire to compete may have been reduced.

Table 1: Descriptive Results

Panel A: Effort Duration [a]

	Incentive Scheme			
	Fixed Wage	**Piece-rate Pay**	**Fixed Wage plus Recognition**	**Average**
No Creativity Training	239.87 (79.02) n = 20	283.58 (70.74) n = 20	283.16 (82.59) n = 19	268.63 (78.95) n=59 [b]
Creativity Training	250.86 (85.00) n = 20	294.41 (81.94) n = 19	307.78 (81.42) n = 17	282.91 (85.04) n = 56 [b]

Panel B: Performance and Percentage of Unknown Problems Solved [Percentage][b]

	Fixed Wage		**Piece-rate Pay**		**Fixed Wage plus Recognition**		**Average**	
	Performance	**Percentage**	**Performance**	**Percentage**	**Performance**	**Percentage**	**Performance**	**Percentage**
No Creativity Training	2.55	0.40	1.55	0.25	2.15	0.34	2.05	0.33
	(1.28)	(0.22)	(1.36)	(0.21)	(1.50)	(0.23)	(1.40)	(.23)
	n = 20		n = 20		n = 20		n = 60	
Creativity Training	2.55	0.40	3.10	0.52	3.40	0.56	3.02	0.49
	(1.64)	(0.26)	(1.68)	(0.28)	(1.54)	(0.25)	(1.67)	(.28)
	n = 20		n = 20		n = 20		n = 60	

[a] See variable definitions in Appendix F.

[b] The sample sizes are less than 60 because individuals who solved all six problems are excluded from the calculation of **Effort Duration.**

Table 2: The Effects of Incentive Scheme and Creativity Training on Effort Duration

Panel A: ANOVA

Source[a]	*DF*	*MS*	*F*	*p*
Intercept	1	8769651.015	1364.211	.000
Creativity Training	1	6862.598	1.068	.304
Incentive Scheme	2	28859.488	4.489	.013
Creativity Training * Incentive Scheme	2	579.618	.090	.914
Residual	109	6428.368	.997	
Total	115	0.37	.712	

Panel B: Planned Simple Contrasts

Comparison	Contrast	*p*
1. H1: Piece-rate Pay vs. Fixed Wage	43.49	0.018
2. H2: Fixed Wage plus Recognition vs. Fixed Wage	49.42	0.008
3. Piece-rate Pay vs. Fixed Wage plus Recognition	-5.93	0.759

[a] See Appendix F for variable definitions.

5.3 The Effects of Incentive Schemes on Creative Problem-solving Performance in the Absence of Creativity Training

Hypotheses 3 and 4 predict that even though individuals may work longer in response to receiving *Performance Incentives* as compared to *Fixed Wage*, individuals' *Performance* may not increase due to higher likelihood of "choking under pressure." Panel B of Table 1 shows that participants who received *Piece-rate Pay* solved only 1.55 problems compared to those who received *Fixed Wage* and solved 2.55 problems. Similarly, those who received *Fixed Wage plus Recognition* solved 2.15 problems on average, which was not greater than what the participants in the fixed wage condition produced. A linear regression was used to test the effects of *Incentive Schemes* and *Training* on *Performance*.[53]

[53] The alternative statistical tests in involves using Poisson loglinear model or the negative binomial distribution (GLM in SPSS). The Poisson model can be appropriate when the dependent variable is count data, which is what I have for *Performance*. However, the advantage of using Poisson models has to do with analyzing count

In the regression, *Performance* was the dependent variable, and *Piece-rate Pay, Fixed Wage plus Recognition*, and *Training* were the independent variables.[54] I also included *Accounting Double Degree, Cognitive Ability, Cognitive Flexibility, Prior Experience, and Age* as control variables. Control variables were included to remove the differences in *Performance* caused by individual ability and prior task knowledge. However, the removal of the control variables did not impact the significance of the results. Moreover, using an OLS regression with *Percentage of Unknown Problems Solved* [*Percentage*] as the dependent variable, I obtained similar results.

Panel A of Table 3 shows the results of the regression. The coefficient on *Piece-rate Pay* was negative and significant (Table 3 Panel A: B = -.95, t = -2.13, p = .036), and the coefficient on *Fixed Wage plus Recognition* was also negative but non-significant (Table 3 Panel A: B = -.04, t = -.10, p = .924). The lack of significant positive effects means that there is no evidence to reject Hypotheses 3 and 4 - null hypotheses - in support of the alternative that *Performance Incentives* lead to better *Performance* than *Fixed Pay* when *Creativity Training* is absent. Instead, the results suggest that *Piece-rate Pay* may lead to choking which contributes to lower *Performance* than *Fixed Wage* does. In contrast, *Fixed Wage plus Recognition* did not negatively affect *Performance* as much as *Piece-rate Pay*.

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data that have skewed distributions with a lot of zeros. My *Performance* variable was more normally distributed. The negative binomial model is also inappropriate because it deals with over-dispersed data; a Pearson Chi-Square statistic of .797 shows that *Performance* was not over-dispersed. After comparing the histogram of the residuals for both Poisson and linear regressions, I found that both models gave me random errors that fit a normal distribution. Further, the statistical results were consistent irrespective of model chosen. Therefore, there is no advantage in using Poisson model over regular linear model in my study.

[54] Rather than using *Incentive Scheme* as I did in the ANOVA in Table 2, I entered piece-rate pay and fixed wage plus recognition separately into the model because their coefficients represent the effect of the different performance incentives on performance in comparison to the control condition, fixed wage.

With respect to Research Question 1, I modified the regression to include *Fixed Wage* rather than *Piece-rate Pay* as one of the independent variables. This change allowed me to use *Piece-rate Pay* as the baseline condition and examine whether *Fixed Wage plus Recognition* results in significantly higher *Performance*. Results from Panel B of Table 3 show that the coefficient on *Fixed Wage plus Recognition* was significant (B = .91, t = 2.02, p = .046). This suggests that, in absence of *Creativity Training*, *Incentive Schemes* involving recognition can be more effective than incentive schemes that involve piece-rate pay. In Section 3.2, I discuss the potential for recognition to increase motivation, but not generate the same amount of performance pressure as monetary rewards (i.e., piece-rate pay), because the asymmetric nature of the performance disclosure means that low performing individuals would want to avoid being embarrassed. In the previous section, I show that recognition increased time spent on the problems by the same amount as piece-rate pay, suggesting the participants in both groups were equally motivated to do well. Since *Performance* was different between these two conditions, the conjecture that recognition may produce lower harmful performance pressure than piece-rate pay is partially supported.

Table 3: The Effects of Incentive Scheme and Training on Creative Problem-solving Performance

Panel A Fixed Wage as the Base-line Condition

	B	*SE*	*t*	*p*	95% confidence interval for B *Lower*	*Upper*
Intercept	3.35	1.41	2.37	.019	.554	6.148
Piece-rate Pay	-.95	.45	-2.13	.036	-1.833	-.065
Fixed Wage plus Recognition	-.04	.45	-.10	.924	-.930	.844
Training	-.12	.44	-.28	.779	-.999	.751
Piece-rate Pay*Training	1.82	.63	2.91	**.002**	.579	3.057
Fixed Wage plus Recognition*Training	1.19	.64	1.85	**.033**	-.082	2.461
Prior Experience	1.08	.37	2.91	.004	.346	1.823
Cognitive Ability	.12	.08	1.63	.107	-.027	.271
Cognitive Flexibility	.12	.14	.87	.384	-.152	.391
Accounting Double Degree	.92	.35	2.60	.010	.219	1.615
Age	-.12	.06	-1.86	.066	-.249	.008

Panel B Piece-rate Pay as Base-line Condition

	B	*SE*	*t*	*p*	95% confidence interval for B *Lower*	*Upper*
Intercept	2.40	1.35	1.78	.078	-.272	5.075
Fixed Wage	.95	.45	2.13	.036	.065	1.833
Fixed Wage plus Recognition	.91	.45	2.02	.046	.017	1.795
Training	1.69	.44	3.84	.000	.820	2.568
Fixed Wage*Training	-1.82	.63	-2.91	.004	-3.057	-.579
Fixed Wage plus Recognition*Training	-.63	.63	-.99	.324	-1.884	.628
Prior Experience	1.08	.37	2.91	.004	.346	1.823
Cognitive Ability	.12	.08	1.63	.107	-.027	.271
Cognitive Flexibility	.12	.14	.87	.384	-.152	.391
Accounting Double Degree	.92	.35	2.60	.010	.219	1.615
Age	-.12	.06	-1.86	.066	-.249	.008

Panel C Fixed Wage as Base-line Condition, Training is Reversed Coded					95% confidence interval for *B*	
	B	*SE*	*t*	*p*	*Lower*	*Upper*
Intercept	3.23	1.41	2.28	.024	.424	6.029
Piece-rate Pay	.87	.45	1.92	**.029**	-.028	1.765
Fixed Wage plus Recognition	1.15	.46	2.47	**.008**	.226	2.068
Training[R]	.12	.44	.28	.779	-.751	.999
Piece-rate Pay*Training[R]	-1.82	.63	-2.91	.004	-3.057	-.579
Fixed Wage plus Recognition*Training[R]	-1.19	.64	-1.85	.066	-2.461	.082
Prior Experience	1.08	.37	2.91	.004	.346	1.823
Cognitive Ability	.12	.08	1.63	.107	-.027	.271
Cognitive Flexibility	.12	.14	.87	.384	-.152	.391
Accounting Double Degree	.92	.35	2.60	.010	.219	1.615
Age	-.12	.06	-1.86	.066	-.249	.008

Panel D Piece-rate Pay as Base-line condition, Training is Reverse Coded					95% confidence interval for *B*	
	B	*SE*	*t*	*p*	*Lower*	*Upper*
Intercept	4.10	1.41	2.90	.005	1.293	6.898
Fixed Wage	-.87	.45	-1.92	.057	-1.765	.028
Fixed Wage plus Recognition	.28	.44	0.63	.533	-.603	1.159
Training[R]	-1.69	.44	-3.84	.000	-2.568	-.820
Fixed Wage*Training[R]	1.82	.63	2.91	.004	.579	3.057
Fixed Wage plus Recognition*Training[R]	.63	.63	0.99	.324	-.628	1.884
Prior Experience	1.08	.37	2.91	.004	.346	1.823
Cognitive Ability	.12	.08	1.63	.107	-.027	.271
Cognitive Flexibility	.12	.14	0.87	.384	-.152	.391
Accounting Double Degree	.92	.35	2.60	.010	.219	1.615
Age	-.12	.06	-1.86	.066	-.249	.008

[1] See Appendix F for variable definitions
[2] All p-values are two-tailed except for directional predictions. One-tailed p-values are indicated in **bold**

5.4 The Effects of Creativity Training on Creative Problem-solving Performance

Hypothesis 5 predicts that, in the *Fixed Wage* condition, individuals who receive *Creativity Training* will have higher *Performance* than those who do not receive *Creativity*

Training. Panel A of Table 3 shows that the coefficient on *Training* was insignificant (B = -.12, t = -.28, p = .779) when the *Incentive Scheme* was *Fixed Wage*. This result rejects H5 and suggests that *Creativity Training* may not be effective in some situations.

In Section 3.3, I discuss that training may not be effective if individuals are not motivated to learn and to apply training techniques. In a pilot study with participants (also students from the same university) earning a fixed wage ($15), I found that the GPT helped generate higher performance with the same group of problems (B = .89, t=2.01, one-tailed p = .026). The instrument of that pilot, however, stated "*keep in mind that the way of thinking that you used during the training task might be helpful for you when solving these problems*" and "*keep in mind that these problems are not very easy, so try to do your best and not become discouraged*" to those in the *Creativity Training* and *No Creativity Training* conditions, respectively. These statements were removed from the final instrument due to potential behavioral effects. For example, the statement in the *Creativity Training* condition may remind individuals to use the training techniques, which may supplant the effect of *Performance Incentives*. Also, the statement in the *No Creativity Training* condition might encourage, or even discourage, individuals from exerting effort independently of *Performance Incentives*.[55] In retrospect, it appears that the removal of these statements reduced the effect of *Creativity Training* in the *Fixed Wage* condition.

The lack of a performance difference between the *Creativity Training* and *No Creativity Training* conditions under *Fixed Wage* might have been caused by a lack of

[55] For instance, stating that the problems are not very easy can deflate a person's self-efficacy, leading to lower effort and performance.

willingness to apply what they learned from training. Panel A of Table 1 shows that under *Fixed Wage*, individuals in the *Creativity Training* and *No Creativity Training* conditions spent about the same amount of time on each unsolved problem (239 and 250 seconds, respectively). In my study, *Creativity Training*, unlike *No Creativity Training*, provided individuals with a strategy for processing information. Therefore, even if the individual was not able to reach a solution for a scenario, diligent application of the GPT will have led to more time spent on decomposing the items in that scenario. In contrast, participants not trained to use the GPT may end their search sooner because they will ignore certain items in the scenario such as the tack box in the candle problem. Therefore, the fact that trained and untrained individuals under fixed wage spent equal amounts of time per problem suggests that participants in the training condition were not very motivated to use the GPT. The lack of difference in time spent may not have been caused, however, by lack of recognition of the usefulness of the training technique. A comparison of the *Training Usefulness* variable shows that on a scale of 1 to 5, participants in the *Creativity Training / Fixed Wage* condition rated usefulness as 3.4 (std. dev. = .83) on average, whereas those in the *No Creativity Training/Fixed Wage* condition rated usefulness to be 2.3 (std. dev. = .78) on average; a t-test shows that the difference was significant ($t = 4.59$, $p < .001$; untabulated).[56]

[56] My results also replicate findings by Burroughs et al., (2011) who used a different type of creativity training and found that creativity training had no effects on performance in the absence of any rewards.

5.5 The Interactive Effect of Performance Incentives and Creativity Training on Creative Problem-solving Performance

Hypotheses 6 and 7 predict that *Performance Incentives* will produce higher *Performance* than *Fixed Wage* in the presence of *Creativity Training*. They imply that *Incentive Scheme* will interact with *Training* rather than having a main effect on *Performance*. Regression results in Panel A of Table 3 supported these interaction predictions. Specifically, the interaction between *Piece-rate Pay* and *Training* was positive (B = 1.82, t = 2.91, one-tailed p = .002). Similarly, the interaction between *Fixed Wage plus Recognition* and *Training* was also positive and marginally significant (B = 1.19, t = 1.85, one-tailed p = .033). See Figure 2 for graphs of these interactions.

In order to test Hypotheses 6 and 7 directly, that is, to show that *Performance* increased with the introduction of *Performance Incentives* when *Creativity Training* was provided, I modified the regression from Panel A of Table 3. Specifically, I reverse coded the *Training* variable such that the condition with *Creativity Training* present was coded as 0 and 1 otherwise. This modification allowed me to set the *Creativity Training / Fixed Wage* condition as the baseline and compare the effects of *Performance Incentives*. Panel C of Table 3 shows the results of the regression with *Training* coded in reverse (represented by the variable *Training[R]*). The positive coefficient on *Piece-rate Pay* suggests that *Performance* was higher than *Fixed Wage* (B = .87, t = 1.92, one-tailed p = .029); the positive coefficient on *Fixed Wage plus Recognition* suggests that *Performance* was also higher than *Fixed Wage* (B = .1.15, t = 2.47, one-tailed p = .008). In short, I found support for Hypotheses 6 and 7.

Finally, in response to Research Question 2, I further modified the regression from Panel C of Table 3. I kept the reverse coding of *Training*, and made *Piece-rate Pay* the baseline condition similar to the modification in Panel B of Table 3. With this specification, the coefficient on *Fixed Wage plus Recognition* represents the difference between that and the *Piece-rate Pay* condition in the presence of *Creativity Training*. Panel D of Table 3 shows that this difference was not significant ($B = .28$, $t = 0.63$, $p = .533$). This result suggests that when *Creativity Training* is present, the two types of *Performance Incentives* do not differ in their effect on *Performance*.

5.6 The Mediation of the Conditional Effect of Performance Incentives on Creative Problem-solving Performance

Hypothesis 8 predicts that *Effort Duration* partially mediates the relationships between *Performance Incentives* and *Performance* in the presence of *Training* as hypothesized in Hypothesis 6 and Hypothesis 7. Because the effect of *Performance Incentives* is conditional on *Training*, my analysis needs to test the possibility that the mediation effect is also conditional on *Training*. I assume that skill and effort act as complements, and because training increases skill, effort becomes more positively associated with performance. In particular, *Performance Incentives* result in additional motivation to consciously monitor the problem solving process, thus prolonging work time (*Effort Duration*). Figure 3 presents a process model of this moderated mediation hypothesis. In order to incorporate both a mediator (*Effort Duration*) and a moderator (*Training*) in the test, I used the PROCESS macro for SPSS by Hayes (2013). Further, I combined *Piece-rate Pay* and *Fixed Wage plus Recognition* into one variable, *Performance Incentives*, in order to do a direct comparison with the *Fixed Wage* condition.

As noted earlier in Section 4.5.1, the *Effort Duration* variable was the average time spent on an unsolved problem. Therefore, it is important to note that, in order to incorporate the variable *Effort Duration* into the process model, I had to remove five individuals from my sample because they solved every problem and thus no *Effort Duration* measure could be calculated for these individuals. Four out of the five individuals were from the *Performance Incentives* conditions. Panel A of Table 5 shows the result of the test using the *Performance* as the dependent variable. Consistent with results in Section 5.2, introducing *Performance Incentives* increased *Effort Duration* (time spent on each unsolved problems) by 46 seconds (Table 4 Panel A: link a, p = .004). Each additional second, in turn, increased the number of problems solved by .0041 (approximately one additional problem solved for every four additional minutes) (Table 5 Panel A: link b_1, p = .084). This link is not significant at the 5% level but significant at the 10% level. As discussed in Section 3.4, individuals who did not receive Creativity Training might have been able to locate the problem solution by first exhausting the obvious, but incorrect solutions (mental associations that are common) and then moving onto more remote associations. This strategy is a time-consuming strategy, and my result indicates that each additional minute spent only improves the odds of solving the problems by a very small amount.

Tests of the indirect effect of *Effort Duration* show that when there was no *Creativity Training*, the mediation effect was not significant (Table 5 Panel C: indirect effect = .19, CI = [-.011, .531]). Also, when participants received Creativity Training, the mediating effect of Effort Duration was not significant (Table 5 Panel C: indirect effect = .14, CI=[-.065, .480]). Thus, Hypothesis 8 is not supported (Table 6 Panel D). While the results appear to refute the idea that effort duration is beneficial to creative problem-solving *Performance* in the presence of *Creativity Training*, two data measurement problems must be noted. First, the removal of the top performers from the *Performance Incentive* condition likely weakened the relationship between *Effort Duration* and *Performance*. These individuals probably exerted high effort during the task, or would have spent a long time on the task if they needed to do so. Second, I acknowledge in Chapter 4 that effort has multiple dimensions and, with the exception of *Effort Duration*, cannot be measured with precision in my study. In particular, I was unable to observe the amount of effort participants spent on applying the GPT; if an individual did not use the training, then the individual would only have been as efficient as those who did not receive *Creativity Training*.

The conditional results on the direct effect of *Performance Incentives* on *Performance* suggest that *Creativity Training* also affects effort dimensions other than *Effort Duration*. The direct effect represents the residual impact of *Performance Incentives* after partialling out the effect of *Effort Duration*. I found a negative direct effect, which means that *Performance Incentives* reduced the individuals' number of problems solved by .80 problems (Table 5 Panel A: link c', p = .039). *Training* also influenced the results, i.e., when individuals received *Creativity Training*, the effect was positive but not significant (Table 5 Panel B: Effect = .59, p = .142). These results suggest that, without *Creativity Training*, *Performance Incentives* generate a negative effect on *Performance,* and *Creativity Training* mitigates this problem.

Table 4: Tests of the Moderation of Direct and Indirect Effects Model

Panel A: Regression results [N=115][a]

	Consequent								
	M (Effort Duration)				Y (% of Unknown Problems Solved)				
Antecedent	*Link*	*Coeff.*	*SE*	*p*[b]	*Link*	*Coeff.*	*SE*	*p*
Constant	i_1	245.36	12.53	<.001	i_2	1.713	1.539	.268
X (Performance Incentive)	a	46.34	15.51	.004	c'	-.795	.380	.039
M (Effort Duration)		-----	-----	-----	b_1	.004	.002	.084
V (Creativity Training)					b_2	.068	.881	.939
M x V					b_3	-.001	.003	.749
X x V					b_4	1.381	.540	.012
Covariates:[c]								
Age		-----	-----	-----		-.066	.062	.287
Accounting Double Degree		-----	-----	-----		.839	.338	.015
Prior Experience		-----	-----	-----		.891	.356	.017
Cognitive Ability		-----	-----	-----		.109	.071	.127
Cognitive Flexibility		-----	-----	-----		-.033	.132	.801
		R^2 = .073				R^2 = .304		
		F(1, 113) = 8.93, p = .004				F(10, 104) = 4.54, p < .001		

Panel B: Conditional direct effect of X on Y at values of the moderator

Creativity Training	*Effect*	*SE*	*t*	*p*	*LLCI*[d]	*ULCI*[d]
Absent	-.80	.38	-2.09	.039	-1.549	-.041
Present	.59	.40	1.48	.142	-.199	1.372

Panel C: Conditional indirect effect of X on Y at values of moderator

Creativity Traininng	*Effect*	*Boot SE*	*LLCI*	*ULCI*
Absent	.19	.13	-.011	.531
Present	.14	.13	-.065	.480

Panel D: Test of moderated mediation

Mediator	*Index*	*SE (Boot)*	*Boot LLCI*	*BootULCI*
Effort Duration	-.05	.18	-.407	.284

Note:

[a] Five data points are excluded due to missing data. Effort Duration cannot be calculated for those who answered all questions correctly.

[b] P values are two-tailed.

[c] The covariates were not included in the regression with the mediator, effort duration, as the dependent variable. These individual differences have theoretical links to creativity but not to effort duration. However, results do not change if they are included in the first regression as none are significantly associated with Effort Duration.

[d] The level of confidence for all confidence intervals is 95%. Confidence intervals are calculated from 5000 bootstrapped samples.

5.7 Supplemental Analyses

A proxy for effort direction

Because effort direction is not directly observable, I used a measure, *Efficiency*, to proxy for its effect. *Efficiency* is defined as the amount of time per problem solved. I expect that individuals who shift their focus to applying GPT will reduce the amount of time needed to solve problems in the performance incentive conditions. The descriptive statistics for

Efficiency are shown in Panel A of Table 5. I found that, on average, participants in the *Performance Incentives* conditions spent 1,057 seconds to solve each problem, a number that is higher than the 605 seconds spent per problem by those in the *Fixed Wage* condition. However, with *Creativity Training*, participants in the *Performance Incentive* conditions spent only 758 seconds to solve each problem, a number equal to the time spent by those in the *Fixed Wage* condition. The differences in time spent suggest that those in the *Creativity Training / Performance Incentive* condition work smarter, but not necessarily longer than those in the *No Creativity Training* / *Performance Incentive* condition. An ANOVA showed that there was a partially significant interaction between *Incentive Scheme* and *Training* (F = 2.73, p = .070; not tabulated). In summary, these results suggest that *Creativity Training* allowed the individuals who were incentivized to be more efficient (compared to *Fixed Wage*) than the individuals without training.

Table 5: Descriptive Statistics of Process Variables

Panel A: Means (SD) of Efficiency [a]

	Incentive Scheme		
	Fixed Wage	*Piece-rate Pay*	*Fixed Wage plus Recognition*
No Creativity Training	605.14	1127.06	986.49
	(298.19)	(535.20)	(518.88)
Creativity Training	758.34	866.14	651.60
	(601.23)	(651.46)	(364.94)

Panel B: Means (SD) of Interest

	Incentive Scheme		
	Fixed Wage	*Piece-rate Pay*	*Fixed Wage plus Recognition*
No Creativity Training	4.00	3.90	4.21
	(.78)	(.85)	(.50)
Creativity Training	3.95	4.18	4.10
	(.59)	(.75)	(.68)

[a] See Appendix F for variable definitions

Intrinsic motivation

I explore the possibility that the drop in *Performance* observed in the *Piece-rate Pay / No Creativity Training* condition was caused by a drop in intrinsic motivation rather than as a result of performance pressure. According to the over-justification hypothesis, individuals who initially like a task may find the task less likeable after being told that they will be paid for doing the task (Fessler, 2003; Lepper, Greene, & Nisbett, 1973). This hypothesis relies on the assumption that individuals think more interesting tasks can be done for no pay and compensated tasks are less interesting. In other words, intrinsic motivation can be crowded out by the external rewards, and the lack of intrinsic motivation can reduce the person's ability to be creative (Amabile, Hennessey, & Grossman, 1986; Frey & Jegen, 2001). I measured *Interest* by asking participants to rate how interesting the task was using three 7-point Likert-scaled questions (see questions 8 to 10 in Appendix E). If *Performance Incentives* reduce the attractiveness of the task, participants in the *Performance Incentive* condition will rate the task as less interesting than those in the *Fixed Wage* condition. The three questions were averaged to create a single measure after factor analysis produced one factor with high reliability (Cronbach's $\alpha = .82$). Panel B of Table 5 presents the descriptive statistics for *Interest*. ANOVA revealed no statistical difference in *Interest* between any of the three *Incentive Scheme* conditions in either *Training* conditions, suggesting that the difference in *Performance* between *Piece-rate Pay* and *Fixed Wage* conditions cannot be attributed to participants having lower intrinsic motivation. This result suggests that, in my setting, *Performance Incentives* did not crowd out intrinsic motivation.[57] By ruling out the crowding out explanation, it is likely that the decrease in *Performance* was due to participants experiencing performance pressure.

The nature of the interaction between performance incentives and creativity skills

In section 5.5, I show that individuals who receive performance incentive and creativity training outperform those who receive fixed wage and creativity training. In this section, I investigate whether performance incentives only interact with the skill provided in my training module or also with skills participants already have (e.g., participants may have acquired skills outside the study). This analysis can help to provide corroborating evidence of my theory and improve the generalizability of my results. To generate this evidence, I interacted the variables *Cognitive Ability* and *Cognitive Flexibility* with the incentive variables *Piece-rate Pay* and *Fixed Wage plus Recognition*, and appended the interaction terms, in pairs, to the regression model used in Panel A of Table 3.

[57] The average intrinsic motivation is 4.06 out of 5, suggesting most participants thought that the problems were quite interesting.

Table 6: The Interaction of Performance Incentives with Individual Differences in Creativity Skills

Panel A: Interacting Performance Incentives with Cognitive Ability

	B	SE	t	p
Intercept	4.31	1.29	3.33	.001
Piece-rate Pay	-.94	.46	-2.05	.043
Fixed Wage plus Recognition	-.05	.46	-.10	.918
Training	-.10	.45	-.22	.824
Cognitive Ability	.17	.24	.70	.483
Piece-rate Pay*Training	1.81	.64	2.83	.006
Fixed Wage plus Recognition*Training	1.17	.65	1.79	.076
Piece-rate Pay*Cognitive Ability	-.02	.32	-.06	.951
Fixed Wage plus Recognition*Cognitive Ability	.15	.33	.45	.656
Prior Experience	1.07	.38	2.83	.006
Cognitive Flexibility	.13	.14	.94	.350
Accounting Double Degree	.90	.36	2.52	.013
Age	-.12	.07	-1.79	.076

Panel B: Interacting Performance Incentives with Cognitive Flexibility

	B	SE	t	p
Intercept	4.42	1.30	3.39	.001
Piece-rate Pay	-.96	.44	-2.17	.033
Fixed Wage plus Recognition	-.02	.44	-.04	.971
Training	-.30	.44	-.68	.498
Cognitive Flexibility	-.31	.24	-1.31	.194
Piece-rate Pay*Training	2.00	.62	3.21	.002
Fixed Wage plus Recognition*Training	1.19	.64	1.84	.068
Piece-rate Pay*Cognitive Flexibility	.61	.34	1.80	.075
Fixed Wage plus Recognition*Cognitive Flexibility	.63	.32	1.96	.053
Prior Experience	1.08	.37	2.91	.004
Cognitive Ability	.20	.13	1.58	.118
Accounting Double Degree	.90	.35	2.57	.012
Age	-.12	.07	-1.82	.071

[1] See Appendix F for variable definitions
[2] Cognitive Ability and Cognitive Flexibility are standardized to avoid multi-collinearity issues that may arise from creating interaction terms using continuous variables

Panel A of Table 6 shows that the interaction between *Cognitive Ability* and *Piece-rate Pay* is not significant (Panel A, Table 6; B = -.02, t = -.06, p = 951) and neither is the interaction between *Cognitive Ability* and *Fixed Wage plus Recognition* (Panel A, Table 6; B = .15, t=.33, p = .656). In contrast, I find significant interactions between *Cognitive Flexibility* and *Piece-rate Pay* (Panel B, Table 6; B = .61, t = 1.80, p = .075) and between *Cognitive Flexibility* and *Fixed Wage plus Recognition* (Panel B, Table 6; B = .63, t = 1.96, p = .053). These results show that performance incentives interact with only certain type of skills.[58] Recall that *Cognitive Ability* is measured as general intelligence using a vocabulary test, whereas *Cognitive Flexibility* is measured as the ability to do remote association problems, a common measure of people's ability to achieve insight. Hence, these results suggest that performance incentives are complementary to higher creativity insight skills, but not higher general intelligence. More importantly, the fact that I find positive interactions between performance incentive variables and *Cognitive Flexibility* suggests that my findings generalize beyond the type of training I provided. The caveat to my result is that if the training does not focus on creativity skills, the results would be different. Finally, my main results are robust to these changes in model specifications.

[58] I also interacted the performance incentive variables with *Accounting Double Degree*, which is significantly positively associated with higher performance. However, there are only 19 participants (out of 120) who are enrolled in accounting double degree programs and the number of individuals falling into either *Piece-rate Pay* and *Fixed Wage plus Recognition* conditions are even smaller (6 and 4 participants respectively). As a result of such uneven cell sizes, the results are difficult to interpret. The results of that regression show no significant interactions for these variables.

5.8 Conclusion

This chapter provides results for my hypotheses and research questions. Table 7 provides a list of the hypotheses and results. Hypotheses 1 and 2 consider the effects of *Incentive Scheme* on *Effort Duration*. Consistent with both hypotheses, I found that *Piece-rate Pay* and *Fixed Wage plus Recognition* motivated individuals to spend more time on the problem solving task. Hypotheses 3 and 4 and Research Question 1 consider how *Incentive Scheme* affects creativity problem solving performance. Consistent with my expectations, neither *Piece-rate Pay* nor *Fixed Wage plus Recognition* produced higher *Performance* than *Fixed Wage* in the absence of *Creativity Training*. I also found that the *Fixed Wage plus Recognition* condition had higher *Performance* than the *Piece-rate Pay condition* in the absence of *Creativity Training.* Hypothesis 5 tests whether *Creativity Training* produces higher *Performance* than *No Creativity Training* under *Fixed Wage*. Contrary to expectations, *Creativity Training* did not produce higher *Performance* under *Fixed Wage*.

Hypotheses 6 and 7 and Research Question 2 explore whether *Performance Incentive* increase performance more with *Creativity Training* than with *No Creativity Training.* I found that both *Piece-rate Pay* and *Fixed Wage plus Recognition* positively interacted with *Creativity Training* such that performance was higher in these two *Performance Incentives* conditions than in the *Fixed Wage* condition when *Creativity Training* was present. However, there were no *Performance* differences between the two *Performance Incentive* conditions in the presence of *Creativity Training*. Finally Hypotheses 8 examines whether *Effort Duration* plays a mediating role in the relationship between *Performance Incentives* and *Performance,* and whether *Training* moderates the indirect relationship. I found a marginally significant indirect effect through *Effort Duration,* but found no evidence that this indirect effort was conditional on the type of *Training*. It appears that *Training* impacted the direct relationship between *Performance Incentives* and *Performance* more than it impacted the indirect relationship. However, due to the difficulty of measuring other effort related variables, the significant direct relationship may, in fact, represent one or more mediated relationships that cannot be tested in this study.

Table 7: Summary of Hypotheses Testing

Hypothesis	**Result**
H1: Individuals receiving piece-rate pay contingent on creative problem-solving performance will exert higher effort by working longer on the task than individuals receiving fixed wages alone.	Supported
H2: Individuals receiving recognition in addition to fixed wage will exert higher effort by working longer on the task than those receiving fixed pay alone.	Supported
H3: Despite working on the task for longer, individuals receiving piece-rate pay will not have higher performance on the creative problem-solving task than those receiving fixed wages alone.	Supported
H4: Despite working on the task for longer, individuals receiving fixed wage plus recognition will not have higher performance on the creative problem-solving task than those receiving fixed wages alone.	Supported
H5: Individuals who receive GPT training will have higher problem-solving performance than individuals who do not receive GPT training.	Not Supported
H6: In the presence of creativity training, those receiving piece-rate pay will have higher creative problem-solving performance than those receiving fixed wage alone.	Supported
H7: In the presence of creativity training, those receiving fixed wage plus recognition will have higher creative problem-solving performance than those receiving fixed wage alone.	Supported
H8: In the presence of creativity training, those receiving performance incentives (piece-rate pay, recognition) will have higher creative performance than those receiving a fixed wage, and this effect is partially mediated by effort duration on the task.	Not Supported

Chapter 6 Conclusion

6.1 Introduction

In Section 6.2 of this chapter, I discuss the results of hypotheses and research question testing. In Section 6.3, I discuss limitations of this study and explore opportunities for future research. Finally, I conclude in Section 6.4.

6.2 Discussion of Hypotheses Testing and Research Question Results

This study examined the interactive effects of incentive scheme (fixed wage, piece-rate pay, or fixed wage plus recognition) and training (creativity training or no creativity training) on effort duration and performance on a creative problem-solving task. I found that, compared to fixed wage, piece-rate pay and fixed wage plus recognition led to higher effort duration regardless of training. However, effort duration was not different between the two performance incentive conditions. These results are consistent with the prediction that tying rewards to performance increases the instrumentality of the performance goal, and therefore motivates greater effort from individuals. My results also suggest that recognition rewards can be effective tools to increase motivation, because individuals care about how they perform in comparison to their peers.

I found that, when creativity training was not provided, performance incentives failed to increase individuals' performance despite increases in their effort duration. The lack of positive results is consistent with the theory suggesting that incentives produce performance pressure which blocks creative thinking. Once individuals received creativity training, performance incentives had a positive effect on performance as individuals from the piece-rate pay and fixed wage plus recognition conditions enjoyed superior results relative to those receiving only fixed wage. Creativity training did not have a positive effect on its own. However, creativity training mitigated the negative effect of performance pressure caused by incentives. Supplemental analysis showed that individuals who received both performance incentives and creativity training were more efficient (spent less time per problem solved) than those who received performance incentives but no creativity training, suggesting that creativity training enables incentivized individuals to work smarter.

Tests of the indirect effects offer a more nuanced explanation of my results. In particular, higher effort duration was marginally positively related to higher performance, but the effect was small. In other words, significant time was needed to obtain only an incremental increase in performance. When this positive indirect effect was balanced against the negative direct effect of performance incentive on performance, the net effect was negative, as shown in the piece-rate pay / no creativity training condition. Contrary to my predictions, I did not find the indirect effect of effort duration on performance to be more positive with creativity training than without, suggesting that the interactive effect between performance incentives and creativity training may flow throw mediators other than effort duration.

6.3 Limitations and Opportunities for Future Research

Like all studies, this study is subject to limitations that provide opportunities for future research. First, my application of economic and psychology theory generalizes only to the extent that my manipulations and creative-problem solving task capture important elements of the work of knowledge workers in real life. In order to design an internally valid study, I abstracted from practice. For example, the insight problems used were considerably less complex than problems faced by real designers and consultants, although the reduced complexity was balanced with a reduction in time allowed to solve the problems. In order to test the robustness of my results, future research can investigate other types of creative problem-solving tasks, which will require different creativity training programs. As discussed, the insight problems I used gave me a clean measure of creative problem-solving performance but may not represent all aspects of creativity. In particular, the constraints designed into the problems reduced the number of possible outcomes and made the best solutions easier to identify. Although I believe that the insight problems in this study could proxy for the problems faced by real organizations because organizations almost always face constraints, and that adapting the solution to the constraints is considered creative, my task and results may not generalize to fields where being *different* is a key consideration, e.g., fine arts and literature.

Second, this study does not include performance feedback. In organizations, employees often seek and receive feedback in order to improve their performance; therefore, it is conceivable that feedback seeking behavior may moderate the effect of performance incentives (de Stobbeleir, Ashford, & Buyens, 2011). McCaffrey's (2012) study showed that paired with feedback, GPT training helped individuals solve 70% to 80% of the problems, a level much higher than what participants in my study achieved. More feedback may also elucidate the relationship of self-set goals and performance, which my study could not do.

Hence, future research can introduce feedback, even if in the form of imprecise feedback from co-workers.

Third, this study does not examine the potential synergistic effect of piece-rate pay plus public recognition on relative performance. Prior research (e.g., Tafkov 2013) shows that performance-based pay moderates the effect of RPI because individuals believe that, under such settings, performance information will be the most accurate and, as a result, expend more effort than when receiving piece-rate pay or recognition alone. Hence, one might expect that creative problem-solving performance will be even higher if recognition is combined with piece-rate pay. The combination of monetary and recognition-based incentives may be very attractive to employees and cause them to exert greater effort. However, as the process model results in Section 5.6 show, the positive effect of effort duration on performance is significant, but weak. As such, combining recognition and piece-rate pay may not generate results superior to those generated by than either performance incentive alone. For future research, it would also be useful to compare the effects of recognition with full public RPI as operationalized in Tafkov (2013) and Hannan et al. (2012). If performance pressure truly hurt performance in a setting without training, public RPI would generate lower performance than recognition.

Fourth, participants were introduced to their incentive schemes before they received their training. This design choice was made to reflect real life situations in which employees almost always know their compensation scheme prior to starting work. Nonetheless, the consequences of using this design raises the possibility that the performance increase found in my study could have been caused by greater attention being paid to the training program and better skill development. Examination of time spent on training suggests that incentivized individuals did work harder on the training program by spending more time, but I am unable to measure the amount of learning that occurred during training. Therefore, future research could explore whether incentives introduced after training lead to higher performance. Also, future research could examine whether incentivizing training improves performance in a post-training task which is not incentivized.

As a new research question, one might investigate whether offering recognition rather than piece-rate pay is better for attracting employees. In my study, individuals were not allowed to choose their incentive schemes, but prior research shows that individuals sometimes made inaccurate predictions about their creative abilities; individuals who opted for less risky incentive schemes nevertheless did as well in a creative task as those who picked the creativity-based performance incentive (Kachelmeier & Williamson, 2010). Hence, offering recognition on top of fixed wage may also help attract capable but risk-averse individuals who may balk at piece-rate pay because the minimum guaranteed amount, if any, does not meet their reservation wages.

6.4 Conclusion

Notwithstanding the limitations, I believe my study makes a valuable contribution to the incentive contracting and creativity literatures. First, today's knowledge-based economy has increased the need for creative solutions to organizational problems (Forrester, 2014; IBM, 2010). Incentive compensation remains one of the important and popular tools managers can use to motivate employees, but the relationship between performance incentives and creativity is not well-understood (Burroughs et al., 2011; Kachelmeier et al., 2014; Shalley & Gilson, 2004). My findings highlight the importance of motivating higher effort using incentives but, at the same time, the need to minimize performance pressure because people under pressure often direct their effort toward uncreative (and unproductive) processes.

Confronted with the difficulty of using performance incentives to generate high creative performance, organizations can provide creativity training to help employees develop relevant creative problem-solving skills. This study is the first to show that, compared with those receiving fixed pay, individuals respond to performance incentives and use what they learn from training to greater extent and achieve greater results. Although both groups received the same training, there are significant differences in final performance. My results also show that organizations that wish to reward creative performance may use non-monetary rewards such as recognition to motivate individuals. In the presence of creativity training, recognition increases performance just as much as piece-rate pay does as compared with fixed wage. Given that I used a fairly basic type of recognition, it is possible that recognition in practice may offer even greater motivational powers than piece-rate pay. Per my results, training alone was not sufficient to lead to higher performance. I interpret this result to mean that employees need sufficient motivation to apply training techniques. In conclusion, for “hard-to-incentivize” creative activities, it is important to provide both performance incentives and creativity training to help employees achieve high performance.

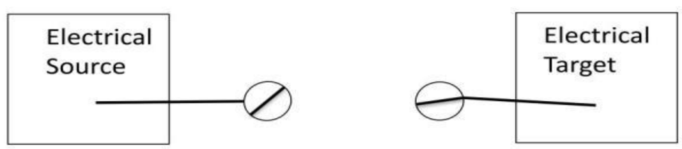
Appendices

Appendix A: Insight Problems Used and Solutions

Practice Problem – Circuit Problem

Circuit Problem

You need to connect the line of electricity from an electrical source to an electrical target, which are un-movable, as shown in the diagram below. One 3-inch (7.62 cm) wire is fused to the electrical source. Another 3-inch wire is fused to the electrical target. The ends of the wires were screwed into a wooden table in your workshop by a screwdriver, which you still possess. You are missing the 3-inch wire that should connect the two screws. You also have a plastic ruler and a metal thumb tack, but have access to nothing else. How can you bridge the gap between the two screws so that when the electrical source is activated the electricity will flow to the target?



Solution: Use the metal part (most likely to be steel) of the screwdriver to complete the circuit

Remunerated Test Problems

Watch Problem

You own a wristwatch with a leather band. You are in an empty room and you need to open the battery case on the back of the watch, which is secured with a small screw. You do not want to damage the watch. You cannot leave the room and no one can bring you anything. Your fingernail is not strong enough to turn the screw. How do you do it?

Solution: the rectangular metal piece on the watch buckle can serve as a screwdriver

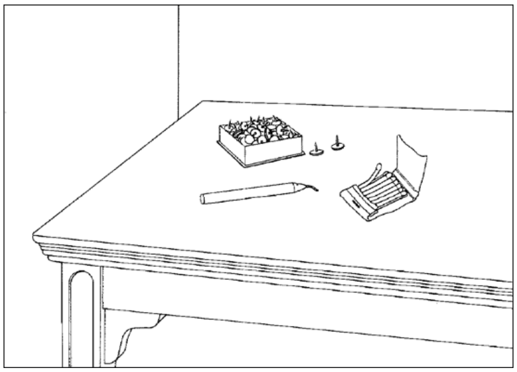
Stuck Truck Problem

A truck driver was driving his delivery truck under an overpass when suddenly he came to a screeching halt. He wasn't paying attention and inadvertently drove under the overpass that was just barely as high as his truck. The truck top was wedged so tightly that he could not go forward or backward. Without damaging either the top of the truck or the overpass in any way, how can he get his truck unstuck all by himself so he can drive away? You may assume the truck is a standard transport truck that consists of a tractor and a trailer.

Solution: the driver can deflate the tires and drive out slowly

Candle Problem (Duncker 1945)

Sitting on a table are a candle, a box of tacks, and a book of matches. You must attach the candle to the wall so that it can burn upright and won't drip wax onto the table. How would you solve the problem?



Solution: Empty the box of tacks, tack the box on the wall, and place the candle in the box

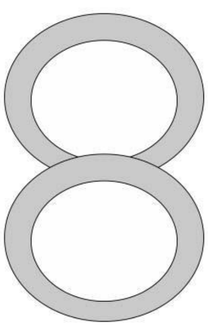
Tower Problem

You are locked in an empty room with an open window that is at the top of a tower that is 100 feet tall. You have a 60 foot rope. How can you escape the tower without severely injuring yourself by falling the final 40 feet?

Solution: the rope is made up of multiple strands, untangle the strands and make a 120 foot rope and use it to escape the tower.

Rings Problem

You need to connect two rings together in the configuration in the diagram below so that when you grab the top ring and lift it up, the bottom ring will follow. Each ring weighs 3 pounds, is 6 inches (15.24 cm) in diameter, and is made of solid gold. You do not want to damage the rings. You have a long, thin candle, a strike anywhere match, and a 2 inch (5 cm) cubic block of steel. How can you connect the two rings?



Solution: The wick inside the candle is also a long string. Shave the wax from the candle using the steel cube, and then use the string to tie the rings together

Desk Lamp Problem

For some bizarre reason, a desk lamp is screwed to the wall by its base. You need to remove the lamp from the wall without damaging either the wall or the lamp. The room is empty, except for you – and your pockets are empty. You cannot leave the room and no one can bring you anything. How can you remove the lamp from the wall?

Solution: the prongs on the lamp’s electrical socket plug can be used to loosen the screw

Appendix B: Training Instructions

Generic Parts Technique Training Materials *(Adapted from McCaffrey 2011)*

Objective

The objective of the following exercise is getting you to learn the Generic Parts Technique (GPT). The GPT is designed to help people decompose a common object into its "raw" components. After learning this technique, people will be more able to recognize things for *what they are*, rather than what *they are made to be*; as a result, people can solve problems even when they do not have all the tools. In other words, the GPT can increase people's resourcefulness.

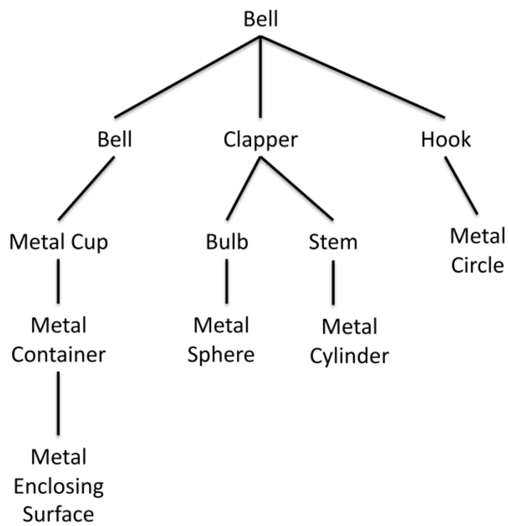
GPT, in its simplest form, involves asking yourself two questions:

1. Can I decompose this further into components?
2. Does my description imply a use? If so, continue decomposing by creating a generic description using words that only speak to physical attributes, such as <u>shape</u> and <u>material</u>.

Consider the example of a bell

Bell

Using a tree diagram, the bell can be broken down to its raw components in the following way:



For commonly known objects, people often start the process by listing the various components according to their uses. For example, the bell body, the hook which is designed to hang the bell, and the clapper which is designed to swing inside and strike the bell. The clapper can be further decomposed into the bulb and the stem.

However, describing the components by their original uses implies that they can be used to do only one thing (e.g., the bell makes sound when struck). Our goal is to recognize the objects for what they are so that the objects can serve multiple purposes. Therefore, further generalizing is necessary.

The bell may be described as a 'metal cup' which suggests that it can also hold liquids. But the word 'cup' still implies a use.

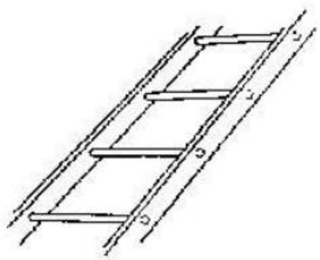
Next, we can describe the metal cup as a 'metal enclosing surface'. This new term does not imply an immediate use because it describes the shape of the object and its materials. However, recognize that this generic description is very useful because it allows us to think about a large number of potential uses such as to trap insects because it is an enclosure, or to hide small objects because it is opaque.

Similar to the bell, the clapper is made up of a bulb and stem, but in the truest form they are a metal sphere and a metal cylinder attached to each other, the most common of objects. Along the same vein, the hook is a metal circle. You should aim for this level of generalization when learning to apply the GPT.

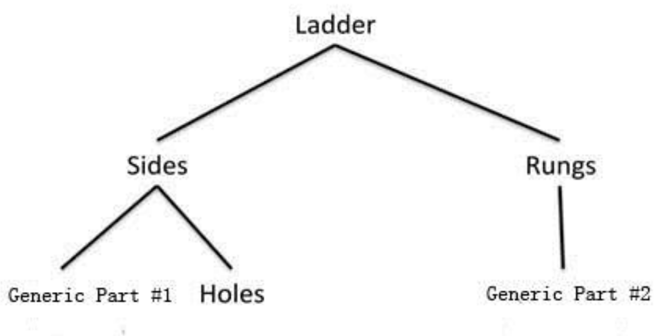
Practice Items: Exercise 1

For the object below, fill in the missing parts in the tree diagram. For each component, ask yourself "Does this part name imply a use?" That is, does it have a use associated with it?

Ladder

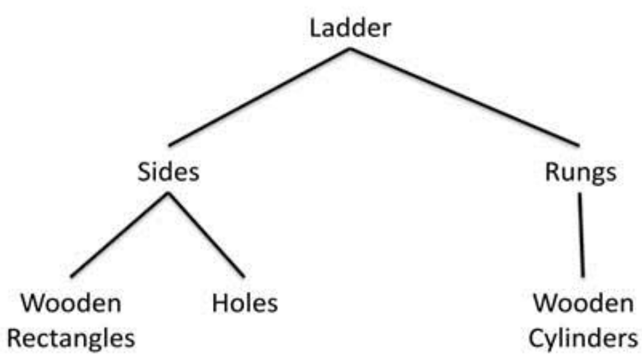


[Participants fill in the missing parts in the text boxes given]



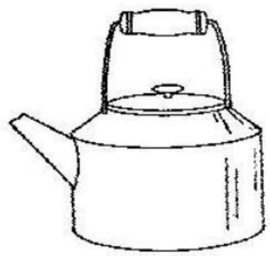
Solution:

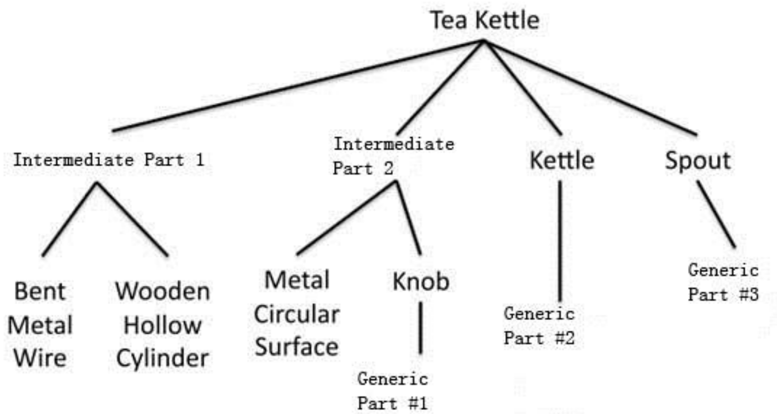
Did you describe the components in terms of uses or shapes and materials? Notice that at the bottom of the tree, <u>the descriptions do not imply uses</u>.



Practice Items: Exercise 2

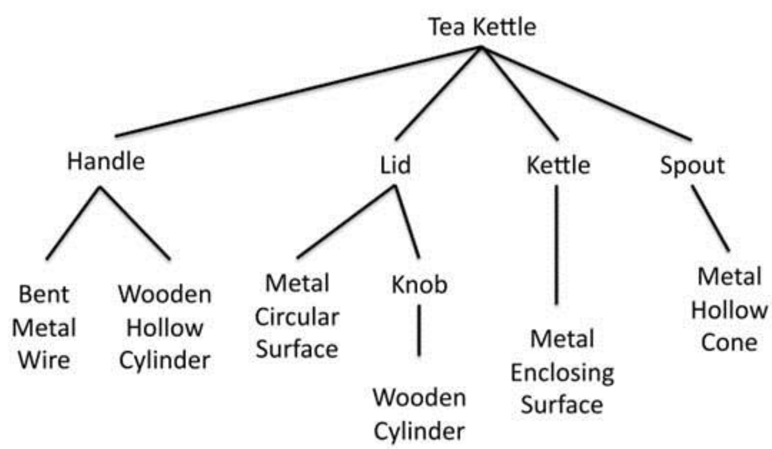
Kettle





[Participants fill in the missing parts in the text boxes given]

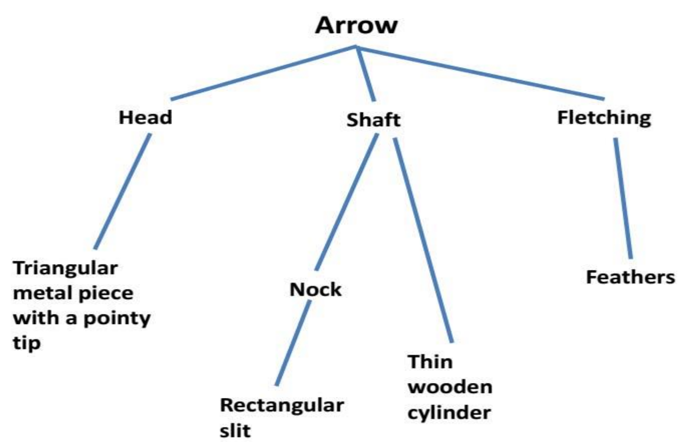
Solution:



Practice Items: Exercise 3

Arrow

[Unlike in Exercise 1 and 2, this exercise required the participants to create a complete tree diagram. They are given five textboxes]



Word Association Task

You will now complete a free word association task. There are 150 stimulus words presented on two pages (75 words on each page). Each word is followed by a blank textbox for your response. After reading each word, please type the very first word that comes into your mind in the adjacent textbox. There are no right or wrong answers; we are only interested in your first response.

This is a timed task. You will have 5 minutes to type your responses to the 75 words on each of the two pages. That is 4 seconds maximum per stimulus word. Begin with the first word and proceed down the list in order. Use only a single word for each response. Try not to skip any words. Work **<u>quickly</u>** until you have finished both pages.

Below is a screenshot of the task:

After reading the word on the left, please type the first word you think of in the adjacent box. Use the 'Tab' key to advance to the next word

Flower	
Dark	
Music	
Sickness	
Man	
Deep	
Soft	
Eating	
Mountain	
House	
Black	
Button	
Comfort	
Hand	
Short	

Appendix C: Task Instructions and User Interface

Tasks Instructions

Your Task: Solve 6 Main Problems

You will now attempt to solve 6 problems.

Listed below are the task instructions. It is **critically important** that you pay attention to these points:

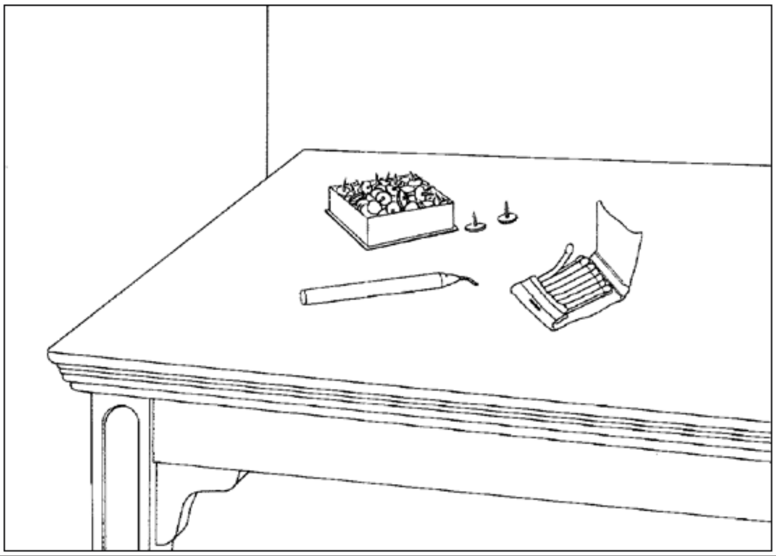
1. **Integrity**: please help me maintain the integrity of the data by independently completing this task
2. **Real-world objects:** The objects described in each problem are common real-world objects. You may assume that they possess the same properties as in real life.
3. **Outside objects:** Please **do not** attempt to solve the problems using objects outside of those described (in text or in pictures). If you solve a problem using objects that are not described in the problem (e.g., clothing, objects in your pockets, jewelry, etc.), then that solution will not count.
4. **Time limit:** You will have a maximum of **7 minutes** to solve each problem. However, if you quickly find a solution to a problem or you want to give up on a problem, then you may advance to the next problem before the 7 minutes are up. If you advance to the next problem before the 7 minutes are up, you will NOT be able to come back to the problem later.
5. **Solutions:** During the 7 minutes for each problem, write down all plausible solutions you can think off, up to 5 different solutions can be submitted. We will examine all ideas and only select the best idea from your entry. You should be able to describe each idea in one sentence; therefore, you are limited to 150 characters per space.
6. **Assumptions:** Please **do not** make many assumptions. If you find yourself making many assumptions or if your solution is very difficult to describe, then it is highly likely that you are going down the wrong path.

Click next when you are ready to start. You will be reminded of these instructions at the beginning of each problem.

User Interface

06 48

Sitting on a table are a candle, a box of tacks, and a book of matches. You must attach the candle to the wall so that it can burn upright and won't drip wax onto the table. How would you solve the problem?



Solution 1

Solution 2

Solution 3

Solution 4

Solution 5

Next

Appendix D: Instructions about Incentive Schemes

Fixed pay condition

Your task in this study is to solve 6 problems. Your total pay **will not be** based on how many problems you solve. You are guaranteed to receive $15 (including a $6 show up fee) regardless of whether you complete your task. You will be paid the amount you earn within the next two weeks.

Piece-rate pay condition

Your task in this study is to solve 6 problems. Your total pay **will be** based on how many problems you solve. You are guaranteed to receive a $6 show up fee regardless of whether you complete your task. If you complete your task, you will be paid an additional $3 for each problem solved for a maximum total of $24 ($6 show up fee and $18 for solving all six problems) and a minimum total of $6 ($6 show up fee and $0 for solving none of the six problems). You will be paid the amount you earned within the next two weeks.

Fixed pay plus recognition condition

Your task in this study is to solve 6 problems. Your total pay **will not be** based on how many problems you solve. You are guaranteed to receive $15 (including a $6 show up fee) regardless of whether you complete your task. You will be paid the amount you earn within the next two weeks.

In addition to receiving your payment, you will receive an email that will be sent out to everyone who participated in the same condition of the study as you did. The email will congratulate the **top five** performers (out of twenty) who solved the most problems. The name, academic program, and the scores of these top performers will be included in the email (as long as the top performers allow their names to be made available in the email). In addition to the information regarding top performers, **everyone will also receive their own performance scores**. Below is a sample of what the email will look like.

> To: Your name
>
> Date: Friday, November 12, 2014
>
> Topic: Top Performers on Project: Determinants of Creative Problem Solving
>
> Dear participants,
>
> I wish to congratulate the following individuals who solved the greatest number of problems among 20 of their peers. Their performance is a strong indicator of their outstanding problem solving ability, creativity, and hard work.

- Individual A, academic program, # of problems solved
- Individual B, academic program, # of problems solved
- Individual C, academic program, # of problems solved
- Individual D, academic program, # of problems solved
- Individual E, academic program, # of problems solved

In comparison to the top performers, you solved # of problems.

Thank you for participating in this study.

Sincerely,

Appendix E: Questionnaires

Pre-task questions

Before you attempt the main problems, please answer the following questions.

1) Please rate how confident you are that you can solve the problems (similar to the circuit problem you just completed) at each of the levels described below:

Rate your degree of confidence by recording a number from 0 to 100 where:

0 represents "cannot do at all", 50 represents "moderately can do", and 100 represents "highly certain can do"

	Confidence (0-100)
I can solve at least 1 of the 6 problems	______
I can solve at least 2 of the 6 problems	______
I can solve at least 3 of the 6 problems	______
I can solve at least 4 of the 6 problems	______
I can solve at least 5 of the 6 problems	______
I can solve all 6 problems	______

2) Please set a goal for the number of problems you commit to solving by selecting a number from 0 to 6. [Participants are provided with a drop-menu with these 6 choices].

[Participants answer these questions on 5-point Likert scales]

3) Please select your level of agreement to the following statements

1. I am strongly committed to pursuing this problem-solving goal.
2. Quite frankly, I don't care if I achieve this problem-solving goal.
3. Since it's not always possible to tell how tough the problems will be until you have seen them, it's hard to take this goal seriously.
4. I think this problem solving goal is a good goal to shoot for.

Post-experiment questionnaire:

Questions 1 to 3 measure the perceived usefulness of the training exercise on 5-point Likert Scales

1. The training exercise was relevant to the problems assigned to me.
2. The training materials could be immediately applied to the problems assigned to me.
3. The exercise from the training program helped me to solve the assigned problems.

Questions 4 to 6 are exclusive to the GPT training condition and measure motivation to transfer training on 5-point Likert Scales

4. I used what I learned from the Generic Parts Technique (GPT) when attempting to solve the problems assigned to me.
5. I applied the GPT by actually drawing tree diagrams for each problem.
6. I applied the GPT by decomposing the objects described in each problem into smaller parts.

Question 7 is a self-assessment of effort

7. Please rate the level of effort you applied towards attempting to solve each of the 6 problems. [participants use a slider from 0 to 100 to rate their effort. 0 = did not work hard at all, 100 = worked as hard as I possibly could]

Questions 8 to 10 measure the intrinsic interest on 7-point Likert scales using relevant questions taken from the Intrinsic Motivation Inventory (www.selfdeterminationtheory.org)

8. I very much enjoyed working on this problem-solving task.
9. This problem-solving task is fun.
10. This problem-solving task is very interesting.

Appendix F: Variable Definitions

Accounting Double Degree - a dichotomous variable with 1 representing students who are enrolled in another major in addition to accounting and 0 otherwise.

Cognitive Ability - The score (between 0 - 12) on the WordSum task which tests participants' vocabulary.

Cognitive Flexibility - The score (between 0-3) on the remote associations test.

Effort Duration - The number of seconds each person spent on average on problems they did not successfully solve. Because each problem has a time limit of 7 minutes, the maximum allowed time is 2,520 seconds.

Incentive Scheme – Incentives are manipulated at three levels. Participants either receive fixed pay, piece-rate pay, or fixed wage + recognition.

> **Fixed Wage** – Coded as 1 if participant receive only $15 fixed payment, 0 otherwise.
>
> **Piece-rate Pay** – Coded as 1 if participants receive the piece-rate rate of $3 per problem solved plus $6 walk-in fee, 0 otherwise. The minimum pay in this condition is $6, the maximum is $24.
>
> **Fixed Wage plus Recognition** – Code as 1 if participants have the ability to receive recognition for high performance (top quartile) in addition to $15 fixed wage, 0 otherwise.

Performance – Represents creative problem-solving performance and is measured as the number of problems (out of six) solved by the participant.

Percentage of Unknown Problems Solved or **[Percentage]** – An alternate form of performance that removes the effect of prior experience with the problems in the task. It is calculated by (Number of problems solved - number of problems known before the experiment) / (6 - Number of problems known before the experiment).

Prior Experience - Measures the number of instances where the participant has previously seen the problem at hand and remembers the solution.

Training Usefulness – An aggregate measure of the perceived relevance and usefulness of the training exercise. This measure averages Questions 1 to 3 in the post-experiment questionnaire (Appendix E)

Figures

Figure 1 Experimental Design and Flowchart

Panel A: Table of Experimental Conditions

Performance Incentive[1] / Creativity Training[2]	Fixed Wage Only	Piece-rate Pay	Fixed Wage plus Recognition
Absent	A	B	C
Present	D	E	F

---

1 Participants are rewarded in one of three ways. First, a fixed wage is earned as long as the participant takes part in the task, but no bonuses are provided. This condition serves as baseline for the other conditions. Second, a piece-rate is paid, in which participants make a smaller fixed wage and are eligible for production bonuses. Third, participants earn a fixed wage similar to the fixed wage only condition, but compete with other participants for an opportunity to be recognized for high performance, which is determined by the number of problems solved. Recognition is reserved for the top quartile of participants in the same condition.

2 Participants either receive creativity training or complete an exercise that takes the same time as creativity training but does not improve creativity skills.

Panel B: Flowchart of Experimental Procedure

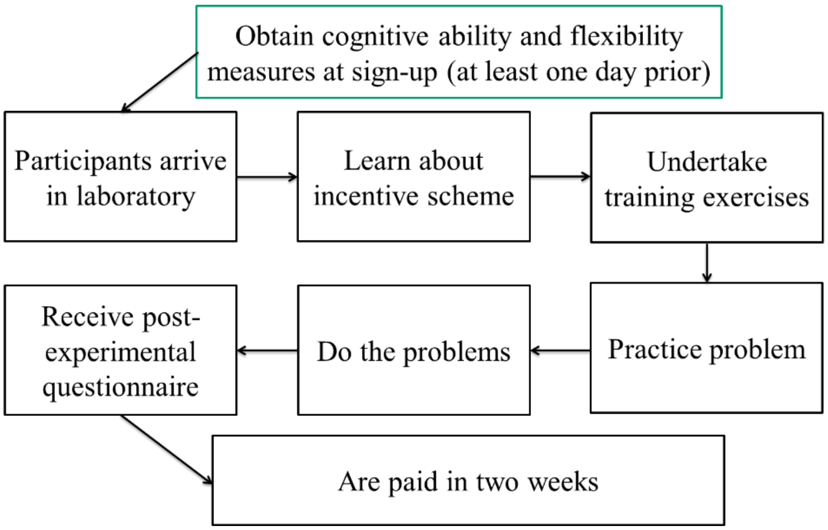
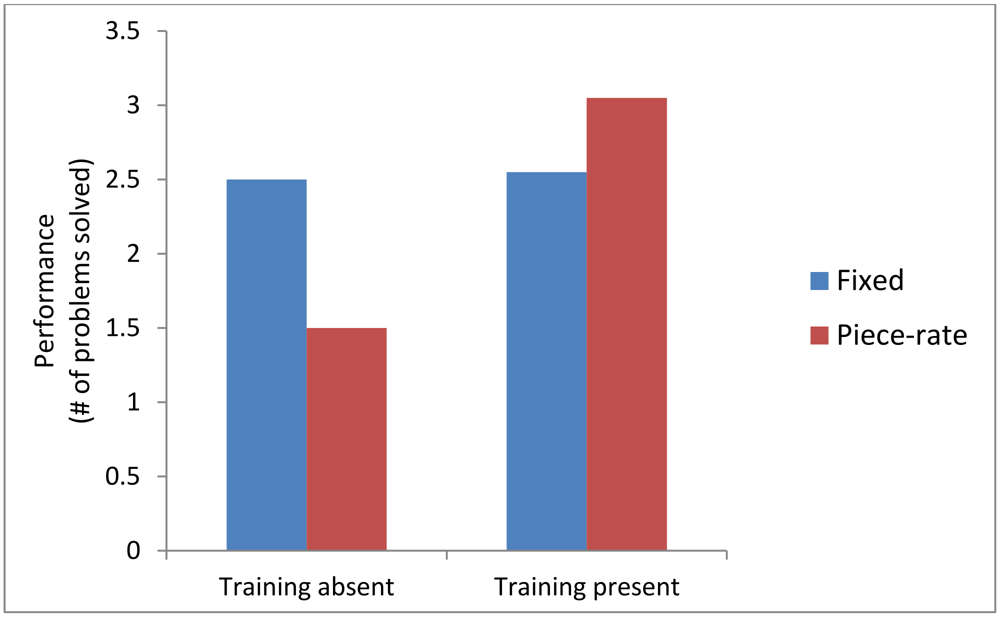


Figure 2 The Effects of Incentive Scheme and Creativity Training on Performance

Panel A: Comparing Fixed Wage and Piece-rate Pay (n = 80)



Panel B: Comparing Fixed Wage and Fixed Wage plus Recognition (n = 80)

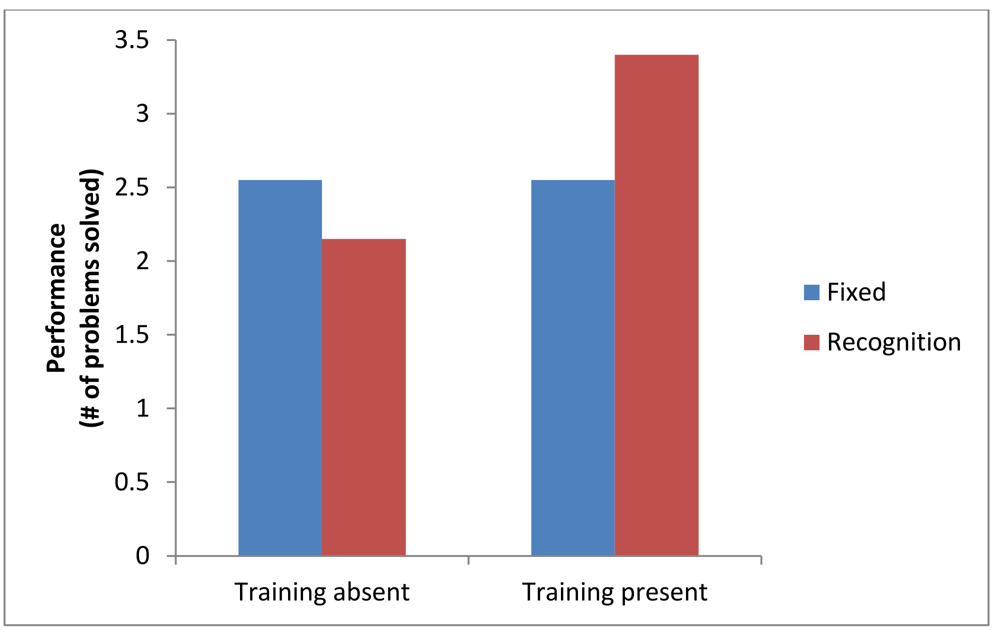
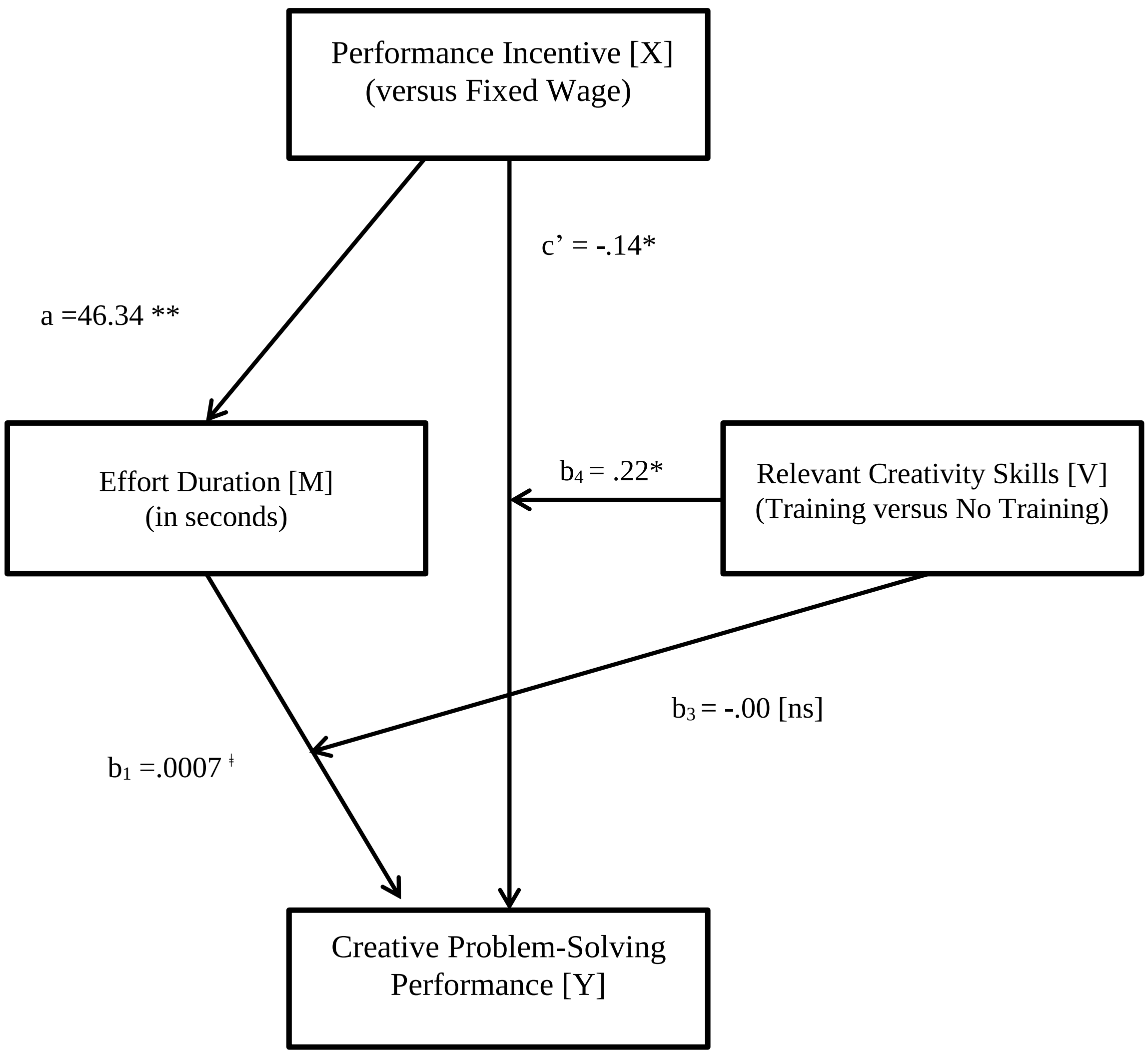


Figure 3 Moderation of Direct and Indirect Effects Model



Notes:

1. ** $p < .01$, * $p < .05$, ǂ $p < .1$
2. The letter coding of the coefficients corresponds to those in Panel A of Table 5.
3. See Appendix F for variable definitions.

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