University of Alberta

Learned Industriousness and Intrinsic Motivation: Effects of Rewards and Task Difficulty on Students' Free-Choice Performance and Interest

by

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A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
in
Psychological Studies in Education

Department of Educational Psychology

Edmonton, Alberta
Fall 2007

Your file Votre référence
ISBN: 978-0-494-32959-7
Our file Notre référence
ISBN: 978-0-494-32959-7

Abstract

This research investigated how rewards affect students' motivation and performance when the rewards are tied to task difficulty. Undergraduate university students ($N = 162$) engaged in a problem-solving activity. The design was a 2 x 2 x 2 factorial with two levels of reward (reward and no reward), two levels of task difficulty (easy and difficult), and two levels of testing (test and no test). Time spent on the experimental task and ratings of task interest during a free-choice period were used as indicators of intrinsic motivation. A major finding was the interaction of reward and task difficulty on the free time and performance measures of intrinsic motivation. Participants who were rewarded for a difficult task spent more time on FTD in a free-choice period than participants not rewarded for a difficult task; participants who were rewarded for an easy task spent significantly less free time on FTD during the free-choice period. Findings are discussed in terms of cognitive evaluation, attribution, social-cognitive, and learned industriousness theories.

Dedication

I would like to dedicate this doctoral dissertation to my late father, Alexander Norman MacIsaac, who was my role-model for hard work, persistence, and personal sacrifices, and who instilled in me the inspiration to set high goals and the confidence to achieve them. There is no doubt in my mind that without his continued support and guidance I could not have completed this process. Thank you, Dad…I miss you more than words can say.

Acknowledgments

For your patience, your guidance, your persistence, your leadership, your support, your determination, your funding!, your friendship, and so much more…thank you immensely to Dr. Judy Cameron and Dr. David Pierce, my amazing co-supervisors.

For the overwhelming effort you put into the editorial process, for your invaluable input, and for agreeing to be the chair of my dissertation committee, thank you Dr. Robert Frender. For the challenge and insight that you both provided as members of my dissertation committee, thank you Dr. Carol Leroy and Dr. George Buck.

Dr. Robert Eisenberger, thank you for agreeing to be the external member of my dissertation committee, and for your insightful suggestions on how to improve my work. My *entire* study is based on your theory…I am grateful for the inspiration.

Without you, Wiz, I would have lost my sanity and run screaming from this dissertation. I am so grateful that I met a great friend like you to accompany me throughout this occasionally nightmarish experience. You were there through the courses, the statistics, the anxiety, the self-doubt, the COUNTLESS revisions, and the subsequent tears…to my best friend…I will never be able to thank you enough.

Finally, to the rest of my family and friends, who put up with my moods, my crabbiness, my irritability, and my generally annoyed state of mind for SO LONG…I love you all.

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Chapter 1

INTRODUCTION

It is not uncommon to observe one person working harder at a task than another even when both are equally capable and competent. One student diligently studies and completes math review sheets at the end of each chapter while another crams the night before the exam. Some teachers spend hours preparing their classes and including new material in their lectures; others reach for last year's notes. Eisenberger (1992) has suggested that individual differences in industriousness are learned. Eisenberger's learned industriousness theory is built upon the concept of effort. Rewarding people for successfully achieving a certain level of performance is said to help them learn a general level of industriousness. If individuals are rewarded for expending high effort, the sensation of high effort is conditioned; this increases people's readiness to expend high effort on subsequent tasks. In contrast, when people reap the rewards for putting in low effort on an activity, they learn to expend less effort on later tasks. The primary purpose of the present study was to test learned industriousness theory by investigating how rewards affect students' motivation and performance when the rewards are tied to task difficulty. What follows are sections that provide background information for the present study, including information about the positive and negative effects of rewards; theoretical accounts of reward effects; and a brief review of studies that specifically examined rewards, task difficulty, and intrinsic motivation. Finally, a rationale for the present study is provided.

Background to the Study

Rewards and incentives are frequently used in educational settings to improve student motivation and performance. However, over the past thirty years, several researchers in education and psychology have argued that rewards are harmful (e.g., Deci, Koestner, & Ryan, 1999a; Kohn, 1993). Their view is that high grades, prizes, and praise are effective in getting people to perform an activity, but performance and interest are maintained only as long as the reward keeps coming. The claim is that, once the rewards are no longer available, people's intrinsic motivation to engage in activities is undermined. Those who hold this perspective cite experimental studies in social psychology to support their viewpoint. Since the 1970's, over 150 experiments have been conducted to examine how rewards impact people's motivation and performance. The accepted wisdom based on these studies has been that rewards produce negative effects on intrinsic motivation.

In the last 10 years, the accepted wisdom has been challenged. Several reviews of the literature and meta-analyses of the studies have been conducted. The findings have resulted in an interesting debate with one side arguing that rewards are inherently detrimental (Deci et al., 1999a; Deci, Koestner, & Ryan, 2001; Lepper, Keavney, & Drake, 1996; Ryan & Deci, 1996). On the other side are researchers who argue that the negative effects of reward are limited and circumscribed, and that rewards can be used to increase motivation and performance (e.g., Cameron, 2001; Cameron, Banko, & Pierce, 2001; Cameron & Pierce, 1994; Dickinson, 1989; Eisenberger & Cameron, 1996; Flora & Flora, 1999).

Current research has moved beyond the debate about negative effects of reward on intrinsic motivation, and now focuses on the particular reward conditions that produce positive or negative effects (Cameron, Pierce, Banko, & Gear, 2005; Houlfort, Koestner, Joussemet, Nantel-Vivier, & Lekes, 2002; Pierce, Cameron, Banko, & So, 2003). The present study aims to further our understanding of the conditions under which reward procedures are harmful or beneficial.

Positive and Negative Effects of Rewards: What the Research Shows

Meta-analytic reviews of experiments on rewards and motivation have identified a number of conditions under which rewards can produce negative, neutral, or positive effects (Cameron & Pierce, 1994; Deci et al., 1999a; Cameron et al., 2001; Eisenberger & Cameron, 1996; Eisenberger, Pierce, & Cameron, 1999). In the most recent meta-analytic review of the literature (Cameron et al., 2001), negative effects were detected in studies in which participants engaged in a task of high initial interest and in which the rewards signified failure or were loosely tied to behavior. Specifically, decreases in motivation and performance were found when rewards were not tied to meeting a specific performance standard, when the standards for receiving the reward were not clearly outlined (the contingency was vague), when participants were unable to meet the contingency required to obtain the reward, or when participants received less than maximal reward.

Positive effects of reward were found on high interest tasks when tangible rewards were offered to individuals for meeting or surpassing set performance standards. Rewards were found to increase motivation on tasks of low initial interest.

That is, in studies where rewards were offered for tasks that were not of high initial interest, motivation for that task increased after participants were rewarded. Praise was found to produce positive effects on both high and low interest tasks.

In sum, rewards have been shown to produce negative and positive results. Generally, the meta-analyses show that tangible rewards produced negative effects on measures of intrinsic motivation when they were offered and given without regard to any specific level of performance. Positive effects were found when individuals were rewarded for reaching or exceeding an absolute standard (achieving a certain score on a task) or a normative standard (doing better than others).

Theoretical Accounts of Reward Effects

The main theoretical explanations for the negative effects of rewards on intrinsic motivation come from cognitive evaluation theory (CET) (Deci et al., 1999a) and attribution theory (Lepper, Greene, & Nisbett, 1973). From both these perspectives, the view is that when individuals like what they are doing, they experience feelings of competence and self-determination, and they attribute their performance to internal causes. When rewards are offered for performing an activity, however, the claim is that people begin to do the activity for the external reward rather than for internal reasons. As a result, perceptions of competence and self-determination are said to decrease and intrinsic motivation declines.

Both CET and an attributional account focus on negative effects of reward. Neither theory offers explanations for when and under what conditions one can expect rewards to increase people's intrinsic motivation. It is clear from meta-analytic reviews of studies on the effects of reward on intrinsic motivation that rewards can be used to produce negative and positive effects. Thus, what is needed is a theoretical perspective that can account for both decremental and incremental effects of reward.

Social cognitive theory (Bandura, 1986), which provides an alternative to CET and attribution theories, predicts that rewards can have positive and negative effects on performance and motivation. When rewards are given for attainment of challenging performance standards, social cognitive theory states that people learn cognitions of self-efficacy (beliefs that they are able to cope with challenges and demands of tasks and activities). Greater perceptions of self-efficacy are linked to higher intrinsic motivation. Pierce et al. (2003) tested this approach by assessing how rewards affected students' intrinsic motivation when the rewards were tied to meeting an increasingly demanding performance standard (progressive) versus an unchanging standard (constant). Results indicated that the progressive reward conditions induced higher levels of intrinsic motivation than the constant reward condition and than the no-reward conditions. However, the measures of self-efficacy did not mirror this difference. That is, there was no evidence that progressive reward caused changes in self-efficacy that in turn produced changes in intrinsic motivation. In the Pierce et al. experiment, the data were most consistent with a learned industriousness interpretation whereby the progressive reward condition increased striving or effort that was paired with rewards. Learned industriousness theory is usually tested by varying task difficulty rather than performance standards.

Learned industriousness theory. Learned industriousness theory (Eisenberger,

1992) is built upon the concept of effort. Eisenberger has suggested that people learn a general level of industriousness, or a general tendency to persist and take on difficult and challenging tasks. When individuals are rewarded for expending high amounts of effort on a task, the sensations of high effort acquire secondary reward properties, thereby increasing the amount of effort individuals subsequently choose to spend performing this and other related tasks. Conversely, when rewards are given for low effort on a task, sensations of low effort are conditioned and acquire secondary reward value, decreasing the amount of effort an individual later chooses to spend on the task or on other similar activities.

Research has shown that, consistent with learned industriousness theory, reward for high task difficulty contributes to durable individual differences in performance and striving. For example, college students rewarded for solving difficult cognitive problems subsequently wrote higher quality essays than did students who had been rewarded for solving easy cognitive problems (Eisenberger, 1992). Eisenberger and Armeli (1997) found that rewarding children for high levels of creative performance on one task increased their subsequent creativity on another task. Learned industriousness theory's explanation for these differences is that those individuals became conditioned to expend more effort. That is, those participants who completed more difficult or challenging tasks put in more effort to obtain the rewards; thus, sensations of high effort were paired with rewards and these sensations of striving took on secondary reward properties leading to an increase in the general tendency to work hard and persist on tasks.

Learned industriousness theory may help to explain the findings from studies on rewards and intrinsic motivation. As noted, meta-analyses have shown that rewards increased intrinsic motivation when participants were rewarded for meeting performance standards. Decreases in intrinsic motivation were found when individuals were offered and given rewards regardless of level of performance. From the perspective of learned industriousness theory, when individuals are rewarded for meeting or surpassing a specified standard, they must exert effort. High levels of effort become conditioned with reward properties leading to subsequent striving, persistence, and motivation. On the other hand, when people are rewarded regardless of performance level, they are conditioned to put in less effort on future tasks; that is, performance and intrinsic motivation declines.

One issue surrounding a learned industriousness explanation of reward effects concerns how stringent performance standards must be in order for high effort to become conditioned. This issue was also addressed in the recent study conducted by Pierce et al. (2003). As noted, Pierce et al. examined how rewards based on meeting an unchanging standard (constant) versus an increasingly demanding standard (progressive) impacted students' intrinsic motivation. In the constant conditions, participants were required to solve three puzzle problems on each of three trials. In the progressive conditions, participants were first asked to solve one, then three, and then five problems over the trials. Rewarded participants were offered money for each correct puzzle solution; participants in the no-reward conditions were not offered money. Intrinsic motivation was measured by time (in minutes) participants spent on the puzzles in a free-choice phase without reward. The major result of the study was that participants who were rewarded for meeting progressively demanding performance standards spent significantly more time on the task in the free-choice phase than those who were rewarded for attaining a constant level of performance and than those who were not rewarded for meeting a performance standard.

Pierce et al. (2003) suggested that the findings were consistent with an extension of learned industriousness theory. Specifically, they suggested that participants who were rewarded for achieving increasingly challenging levels of performance experienced sensations of rising effort paired with reward. This pairing of mounting effort with reward ensured that sensations of rising effort acquired secondary reward value. Once these sensations were conditioned, people exerted more effort later and chose to spend more time on the puzzle task in a free-choice period. In other words, when rewards were given for achievement on a progressively difficult task, individuals became intrinsically motivated toward the activity.

Pierce et al.'s (2003) study shows that it is not simply tying rewards to performance standards that leads to increases in intrinsic motivation; the task demands and standard must be challenging. Based on this interpretation, it follows that when individuals are rewarded for performing an easy task (a task that requires little hard work and striving), sensations of low effort will become paired with reward, and subsequently lead to lower effort on subsequent tasks than those not rewarded for performing an easy task. On the other hand, when individuals are rewarded for performing challenging tasks, sensations of high effort levels will become paired with reward, and therefore lead to higher effort on later tasks than those who are not rewarded for difficult tasks.

The numerous studies on rewards and intrinsic motivation that have been conducted over the past thirty years have used many different types of tasks (e.g., puzzle solving, drawing pictures, solving anagrams), which may have varied in difficulty level. Differences in difficulty level may account for the variability in outcomes on measures of intrinsic motivation (positive and negative effects) and could be directly relevant to an explanation put forth by learned industriousness theory. In other words, it may be that in studies that showed negative effects, participants were rewarded for engaging in easy tasks that required little effort. It is also possible that positive effects were obtained when participants were rewarded for succeeding at relatively difficult tasks that required high effort, generating increased levels of intrinsic motivation. To test this possibility, it is necessary to conduct a study where task difficulty is directly manipulated. An examination of the literature on rewards and intrinsic motivation indicates that there have been three studies that have assessed the effects of reward and task difficulty on measures of intrinsic motivation. Each of these studies is briefly outlined below, and the findings are discussed in terms of learned industriousness theory.

Rewards, Task Difficulty, and Intrinsic Motivation

To date, three studies have examined the effects of rewards and task difficulty on measures of intrinsic motivation. The first study was a 2 x 2 factorial design with two levels of task difficulty (low difficulty, with a train track set to make few errors, and high difficulty, with a train track set to make many errors) and two levels of reward (reward, no reward) (Salancik, 1975). A self-report measure of intrinsic motivation indicated a statistically significant reward by task difficulty interaction, where participants who completed the low difficulty task reported greater task liking when not paid than when paid, and participants who were paid for the high difficulty task reported greater task liking than those not paid. Arkes (1979) assessed the effects of rewards and task difficulty on intrinsic motivation using a 2 x 2 factorial design with two levels of reward (reward for completing puzzles, no reward) and two levels of stated task difficulty (easy, difficult). Findings suggested an interaction between reward and task difficulty on a task-liking measure, although it was not statistically significant. Rewarded participants in the easy condition expressed less task liking than the non-rewarded group; on the difficult task, rewarded participants indicated greater task liking than the non-rewarded group. The third study (So, 2001; Cameron, Pierce, & So, 2004) was a 2 x 2 factorial design with two levels of reward (reward, no reward) and two levels of task difficulty (easy and moderately difficult). All participants were given a timed test on problems similar to those given in a learning phase. Results showed a significant interaction of reward by task difficulty on test performance. When a moderately difficult task was assigned, rewarded participants performed higher on the test than those not rewarded; when a low difficulty task was assigned, the non-rewarded participants performed higher than those who were rewarded. As well, on measures of intrinsic motivation (time on task in a free-choice period, performance during the free-choice phase, and task liking), So's pattern of results was similar, although the separate univariate tests of these three measures were not significant.

Although the experiments conducted by Salancik (1975) and Arkes (1979) were not designed as tests of learned industriousness theory, the results are in accord with the theory. That is, the findings suggest that on difficult tasks, pairing reward with high effort led to greater task liking (greater intrinsic motivation). On easy tasks, pairing reward with low effort led to lower intrinsic motivation, or less task interest. Taken together, the findings of Salancik (1975), Arkes (1979), and So (2001) can be interpreted from a learned industriousness perspective. The pattern of results in each of these studies suggests that intrinsic motivation increased when rewards were given for succeeding at a difficult task; rewards given for achievement on a task of low difficulty reduced motivation. According to learned industriousness theory, a more difficult task induces higher effort than an easy one; the pairing of reward with high effort conditions sensations of striving with secondary reward value, which in turn results in higher levels of intrinsic motivation. Conversely, participants rewarded for tasks of low difficulty become conditioned to sensations of low striving that also acquire secondary reward value, resulting in lower intrinsic motivation.

Although Salancik's (1975), Arkes' (1979), and So's (2001) studies are in accord with an extension of learned industriousness theory to intrinsic motivation, there are difficulties. The sample size in each of the studies was small, making the power of the statistical tests low. The lack of power is evident in So's experiment; the separate univariate tests for intrinsic motivation measures were not statistically significant, whereas the multivariate test yielded a significant result. Another problem concerns

Salancik's and Arkes' manipulations of task difficulty. In Salancik's study, task difficulty was manipulated by a predetermined number of errors that participants would make. In Arkes' study, the task did not vary in terms of difficulty; participants were simply told that the task was easy or difficult. Neither of these procedures are typical manipulations of task difficulty in the literature on learned industriousness. In addition, So's study was different from the typical reward and intrinsic motivation experiment. Prior to the free-choice phase, participants were required to complete a timed test. The impact of the test phase on subsequent free-choice measures of intrinsic motivation needs to be examined in future studies.

Purpose of the Study

The current study was designed to build upon the work of Salancik (1975), Arkes (1979), and So (2001) to assess the effects of reward and task difficulty on intrinsic motivation, and to provide a direct test of learned industriousness theory. Other competing theories are also examined, including cognitive evaluation theory, attribution theory, and social cognitive theory. The sample size in the present study was larger than that used in the previous studies; thus, the power of the statistical test to detect an interaction effect of reward by task difficulty was increased. The task used, Find the Difference, was the same activity as that used in So's study, but the difference between the difficulty levels of the easy and the difficult task were increased. In addition, a test situation was compared with a no-test situation. The test/no-test phase was included to determine whether requiring participants to take a test affected subsequent assessment of intrinsic motivation in the free-choice period. One possibility is that taking a test increases feelings of being controlled thereby decreasing intrinsic motivation; another possibility is that a test provides positive competence feedback to participants leading to increases in intrinsic motivation.

Eisenberger's (1992) learned industriousness theory allows for predictions to be made about both positive and negative effects of reward on intrinsic motivation in this study. It was predicted that those participants who were rewarded for succeeding on a difficult task would display an increase in intrinsic motivation relative to non-rewarded participants. From the perspective of learned industriousness theory, succeeding at a difficult task requires high effort. The pairing of reward and high effort would condition sensations of elevated effort with secondary reward value. Once sensations of high effort acquired reward value, participants rewarded for success on tasks of high difficulty would generate these sensations by working hard on the task during a free-choice period. On the other hand, it was predicted that the pairing of reward with low effort (an easy task) would condition sensations of low effort with secondary reward value, and lead to low effort on the task.

The test phase allowed for an assessment of performance after reward had been paired with effort. Based on other studies of learned industriousness and So's (2001) findings, it was expected that test performance would be enhanced by pairing high effort and reward, whereas performance would be impaired by rewarding low effort. Finally, the present study assessed generalization of intrinsic motivation to related puzzle solving activities. Based on learned industriousness theory, it was predicted that rewarding high task difficulty would lead to more time spent on other puzzles, whereas rewarding low task difficulty would result in less time spent on solving other puzzle problems relative to non-rewarded groups.

Chapter 2

REVIEW OF THE LITERATURE

In this chapter, the literature on rewards, performance, and intrinsic motivation is reviewed. The chapter begins with a definition of the constructs of intrinsic and extrinsic motivation, and the origin of the view of detrimental effects of rewards is reviewed. Following this, the typical experiment on reward and intrinsic motivation is outlined, and a review of the experiments and meta-analyses on rewards and intrinsic motivation is presented and discussed. Next, prominent theoretical perspectives on rewards and intrinsic motivation are presented, followed by a review of studies that examined rewards, task difficulty, and intrinsic motivation. The chapter ends with a brief outline of the purpose of the present study and with specific hypotheses and theoretical predictions.

Intrinsic and Extrinsic Motivation

Intrinsic motivation has been described as another way of saying that people are interested in and enjoy what they are doing. People are said to be intrinsically motivated when they engage in an activity for its own sake, rather than for an extrinsic reward (Deci, 1975). The term intrinsic motivation is often used in contrast to extrinsic motivation; extrinsically motivated behaviors are those in which an external controlling factor can readily be identified. If people play games, paint pictures, or solve puzzles for no obvious reason, they are said to be intrinsically motivated. On the other hand, students who study hard to obtain high grades, employees who work extra hours for pay, and children who do their homework to please parents are said to be extrinsically motivated.

Cameron and Pierce (2002) have noted that there is a difficulty with these definitions. Intrinsic motivation is generally defined by behavior performed in the absence of obvious external factors such as extrinsic rewards. Therefore, when we do not know why a person engages in a behavior, the behavior is classified as intrinsically motivated. The problem is that when behavior is due to distant, hidden, or obscure external causes we may not know about, that behavior gets mistakenly labeled as intrinsically motivated.

For example, a visiting grandmother may observe her young granddaughter, Chelsea, reading every night and conclude that Chelsea enjoys reading and is highly intrinsically motivated to read. What her grandmother may not know, however, is that Chelsea's parents want Chelsea to read more, so they are paying her one dollar for every book she reads. Through this example, it is evident that behaviors that we sometimes conclude are intrinsically motivated may not be after all. Although the intrinsic and extrinsic motivation terms are confusing, many psychologists use these terms and much research has been devoted to the topic of intrinsic motivation.

Origins of the Detrimental Effects of Reward

The view that intrinsic and extrinsic motivation are independent (two separate, autonomous concepts) was prevalent throughout the 1950s and 1960s. Theorists assumed that intrinsic and extrinsic rewards were additive and combined to increase overall performance and motivation (Porter & Lawler, 1968; Vroom, 1964). The view was that motivation to perform a task (e.g., a job) would be at its highest when someone was interested, challenged, and extrinsically rewarded for performance (e.g., with pay). In other words, productivity and interest would be highest when intrinsic motivation was supplemented with extrinsic incentives.

In the late 1960s, DeCharms (1968) postulated that extrinsic rewards could be harmful to overall motivation. DeCharms speculated that intrinsic and extrinsic motivation might not be additive and that external rewards might interfere with intrinsic motivation. He also suggested that external rewards could change people's perceptions about the causes of their behavior. That is, if people were rewarded for engaging in an activity, they would begin to perceive themselves as doing the activity for the reward rather than for interest or enjoyment. In that way, it was suggested that external rewards could undermine intrinsic motivation.

The idea that extrinsic rewards could disrupt a person's intrinsic motivation led to the detrimental effects of reward hypothesis. This hypothesis states that external rewards undermine intrinsic motivation, either by altering perceptions of competence and self-determination or by deflecting the source of motivation from internal to external causes. This hypothesis generated a large number of experiments designed to investigate the relationship between external rewards and intrinsic motivation.

The Typical Experiment on Rewards and Intrinsic Motivation

Deci (1971) was the first researcher to experimentally investigate the effects of reward on intrinsic motivation. Since his initial study, more than 150 studies have utilized a similar between-groups design to investigate the topic. In a typical study, participants complete a purportedly interesting task (e.g., playing word games, solving or assembling puzzles, or drawing). Rewards offered to participants are either verbal (e.g., positive feedback, praise, or approval) or tangible (e.g., candy, money, or gold stars). Rewards may be offered beforehand (expected) or presented unexpectedly following the activity (unexpected). In some experiments, the rewards are offered for meeting or exceeding a specified standard; in other experiments, reward is offered simply for performing an activity or for completing a task. A control group engages in the activity and is not offered a reward. Participants in a reward condition usually participate in a 10-minute to 1-hour intervention.

After participants engage in the target activity, both the rewarded and non-rewarded participants are then observed during a non-reward period (which lasts anywhere from 2 minutes to 1 hour) where they are free to engage in the target activity or an alternate activity (e.g., reading a magazine). The amount of time participants engage in the target activity during this free time period, their performance on the task during free time, and/or self-reported task interest are typically used as measures of intrinsic motivation. If rewarded participants express less task interest, perform at a lower level, or spend less free time on the activity than non-rewarded participants, intrinsic motivation is assumed to be undermined by reward.

Research on Rewards and Intrinsic Motivation

There have been several meta-analytic reviews of the numerous intrinsic motivation studies (Cameron & Pierce, 1994; Cameron, et al., 2001; Deci, et al., 1999a; Eisenberger & Cameron, 1996). Cameron and Pierce's (1994) meta-analysis sparked a major debate, resulting in a flurry of research and controversy (Cameron, 2001; Cameron & Pierce, 1996; Cameron et al., 2001; Deci, et al., 2001; Deci, Koestner, & Ryan, 1999b; Eisenberger & Cameron, 1996; Eisenberger, Pierce, et al., 1999; Lepper, Henderlong, & Gingras, 1999; Lepper, et al., 1996; Ryan & Deci, 1996).

Meta-Analysis by Cameron and Pierce (1994)

In Cameron and Pierce's (1994) meta-analysis of reinforcement, rewards, and intrinsic motivation, the studies in their analysis used group designs to assess the effects of reward on intrinsic motivation. In this design, rewarded subjects are compared to non-rewarded controls; intrinsic motivation is measured by differences between groups on task interest, time spent on a task following the removal of a reward (free time phase), performance during the free time period, and willingness to volunteer for future studies without reward. Cameron and Pierce's analysis assessed the overall effects of rewards on various intrinsic motivation measures, as well as the effects of a number of different reward characteristics.

In their meta-analysis, Cameron and Pierce (1994) used a hierarchical analysis. In a hierarchical meta-analysis, all studies are included in an overall analysis, and researchers search for moderator variables. The studies are broken out by one key moderator, then another, and so on. The moderators the researchers choose to examine may be based on theoretical considerations or on differences between the studies (Cameron et al., 2001).

Thus, Cameron and Pierce (1994) broke rewards into reward type (verbal vs. tangible), reward expectancy (expected vs. unexpected), and reward contingency (rewards contingent on task completion or performance quality vs. rewards not contingent on task completion or performance quality). Results indicated that, overall, reward did not negatively impact intrinsic motivation. Rewards were found to have negative effects only under a highly specified set of conditions. Specifically, when participants were offered a tangible reward (expected) that was delivered without regard to level of performance, participants spent less time on a task than control subjects did once the reward was removed. They did not, however, report less task interest. Additional findings indicated that verbal rewards produced an increase in intrinsic motivation, and that tangible rewards produced no negative effect when they were delivered unexpectedly and when they were contingent on level of performance or for completing or solving a task. Cameron and Pierce emphasized that it is the promise of reward that may have negative effects on intrinsic motivation; however researchers often conclude that reward itself is harmful, which has led to a great deal of misunderstanding about the effects of reward and reinforcement on intrinsic motivation.

Reactions to Cameron and Pierce's (1994) Meta-Analysis

The results of this meta-analysis provoked discontent from a number of researchers. Kohn (1996) suggested that Cameron and Pierce (1994) demonstrated poor methodology, ignored important distinctions about different forms of praise, and omitted certain relevant research from their findings. Lepper et al. (1996) vehemently claimed that Cameron and Pierce's conclusion was overly simplistic and had little theoretical or practical value; they went on to state that the results of the meta-analysis were a direct consequence of Cameron and Pierce's systematic and consistent misuse of meta-analytic procedures (including inappropriate analyses and unwarranted inferences). Similarly, Ryan and Deci (1996) stated that Cameron and Pierce's conclusions that rewards do not lower intrinsic motivation was a misrepresentation of the literature based on a flawed meta-analysis. After offering their critique of cognitive evaluation theory, Ryan and Deci accused Cameron and Pierce of "defending their behaviorist theoretical turf" (p. 33).

In response to the growing controversy surrounding their 1994 meta-analysis, Cameron and Pierce (1996) replied to the researchers who had rebuked their meta-analysis. In their response, they reiterated that their original meta-analytic procedures were appropriate, robust, and statistically correct. The authors' conclusion was that negative effects of rewards occur under limited conditions, and that the results and conclusions of their meta-analysis would not be altered by their critics' accusations and protests.

Eisenberger and Cameron's (1996) Review

In the same year that Cameron and Pierce (1996) replied to the group of researchers who had disagreed with the findings of their original meta-analysis, Eisenberger and Cameron (1996) wrote another article published in *American Psychologist*. Eisenberger and Cameron proposed that the claimed negative effects of reward on task interest and creativity were nothing more than myth, and that considerable evidence exists that the conditions producing those effects are limited and easily avoided. The researchers reiterated the results of Cameron and Pierce's (1994) meta-analysis that, for time spent on task after receiving a reward, negative effects on intrinsic motivation are found only when rewards are tangible, expected, and independent of performance on a task. Verbal rewards increase the time spent performing the task. Results concerning attitude towards the task indicated that there was no evidence of a detrimental effect of any type of reward (tangible or verbal) on intrinsic motivation.

Meta-Analysis by Deci et al. (1999a)

On the heels of the controversial 1994 meta-analysis by Cameron and Pierce and the 1996 review by Eisenberger and Cameron, Deci et al. (1999a) conducted another meta-analysis of 128 studies that examined the effects of extrinsic rewards on intrinsic motivation. Deci et al. used the same type of hierarchical analysis as Cameron and Pierce (1994), but they also included unpublished master's theses and PhD dissertations in their analysis. Their results were as follows. In general, for interesting tasks, tangible rewards had a significant negative impact on intrinsic motivation; this effect held for participants in preschool through to college. An exception was that although performance-contingent rewards undermined free-choice behavior, they did not affect participants' self-reported task interest. Verbal rewards, however, had a significant positive effect on intrinsic motivation; this effect was found for college students and not children. There was no undermining of intrinsic motivation for unexpected or non-contingent tangible rewards. The undermining effect of reward on intrinsic motivation was stronger for the free-choice measure than for the self-report measure.

Deci et al. (1999a) criticized Cameron and Pierce's (1994) meta-analysis on a number of grounds. Deci et al. stated that Cameron and Pierce's and Eisenberger and Cameron's (1996) failure to detect more pervasive negative effects was due to methodological inadequacies (Cameron et al., 2001). Specifically, they criticized Cameron and Pierce and Eisenberger and Cameron for the following: (a) collapsing across tasks with high and low initial interest and omitting a moderator analysis of initial task interest, (b) including a study that used an inappropriate control group, (c) omitting studies or data as outliers rather than attempting to isolate moderators, (d) omitting studies that were published during the period covered by their meta-analysis, (e) omitting unpublished doctoral dissertations, and (f) misclassifying studies into reward contingencies as defined by cognitive evaluation theory (Cameron et al., 2001).

Reaction to Deci et al.'s (1999a) Meta-Analysis

In an article that appeared in the same issue of the *Psychological Bulletin* as did Deci et al.'s (1999a) meta-analysis, Lepper et al. (1999) pointed out the contrasts between Deci et al.'s and Cameron and Pierce's (1994) meta-analyses. Lepper et al. suggested that meta-analysis may not be the best way to inform readers when the literature on the topic is procedurally diverse, theoretically driven, or empirically complex, such as the literature on rewards and intrinsic motivation. Further, it was asserted that the "apparent precision" (p. 674) of meta-analysis may merely be an illusion due to simplistic numerical estimates of effect sizes that are used to compare the results of experiments that vary widely along many dimensions. It was also postulated that meta-analyses are not inherently more objective than traditional reviews, that researchers should not rely on statistics alone to guarantee the accuracy of their conclusions, and that meta-analysis may not be an appropriate procedure when examining the literature on rewards and intrinsic motivation.

In a response to Deci et al.'s (1999a) meta-analysis, Eisenberger, Pierce, et al. (1999) argued that reward can either decrease, have no effect, or increase intrinsic motivation depending on its method of presentation. The authors further asserted that applied studies (which contain features of everyday life) have typically found either positive or null effects of reward on intrinsic motivation, and these results contradict cognitive evaluation theory. Eisenberger, Pierce, et al. introduced general interest theory, which suggests that intrinsic motives are more diverse than solely competence and self-determination. This view also implies that reward can have incremental as well as decremental effects on intrinsic motivation. If the content of tasks and the context in which they are presented include ways that help satisfy our needs, wants, or desires, intrinsic motivation increases. Conversely, if the content of tasks and the context in which they are presented does not help satisfy our needs, wants, or desires, intrinsic motivation declines.

Included in Eisenberger, Pierce, et al.'s (1999) article were the results of two smaller meta-analyses of lab studies and a narrative review of applied studies on reward and intrinsic motivation. One meta-analysis concerned the effects of tangible reward on perceived self-determination (which is assumed by cognitive evaluation theory to account for decremental reward effects on intrinsic motivation). Their second meta-analysis distinguished the predictions of cognitive evaluation theory and general interest theory concerning how performance-contingent rewards affect intrinsic motivation. The results of these meta-analyses were as follows. Reward increased perceived autonomy (self-determination); reward ameliorated the effects of failure on intrinsic motivation; reward contingent on meeting an absolute performance standard either increased or did not affect intrinsic motivation, depending on the intrinsic motivation measure used; and reward contingent on surpassing the performance of others increased intrinsic motivation. These results were not in accord with cognitive evaluation theory; however, they provided support for general interest theory.

Over the next few years, the debate continued. Researchers argued back and forth about the conditions that lead to negative, neutral, and positive effects of reward on intrinsic motivation, how to define certain constructs in the field, proper methodology of meta-analyses, and proper classification of reward contingencies (see Cameron, 2001; Cameron et al., 2001; Cameron & Pierce, 2002; Deci et al., 1999b; Deci et al., 2001; Eisenberger, Pierce, et al., 1999).

The Most Recent Meta-Analysis: Cameron et al. (2001)

In the most recent meta-analytic review of the literature, Cameron et al. (2001) identified a number of conditions under which rewards were found to produce positive, negative, or neutral effects on measures of intrinsic motivation. Negative effects were detected when rewards signified failure or were loosely tied to behavior. For example, when participants were unable to meet the contingency and received less than maximal reward, or if the performance standards for receiving a reward were unclear (i.e., the standards for receiving the reward were not clearly outlined for participants), decreases in intrinsic motivation were found.

Rewards were found to increase intrinsic motivation on tasks of low initial interest. That is, when rewards were offered for tasks that were not of high initial interest, motivation for that task increased after participants were rewarded. Positive effects were also found on high interest tasks when participants were verbally praised for their work and when tangible rewards were offered to individuals for meeting or surpassing set performance standards. Praise was found to produce positive effects on both high and low interest tasks. Negative effects were found when a task was of high initial interest, when the rewards were tangible or offered beforehand, and when the rewards were delivered without regard to success on the task or to any specified level of performance.

Summary of Results of the Meta-Analyses and Recent Research

Cameron et al. (2001) noted that their pattern of findings for expected tangible reward contingencies differed from the results of Deci et al.'s (1999a) meta-analysis. The authors stated that whereas Deci et al. presented a picture of pervasive negative effects, their results depicted circumscribed negative effects. Deci et al. used reward contingencies that were theoretically relevant, but that were collapsed over distinct reward procedures. For example, on free-choice intrinsic motivation, Deci et al. obtained a negative effect for performance-contingent reward by combining distinct procedures and including some studies of rewards offered for each unit solved, rewards offered for doing well, rewards offered for surpassing a score, and rewards offered for exceeding others. Cameron et al. showed that these diverse reward procedures produce different effects on free choice; and therefore concluded that it was unwise to collapse them into a single category of performance-contingent reward. In addition, Deci et al. reportedly collapsed over reward categories for the task-interest measure, and omitted several positive effects that, when included, would have resulted in positive findings for task interest. Cameron et al. concluded that their meta-analysis indicates that rewards do not have pervasive negative effects when improvements to Deci et al.'s categorization of reward contingencies are made and all available studies are included.

Deci et al. (1999a) obtained negative effects of tangible reward contingencies by using cognitive evaluation theory to guide the classification of studies (Cameron et al., 2001). Cameron et al. indicated that by classifying studies according to the actual contingency used, different effects were obtained. These authors stressed that the results of a meta-analysis can be drastically altered by assigning studies to categories based on a particular theoretical orientation. They further postulated that the difference between their findings and those of Deci et al. points to a lack of standardization of reward procedures and definitions and suggests that, overall, the literature on rewards and intrinsic motivation is one of meager effects.

Overall, rewards have been shown to produce both negative and positive results. Meta-analyses and recent studies show that tangible rewards produced negative effects on measures of intrinsic motivation when they were offered and given without regard to any specific level of performance. On the other hand, positive effects were found when individuals succeeded at reaching or exceeding an absolute standard (achieving a certain score on a task) or a normative standard (i.e. doing better than 50% of others who had done the task). Recent research in the area of rewards and intrinsic motivation has focused on identifying the conditions under which rewards have positive or negative effects. What is needed is an explanation of when these different positive and negative effects of rewards occur.

Theoretical Perspectives on Rewards and Intrinsic Motivation

Several theories have been put forward to account for the negative and positive effects of rewards on intrinsic motivation. For the purposes of the present study, the following theoretical orientations are discussed: cognitive evaluation theory (Deci et al., 1999a), attribution theory (Lepper, et al., 1973), social cognitive theory (Bandura, 1986), and learned industriousness theory (Eisenberger, 1992).

Cognitive Evaluation Theory

One of the main theoretical perspectives regarding the effects of rewards on intrinsic motivation comes from cognitive evaluation theory (CET) (Deci et al., 1999a). According to this theory, the effects of a reward depend on the functional significance, or the interpretation that a person gives to the reward. This theory postulates that self-determination (also referred to as autonomy) and competence both underlie intrinsic motivation. Thus, the effects of a reward on intrinsic motivation depend on how the reward affects a person's perceived self-determination and perceived competence.

Rewards can be either informational (as indicators of competence) or controlling. That is, if a reward threatens a person's self-determination, it ultimately leads to an external perceived locus of causality, it is perceived as controlling, and it subsequently undermines intrinsic motivation. Rewards can have a positive effect when they provide information to a person. This informational aspect of reward can provide satisfaction of a person's need for competence. In this case, rewards may be perceived as indicators of competence and therefore enhance intrinsic motivation.

Because rewards may be perceived as either controlling or as indicators of competence, these factors could work against each other. Therefore, Deci et al. (1999a) proposed that some additional factors need to be taken into account when determining whether a reward increases or decreases intrinsic motivation. It should be noted that CET predicts that only expected rewards will affect intrinsic motivation, because a reward cannot control behavior if the reward is unexpected. Expected rewards are those that participants are aware they will receive; unexpected rewards are rewards that participants are unaware they will receive.

To summarize and give an example of the effects of reward on intrinsic motivation from the CET perspective, rewards are most harmful when they are tangible and offered before people engage in an activity. For example, if a reward is offered to me for meeting a performance standard, doing a task, or completing a task, the claim is that I may experience the reward as controlling, and my self-determination will decrease. However, if rewards are specifically tied to my performance, they may also signify feedback to me and increase my feelings of competence. This theory postulates that the negative and controlling function of the reward will ultimately be stronger than the positive feedback function; thus, rewards given to me based on my performance will override the potential positive effects of increased competence by reducing my levels of self-determination and will subsequently reduce my intrinsic motivation for the activity.

Studies that have assessed autonomy and intrinsic motivation. A few studies have assessed the effects of performance-contingent rewards on measures of autonomy and intrinsic motivation. Ryan, Mims, and Koestner (1983) varied the context in which performance-contingent rewards were delivered in an experiment on autonomy and intrinsic motivation. When the context was informational (participants were offered reward for doing well), intrinsic motivation increased as compared to a control group. When the context was controlling (participants were told they should perform up to a specific standard for reward), intrinsic motivation decreased. There was no effect of the reward on autonomy, which suggests that rewards may increase or decrease intrinsic motivation while leaving levels of autonomy unchanged.

Eisenberger, Pierce, et al. (1999) reviewed several studies that measured the effects of rewards on intrinsic motivation and autonomy and found that overall, contrary to CET, rewards increased perceptions of autonomy. In fact, Eisenberger, Pierce et al. suggested that rewards based on performance actually increase perceived autonomy because rewards convey freedom of action to the performer; Eisenberger, Rhoades, and Cameron (1999) tested this hypothesis and found that performance-contingent rewards increased autonomy, and that autonomy positively mediated the impact of rewards on intrinsic motivation as measured by task interest.

Different definitions of autonomy. Houlfort et al. (2002) proposed that the conflicting results regarding the effects of rewards on autonomy and intrinsic motivation obtained by different research teams was due to the way in which these researchers operationalize autonomy. These authors suggested that autonomy refers to "the extent to which the initiation and regulation of one's actions is determined by personal interests and meaningful values (i.e., by the self) versus being pressured and coerced by external contingencies" (p. 282).

Whereas CET assesses perceived autonomy in terms of the phenomenological experience of pressure and tension versus freedom, autonomy can also be assessed in terms of the availability of behavioral options. Houlfourt et al. (2002) suggested distinguishing these two ways of measuring perceived autonomy as *affective* and *decisional.* It was proposed that cognitive evaluation theorists generally evaluate the affective experience of autonomy (feelings of pressure and tension versus freedom), whereas Eisenberger, Rhoades, et al. (1999) assessed the decisional experience of autonomy (judgments about one's opportunity to decide among behavioral options).

Houlfort et al. (2002) performed two lab studies to test whether performance-contingent rewards have differential impacts on perceived competence and autonomy. The first study was modeled after Ryan et al.'s (1983) laboratory study with college students, and sought to examine the effect of performance-contingent rewards on perceived autonomy, perceived competence, and intrinsic motivation. Their study included an assessment of both decisional and affective autonomy, and varied whether the performance-contingent rewards were delivered in an informational or controlling manner using the same procedures as Ryan et al.. The second study was a replication of the first, but was performed with elementary school children; the informational/controlling component was not included in the second study.

Their findings suggested that performance-contingent rewards had a negative impact on affective autonomy but not on decisional autonomy. The informational/controlling manipulation in the first study had no effects. In addition, results suggested that performance-contingent rewards had a positive effect on feelings of competence. However, Houlfort et al. (2002) did not find negative effects of performance-contingent rewards on intrinsic motivation; in their second study, performance-contingent rewards increased intrinsic motivation. Thus, it is not clear whether autonomy is the critical mediator of the impact of rewards. Nonetheless, Houlfort et al.'s new conceptualization of autonomy may help resolve divergent findings on the impact of performance-contingent rewards on autonomy.

Attribution Theory

Another perspective on the effect of rewards on intrinsic motivation comes from Lepper et al. (1973). According to attribution theory, if individuals observe another person engaging in an activity, they infer that the other person is intrinsically motivated to engage in that activity if there are no salient, unambiguous, and extrinsic reasons to which to attribute the other person's behavior. Self-perception theory (Bem, 1972) proposes that people engage in similar processes of inference about their own behavior and its meaning. If there are external reinforcement contingencies surrounding our behavior that are salient, unambiguous, and sufficient to explain it, we attribute our behavior to these external circumstances. That is, we attribute the behavior to external causes.

However, if external contingencies are not perceived, are unclear, invisible, and insufficient to account for our actions, we tend to attribute our behavior to our own dispositions, interests, and desires (i.e. we are intrinsically motivated). For example, I might decide to complete my dissertation this year because my supervisor orders me to do it (i.e., an external cause for my behavior). On the other hand, I may complete it because of an inner desire to accomplish my goals, as well as a love for the research I am doing (i.e., an internal cause for my behavior). However, I could also complete my dissertation because of pressure from my supervisors in combination with a desire to achieve my goals. That is, both internal and external factors can combine to produce greater motivation to get my dissertation done.

According to DeCharms (1968), people generally perceive themselves to be the locus of causality of their own behavior. If individuals perceive themselves as the locus of causality of their own behavior, they are intrinsically motivated. If they perceive the locus of control to be external, they are extrinsically motivated. The critical difference between these two states, according to DeCharms, is the feeling of personal causation. An undermining of intrinsic motivation would be a consequence of the switching of perceived locus of control from internal to external factors, which often results after a reward is offered.

Principles from attribution theory (DeCharms, 1968; Kelley, 1973) and self-perception theory (Bem, 1972), taken together, have a number of implications (Greene, Sternberg, & Lepper, 1976; Lepper et al., 1973), one of which is the overjustification hypothesis. An explanation of this hypothesis is as follows. If I enjoy doing an activity, what would happen to my feelings about this activity if I get paid for it? Lepper et al.'s (1973) theory predicts that, at least under some conditions, I may experience a drop in my intrinsic motivation to perform the activity. The reasoning for this is as follows. Upon reflecting upon my behavior, I might come to the conclusion that I chose to engage in the activity partly to get the external reward, which may make me feel over-rewarded. I would then perceive my intrinsic motivation to be lower than it previously was. Therefore, I would shift from explaining my behavior purely in terms of intrinsic motivation to explaining my behavior partly in terms of external rewards. The end result is that I now have too many good reasons (justifications) to perform the activity to continue to view it as intrinsically motivated. This process is known as the overjustification effect.

Another principle, the principle of discounting, is relevant in this case. The more likely that the external causes of my behavior are conspicuous or salient (i.e., if my supervisors demand to meet weekly with me to monitor my progress on my dissertation), the more likely I am to downplay the extent that internal causes play a role. Because I now have two potential causes for explaining my behavior, I may discount the role of intrinsic motivation, and thus experience a decline in intrinsic motivation.

In summary, from the view of self-perception and attribution/overjustification theory (Lepper et al., 1973), rewards that are specifically linked to performance are thought to decrease intrinsic motivation by changing people's locus of control. That is, people who are rewarded may attribute their behavior to external forces (i.e., rewards) instead of internal forces (i.e., intrinsic motivation). Attribution theory thus predicts that rewards result in lowered intrinsic motivation due to the expectation that when the external cause is removed, the internal reason for doing a task in gone. Thus, rewards are said to decrease intrinsic motivation by altering people's attributions of causation for their behavior. As with cognitive evaluation theory, the focus of attribution theory has generally been on the negative effects of rewards.

Studies that have assessed attribution and intrinsic motivation. Only a few researchers have assessed the effects of performance-based rewards on participants' attributions of performance, with differing results. Rewards were found to have no effects on internal/external attributions (Arnold, 1985; Weinberg & Jackson, 1979). Brockner and Vasta (1981) found that rewarded participants attributed less of their behavior to internal factors than did non-rewarded participants. In 1979, Wimperis and Farr indicated that participants who were rewarded for meeting a performance standard made attributions to internal and external factors. Lepper and Henderlong (as cited in Sansone & Harackiewicz, 2000) found that increased attributions of control by external factors led to low levels of personal autonomy, which subsequently resulted in a loss of intrinsic motivation.

Difficulties with CET and Attribution Theory

Generally speaking, CET and attribution theory predict negative effects of reward. From the perspective of both theories, offering rewards for an activity that is interesting will ultimately lead to negative effects on intrinsic motivation because feelings of competence will be overridden by feelings of control, or because there is a shift in the locus of causality from internal to external, leading to a decline in intrinsic motivation. Even if a reward provides informational feedback that increases competence, the overriding aspect of control is expected to be stronger than the feedback function. The prediction from these theories for the present research is that the termination of rewards will create the most detrimental effect in a situation where task difficulty is relatively high and where the highest standard must be achieved. A major deficit associated with these two theories is that although they can predict negative effects of reward on intrinsic motivation, they do not predict the positive effects of reward.

Social Cognitive Theory

Bandura (1986) presented an analysis of rewards and intrinsic motivation based on social cognitive theory. Stated simply, rewards serve as incentives. People typically use the pattern of feedback they obtain from receiving rewards over time as information about how to obtain certain outcomes. It is natural for people to repeat the actions that produce rewards, as well as to avoid actions that produce negative consequences for their behavior. In this way, rewards begin to produce expectations for certain outcomes, or create reward expectancies.

From the perspective of social cognitive theory, extrinsic rewards can have differential effects. The effect of a reward depends on whether or not people come to value an activity. If rewards are provided and they signal that an activity is not interesting, people will gradually learn to devalue it. For example, if children are offered five dollars to vacuum the living room, they will likely begin to dislike doing it. If rewards signify proficiency, people will learn to enjoy the activity. For example, if children are given a reward for a good job of the vacuuming, they may begin to enjoy cleaning. According to social cognitive theory, a reward itself has no inherent negative effect. Instead, it is the message that is conveyed to the person by the reward that ultimately produces differential effects on interest and performance. Rewards that are given for routine activities without regard to skill or mastery will reduce intrinsic motivation, as there is little indication of self-competency conveyed by the reward. Rewards that are given for mastery of a task develop perceptions of self-efficacy and competence, and subsequently increase task interest.

From the viewpoint of social cognitive theory, external rewards are an essential component in helping to develop a person's self-regulation. If a reward is given for mastery of challenging tasks, personal competency is developed. As people develop self-efficacy based on their accomplishments, activities that used to be of little or no interest will begin to become more interesting. From this perspective, personal competency is a central component in the performance and interest of an activity. If a reward is offered for succeeding at a challenging task, social cognitive theory would predict that individuals will experience an increase in both self-efficacy and competence, which will then result in higher levels of intrinsic motivation. Conversely, if a reward is offered without regard to skill or mastery, individuals will not develop self-efficacy or feelings of competence; a resulting decline in intrinsic motivation is predicted.

Sansone and Harackiewicz (2000) presented a theoretical analysis of the effects of reward and intrinsic motivation that is similar to Bandura's (1986) analysis of competency-contingent reward. The authors argued that rewards may "generate positive motivational process as individuals approach and perform activities eager to attain competence" (p. 87) when they are offered for meeting a performance standard. Such rewards are postulated to lead to feelings of pride and accomplishment. In this situation, rewards signify the value of competence under these conditions. Thus, rewards that symbolize higher levels of achievement are expected to generate greater positive motivation.

In sum, from the perspective of social cognitive theory, rewards given for achievement can result in high task interest via the mediators of self-efficacy and perceived competence. Conversely, rewards given for repetitive performance without challenge can reduce intrinsic motivation by lowering self-efficacy and competence. Thus, social cognitive theory can predict both positive and negative effects of reward on intrinsic motivation.

Learned Industriousness Theory

Learned industriousness theory is another perspective that may help explain both positive and negative effects of rewards on intrinsic motivation. It should be noted that although social cognitive theory and learned industriousness theory sound similar, a major difference between the two theories are the factors thought to mediate the effect of rewards on intrinsic motivation. Whereas learned industriousness theory is concerned with the conditioning of effort, it is the message that a reward conveys to a person that is of importance to social cognitive theorists.

From the perspective of learned industriousness theory, physical effort is said to involve the subjective experience that accompanies bodily movement when it meets resistance or when muscles are fatigued (English & English, 1968). Cognitive exertion refers to the sensation experienced when mental activity encounters obstacles like fatigue or complex reading material (Eisenberger, 1992). For the purpose of this study, high levels of effort are presumed to be associated with high levels of task difficulty.

Learned industriousness theory assumes that different kinds of physical and cognitive tasks produce similar subjective experience. For example, the experience of cognitive effort that I expend on this dissertation is similar, in my view, to that involved in writing a small book (a difficult task). If the sensations of effort are similar across different tasks, it follows that learning to expend high effort in one task may increase the likelihood of high effort in subsequent tasks; essentially, an individual's decision concerning how much effort to exert in goal-directed behavior is influenced by the generalized effort of prior reward for low or high effort (Eisenberger, 1992). To continue with the previous example, if I exert high cognitive effort on a difficult task such as writing a small book and I subsequently get it published, this experience may increase my tendency to exert high cognitive effort on the difficult task of writing this dissertation.

According to learned industriousness theory, rewarding a difficult task produces classical conditioning that involves pairing effort (the conditioned stimulus) with reward (the unconditioned stimulus), leading to conditioned sensations of effort because the effort acquires secondary reward properties. This means that when a difficult task is followed by a reward, the high effort required to complete that difficult task becomes conditioned (reinforced), and people subsequently increase the amount of effort they choose to spend performing this and other difficult tasks. Rewarding people for successfully achieving a certain level of performance is said to help them learn a general level of industriousness.

To briefly summarize this theory, if individuals are rewarded for expending high effort on a difficult task, the sensation of high effort is conditioned; this increases their readiness to expend high effort on subsequent tasks. In contrast, rewards given for low effort on an easy task conditions sensations of low effort, and people expend less effort on later tasks.

Research that supports learned industriousness theory. Consistent with learned industriousness theory, research has shown that reward for high task difficulty contributes to individual differences in effort expenditure (Eisenberger, 1992). Several studies have been conducted that manipulate reward and task difficulty and provide support for learned industriousness theory. Table 2.1 presents a number of studies that examined the effects of reward and task difficulty on subsequent performance. Each of the studies presented in Table 2.1 shows that when participants are rewarded for difficult tasks, they work harder, are more persistent, perform at a higher level, or are more creative on different subsequent tasks than those rewarded for easy tasks than those who are not rewarded.

For example, as shown in Table 2.1, Eisenberger and Leonard (1980) rewarded college students for solving complex anagrams (high cognitive difficulty) or simple anagrams (low cognitive difficulty). The findings indicated that rewarding high cognitive difficulty resulted in greater persistence on a second task of unsolvable perceptual problems. Similarly, Eisenberger, Heerdt, Hamdi, Zimet, and Bruckmeir (1979) rewarded children if they spelled five words correctly (high task difficulty); a second group of children was rewarded if they spelled only one word correctly (low task difficulty). On a subsequent task, children in the high task difficulty condition worked harder and solved more problems than those in the low task difficulty group. The experiments in Table 2.1 indicate that rewarding high task difficulty leads to generalization of high effort to other tasks.

Although the studies outlined in Table 2.1 demonstrated that rewarding high effort leads to generalization of high effort to other tasks, none of the studies examined how rewards for high versus low task difficulty impacted subsequent intrinsic motivation.

Table 2.1.
Experiments Testing Learned Industriousness Theory

Study	Participants	Task	Conditions	Findings
Eisenberger, Heerdt, Hamdi, Zimet, & Bruckmeir (1979) Exp. 1	Psychiatric patients	Card sorting	1) rewarded for sorting many cards (high effort) 2) rewarded for sorting few cards (low effort) 3) no reward – simply asked to sort cards	Those rewarded for high effort spent more time on subsequent custodial work than the other groups
Eisenberger et al. (1979) Exp. 2	Learning disabled students	Spelling words	1) rewarded for spelling each word correctly (low effort) 2) rewarded for spelling 5 words correctly (high effort) 3) no reward – simply asked to spell words	The rewarded high effort group spent more time and completed more work on a subsequent math and handwriting task than the other groups
Eisenberger & Leonard (1980) Exp. 3	College students	Solving anagrams	1) rewarded for solving complex anagrams (high effort) 2) rewarded for solving simple anagrams (low effort) 3) rewarded for unsolvable anagrams 4) no reward – simply read anagram words	Those rewarded for high effort showed greater persistence on a subsequent perceptual task than the other groups
Eisenberger, Mitchell, McDermott, & Masterson (1984)	Learning disabled students	Reading aloud	1) rewarded for reading accuracy 2) rewarded for reading speed 3) rewarded for completion of simple reading task	On a subsequent drawing and story telling task, those rewarded for reading accuracy produced more accurate drawings and stories than the other groups. Those reward for reading speed

				constructed stories and drew more quickly than the other groups
Eisenberger, Mitchell, & Masterson (1985)	Second and third grade students	Object counting, picture memory, and shape matching	1) rewarded for completing easy tasks (low effort) 2) no reward for easy tasks 3) rewarded for difficult tasks (high effort) 4) no reward for difficult tasks	Those rewarded for high effort showed greater self control on a subsequent copying task than the other groups
Eisenberger & Adornetto (1986)	Second and third grade students	Object counting, picture memory, and shape matching	1) rewarded for completing easy tasks (low effort) 2) no reward for easy tasks 3) rewarded for difficult tasks (high effort) 4) no reward for difficult tasks	Those rewarded for high effort showed greater self control on a subsequent copying task than the other groups
Eisenberger & Armeli (1997) Exp. 1	Elementary school children	Generating uses for common objects	2 X 3 design; 2 levels of divergent thought (high – required to generate novel uses of objects; low – required to generate typical uses of objects); 3 levels of reward (large, small, no reward)	Those rewarded for high divergent thought (high effort) were more creative on a subsequent drawing task than the other groups
Eisenberger & Armeli (1997) Exp. 2	Elementary school children	Generating uses for common objects	2 X 2 design; 2 levels of divergent thought (high – required to generate novel uses of objects, low – required to generate typical uses of objects); 2 levels of reward (reward, no reward)	Those rewarded for high divergent thought (high effort) were more creative on a subsequent drawing task than the other groups

A study conducted by Pierce et al. (2003) examined how rewards affected students' intrinsic motivation when the rewards were tied to meeting increasingly demanding performance standards (progressive) versus an unchanging standard (constant). The study used a 2 x 2 factorial design with two levels of performance standard (constant, progressive) and two levels of reward (reward, no reward); participants were required to work on a puzzle solving task. In the constant conditions, participants were required to solve three puzzle problems on each of three trials. In the progressive conditions, participants were first asked to solve one, then three, and then five problems over the trials. Those participants in the reward condition were offered money for each correct puzzle solution; those participants in the no-reward conditions were not offered money. The measure of intrinsic motivation was the amount of time participants spent on the puzzles in a free-choice phase without reward. The major result of the study was that participants in the reward/progressive condition (i.e., who were rewarded for meeting progressively demanding performance standards) spent significantly more time on the puzzle solving task in the free-choice phase than those who were rewarded for attaining a constant level of performance and than those who were not rewarded for meeting a performance standard.

The findings of Pierce et al.'s study (2003) were explained using an extension of learned industriousness theory. Specifically, it was proposed that when rewards were given for achievement on a progressively difficult task, individuals became conditioned to put in high levels of effort. Participants who were rewarded for achieving increasingly challenging levels of performance experienced sensations of rising effort paired with reward, which conditioned sensations of high effort that acquired secondary reward value. Once sensations of effort acquired secondary reward value, people exerted more effort later and chose to spend more time on the puzzle task in a free-choice period.

An issue that surrounds learned industriousness theory involves how stringent performance standards must be in order to condition high levels of effort. An important implication of Pierce et al.'s (2003) study is that simply tying rewards to performance standards does not necessarily lead to increases in intrinsic motivation. Rather, the task and standard must be challenging. When individuals are rewarded for performing a difficult task (a task that requires high effort), sensations of high effort paired with reward would lead to higher effort on subsequent tasks. On the other hand, it follows that when individuals are rewarded for performing an easy task (a task that requires little effort), sensations of low effort become conditioned after being paired with reward and lead to lower subsequent levels of effort.

A number of studies have been conducted over the past thirty years in the area of rewards and intrinsic motivation. Different researchers have chosen to utilize many different types of tasks that presumably vary in difficulty level. For example, participants have been rewarded for solving anagrams, solving puzzles, and drawing. The differences in the outcomes of these studies could be directly relevant to an explanation put forth by learned industriousness theory. In Chapter 1, it was noted that varying levels of task difficulty on these tasks may help account for the variability that has been found on indices of intrinsic motivation. This suggests that in studies where negative effects of reward have been found, participants may have been rewarded for engaging in easy tasks that required little effort, thus negative effects of reward were obtained by the conditioning of low effort. Conversely, it is possible that positive effects of reward on intrinsic motivation were obtained when participants were rewarded for succeeding at difficult tasks that required high effort levels, thus conditioning high levels of subsequent effort. In order to test this possibility, a study must be conducted where task difficulty is directly manipulated.

Although Pierce et al.'s (2003) study examined how rewards affected students' intrinsic motivation when the rewards were tied to meeting increasingly demanding performance standards, the study was not a direct test of the effects of task difficulty and rewards on intrinsic motivation. Studies that provide tests of the effects of reward and task difficulty are scarce in the literature on rewards and intrinsic motivation; a review of the literature indicated only three studies to date that have assessed the effects of reward and task difficulty on measures of intrinsic motivation. Each of these studies is described below and the findings are discussed in terms of learned industriousness theory.

Studies Involving Rewards, Task Difficulty, and Intrinsic Motivation

Salancik (1975) conducted a study that examined the effects of rewards and task difficulty on measures of intrinsic motivation. Undergraduate students were asked to run an electric train car around a track and to try to keep it on the track. Using a 2 x 2 factorial design, the study included two levels of task difficulty (low difficulty, with the train track set to make few errors versus high difficulty, with the track set to make many errors) and two levels of reward (reward, no reward). Rewards were offered for performing above a pre-established norm that was set by participants' peers in prior runs of the experiment. All participants were told they performed above the norm. Subsequent free time spent on the task during a free-choice period, as well as task liking and enjoyment were used as measures of intrinsic motivation. As a manipulation check, participants were asked to rate task difficulty. Those in the low difficulty group perceived the task as easier than those in the high difficulty group ($p = 0.04$), suggesting that the researcher's manipulation was successful.

The results indicated a statistically significant interaction of reward by task difficulty on the self-report measure of intrinsic motivation. That is, those assigned to the low difficulty task reported less task liking when they were rewarded than when they were not rewarded for a low difficulty task. On the other hand, participants who were rewarded for the high difficulty task reported greater task liking than those not rewarded for the high difficulty task. On the free time measure of intrinsic motivation, a similar patter of results was found, although those results were not statistically significant.

Another study that assessed the effects of rewards and task difficulty on intrinsic motivation was conducted by Arkes (1979). In a 2 x 2 factorial with two levels of reward (reward for completing puzzles, no reward) and two levels of stated task difficulty (easy, difficult), undergraduate students were required to engaged in a puzzle solving task. Participants assigned to the easy condition were informed that they would work on easy tasks while others would receive difficult tasks. Participants in the difficult condition were told they would be given difficult tasks while others would receive easy tasks. In actuality, all participants were given the same task. Thus, what varied was whether participants were told the task was easy or difficult. Indices of intrinsic motivation included time on task in a free-choice period without reward and task liking.

Although the results were not statistically significant, findings showed an interaction of reward by task difficulty on the task-liking measure. More specifically, rewarded participants in the easy condition expressed less task liking than the non-rewarded group. Rewarded participants in the difficult condition indicated greater task liking than the non-rewarded group. A somewhat similar pattern of results was found for the time measure, whereby participants in the easy no-reward group spent more time on the task than the easy rewarded-group participants.

The experiments conducted by Salancik (1975) and Arkes (1979) were not tests of learned industriousness theory. However, the results of these studies are consistent with the theory. Findings suggest that on a difficult task, pairing reward with high effort led to greater intrinsic motivation (greater task liking and greater persistence in a free-choice period). On an easy task, pairing reward with low effort led to lower intrinsic motivation (less task interest and less free time on the task in a free-choice period).

A third study conducted on rewards and intrinsic motivation that directly manipulated task difficulty was conducted by So (2001) (reported in Cameron, Pierce, & So, 2004). So's study was a 2 x 2 factorial design with two levels of reward (reward, no reward) and two levels of task difficulty (easy, moderately difficult). Participants were required to engage in a problem-solving activity. Half of the participants were required to engage in an easy task (solve two problems) and the other half were required to engage in a moderately difficult task (solve four problems). In a learning phase, rewarded participants were offered money for solving the problems; non-rewarded control groups were not offered pay. Following the learning phase, all participants were given a timed test on problems similar to those given in the learning phase. Performance on the test was measured as number of correct solutions on the puzzle-solving task. The test phase was followed by a free-choice period where participants could continue to engage in the target activity or other activities. Intrinsic motivation was measured as time on the target task during the free-choice period, performance on the task in the free-choice phase (number correct), and by self-reported task interest.

Findings showed a significant interaction effect of reward by task difficulty on test performance ($p<.05$). More specifically, when a moderately difficult task was assigned, rewarded participants performed better on the test than those not rewarded. Conversely, when a low difficulty task was assigned, the non-rewarded participants performed better than those who were rewarded. Findings indicated a similar pattern on the three measures of intrinsic motivation (time on task in free-choice period, performance during the free choice period, and self-reported task interest), however the results were not statistically significant.

The pattern of means showed an interaction of reward by task difficulty on the free-choice performance measure. For the moderately high difficulty groups, rewarded participants outperformed non-rewarded participants in a free-choice period. For low difficulty groups, the non-rewarded participants outperformed rewarded participants. Reward participants in the low difficulty condition spent less free time on FTD puzzles than non-rewarded controls. In addition, for moderately difficult groups, rewarded participants reported greater task enjoyment than non-rewarded participants. A multivariate analysis of the three measures of intrinsic motivation indicated that reward for solving moderately difficult tasks significantly increased intrinsic motivation; reward for easy tasks significantly decreased intrinsic motivation as compared to non-rewarded controls.

Findings from the studies conducted by Salancik (1975), Arkes (1979), and So (2001) can be interpreted from and are consistent with learned industriousness theory. In each of these studies, the pattern of results suggests that when participants were rewarded for succeeding at a difficult task, intrinsic motivation increased. When rewards were given for achievement on a task of low difficulty, a reduction in motivation was found. As explained from a learned industriousness perspective, a more difficult task requires higher effort; the pairing of reward with high effort conditions sensations of high effort that acquire secondary reward value, which results in higher levels of intrinsic motivation. On the other hand, participants rewarded for tasks of low difficulty become conditioned to sensations of low effort that acquire secondary reward value, resulting in lower intrinsic motivation.

Despite providing support for learned industriousness theory, there are difficulties with Salancik's (1975), Arkes' (1979), and So's (2001) studies. A major problem concerns the sample size of the studies. In all three studies, the sample size was small, which made the power of the statistical tests to detect significant differences between groups low. An example of this low power was evident in So's study, where no significance was found for univariate analyses, although combining the three measures of intrinsic motivation in a multivariate analysis produced a statistically significant result.

An additional concern with Salancik's (1975) and Arkes' (1979) studies involves their manipulations of task difficulty. In Salancik's study, task difficulty was manipulated by a predetermined number of errors that participants would make. In Arkes' study, the task did not vary in terms of difficulty; participants were simply told that the task was easy or difficult. The dilemma is that neither of these are true manipulations of task difficulty. So's (2001) study included a more characteristic manipulation of task difficulty. Lastly, one particular phase of So's study was somewhat different from the typical reward and intrinsic motivation experiment, whereby prior to the free-choice phase, participants were required to complete a timed test. The impact of the test phase on later dependent measures has yet to be examined in future studies. For example, it could be that the lack of significance found on the three measures of intrinsic motivation resulted from the test phase that was included in So's design.

Hypotheses and Predictions

The current study was designed to build upon the work of Salancik (1975), Arkes (1979), and So (2001); the intent was to assess the effects of reward and task difficulty on intrinsic motivation, and to provide a direct test of learned industriousness theory. In addition, other competing theories were examined, including cognitive evaluation theory, attribution, and social cognitive theory. The sample size of the present study is larger than the sample size in previous studies in order to increase the power of the statistical test to detect an interaction between reward and task difficulty. The FTD task used in the present study was the same task So (2001) used, however the difference between the difficulty level for the easy and the difficult task was increased. In addition, a test situation was compared with a no-test situation to determine whether a required test increased participants' feelings of being controlled, thus reducing intrinsic motivation in a free-choice phase. Another possibility was that the test might provide valuable performance feedback, which would increase feelings of competence and increase intrinsic motivation.

Based on the theories evaluated in this study, a number of specific predictions can be made about the overall effects of reward and task difficulty on intrinsic motivation, the effect of the test phase on performance, and the generalization of intrinsic motivation to related puzzle solving activities.

Both cognitive evaluation theory and attribution theory predict that, overall, rewards based on meeting a performance standard (easy or difficult) will lead to decreases in intrinsic motivation. Cognitive evaluation theory predicts that although competence may increase, the controlling aspect of the reward will override increased feelings of competence. Autonomy (self-determination) will decrease, and intrinsic motivation will decline. Attribution theory makes similar predictions. Rewards are expected to shift perceptions of causation from internal to external factors and ultimately result in disrupted intrinsic motivation.

Social cognitive theory predicts that participants rewarded for achievement on a difficult, challenging task will develop high personal standards, positive evaluations of their performance, and increased self-efficacy or competence. The greater perception of self-efficacy resulting from being rewarded for a difficult task is proposed to lead to higher levels of intrinsic motivation than from perception of self-efficacy resulting from being rewarded for an easier task and than from perception of self-efficacy resulting from being in a non-rewarded control group. Conversely, a negative effect of reward and task difficulty on intrinsic motivation might be obtained according to social cognitive theory. This theory would predict that rewards given for easy tasks (low levels of achievement) will offer participants little feedback regarding their performance, leading to a decline in task interest due to lowered self-efficacy and lower feelings of competence.

Learned industriousness theory predicts an interaction between reward and task difficulty on measures of intrinsic motivation. That is, it is expected that participants who are rewarded for high difficulty tasks will display an increase in intrinsic motivation through the pairing of effort and reward. When reward is paired with difficult tasks, sensations of high effort will become conditioned by the reward and acquire secondary reward properties. Thus, participants rewarded for high levels of cognitive effort will be conditioned by the reward to exert high effort levels on subsequent tasks. Learned industriousness theory also predicts that there will be a negative effect of reward on intrinsic motivation. Those participants who are rewarded for low task difficulty are expected to experience a decline in intrinsic motivation through the conditioning of the sensation of low effort, which will lead to low effort exertion on later tasks.

The test phase allows for an assessment of performance after reward has been paired with effort. It is expected that test performance will be impaired by rewarding low effort, and enhanced by pairing high effort and reward. Finally, generalization of intrinsic motivation to other related puzzle solving activities is assessed by this study.

Chapter 3

METHOD

Design

The experiment used a 2 x 2 x 2 factorial design with two levels of reward (reward and no reward), two levels of task difficulty (easy and difficult), and two levels of testing (test and no test), all of which were between-subject variables.

Participants

Participants ($N = 162$) were recruited from an introductory sociology class at a Canadian university. Students were read a description of the study, were asked to volunteer if they were interested in puzzle solving (forms and questionnaires are in the Appendixes), and were told they would receive a two-mark bonus on their overall mark in the class if they participated in the study. Participants were randomly assigned to one of the eight conditions and participated in the study individually. Table 3.1 shows the number of participants per condition.

Table 3.1

Number of Participants in Each Experimental Condition

	Reward		No reward	
Condition	Test	No test	Test	No test
Easy task	20	20	20	21
Difficult task	21	20	20	20

Note. $N = 162$

Procedure

The study was conducted at the Centre for Experimental Sociology at the University of Alberta. When participants arrived at the centre, they were taken to a room and seated at a table. Participants were told that the study was about puzzle-solving and behavior. Participants were told that the sessions were being video-taped. They were asked to sign a consent form if they wished to participate in the study. Next, a questionnaire was administered to assess participants' general interest in puzzle-solving.

Sample Task

Participants were shown a sample of the task, a "Find the Difference" (FTD) problem. The object of the task was to find differences between two pictures; for each problem, there are six possible differences. This task has been used in previous research and has been found to be interesting to university students (Eisenberger, Rhoades, et al., 1999). The basic instructions to participants were as follows:

> You will be working on a recognition task. It is a "Find the Difference" task. There will be two pictures on a page and there are six differences between each picture. You will be asked to find and circle differences between the pictures. You will use a marker to circle the items that are different in the bottom picture.

Participants were asked to find and circle two differences between the sample pictures, then verbally repeat the instructions of the task to ensure their understanding. Following the sample task, participants were administered a second questionnaire to assess their interest in FTD, how difficult they found the task, their perceived competence, how autonomous they felt, and their anxiety level.

Learning Phase

Next, participants were presented with three sets of two FTD pictures. Participants were presented with a different pair of pictures in random order on each of three trials (learning phase). During the three trials, participants were treated differently by experimental condition. Participants assigned to the *Easy* (low task difficulty) condition were asked to find two differences on each picture; those in the *Difficult* (high task difficulty) condition were asked to find five differences on each picture. Participants in the reward conditions were offered and given four dollars for each correct set of pictures; the money was given to them after each trial (total of $12). Those participants in the no reward groups were not offered pay; however they were paid $12.00 once the experiment was over.

All participants were instructed to start finding differences when they were ready and to alert the researcher when they were finished. Once a pair of pictures was presented, the researcher waited at a table in the corner of the room until the participant had found the required number of differences. The experimenter verified that the differences found were actual differences between the two pictures. Participants who were able to find the required amount of differences moved on to the next trial; those who did not meet the criterion were asked to continue to find differences until they found the required number.

Following the learning phase, participants completed additional questionnaires. One questionnaire used the same items as those given following the sample task and was designed to assess task interest, task difficulty, feelings of competence, and autonomy. Another questionnaire asked participants to rate their feelings of autonomy, anxiety, their reasons for doing the task, and their attributions of performance on 7-point Likert scales. Participants in the reward conditions completed an additional set of items that asked them to rate their feelings about receiving money on 7-point Likert scales.

Test Phase

After filling out the questionnaires, participants in the *Test* condition were given a timed test using 10 new FTD puzzles (test phase). Participants were told that in a three-minute time period, they would be given 10 FTD puzzles. They were instructed to find as many differences as possible. Participants in the test condition were also given a performance standard; they were instructed that students generally fall into one of three categories, whereby students usually find less than 15 differences, between 15 and 20 differences, or more than 20 differences. After the timed test, all participants were told that they had found more than 20 differences. Pilot testing indicated that university students were all able to find more than 20 differences in a three-minute period. Those participants in the *No Test* condition were simply asked to work on the 10 FTD puzzles while the researcher prepared for the next phase of the experiment. The participants in the No Test condition were timed for 3 minutes, but they were unaware that they were being timed. Their performance on the FTD puzzles during this period was later evaluated to compare to the performance of the participants in the Test condition.

After the test phase, participants completed a series of questionnaires that again assessed task interest, task difficult, competence, and autonomy. They also rated their feelings about self-determination (autonomy), anxiety, their reasons for doing the task, and their attributions of performance.

Free-Choice Period

A free-choice period followed the test phase. Across all conditions, participants were told that another person had arrived for the study and it would take a few minutes to get the new participant set up in the next room. The researcher told participants that they could read magazines, work on other puzzles (a booklet of different puzzles was available), or work on more FTD puzzles while they waited. During this time, two magazines (*Time* and *Newsweek*), a booklet of general puzzles, and a new book of FTD puzzles were available to participants. The experimenter then left the room.

After 10 minutes, the experimenter returned, and participants completed two more questionnaires. The first questionnaire assessed general puzzle solving interest, as well as FTD puzzle solving interest and difficulty. The final questionnaire contained two open-ended questions and was designed to assess whether the participants formed any specific ideas about the purpose of the study and whether those ideas affected their performance. The first question asked "during the experiment, did you form any specific ideas about the purpose of this study?". This item was coded as 1 = *not at all suspicious*, 2 = *slightly suspicious*, and 3 = *suspicious*. The second question asked "how did your ideas about the purpose of the study affect your performance?". This item was coded as 1 = *my ideas about the study did not affect my performance*, and 2 = *my ideas about the study did affect my performance*. Participants who received a 3 (were suspicious) on the first item were to be removed from the study. No participants received a 3 on the first item, and no participants indicated that their ideas about the study affected their performance.

Finally, all participants were debriefed. During the debriefing, all participants were informed about the purpose of the study, the major dependent and independent variables under investigation, and the constructs that were being studied.

Measures of the Dependent Variables

Intrinsic Motivation

Time on FTD puzzles, time on other puzzles, and total time on puzzles during the free-choice phase were used as measures of intrinsic motivation. Time measures were calculated from the videotapes; an assistant blind to the experimental conditions observed the tapes and recorded the time on FTD puzzles, other puzzles, and magazines during the free-choice period. In terms of the reliability of the coding procedure, 16 tapes (10%) were coded by a second person to ensure reliability of the coding (two tapes per condition were randomly selected). The coding was considered reliable if the raters recorded time on any activity within 20 seconds of each other, because participants often changed activities, resulting in different judgments being made about when an activity stopped and another started. The coding of all tapes was accurate within 20 seconds. Another measure of intrinsic motivation was participants' ratings of FTD interest and general puzzle solving interest measured on bipolar items at the end of the free-choice period.

Behavioral measures of intrinsic motivation. Performance during the learning phase was measured as the time (in minutes) participants took to reach the criterion, and the number of errors they made over the three trials. Performance measures for the test phase were the number of correct differences found, the number of errors, and the number of puzzles worked on.

Semantic differential measures of intrinsic motivation. Throughout the study, task interest was measured with semantic differentials (bipolar items) (*interesting-boring, exciting-dull, enjoyable-unpleasant, entertaining-tedious*). The semantic differentials were also used to measure task difficulty (*challenging-not challenging, demanding-undemanding, difficult-easy, complex-simple*), competence (*confident-unsure, competent-incompetent, capable-unable*), autonomy (*at ease-intimidated, easy-going-overwhelmed, self-controlled-pressured, free-constrained*), and anxiety (*calm-anxious, relaxed-nervous, stress-free-tense*). Each was measured on a 7-point scale and later coded 3, 2, 1, 0, -1, -2, and -3. For each item, the first descriptor in the pair was coded with positive numbers.

The four interest items were combined (summed and divided by four) to create a composite measure of general puzzle solving interest before the learning phase (reliability: $\alpha = .89$). Composite measures were also created for FTD task interest ($\alpha = .87$) FTD task difficulty ($\alpha = .89$), competence ($\alpha = .87$), and autonomy ($\alpha = .94$) before the learning phase. Measures of anxiety were dropped from the study due to an error on the questionnaire; one of the four items meant to measure anxiety was accidentally paired with itself. The composite measure of anxiety subsequently created could not be included as a reliable composite measure of anxiety ($\alpha = .68$).

Composite measures were also created after the learning phase for FTD task interest ($\alpha = .92$), FTD task difficulty ($\alpha = .80$), competence ($\alpha = .87$), and autonomy ($\alpha = .96$). Composite measures were created after the test phase for FTD task interest ($\alpha = .87$) FTD task difficulty ($\alpha = .89$), competence ($\alpha = .91$), and autonomy ($\alpha = .96$). Finally, composite measures of FTD task interest ($\alpha = .93$), FTD task difficulty ($\alpha = .89$), and general puzzle-solving interest ($\alpha = .94$), were created after the free-choice phase.

Likert Measures

7-point Likert scales ranging from 1 = *not at all*, to 7 = *very much* were used following the learning and testing phases to measure whether participants attributed their performance to external factors (how much participants wanted to do well to please the researcher, were concerned about their performance being evaluated, assigned their performance to time pressure, pressure from the situation, feedback from the researcher, luck) or internal factors (how much effort or energy went into solving the puzzles, how much their performance on the FTD puzzles was due to skill, interest, effort). Composite measures were created after the learning phase of external attributions of performance ($\alpha = .71$) and internal attributions of performance ($\alpha = .79$), as well as after the testing phase ($\alpha = .70$, $\alpha = .83$, respectively).

After the learning and testing phases, participants also rated how much they enjoyed doing the Find the Difference Puzzles, and whether participants were motivated to do well on the FTD puzzles. A composite measure of motivation was not created because these two items did not correlate highly together ($\alpha = 0.45$). Composite measures were created for performance evaluation after the learning phase ($\alpha = 0.78$), and after the testing phase ($\alpha = .75$), which included questions that asked how poorly or well participants felt they did on the FTD puzzles (1 = *very poorly*, 7 = *very well*), and how competent they felt about the FTD puzzles (1 = *not at all competent*, 7 = *extremely competent*). One Likert item after the learning phase assessed participants' choice as to whether or not to do the FTD puzzles (1 = *very little*, 7 = *very much*).

After the learning phase, participants in the reward conditions rated how they felt about receiving money in terms of control, enjoyment, pressure, feedback, distraction, motivation, and interest on the same 7-point Likert scales (1 = *not at all*, 7 = *very much)*.

Ethical Considerations

This study was approved by the Faculties of Education and Extension Research Ethics Board at the University of Alberta.

Chapter 4

RESULTS

Analysis of Measures Prior to the Learning Phase

A 2 x 2 x 2 analysis of variance (ANOVA) with 2 levels of reward (no reward and reward), 2 levels of task difficulty (easy and difficult), and 2 levels of testing (no test and test) was conducted on the composite general puzzle-solving interest measure taken prior to the learning phase. There were no significant main or interaction effects, indicating that the groups were equated at the outset of the study (overall $M = .86$, $SD = 1.03$).

Similar ANOVAs were carried out after the FTD sample was shown for ratings of interest in FTD puzzles ($M = .60$, $SD = 1.05$), task difficulty ($M = -.82$, $SD = 1.16$), competence at FTD ($M = 1.56$, $SD = 1.02$), and autonomy ($M = 1.16$, $SD = 1.17$). For all analyses, there were no significant main or interaction effects. Overall, there was no evidence of differences between the groups before the experiment began.

Measures of Intrinsic Motivation

Free Time on FTD

One measure of intrinsic motivation was the amount of time (seconds) that participants spent on the FTD task during the free-choice period. Initial analyses involved assessing whether there were differences by gender or by ethnicity. In terms of gender, there were 43 males in the study and 119 females. An ANOVA indicated no significant main or interaction effects by gender; for males, $M = 167.65$, $SD = 189.15$; for females, $M = 163.21$, $SD = 164.91$. There also were no significant differences by ethnicity. In terms of ethnicity, there were 99 White participants, 33 Asian participants, and 30 participants whose ethnicity was classified as Other. An ANOVA indicated no significant main effects or interaction effects of ethnicity. The overall mean for White participants was $M = 161.88$, $SD = 170.84$; the overall mean for Asian participants was $M = 185.21$, $SD = 181.02$; the overall mean for participants classified as Other was $M = 149.77$, $SD = 164.26$. Because there were no differences by gender or ethnicity, these categories were collapsed for subsequent analyses.

Another analysis involved assessing whether there were differences between the three experimenters who ran the study. In terms of experimenter effects, an ANOVA indicated that there were significant differences between experimenters, $F(2, 159) = 6.43$, $p < .01$. A Bonferroni post hoc comparison of the three experimenters indicated that the participants of one experimenter spent significantly more free time on the task ($M = 223.84$, $SD = 198.54$) than the participants of the other two experimenters ($M = 106.17$, $SD = 137.42$; $M = 150.58$, $SD = 150.03$, respectively). Because one experimenter's participants spent more free time on FTD puzzles in the free-choice period, it was important to determine if there was experimenter bias. That is, it was necessary to determine whether there were differential effects across the conditions by this experimenter.

The next analysis was a 2 x 2 x 2 x 3 ANOVA on free time on FTD puzzles. The between groups were reward-no reward, easy task-difficult task, test-no test, and experimenter. There were no two-way or three-way interactions by experimenter. In other words, the experimenter's participants who spent more time on the task in the free-choice period did so across all the conditions, suggesting that there was not experimenter bias (the difference did not affect the groups differentially).

A 2 x 2 x 2 ANOVA was then conducted on the free time on FTD measure. The results showed a significant main effect of reward, $F(1, 154) = 6.63, p = .01$; no main effect of task difficulty, $F(1, 154) = 2.24$, *n.s.*; and a significant main effect of test, $F(1, 154) = 5.65, p = .02$. There was a significant interaction of reward by task difficulty, $F(1, 154) = 26.71, p <.01$; no interaction of reward by test, $F(1, 154) = 1.03$, *n.s.*; no interaction effect of task difficulty by test condition, $F(1, 154) = .31$, *n.s.*; and no three-way interaction effect of reward by task difficulty by test condition, $F(1, 154) = .004$, *n.s.*

In terms of main effects, findings showed that, overall, those participants who received a reward for meeting a standard spent more free time on the FTD task (in seconds) (M = 196.28., SD = 166.7) than non-rewarded participants (M = 132. 49, SD = 170.47). As well, participants who were given a test spent more free time on the task (M = 193.89, SD = 183.15) than those who did not take a test (M = 134.89, SD = 153.63).

Figure 4.1 portrays the interaction effect of reward by task difficulty on time on task during the free-choice period. The reward by task difficulty interaction showed that participants who were rewarded on the difficult task spent more time on FTD in the free-choice period (M = 276.73, SD = 160.74) than participants who were not rewarded on the difficult task (M = 87.63, SD = 153.31). In contrast, participants who were rewarded for an easy task spent significantly less free time on FTD during the free-choice period ($M = 113.83$, $SD = 129.33$) than those participants not rewarded for the easy task ($M = 176.27$, $SD = 176.71$).

A post hoc analysis of simple main effects on the significant interaction of reward by task difficulty on time on task during the free-choice period was done to determine if there were significant differences between the group means of reward versus no reward within the easy group, as well as reward versus no reward within the difficult group. Results indicated that the means were significantly different in both cases, $F(1, 158) = 6.53, p = .01$, and $F(1, 158) = 22.04, p < .01$, respectively.

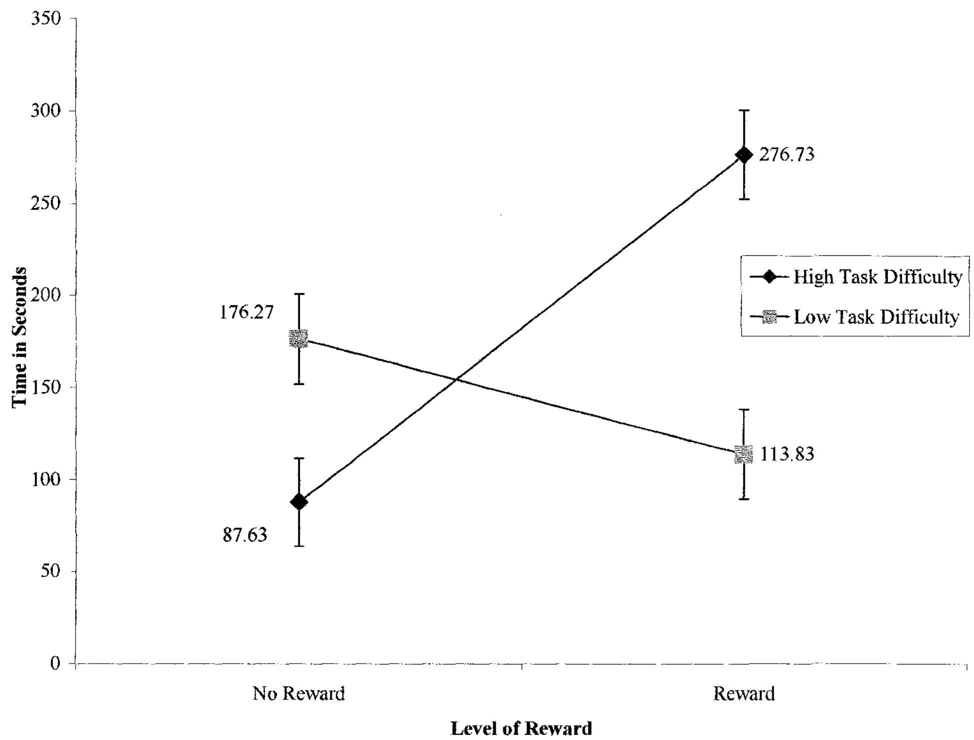


Figure 4.1. Plot of the interaction effect of reward by task difficulty on time on task during the free-choice period. Means and standard errors are shown for each condition.

Free Time Spent on Other Puzzles

During the free-choice period, participants were free to engage in FTD puzzles, other puzzles (a variety of puzzles including crosswords, hidden pictures, word search, etc.), read magazines, or just remain seated and wait for the experimenter. A 2 x 2 x 2 ANOVA on time spent on other puzzles showed no main effect of reward, no main effect of test, but a significant main effect of task difficulty, $F(1, 154) = 4.72, p = .03$. Participants who engaged in the difficult task spent more free time on other puzzles ($M = 203.33$, $SD = 176.85$) than participants who engaged in the easy task ($M = 145.81$, $SD = 166.84$). There was also a significant interaction of reward by task difficulty, $F(1, 154) = 9.12, p < .01$.

Figure 4.2 portrays the interaction effect of reward by task difficulty on time on other puzzles during the free-choice period. Participants rewarded on the difficult task spent more time on other puzzles ($M = 257.76$, $SD = 158.59$) than participants who were not rewarded on the difficult task ($M = 147.55$, $SD = 179.03$). Participants who were rewarded for an easy task spent significantly less free time on other puzzles ($M = 121.15$, $SD = 164.45$) than those participants not rewarded for the easy task ($M = 169.88$, $SD = 167.63$).

A post hoc analysis of simple main effects on the significant interaction of reward by task difficulty on free time spent on other puzzles was done to determine if there were significant differences between the group means of reward versus no reward within the easy group, as well as reward versus no reward within the difficult group. In this case, the means were significantly different in the reward versus no reward within the difficult group, $F(1, 158) = 13.46, p < .01$, but were not significantly different in the reward versus no reward within the easy group, $F(1, 158) = .36$, *n.s.*

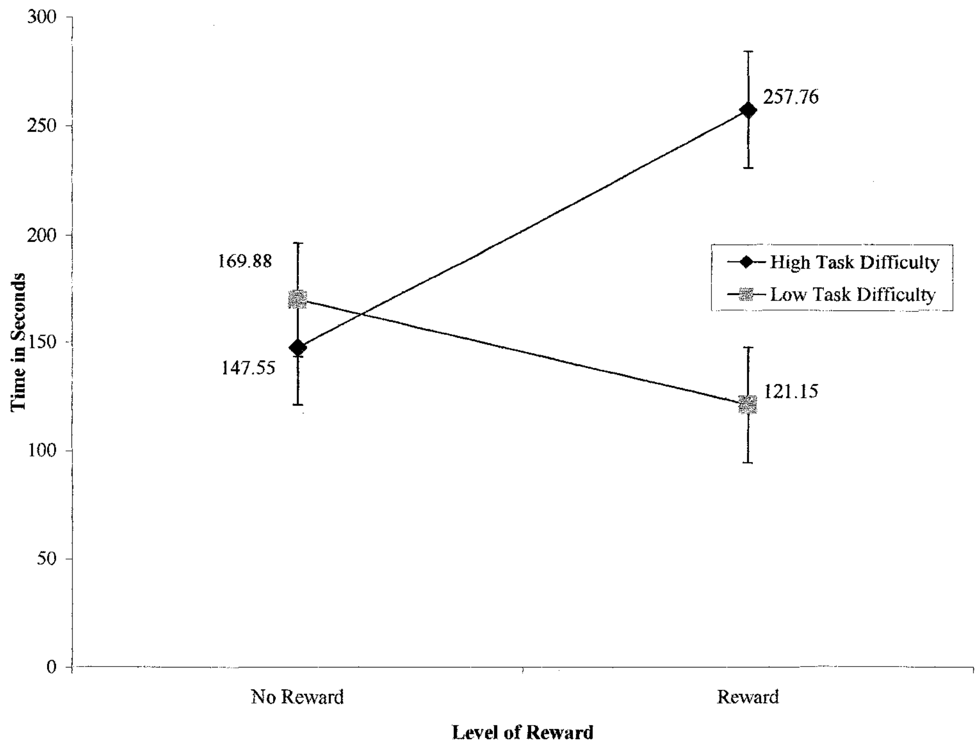


Figure 4.2. Plot of the interaction of reward by task difficulty on time solving other puzzles during the free-choice period. Means and standard errors are shown for each condition.

Total Free Time Spent on Puzzles (FTD and Other Puzzles)

A 2 x 2 x 2 ANOVA on total time spent on puzzles (FTD and other puzzles) showed a main effect of reward, $F(1, 154) = 10.01, p < .01$. Rewarded participants spent more time overall on puzzle solving (M= 386.58, SD = 221.7) than non-rewarded participants (M = 292.7, SD = 211.69). There was also a main effect of task difficulty, $F(1, 154) = 9.99, p < .01$; those who engaged in the difficult task spent more time solving puzzles (M = 386.56, SD = 223.12) than those who engaged in the easy task (M = 292.73, SD = 210.21). There was no main effect of test condition.

Findings indicated a significant interaction of reward by task difficulty, $F(1, 154) = 50.39$, $p < .01$; no other interaction effects were detected. Figure 4.3 shows this interaction effect. The significant interaction showed a similar pattern of means as the ones for time spent on FTD puzzles and time spent on other puzzles.

A post hoc analysis of simple main effects on this significant interaction was done to determine if there were significant differences between the group means of reward versus no reward within the easy group, as well as reward versus no reward within the difficult group. In this case, the means were significantly different in both cases, $F(1, 158) = 7.67$, $p < .01$, and $F(1, 158) = 52.78$, $p < .01$, respectively.

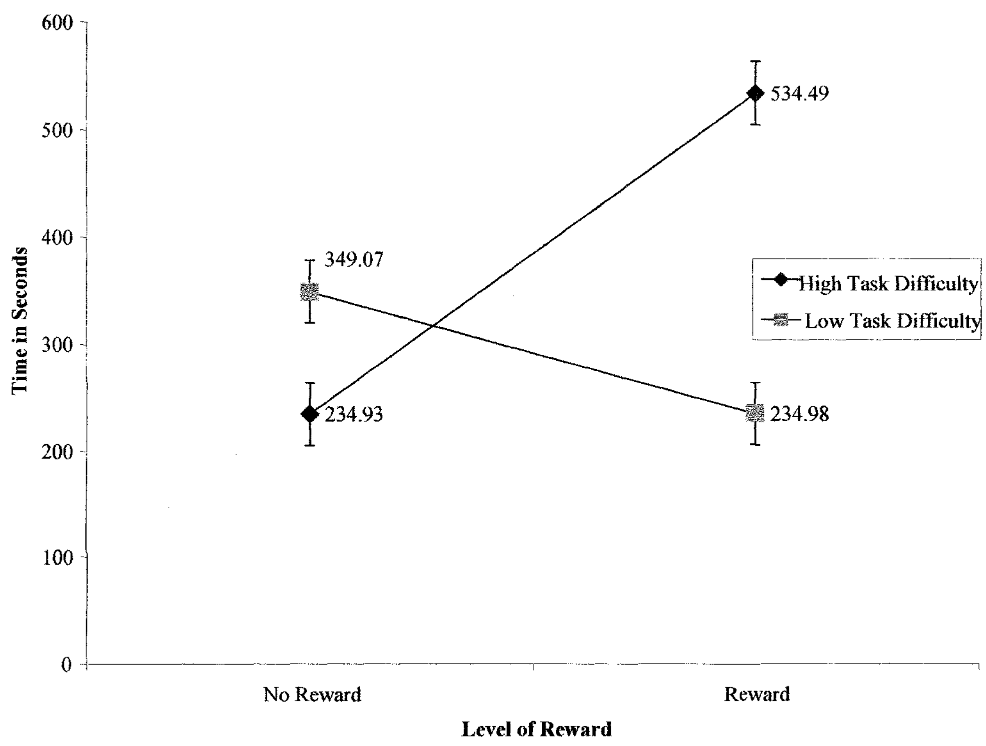


Figure 4.3. Plot of the interaction effect of reward by task difficulty on total time on puzzles during the free-choice period. Means and standard errors are shown for each condition.

Free Time on Magazines (Off-Task Activity)

A 2 x 2 x 2 ANOVA on total time spent on magazines showed a significant main effect of reward, $F(1, 154) = 9.12, p < .01$ and a significant main effect of task difficulty, $F(1, 154) = 7.06, p = <.01$. Those participants in no-reward conditions (M = 296.46, SD = 217.72) spent more time reading magazines than those in reward conditions (M = 206.35, SD = 217.08). The participants who completed a difficult task spent significantly less time reading magazines (M = 211.62, SD = 224.13) than those who completed an easy task (M = 291.19, SD = 212.60).

The interaction of reward by task difficulty was also significant, $F(1, 154)$ = 52.12, $p < .01$. Results indicated that participants rewarded for an easy task spent significantly more time reading magazines (M= 353.38, SD = 202.23) than participants not rewarded for an easy task (M = 230.51, SD = 207.09). Participants rewarded for a difficult task spent significantly less time reading magazines (M= 62.90, SD = 108.03) than participants not rewarded for a difficult task (M = 364.05, SD = 209.75).

Not surprisingly, this interaction is the opposite of the interaction of time spent puzzle solving. As noted earlier, the reward by task difficulty interaction showed that participants who were rewarded on the difficult task spent more time on FTD in the free-choice period than participants who were not rewarded on the difficult task, whereas participants who were rewarded for an easy task spent significantly less free time on FTD during the free-choice period than those participants not rewarded for the easy task. There was no significant main effect of test; there were no other significant interaction effects, and no three-way interaction effect of reward by task difficulty by test condition.

FTD Task Interest Intrinsic Motivation

A 2 x 2 x 2 ANOVA conducted on the FTD task interest intrinsic motivation composite (the four interest items that were combined to create a composite measure of interest in FTD puzzles) after the free-choice phase showed that there were no significant main or interaction effects (overall $M = .46$, $SD = 1.26$).

General Interest in Puzzle Solving

A 2 x 2 x 2 ANOVA on the composite general interest in puzzle solving after the free-choice phase showed no significant main or interaction effects. This indicates that there were no group differences in general puzzle solving interest after the free-choice phase of the experiment. Overall, participants rated puzzle solving as interesting ($M = .68$, $SD = 1.30$).

Performance During the Free-Choice Phase

Performance measures of intrinsic motivation were the number of FTD differences found on FTD puzzles and number of FTD puzzles worked on during the free-choice phase. Two different sets of analyses were performed on the performance measures of intrinsic motivation because some participants did not work on puzzles during the free-choice period. In the first set of analyses, only participants who worked on the puzzles were included. Fifty participants (or 31% of all participants) who did not work on FTD puzzles were excluded; 69% of all participants worked on the puzzles and were therefore included in the analyses. In these analyses, there were 12 participants (10.7%) in the *no reward easy no test* group, 17 participants (15.2%) in the *no reward difficult no test* group, 13 (11.6%) in the *reward easy no test* group, and 12 (10.7%) in the *reward difficult no test* group; there were 13 (11.6%) participants in the *no reward easy test* group, 17 (15.2%) in the *no reward difficult test* group, 12 (10.7%) in the *reward easy test* group, and 16 (14.3%) in the *reward difficult test* group.

Results indicated a significant interaction effect of reward by task difficulty on number of differences found, $F(1, 103) = 9.57$, $p < .01$. Inspection of means indicated that participants who were rewarded for low task difficulty found fewer FTD differences in a free-choice period ($M = 16.40$, $SD = 21.98$) than participants who were not rewarded for an easy task ($M = 22.08$, $SD = 22.11$). Conversely, participants rewarded for a difficult task found more FTD differences in the free-choice period ($M = 31.30$, $SD = 16.70$) than those not rewarded for a difficult task ($M = 12.29$, $SD = 21.67$). There was also a significant effect of test, ($F(1, 103) = 4.65$, $p = .03$); participants who did a test found more FTD differences during free time than those who did not do a test ($M = 24.21$, $SD = 23.15$ and $M = 15.65$, $SD = 19.39$, respectively).

For number of FTD puzzles worked on during the free-choice session, the findings also showed a significant interaction effect of reward by task difficulty, $F(1, 104) = 9.25$, $p = .003$. Participants who were rewarded for low task difficulty worked on fewer FTD puzzles in a free-choice period ($M = 3.80$, $SD = 5.05$) than participants who were not rewarded for an easy task ($M = 5.04$, $SD = 5.28$). Conversely, participants rewarded for a difficult task worked on more FTD puzzles in the free-choice period (*M* = 6.82, *SD* = 3.45) than those not rewarded for a difficult task (*M* = 2.68, *SD* = 4.74). Performance measures for other puzzles worked on in the free-choice period could not be obtained because many participants appeared to work on the puzzles, but did not actively use a pen or pencil to mark on the paper.

In the second set of analyses done on the performance measures of intrinsic motivation, all participants were included, even though some participants did not work on the FTD puzzles and did not find any differences. In these analyses, participants who did not work on FTD puzzles were included because working on "zero" puzzles is technically considered a number of puzzles worked on. For both number of FTD puzzles worked on and number of differences found, a 2 x 2 x 2 ANOVA indicated a significant interaction of reward by task difficulty, $F(1, 154) = 4.84, p = .03$ and $F(1, 154) = 4.58, p = .03$, respectively. As was the case in the first set of analyses, participants who were rewarded for low task difficulty worked on fewer FTD puzzles in a free-choice period (*M* = 2.38, *SD* = 4.38) than participants who were not rewarded for an easy task (*M* = 3.07, *SD* = 4.79). Conversely, participants rewarded for a difficult task worked on more FTD puzzles in the free-choice period (*M* = 4.66, *SD* = 4.29) than those not rewarded for a difficult task (*M* = 2.28, *SD* = 4.47).

In this second set of analyses, results also indicated a significant main effect of test condition for both number of FTD puzzles worked on and number of differences found, $F(1, 154) = 4.04, p = .05$ and $F(1, 154) = 4.41, p = .04$, respectively. An inspection of means indicated that participants who took a test worked on more FTD puzzles during their free time ($M = 3.81$, $SD = 4.94$) than those who did not take a test ($M = 2.40$, $SD = 4.02$). Participants who took a test also found more differences ($M = 17.04$, $SD = 22.34$) than participants who did not take a test ($M = 10.43$, $SD = 17.44$). It should be noted that even when participants who did not work on the FTD puzzles in the free-choice period were excluded from these analyses, a very similar pattern of results was found, including both a main effect of test and an interaction effect of reward by task difficulty on the performance measures of intrinsic motivation during the free-choice phase.

Measures Taken After the Learning Phase

Note that for analyses after the learning phase, a 2 x 2 ANOVA was conducted on each of the measures (2 levels of reward; 2 levels of task difficulty). The test/no-test variable was not analyzed at this point because participants had not yet entered that phase of the study.

Performance During Learning Phase

Performance during the learning phase was measured as the time (in minutes) participants took to reach the criterion, and the number of errors that were made over the three trials. Analyses indicated significant main effects of task difficulty on trials 1 through 3, $F(1, 160) = 85.58, p < .01$, $F(1, 160) = 152.24, p < .01$, and $F(1, 160) = 216.77, p < .01$, respectively, no main effect of reward, and no interaction effect for the amount time it took to reach the criterion. For obvious reasons, it took significantly longer for participants in the difficult group to reach the criterion, as they were required to find more differences than the easy group (for the difficult group on trials 1, 2, and 3 respectively: $M = 107.06$, $SD = 75.52$; $M = 94.00$, $SD = 49.58$; $M = 81.42$, $SD = 33.76$; for the easy group on trials 1, 2, and 3 respectively: $M = 27.79$, $SD = 15.64$; $M = 24.78$, $SD = 9.54$; $M = 24.04$, $SD = 9.54$). Analyses also indicated a significant effect of task difficulty on the number of errors made in the first trial of FTD pictures, $F(1, 160) = 9.17$, $p = .003$. An inspection of means indicated that participants in the high task difficulty group made more errors in the first trial of puzzle solving than participants in the low task difficulty group ($M = .12$, $SD = .37$ and $M = .00$, $SD = .00$, respectively). However, there were no significant main or interaction effects of reward for the number of errors made between groups over the three trials of the learning phase.

Interest in the FTD Task

On the composite measure of FTD interest after the learning phase, a 2 x 2 ANOVA showed no significant main or interaction effects. This indicates that there were no group differences in FTD interest following the learning phase of the experiment. Overall, participants rated the task as interesting ($M = .73$, $SD = 1.11$).

Difficulty of the FTD Task

On the composite measure of task difficulty after the learning phase, a 2 x 2 ANOVA showed a significant main effect of task difficulty, $F(1, 157) = 12.23$, $p < .01$, but no interaction effects. An inspection of means indicated that participants who completed an easy task ($M = -1.86$, $SD = .97$) rated the task as easier than participants who completed a difficult task ($M = -1.31$, $SD = 1.02$).

Feelings of Competence About Puzzle Solving

A 2 x 2 ANOVA on the composite ratings of feelings of competence following the learning phase indicated no significant main or interaction effects. Overall, participants rated themselves as feeling competent (M = 2.02, SD = .91) at doing the FTD puzzles at this point in the study.

Feelings of Autonomy

There were no significant main or interaction effects between groups on the composite measure of autonomy, which indicated that there were no differences between the groups in terms of how autonomous they felt after completing the learning phase (M = 1.72, SD = 1.09).

External Attributions of Performance

On the composite measure of external attribution of performance after the learning phase, a 2 x 2 ANOVA indicated no significant main or interaction effects. Participants did not attribute their performance on the FTD puzzles to external factors at this point in the study (M = 3.22, SD = 1.11).

Internal Attributions of Performance

A 2 x 2 ANOVA on this composite measure taken after the learning phase indicated no significant main or interaction effects. All participants were generally neutral regarding their internal attributions of their performance on the FTD puzzles at this point in the study (M = 4.86, SD = 1.16).

A 2 x 2 ANOVA was performed on the individual item of perceived effort that asked participants whether they felt they were putting effort into solving the FTD puzzles. After the learning phase, there was a significant main effect of task difficulty, $F(1, 158) = 5.27, p = .02$, but no other main or interaction effects. Participants in the high task difficulty group perceived themselves as putting forth more effort ($M = 5.36$, $SD = 1.39$) than participants in the low task difficulty group ($M = 4.81$, $SD = 1.59$).

Self-Evaluation of Performance

A 2 x 2 ANOVA on this composite measure indicated no significant main or interaction effects, indicating there were no differences between treatment groups regarding performance evaluation at this stage of the experiment ($M = 6.15$, $SD = .88$) On average, all participants thought their performance was generally good.

Motivation

Two items assessed motivation on the FTD puzzles after the learning phase. The first item asked whether participants enjoyed doing the puzzles; a 2 x 2 ANOVA indicated no significant main or interaction effects (overall $M = 5.17$, $SD = 1.23$). However, there was a significant effect of reward condition on the item that asked whether participants were motivated to do well on the FTD puzzles, $F(1, 158) = 5.16, p = .02$, but no interaction effects. An inspection of means indicated that those participants who were rewarded for puzzle solving ($M = 5.69$, $SD = 1.39$) reported higher motivation than non-rewarded participants ($M = 5.17$, $SD = 1.49$).

Self-Determination (Choice)

One item after the learning phase assessed participants' choice as to whether or not to do the FTD puzzles. A 2 x 2 ANOVA indicated no main or interaction effects (overall $M = 5.33$, $SD = 1.84$).

Ratings of Monetary Reward

After the learning phase, participants in reward conditions rated the money they received in terms of control, enjoyment, pressure, feedback, distraction, motivation, and interest on 7-point Likert scales. The data were analyzed using one-sample *t*-tests comparing the observed mean against a hypothesized value of 4 (neutral on a 7 point scale). Because there were 10 items tested, the significance level was changed form .05 to .005 for each test using a Bonferroni correction (Shaffer, 1995).

Table 4.1.

Rewarded Participants' Perceptions About Receiving Money.

Items	Mean (*SD*)	*t*-value (*df* = 80)	*p* values
Felt controlled by the money	2.66 (1.72)	-7.05	<.001
Enjoyed receiving money	5.72 (1.56)	9.91	<.001
Made me feel pressured	2.85 (1.91)	-5.42	<.001
Felt overpaid	5.41 (1.91)	6.64	<.001
Provided useful feedback	3.06 (1.79)	-4.69	<.001
Distracted attention from the task	2.01 (1.31)	-13.67	<.001
Motivated me to perform well	4.47 (2.05)	2.06	.043
Felt underpaid	1.15 (.45)	-56.99	<.001
Less interested after money	1.69 (.98)	-21.14	<.001
Deserved to receive money	1.75 (1.31)	-15.45	<.001

Note. The means were compared against the neutral value of 4.

As shown in Table 4.1, 9 of the 10 items were significantly different from neutral using the corrected alpha. On the item that assessed whether money motivated participants to perform well, there was no significant difference from the neutral value of 4. For the other 9 items, results indicated that participants who received rewards did not feel controlled, distracted, pressured, underpaid, or less interested in the task after receiving money. In addition, participants enjoyed receiving the money, and they felt the money provided useful feedback about their performance. However, participants felt overpaid and felt they did not deserve to receive the money. A one-way ANOVA was performed to determine whether there were differences between the high and low task difficulty groups on these two items. Results indicated that there were no significant differences between the high and low task difficulty groups regarding feeling overpaid, $F(1, 79) = 1.17$, *n.s.* or feeling that they did not deserve the money, $F(1, 79) = .29$, *n.s.*

Measures After the Test Phase

Note that for analyses after the testing phase, 2 x 2 x 2 ANOVAs were conducted on each of the measures (2 levels of reward; 2 levels of task difficulty; 2 levels of test).

Performance After Test Phase

Performance measures for the test phase included the number of correct differences found, the number of errors made, and the number of puzzles worked on. 2 x 2 x 2 ANOVAs indicated no significant main effect of reward and no interaction effects on number of correct differences found; however there were significant effects of test/no test, $F(1, 154) = 65.37, p < .001$ and task difficulty, $F(1, 154) = 4.46, p = .04$.

Inspection of means indicated that participants who took a timed test found more correct FTD differences ($M = 29.93$, $SD = 6.31$) than those who did not ($M = 21.51$, $SD = 6.93$). Further, participants who did a difficult task found more correct FTD differences ($M = 26.85$, $SD = 7.78$) than those who did an easy task ($M = 24.58$, $SD = 7.79$). In terms of number of errors made by participants, there were no main effects of reward or task difficulty, and no interaction effects. There was a significant main effect of test on number of FTD puzzles worked on during the test, $F(1, 160) = 54.30, p < .01$; participants in the test condition completed more FTD puzzles ($M = 7.37$, $SD = 1.94$) than those participants who did not complete a timed test ($M = 4.95$, $SD = 2.23$).

Next, a 2 x 2 ANOVA was done to determine the effect of reward and task difficulty on number of correct FTD differences found, number of errors made, and number of puzzles worked on for the participants who took a timed test. There was no significant effect of reward or task difficulty for those who took a timed test on number of correct FTD differences found, number of errors made on the test, or number of puzzles worked on.

Interest in the FTD Task

On the composite measure of FTD interest taken after the test phase, a 2 x 2 x 2 ANOVA showed no significant main effects and no interaction effects. Overall, participants continued to rate the task as interesting (overall $M = .75$, $SD = 1.12$).

Difficulty of the FTD Task

On the composite measure of task difficulty taken after the test phase, a 2 x 2 x 2 ANOVA showed a significant main effect of test, $F(1, 154) = 16.43, p < .01$, but no significant interaction effects. An inspection of means indicated that participants who completed a test (M = -.64, SD = 1.25) rated the task as more difficult than participants who did not complete a test (M = -1.42, SD = 1.17).

Feelings of Competence About Puzzle Solving

A 2 x 2 x 2 ANOVA indicated a significant main effect of test, $F(1, 154) = 6.16$, $p = .01$ on the composite of feelings of puzzle-solving competence after the test phase. No significant interactions were found. Based on these results, it can be determined that participants who engaged in a timed test reported lower feelings of competence (M = 1.63, SD = .96) than participants who did not complete a timed test (M = 2.01, SD = .95).

Feelings of Autonomy

A 2 x 2 x 2 ANOVA on the composite measure of autonomy after the test phase indicated a significant effect of test, $F(1, 154) = 25.28$, $p < .01$. No significant interactions were found. Results indicated that participants who completed a test reported lower levels of autonomy (M = .81, SD = 1.29) than participants who did not (M = 1.80, SD = 1.04).

External Attributions of Performance

On this composite measure taken after the test phase, a 2 x 2 x 2 ANOVA indicated a significant main effect of test, $F(1, 154) = 14.06$, $p < .01$. No other main effects or significant interactions were found. An inspection of means indicates that those participants who took a test reported higher external attributions for their performance (M = 4.48, SD = 1.32) than participants who did not take a test (M = 3.67, *SD* = 1.37), although the mean indicates that participants continued to be generally neutral regarding external attributions of their performance.

Internal Attributions of Performance

On this composite measure taken after the test phase, a 2 x 2 x 2 ANOVA indicated a significant main effect of task difficulty, $F(1, 154) = 5.04, p = .03$ and a significant main effect of test, $F(1, 154) = 4.78, p = .03$. No significant interaction effects were found. An inspection of means indicates that those participants who completed a difficult task reported higher internal attributions for their performance ($M = 5.27, SD = .87$) than participants who did an easy task ($M = 4.89, SD = 1.27$). Further inspection of means indicates that those participants who took a test reported higher internal attributions for their performance ($M = 5.27, SD = .91$) than participants who did not take a test ($M = 4.90, SD = 1.25$). This indicates that participants who were required to do a difficult task and those who took a test reported higher internal attributions of their performance on the FTD puzzles.

As was done after the learning phase, a 2 x 2 ANOVA was also performed after the testing phase on the individual item of perceived effort that asked participants whether they felt they were putting effort into solving the FTD puzzles. After the testing phase, there was a significant main effect of difficulty, $F(1, 154) = 3.99, p = .05$ and a significant main effect of test, $F(1, 154) = 6.02, p = .02$; no other main or interaction effects were found. Participants in both the high task difficulty group and the test group perceived themselves as putting forth more effort ($M = 5.64, SD = .16$ and $M = 5.69, SD$

= .16, respectively) than participants in the low task difficulty group or the no test group ($M = 5.20$, $SD = .16$ and $M = 5.15$, $SD = .16$, respectively).

Self- Evaluation of Performance

On this composite measure taken after the test phase, a 2 x 2 x 2 ANOVA indicated a significant main effect of test, $F(1, 154) = 9.35$, $p < .01$, suggesting that there were differences between participants regarding their performance evaluations at this stage of the experiment. An inspection of means indicates that those participants who took a test reported lower performance evaluations ($M = 5.41$, $SD = .80$) than participants who did not take a test ($M = 5.86$, $SD = 1.03$). There were no other significant main effects or interaction effects on the performance evaluation measure.

Motivation

The same two items used to assess motivation in the learning phase were used to assess motivation on the FTD puzzles after the test phase. For the first item, which asked whether participants enjoyed doing the puzzles, a 2 x 2 x 2 ANOVA indicated no significant main or interaction effects (overall $M = 5.14$, $SD = 1.32$). The item that asked whether participants were motivated to do well on the FTD puzzles (overall $M = 5.31$, $SD = 1.44$) also indicated no significant main effects or interaction effects.

Self-Determination (Choice)

A single item after the test phase assessed participants' choice as to whether or not to do the FTD puzzles. A 2 x 2 x 2 ANOVA indicated no main or interaction effects (overall $M = 5.63$, $SD = 1.64$).

Measures After the Free-Choice Phase

In addition to the measures of intrinsic motivation (free time on FTD; FTD interest; and general puzzle solving interest) taken during the free-choice phase (reported on pages 68 to 74), task difficulty was also rated after the free-choice phase.

Difficulty of the FTD Task

A 2 x 2 x 2 ANOVA on this composite measure taken after the free-choice phase showed a significant main effect of test, $F(1, 154) = 4.64$, $p = .03$, but no significant interaction effects. This indicates that there was a significant difference between the groups in terms of how difficult participants rated the FTD task after the free-choice period. An inspection of means indicates that participants who completed a test ($M = -1.28$, $SD = 1.01$) rated the task as more difficult than participants who did not complete a test ($M = -1.65$, $SD = 1.14$).

Analysis of Repeated Measures

Several measures were taken before and after the test phase. These measures included general puzzle solving interest, FTD task interest, FTD task difficulty, FTD competence, external attribution, internal attribution, participants' performance evaluation, motivation, and self-determination (choice).

To determine whether there was a change over time of these measures as a function of the experimental manipulations, 2 x 2 x 2 x 2 ANOVAs were conducted. Reward (reward and no reward), task difficulty (easy and difficult), and testing (test and no test) were between-subject variables; time (before and after testing) was a withinsubject, or repeated measures variable. Only significant findings for interactions with time with alpha set at .006 (Bonferroni corrected) are reported here.

Test by Time Interactions

The repeated measures ANOVAs revealed significant test by time interactions for FTD interest, $F(1, 154) = 12.53, p = .001$, FTD task difficulty, $F(1, 154) = 12.58, p = .001$, FTD competence, $F(1, 154) = 8.45, p = .004$, external attribution, $F(1, 154) = 71.41, p < .001$, internal attribution, $F(1, 154) = 11.51, p = .001$, motivation to perform well, $F(1, 154) = 21.40, p < .001$, and enjoying the puzzles, $F(1, 154) = 5.92, p = .006$.

Table 4.2.

Means (and Standard Deviations) for Test by Time Interactions.

Test condition	Time: Before	Time: After
	FTD interest	
Test	0.72 (1.08)	0.90[a] (1.08)
No Test	0.74 (1.15)	0.60 (1.16)
	FTD task difficulty	
Test	-1.50 (0.97)	-0.61[a] (1.23)
No Test	-1.68 (1.08)	-1.42 (1.18)
	FTD competence	
Test	2.00 (0.92)	1.63[a] (0.96)
No Test	2.04 (0.90)	2.01(0.95)
	External attribution	
Test	3.07 (1.16)	4.48[a] (1.32)
No Test	3.38 (1.03)	3.69* (1.37)
	Internal attribution	
Test	4.86 (1.06)	5.27[a] (0.91)
No Test	4.87 (1.25)	4.89 (1.26)
	Performing well	
Test	5.16 (1.65)	5.49[a] (1.46)
No Test	5.70 (1.20)	5.12* (1.40)
	Enjoying the puzzles	
Test	5.10 (1.36)	5.26 (1.28)
No Test	5.23 (1.10)	5.01 (1.35)

Note. An [a] indicates that the difference between the means before and after taking a test was significant at $p < .05$. A * indicates that the difference between the means before not taking a test and after not taking a test was significant at $p < .05$.

Table 4.2 shows the means and standard deviations for the time by test effects. Paired-samples *t*-tests were used to clarify results with level of significance set at .05. Participants required to take a test showed increases from before to after the test in composite FTD task interest, external attributions of performance, internal attributions of performance, and were more motivated to perform well. These participants also reported greater FTD task difficulty, and lower competence. For participants not required to take a test, an increase from before to after the test phase in external attribution of performance, and a decrease in motivation to perform well were observed.

Task Difficulty by Time Interactions

The 2 x 2 x 2 x 2 ANOVA analysis of time by experimental condition (reward-no reward, high-low task difficulty, and test-no test) also indicated a significant task difficulty by time interaction for participants' beliefs about FTD task difficulty, $F(1, 154) = 9.61, p = .001$. Examination of Figure 4.4 indicates the pattern of results found for this interaction. Participants who were required to do an easy task and those who did the difficult task reported an increase in FTD task difficulty after taking the test, but the effect was only significant for participants in the low task difficulty group. Both low and high task difficulty participants converge on the task being more difficult after taking the test. For those participants who were required to do an easy task, the only significant finding was a significant increase in reported FTD task difficulty, $t(80) = -6.22, p = .001$ after taking a timed test. That is, before the test, participants in the low task difficulty groups rated the task as easier than they did after the task.

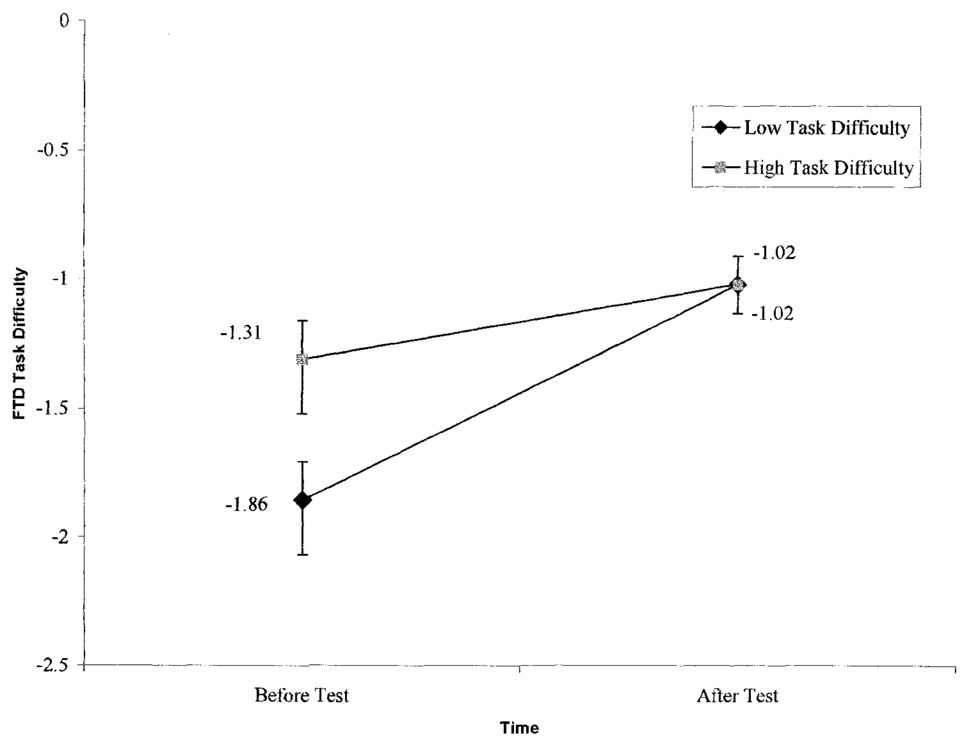


Figure 4.4. Plot of the interaction effect of time by test on task difficulty. Means and standard errors are shown for each condition.

Chapter 5

DISCUSSION

A major finding of this study was the interaction of reward by task difficulty on the free time measure and the performance measures of intrinsic motivation. As expected, the results show that the effects of reward contingencies depend on level of effort and challenge of the task for the free time and performance measures of intrinsic motivation (see also, Arkes, 1979; Salancik,1975; and So, 2001). Participants who were rewarded for high effort and challenge spent more time on that activity, other similar activities, and overall puzzle-solving in the free-choice period than those not rewarded for meeting high standards of performance. As well, performance on the target task during the free-choice phase was higher for participants who had been rewarded on the difficult task than those who had not been rewarded. On the other hand, participants who were rewarded for low effort and challenge spent significantly less free time on the activity, other similar activities, and overall puzzle-solving during the free-choice period than those not rewarded for meeting low standards of performance (they also performed at a lower level on the target task during the free-choice phase).

The pattern of interaction of rewards and task difficulty helps to resolve the debate about positive and negative effects of rewards on people's intrinsic motivation. Deci et al. (1999a) claimed that all rewards based on meeting performance standards are experienced as controlling and lead to a reduction of intrinsic motivation. Cameron et al. (2001) argued that rewards based on meeting an absolute standard (e.g., achieving a specific score on a task), rewards for surpassing a normative standard (e.g., doing better than a certain percentage of others), and rewards for achieving a progressively challenging standard increase intrinsic motivation. The present study shows that rewards have both positive and negative effects on intrinsic motivation depending on whether the rewards are made contingent on task difficulty, challenge, and effort.

In accord with Cameron et al. (2001), rewards tied to meeting a challenging performance standard or to tasks with high difficulty have positive effects, increasing intrinsic motivation for the activity. Deci et al. (1999a) also are correct about the negative impact of rewards—although not because rewards are perceived as controlling. Rewards have negative effects on intrinsic motivation when the rewards are given for meeting low standards of performance involving easy tasks and minimal effort. One implication is that variation in task difficulty over studies of rewards and intrinsic motivation could have contributed to the diverse effects of rewards observed in meta-analytical reviews, even though the reward contingencies appeared similar. Assuming this is the case, the present study has shown that rewards are neither inherently beneficial nor harmful but can have different effects on intrinsic motivation depending on how rewards are allocated for achievement of a performance standard.

The aim of this study was to vary the difficulty of the FTD task. Participants' perceptions of task difficulty after the FTD sample was shown indicated that puzzle solving was rated as easy by most participants. The manipulation of task difficulty therefore decreased perceptions of puzzle solving as an easy task rather than activating perceptions of high task difficulty. A future study should include tasks varying from easy (near -3) to difficult (near +3) to assess the effects of rewards under conditions of more extreme difficulty.

Although puzzle solving was not viewed as difficult based on the experimental manipulations, most previous studies used similar puzzle-solving activities that probably differed in relative ease. Thus, over studies of rewards and intrinsic motivation task difficulty probably varied from *fairly easy* to *not too easy* as opposed to *easy* versus *difficult*. Thus, one qualification should be that rewards based on achievement of challenging but attainable performance standards increase intrinsic motivation. When task difficulty is more extreme, people may fail to achieve the requisite performance level, forego rewards, and decrease in intrinsic motivation for the activity (see, Cameron et al., 2001).

In the present study, there were no differences between groups on the task interest measure of intrinsic motivation. It may be that task interest is not the most useful measure of intrinsic motivation. Other researchers have suggested this and noted that time and task interest measures are not highly correlated in studies of reward and intrinsic motivation (Cameron et al., 2005; Eisenberger, Rhoades, & Cameron, 1999). Apparently, rewards and task difficulty do not impact ratings of interest in a similar manner as free-choice performance measures—suggesting that measurement and theoretical problems must be resolved in the assessment of intrinsic motivation.

The current findings support those of Cameron et al. (2005) who showed that intrinsic motivation for one task transferred to similar activities. In the present study, when participants were rewarded for achieving a difficult standard, they spent more free time on other puzzle-solving activities and more total time solving puzzles in the free-choice period than non-rewarded participants who achieved the same standard. Furthermore, rewards given for meeting an easy standard of performance led participants to spend less time on other puzzle-solving activities in the free-choice period than participants who were not rewarded for performance of an easy task. Together, the findings from this experiment and from Cameron et al. (2005) indicate that people show generalization of intrinsic motivation from the rewarded activity to other similar activities and that this occurs when rewards are explicitly tied to task difficulty.

Test Phase Findings

An important question in this study was whether administration of a timed test affected subsequent intrinsic motivation and performance. The test phase in this study allowed for assessment of performance after reward was paired with task difficulty. Participants who were given a test spent more free time on FTD puzzle solving during a free-choice period than participants who did not take a test, indicating that taking a test enhanced rather than reduced intrinsic motivation.

After taking the test, participants continued to rate the task as interesting, and felt they had choice (self-determination) about doing the puzzles. At the same time, taking a test lead participants to believe the task was more difficult and to assess their competence and performance as less than that of participants not taking a test. From before to after taking a test, participants who took a test showed increased ratings of task difficulty and lower levels of perceived competence. One interpretation is that the test brought about realistic appraisals of performance and competence, especially for those who had been assigned to relatively easy performance levels before the test (Festinger, 1957). This more accurate performance appraisal was maintained into the free-choice phase where participants who took the test still rated the task as more difficult than those who did not take the test.

Participants who took a test also increased their interest in the FTD task, attributed their performance more to both internal and external attributions, and showed increased motivation to perform well. For those participants who did not take the test, assignment of performance to external factors increased, and this was accompanied by a decrease in their motivation to perform well on the puzzle-solving task. Apparently, taking a test enhanced the motivation to perform well—a finding that is at odds with self-determination and the cognitive evaluation theories of intrinsic motivation.

Theoretical Implications

Cognitive Evaluation Theory

From the perspective of cognitive evaluation theory (Deci et al., 1999a), the effects of rewards depend on the person's assessment of self-determination and competence. Although rewards can provide information about performance and indicate competence for a task, rewards usually are perceived as controlling and threatening to self-determination. Based on these assumptions, CET predicts that offering rewards for meeting a performance standard will ultimately decrease intrinsic motivation. CET does not differentiate between rewards given for performance of an easy versus a more challenging task. That is, rewards under both conditions are expected to decrease intrinsic motivation. For the present study, CET predicts that rewards based on meeting a performance standard (easy or difficult) will lead to reduced intrinsic motivation. CET also suggests that although performance-based rewards may signify competence at the task, the rewards will be experienced as controlling, and participants' autonomy and self-determination will be lowered.

Findings from the current experiment do not offer strong support for the predictions of CET. Rewarded participants did not find the rewards controlling; instead rewarded participants reported that they did not feel controlled or pressured by the money, and they were no less interested in puzzle solving after receiving money. As well, rewards did not lead to less feelings of autonomy or self-determination; after the learning phase, there were no differences across conditions on feelings of autonomy.

On the free time and performance measures of intrinsic motivation, rewards reduced intrinsic motivation when participants were rewarded for engaging in an easy task, a finding compatible with the predictions of CET. However, contrary to CET, participants rewarded for achieving a high standard of performance indicated higher free-choice intrinsic motivation than non-rewarded participants. One implication of these findings is that the destructive role of rewards on intrinsic motivation happens only when rewards are tied to easy tasks. What these findings suggest is that rewards should be administered when a task is challenging enough for motivation to be enhanced. The perception of control by rewards as the basis for undermining of intrinsic motivation may have been over-emphasized by CET.

According to CET, the inclusion of a timed test was expected to increase participants' feelings of being controlled, decrease their self-determination, and reduce their intrinsic motivation, especially if the test was perceived as difficult or if a performance standard was required. After engaging in a timed test, participants rated the task as more difficult, reported lower levels of competence and autonomy, and had lower performance self-evaluations than participants who did not complete a timed test. A CET theorist would interpret these findings to be a result of participants' feeling controlled. However, participants who took the test displayed higher intrinsic motivation, as indicated by more time spent in a free-choice period on FTD puzzles, than those who did not take the test. Further, after taking a timed test, participants continued to rate the task as interesting and felt they had choice as to whether or not to do the puzzles—results that are seemingly inconsistent with CET predictions.

Other results that are difficult to explain from the standpoint of CET concern the test by time interactions and test by task difficulty interactions. Over the course of the present study, a CET theorist would predict a decrease in FTD task interest, lowered feelings of competence, and poor motivation to perform well, especially after the introduction of rewards. Results indicated that participants who were required to take a timed test reported significant increases in FTD task interest and were more motivated to perform well following the test; in addition, they spent more time on FTD puzzles in their free time. Overall, the pattern of results from the current experiment is not in accord with predictions of CET or with the more general theory of self-determination (Ryan & Deci, 2000a; Ryan & Deci, 2000b).

Attribution Theory

Attribution theory also predicts that rewards should reduce intrinsic motivation; being rewarded for a task is thought to shift people's perceptions of the causation from internal to external sources, which disrupts or decreases intrinsic motivation. Participants should purportedly determine that when the external cause for their behavior (i.e., the reward) is removed, the internal reason (intrinsic motivation) for doing a task is gone.

Findings from the present study do not offer strong support for attribution theory. Specifically, participants who were rewarded for a challenging task showed higher intrinsic motivation than non-rewarded participants. Further, participants who were rewarded did not shift their perceptions of causation from internal to external factors; after receiving reward, participants were generally neutral regarding both internal and external causes of their behavior.

Social Cognitive Theory

Bandura's (1986) social cognitive theory predicts both positive and negative effects of reward on intrinsic motivation. For social cognitive theory, it is the message that a reward conveys to a person that is of importance. Positive effects of reward on intrinsic motivation are expected when reward is given for achievement of difficult, challenging tasks; this helps people to develop high personal standards, allows them to evaluate their performance positively, and increases their feelings of self-efficacy or competence, which in turn leads to increased intrinsic motivation. Negative effects of reward are expected when people are rewarded for simple tasks that provide them with little feedback, which subsequently lowers perceptions of self-efficacy or competence, and reduces intrinsic motivation.

The results of this study were consistent with some aspects of social cognitive theory. Specifically, the interaction of reward by task difficulty is consistent with social cognitive theory. One major difficulty for social cognitive theory is that participants' perceived competence levels did not change after the introduction of reward, and perceived competence is the major mediator for this theory.

Learned Industriousness Theory

Learned industriousness theory (Eisenberger, 1992) can be used to predict both the positive and the negative effects of rewards on intrinsic motivation under conditions of different task difficulty. An extension of learned industriousness theory to the literature on rewards and intrinsic motivation predicts an interaction of reward and task difficulty on intrinsic motivation, and transfer of intrinsic motivation to related activities. Rewards given for high effort and challenge were expected to lead to more free-choice time on the rewarded activity as well as on other related activities—high intrinsic motivation. Rewards given for low effort and challenge should result in less free-choice time on the rewarded activity as well as on other related activities—low intrinsic motivation.

In accord with these predictions, participants spent more time on task (puzzle-solving) and other related activities (additional puzzle problems) when rewards were tied to performance of a difficult task than when they did the difficult task without reward; participants who received rewards for performance of an easy task showed reduced free-choice time on the rewarded activity and related activities than those who did the easy task without rewards. Overall, rewards tied to high effort and challenge increase intrinsic motivation and transfer intrinsic motivation to other related activities—rewards given for low effort and challenge reduce intrinsic motivation for the target activity as well as for other related activities. Thus, if individuals were rewarded for expending high effort on a difficult task, sensations of high effort were conditioned, which increased their readiness to expend high effort on subsequent and similar tasks. Rewards given for low effort on an easy task conditioned sensations of low effort, and people expended less effort on later and comparable tasks.

Effort and learned industriousness theory. In addition to some changes in perception of task difficulty throughout the study, this study found differences in effort across conditions (perceived effort was measured separately from perceived task difficulty—questions were included that asked participants to rate perceived difficulty of the task as well as their perceived effort levels throughout the study).

When perceived effort was measured after the learning phase, participants who were asked to complete a difficult task felt their performance was more due to effort than participants who did an easy task. Further, after the testing phase, participants who completed a difficult task and participants who took a timed test felt their performance was more due to effort than participants who did an easy task and participants who did not take a timed test. Although learned industriousness theory does not require that people are aware of their effort, these differences in effort ratings are in accord with a learned industriousness interpretation. Overall, the findings of the present study are most in accord with an extension of learned industriousness theory to the problem of rewards and intrinsic motivation.

Educational Implications and Applications

Results from this study indicate that rewards based on a challenging standard can enhance intrinsic motivation for an activity, and that enhanced intrinsic motivation transfers to similar activities. These findings support Cameron et al. (2005), who also found that achievement-based rewards enhanced intrinsic motivation for the target task and subsequently generalized to other similar tasks. If these findings are applicable to classroom situations, this might mean that students rewarded for easy academic tasks will not spend much time on these types of activities on their own; students rewarded for higher levels of achievement, however, would want to do similar academic activities in their spare time and perhaps even in non-school settings (home or library). The advantage of this is that if students are rewarded for succeeding at challenging tasks, teachers can increase students' intrinsic motivation for that activity, as well as increase their motivation to engage in other, similar activities.

Rewards in the present study were given for achievement of an easy task or a relatively difficult one. Based on the results, educators should ensure that the academic performance standards are not only challenging, but also achievable. The work that students are rewarded for should not be too easy. On the other hand, reward for difficult work must be attainable, or students may not learn industriousness and motivation for school work. It appears that a delicate balance exists in terms of challenge and reward if students are to learn involvement and motivation for academic subjects. Furthermore, a greater emphasis on individualized instruction and differentiated curriculum may further this balance.

Unfortunately, individualized instruction is typically not provided in schools unless a student has a disability, and the instruction generally focuses on areas of weakness that require remediation (Konur, 2006). This study was unlike general classroom conditions in that participants were provided with specific individual instruction and immediate feedback. Most classrooms do not have policies in place where students are permitted to work at their own pace and move on when mastery is achieved. Although Alberta Education funding guidelines necessitate that teachers must prepare an individualized program plan for each student with a disability (this plan outlines short-term and long-term academic goals for achievement on the basis of the demonstrated skill level of the student), the average student is not afforded this. More research is necessary to find practical ways of programming academic material for all students in steps that are challenging and achievable, and ways should be found to tie rewards to performance achievement.

Rewards in this study were given for successful achievement, and participants did not move on in the study unless they succeeded. Again, this is not typical of most

Canadian classrooms. If these findings can be generalized to the classroom, this would suggest that teachers should have students meet a specified criterion of performance before they are tested on their knowledge or abilities. It also suggests that teachers should not only ensure that students meet specified criteria before they are tested, but that they are regularly tested. Results of this study suggested that taking a test actually increased participants' task interest and increased their motivation to perform well; teachers may be able to foster interest and motivation for an activity through consistent evaluation of student performance.

Clarification of the conditions under which rewards produce both positive and negative effects will provide valuable guidance for educators who are interested in setting up effective reward and incentive programs. In short, educators need to know the basis upon which they allocate rewards, recognition, and advancement in order to understand the conditions that nurture motivation and increase students' performance. Through learning the appropriate methods for implementing rewards, teachers may set up an environment whereby their students perform at a high level and expend high levels of effort, thereby fostering or enhancing intrinsic motivation.

Conclusion

This study directly manipulated task difficulty and clarifies the literature regarding the application of cognitive evaluation theory to the literature on rewards and intrinsic motivation. It also allows for an extension of learned industriousness theory to explain prior contradictory findings of the effect of reward on intrinsic motivation. The inclusion of a test phase in this study allowed for a novel assessment of performance after reward was paired with effort. As noted previously, further research is needed to determine how difficult a task must be to enhance intrinsic motivation and how intrinsic motivation generalizes to similar situations. In future research, participants can be given a choice between doing an easy versus a difficult task after they have been differentially rewarded. On a practical level, research in this area can help teachers and educators to use rewards effectively in the classroom to promote industriousness and increase motivation and performance.

Quite simply, learned industriousness theory helps explain why some people work harder than others of equivalent ability and motivation. As previously suggested by Eisenberger (1992), by focusing more attention on cultivating high effort levels, educators are able to shift from their traditional focus on talent as the basis for outstanding achievement, which underestimates the importance of hard work. Learned industriousness can be thought of as the channel that helps supply the prolonged effort required for superior achievement. An important goal of our society should be rewarding students for high effort and attending carefully to their individual educational needs.

References

Arkes, H. R. (1979). Competence and the overjustification effect. *Motivation and Emotion,* 143-150.

Arnold, H. J. (1985). Task performance, perceived competence, and attributed causes of performance as determinants of intrinsic motivation. *Academy of Management Journal, 28,* 876-888.

Bandura, A. (1986). *Social foundations of thought & action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Bem, D. J. (1972). *Self-perception theory.* New York: Academic Press.

Brockner, J., & Vasta, R. (1981). Do causal attributions mediate the effects of extrinsic rewards on intrinsic interest? *Journal of Research in Personality, 15,* 201-209.

Cameron, J. (2001). Negative effects of reward on intrinsic motivation – A limited phenomenon: Comment on Deci, Koestner, and Ryan (2001). *Review of Educational Research, 71,* 29-42.

Cameron, J., Banko, K. M., & Pierce, W. D. (2001). Pervasive negative effects of rewards on intrinsic motivation: The myth continues. *The Behavior Analyst, 24,* 1-44.

Cameron, J., & Pierce, W. D. (2002). *Rewards and intrinsic motivation-resolving the controversy.* Connecticut: Bergin & Garvey.

Cameron, J., & Pierce, W. D. (1996). The debate about rewards and intrinsic motivation: Protests and accusations do not alter the results. *Review of Educational Research, 66,* 39-51.

Cameron, J., & Pierce, W. D. (1994). Reinforcement, reward and intrinsic motivation: A meta-analysis. *Review of Educational Research, 64,* 363-423.

Cameron, J., Pierce, W. D., Banko, K. M., & Gear, A. (2005). Achievement-based rewards and intrinsic motivation: A test of cognitive mediators. *Journal of Educational Psychology, 97*, 641-655.

Cameron, J., Pierce, W. D., & So, S. (2004). Rewards, task difficulty, and intrinsic motivation: A test of learned industriousness theory. *Alberta Journal of Educational Research, 50*, 316-319.

DeCharms, R. (1968). *Personal causation.* New York: Academic Press.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology, 18*, 105-115.

Deci, E. L. (1975). *Intrinsic motivation.* New York: Plenum Press.

Deci, E. L., Koestner, R. & Ryan, R. M. (2001). Extrinsic rewards and intrinsic motivation in education: Reconsidered once again. *Review of Educational Research, 71,* 1-27.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999a). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125,* 627-668.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999b). The undermining effect is a reality after all—extrinsic rewards, task interest, and self-determination: Reply to Eisenberger, Pierce, and Cameron (1999) and Lepper, Henderlong, and Gingras (1999). *Psychological Bulletin, 125*, 692-700.

Dickinson, A. M. (1989). The detrimental effects of extrinsic reinforcement on 'intrinsic motivation'. *The Behavior Analyst, 12,* 1-15.

Eisenberger, R. (1992). Learned industriousness. *Psychological Review*, *99*, 248-267.

Eisenberger, R. & Adornetto, M. (1986). Generalized self-control of delay and effort. *Journal of Personality and Social Psychology, 51,* 1020-1031.

Eisenberger, R., & Armeil, S. (1997). Can salient reward increase creative performance without reducing intrinsic creative interest? *Journal of Personality & Social Psychology, 72,* 652-663.

Eisenberger, R., & Cameron, J. (1996). The detrimental effects of reward: Myth or reality? *American Psychologist 51*, 1153-1166.

Eisenberger, R., & Leonard, J. M. (1980). Effects of conceptual task difficulty on generalized persistence. *American Journal of Psychology, 93,* 285-298.

Eisenberger, R., Heerdt, W. A., Hamdi, M., Zimet, S., & Bruckmeir, M. (1979). Transfer of persistence across behaviors. *Journal of Experimental Psychology: Human Learning and Memory, 5,* 522-530.

Eisenberger, R., Mitchell, M., & Masterson, F. A. (1985). Effort training increases generalized self-control. *Journal of Personality and Social Psychology,* 49, 1294-1301.

Eisenberger, R., Mitchell, M., McDermitt, M., & Masterson, F. A. (1984). Accuracy versus speed in the generalized effort of learning-disabled children. *Journal of the Experimental Analysis of Behavior, 42,* 19-36.

Eisenberger, R., Pierce, W. D., & Cameron, J. (1999). Effects of reward on intrinsic motivation -- Negative, neutral, and positive: Comment on Deci, Koestner, and Ryan (1999). *Psychological Bulletin, 125,* 677-691.

Eisenberger, R., Rhoades, L., & Cameron, J. (1999). Does pay for performance increase or decrease perceived self-determination and intrinsic motivation? *Journal of Personality and Social Psychology, 77,* 1026-1040.

English, H. B., & English, A. C. (1968). *A comprehensive dictionary of psychological and psychoanalytical terms.* New York: David McKay.

Festinger, L. (1957). *A theory of cognitive dissonance.* Evanston, Il: Row, Peterson.

Flora, S. R., & Flora, D. B. (1999). Effects of extrinsic reinforcement for reading during childhood on reported reading habits of college students. *The Psychological Record, 49,* 3-14.

Greene, D., Sternberg, B., & Lepper, M. R. (1976). Overjustification in a token economy. *Journal of Personality and Social Psychology, 34,* 1219-1234.

Houlfort, N., Koestner, R., Joussemet, M., Nantel-Vivier, A., & Lekes, N. (2002). The impact of performance-contingent rewards on perceived autonomy and competence. *Motivation and Emotion, 26,* 279-295.

Kelley, H. H. (1973). Attribution theory in social psychology. In D. Levine (Ed.), *Nebraska symposium on motivation.* Lincoln: University of Nebraska Press.

Kohn, A. (1993). *Punished by rewards*. Boston: Houghton Mifflin.

Kohn, A. (1996). By all available means: Cameron and Pierce's defense of extrinsic motivators. *Review of Educational Research, 66,* 1-4.

Konur, O. (2006) Teaching disabled students in higher education. *Teaching in Higher Education, 11*, 351-363.

Lepper, M. R., Greene, D., & Nisbett, R. E. (1973). Undermining children's intrinsic interest with extrinsic reward: A test of the 'overjustification' hypothesis. *Journal of Personality and Social Psychology, 28,* 129-137.

Lepper, M. R., & Henderlong, J. (2000). Turning "play" into "work" and "work" into "play": 25 years of research on intrinsic versus extrinsic motivation. In Sansone, C., & Harackiewicz, J. M. (Eds.). *Intrinsic and extrinsic motivation: The search for optimal motivation and performance, 257-307.* San Diego, CA: Academic Press.

Lepper, M. R., Henderlong, J., & Gingras, I. (1999). Understanding the effects of extrinsic rewards on intrinsic motivation – uses and abuses of meta-analysis: Comment on Deci, Koestner, and Ryan (1999). *Psychological Bulletin, 125,* 669-676.

Lepper, M. R., Keavney, M., & Drake, M. (1996). Intrinsic motivation and extrinsic rewards: A commentary on Cameron and Pierce's meta-analysis. *Review of Educational Research, 66,* 5-32.

Pierce, W. D., Cameron, J., Banko, K. M., & So, S. (2003). Positive effects of rewards and performance standards on intrinsic motivation. *The Psychological Record, 53,* 561-579.

Porter, L. W., & Lawler, E. E. (1968). *Managerial attitudes and performance.* Homewood, IL: Irwin-Dorsey.

Ryan, R. M., & Deci, E. L. (2000a). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55,* 68 -78.

Ryan, R. M., & Deci, E. L. (2000b). When rewards compete with nature: The undermining of intrinsic motivation and self-regulation. In C. Sansone & J. M. Harackiewicz (Eds.), Intrinsic and extrinsic motivation: *The search for optimal motivation and performance, 13-54.* San Diego, CA: Academic Press.

Ryan, R. M., & Deci, E. L. (1996). When paradigms clash: Comments on Cameron and Pierce's claim that rewards do not undermine intrinsic motivation. *Review of Educational Research, 66,* 33-38.

Ryan, R. M., Mims, B., & Koestner, R. (1983). Relation of reward contingency and interpersonal context to intrinsic motivation: A review and test using cognitive evaluation theory. *Journal of Personality and Social Psychology, 45,* 736-750.

Salanick, G. R. (1975). Interaction effects of performance and money on self perception of intrinsic motivation. *Organizational Behavior and Human Performance, 13,* 339-351.

Sansone, C., & Harackiewicz, J. M. (Eds.). (2000). *Intrinsic and extrinsic motivation: The search for optimal motivation and performance*. San Diego, CA: Academic Press.

Shaffer, J. P. (1995). Multiple hypothesis testing. *Annual Review of Psychology, 46*, 561-584.

So, K. C. S. (2001). Do performance standards and task difficulty moderate the effects of rewards on intrinsic motivation. *Unpublished Masters Thesis*. University of Alberta.

Vroom, V. (1964). *Work and motivation*. New York: Wiley.

Weinberg, R. S., & Jackson, A. (1979). Competition and extrinsic rewards: Effect on intrinsic motivation and attribution. *Research Quarterly, 50,* 494-502.

Wimperis, B. R., & Farr, J. L. (1979). The effects of task content and reward contingency upon task performance and satisfaction. *Journal of Applied Social Psychology, 9,* 229-249.

Appendix

Volunteer to Participate in an Experiment
Two (2) Mark Bonus on Overall Marks

We are recruiting participants for a study that concerns learning and puzzle-solving. Volunteers will be asked to participate in a puzzle-solving game called "Find the Difference". The game involves identifying differences between two pictures. Specifically, participants will be trained on the task and then asked to do a number of puzzles.

If you enjoy doing puzzles and would like to participate, your instructor will give you a two (2) mark bonus on your overall marks.

Investigators:

Amber Gear		Department of Educational Psychology
Dr. W. David Pierce	492-0485	Department of Sociology
Dr. Judy Cameron	492-0177	Department of Educational Psychology

Time commitment: approximately one hour

Other information: Volunteers are free to withdraw from the study at any time. Please note that all information gained from the study is confidential. Volunteers will be identified by number only; no individuals will be identified by name.

Consent:
I acknowledge that I have read this form and that I would like to volunteer for the study. I understand that I am free to withdraw from the study at any time and that no names will be used in any way following the research. I further understand that, after the study, I may contact the researchers to make inquiries regarding procedures I do not understand.

Signature: ______________________________ Date: ______________

You will be contacted by the investigators to confirm your time of participation

Name: ____

Phone: ____

Email: ____

Best time to contact you: __________________________

Participant Consent

You have been invited to participate in a research project. The University of Alberta supports the practice of protection for human subjects participating in research. The following information is provided so that you can decide whether you wish to participate in the present study.

The research is being done by Amber Gear for partial fulfillment of a Ph.D. in the department of Educational Psychology. Dr. Judy Cameron and Dr. David Pierce are supervisors of this research study. The findings in this study may be published in a research journal. Data for all uses will be handled in compliance with the University of Alberta Standards for the Protection of Human Research Participants.

In this study, you will be asked to engage in puzzle solving activities. You will also be asked to complete some questionnaires. Your responses to all materials will be anonymous.

The entire experiment takes about 45 minutes to complete. This includes the short questionnaires you are asked to complete. Participants will be asked to come to the Centre for Experimental Sociology in the Tory Building for the experiment. The sessions are videotaped to ensure consistency in the procedure; they are individually examined to ensure that the experiment was properly performed. Videotapes are destroyed once they have been stored for the minimum five-year requirement.

Research assistants will comply with the University of Alberta Standards for the Protection of Human Research Participants. This package can be found by going to http://www.ualberta.ca/~unisecr/policy/sec66.html. Other research personnel will sign confidentiality agreements.

There are certain rights that you have as a research participant. You have a right:

- -To not participate
- -To withdraw at any time without prejudice
- -To continuing and meaningful opportunities for deciding whether or not to continue to participate
- -To opt out without penalty
- -To have any collected data regarding yourself withdrawn from the data base and not included in the study
- -To privacy, anonymity and confidentiality
- -To safeguards for security of data (data are to be kept for a minimum of 5 years following completion of research)
- -To disclosure of the presence of any apparent or actual conflict of interest on the part of the researcher(s).

Your participation in this research is solicited, but is strictly voluntary. Do not hesitate to ask any questions about the study. Be assured that your name will not be associated with the research findings. If you have any concerns, questions, or complaints you may contact Amber Gear at (780) 492-2349 or through email at agear@ualberta.ca. Dr. Judy Cameron may be reached through email at judy.cameron@ualberta.ca. Dr. David Pierce may be reached through email at dpierce@ualberta.ca.

To contact a person not directly involved in the study, please contact the department of educational psychology.

Robin Everall
Associate Chair & Associate Professor, Educational Psychology
Education N 6-107a
(780) 492-1163, robin.everall@ualberta.ca

If you voluntarily agree to participate in the study, please sign below. We appreciate your cooperation.

Signature of participant: ______________________________

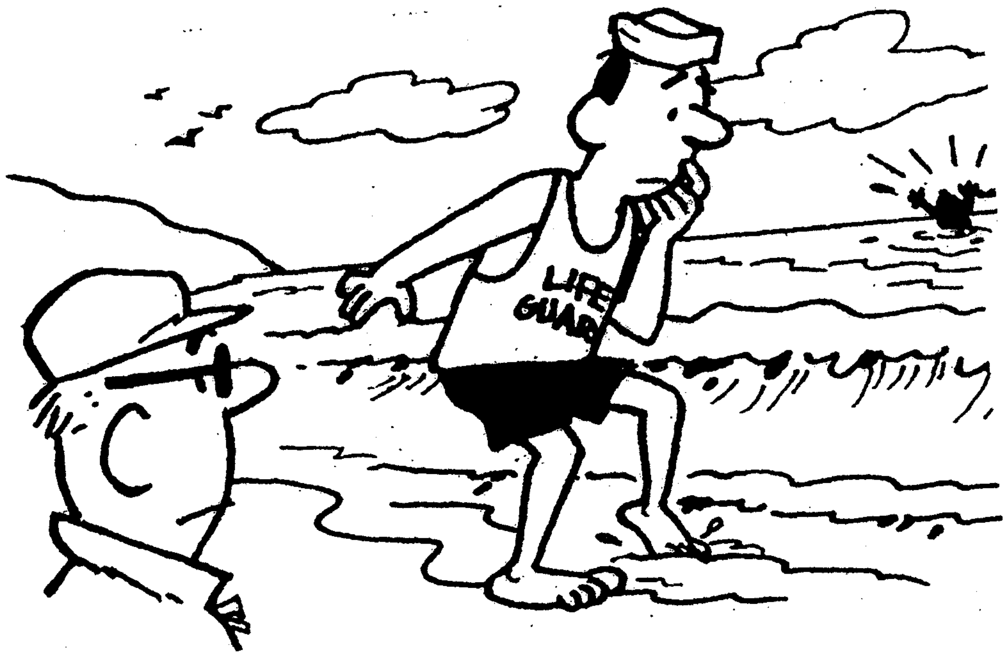
Name of participant (please print): ______________________________

Date: ____________________

GENDER (please circle): MALE FEMALE

This study has been reviewed and approved by the Faculties of Education and Extension Research Ethics Board (EE REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EE REB at (780) 492-3751

Sample Find the Difference Puzzle



Participant # _______________ **Q1**

Place an X on the line that best represents your position.

In general, I find puzzle solving:

interesting	__	__	__	__	__	__	__	boring
dull	__	__	__	__	__	__	__	exciting
enjoyable	__	__	__	__	__	__	__	unpleasant
tedious	__	__	__	__	__	__	__	entertaining

Participant # ______________ **Q2**

Place an X on the line that best represents your position.

I think the Find the Difference puzzles are:

demanding	_	_	_	_	_	_	_	undemanding
challenging	_	_	_	_	_	_	_	not challenging
difficult	_	_	_	_	_	_	_	easy
boring	_	_	_	_	_	_	_	interesting
unpleasant	_	_	_	_	_	_	_	enjoyable
complex	_	_	_	_	_	_	_	simple
exciting	_	_	_	_	_	_	_	dull
tedious	_	_	_	_	_	_	_	entertaining

In terms of solving the Find the Difference Puzzles, I feel:

anxious	_	_	_	_	_	_	_	calm
competent	_	_	_	_	_	_	_	incompetent
constrained	_	_	_	_	_	_	_	free
nervous	_	_	_	_	_	_	_	relaxed
at ease	_	_	_	_	_	_	_	intimidated
confident	_	_	_	_	_	_	_	unsure
unable	_	_	_	_	_	_	_	capable
easy going	_	_	_	_	_	_	_	overwhelmed
pressured	_	_	_	_	_	_	_	self-controlled
stress-free	_	_	_	_	_	_	_	tense

Participant # _______________ **Q3**

Place an X on the line that best represents your position.
I think the Find the Difference puzzles are:

demanding	__	__	__	__	__	__	__	undemanding
challenging	__	__	__	__	__	__	__	not challenging
easy	__	__	__	__	__	__	__	difficult
interesting	__	__	__	__	__	__	__	boring
enjoyable	__	__	__	__	__	__	__	unpleasant
simple	__	__	__	__	__	__	__	complex
exciting	__	__	__	__	__	__	__	dull
entertaining	__	__	__	__	__	__	__	tedious
effortless	__	__	__	__	__	__	__	exerting

Place an X on the line that best represents your position.
In terms of solving Find the Difference puzzles, I feel:

intimidated	__	__	__	__	__	__	__	at ease
tense	__	__	__	__	__	__	__	stress-free
capable	__	__	__	__	__	__	__	unable
free	__	__	__	__	__	__	__	constrained
calm	__	__	__	__	__	__	__	anxious
pressured	__	__	__	__	__	__	__	self-controlled
incompetent	__	__	__	__	__	__	__	competent
nervous	__	__	__	__	__	__	__	relaxed
confident	__	__	__	__	__	__	__	unsure
overwhelmed	__	__	__	__	__	__	__	easy going

Participant # ________________ **Q4**

Please circle a response for each statement according to the following scale:

1	2	3	4	5	6	7
Not at all						Very Much

1) I enjoyed doing the Find the Difference puzzles.

1 2 3 4 5 6 7

2) I wanted to do well to please the researcher.

1 2 3 4 5 6 7

3) I put effort into solving the puzzles.

1 2 3 4 5 6 7

4) I was concerned about my performance being evaluated.

1 2 3 4 5 6 7

5) I was motivated to perform well at the Find the Difference puzzles.

1 2 3 4 5 6 7

6) I put energy into solving the puzzles.

1 2 3 4 5 6 7

7) My performance on the Find the Difference puzzles was due to:

my effort	1	2	3	4	5	6	7
time pressure	1	2	3	4	5	6	7
my skill	1	2	3	4	5	6	7
pressure from situation	1	2	3	4	5	6	7
my interest	1	2	3	4	5	6	7
feedback from the researcher	1	2	3	4	5	6	7
luck	1	2	3	4	5	6	7

8) How poorly or well did you do on the Find the Difference puzzles?

very poorly 1 2 3 4 5 6 7 very well

9) How competent do you feel about Find the Difference puzzles?

not at all competent 1 2 3 4 5 6 7 extremely competent

10) How much choice did you have as to whether or not to do Find the Difference puzzles?

very little 1 2 3 4 5 6 7 very much

Participant # _______________ **Q5**

Some people enjoy getting money for doing these puzzles. Other people don't.

Please circle a response for each of the statements below according to the following scales:

1	2	3	4	5	6	7
Not at all						**Very much**

1) I felt controlled by the money.

1 2 3 4 5 6 7

2) I enjoyed receiving the money.

1 2 3 4 5 6 7

3) Receiving money made me feel pressured.

1 2 3 4 5 6 7

4) After receiving the money, I felt overpaid.

1 2 3 4 5 6 7

5) The money provided me with useful feedback to evaluate my performance.

1 2 3 4 5 6 7

6) Receiving money distracted my attention from the task.

1 2 3 4 5 6 7

7) Receiving money motivated me to perform well on the Find the Difference puzzles.

1 2 3 4 5 6 7

8) After receiving the money, I felt underpaid.

1 2 3 4 5 6 7

9) Receiving money made me feel less interested in doing the Find the Difference puzzles.

1 2 3 4 5 6 7

10) I deserved receiving money for doing the Find the Difference puzzles.

1 2 3 4 5 6 7

Participant # _______________ **Q6**

Place an X on the line that best represents your position.

I find the Find the Difference puzzles:

difficult	_	_	_	_	_	_	_	easy
exciting	_	_	_	_	_	_	_	dull
demanding	_	_	_	_	_	_	_	undemanding
tedious	_	_	_	_	_	_	_	entertaining
enjoyable	_	_	_	_	_	_	_	unpleasant
challenging	_	_	_	_	_	_	_	not challenging
simple	_	_	_	_	_	_	_	complex
exerting	_	_	_	_	_	_	_	effortless

Place an X on the line that best represents your position.
In terms of solving Find the Difference puzzles, I feel:

pressured	_	_	_	_	_	_	_	self-controlled
confident	_	_	_	_	_	_	_	unsure
stress-free	_	_	_	_	_	_	_	tense
incompetent	_	_	_	_	_	_	_	competent
anxious	_	_	_	_	_	_	_	calm
capable	_	_	_	_	_	_	_	unable
easy going	_	_	_	_	_	_	_	overwhelmed
nervous	_	_	_	_	_	_	_	relaxed
at ease	_	_	_	_	_	_	_	intimidated
free	_	_	_	_	_	_	_	constrained

Participant # _______________ **Q7**

Please circle a response for each statement according to the following scale:

1	2	3	4	5	6	7
Not at all						**Very Much**

1) My performance on the Find the Difference puzzles was due to:

time pressure	1	2	3	4	5	6	7
luck	1	2	3	4	5	6	7
my interest	1	2	3	4	5	6	7
my skill	1	2	3	4	5	6	7
feedback from the researcher	1	2	3	4	5	6	7
my effort	1	2	3	4	5	6	7
pressure from situation	1	2	3	4	5	6	7

2) How much choice did you have as to whether or not to do Find the Difference puzzles?

very little 1 2 3 4 5 6 7 very much

3) I put effort into solving the puzzles.

1 2 3 4 5 6 7

4) I put energy into solving the puzzles.

1 2 3 4 5 6 7

5) I enjoyed doing the Find the Difference puzzles.

1 2 3 4 5 6 7

6) I was motivated to perform well at the Find the Difference puzzles.

1 2 3 4 5 6 7

7) How poorly or well did you do on the Find the Difference puzzles?

very poorly 1 2 3 4 5 6 7 very well

8) I wanted to do well to please the researcher.

1 2 3 4 5 6 7

9) How competent do you feel about Find the Difference puzzles?

not at all competent 1 2 3 4 5 6 7 extremely competent

10) I was concerned about my performance being evaluated.

1 2 3 4 5 6 7

Participant # ________________ **Q8**

Place an X on the line that best represents your position.

At this point in the study, I find the Find the Difference puzzles:

entertaining	__	__	__	__	__	__	__	tedious
effortless	__	__	__	__	__	__	__	exerting
dull	__	__	__	__	__	__	__	exciting
boring	__	__	__	__	__	__	__	interesting
enjoyable	__	__	__	__	__	__	__	unpleasant
difficult	__	__	__	__	__	__	__	easy
challenging	__	__	__	__	__	__	__	not challenging
demanding	__	__	__	__	__	__	__	undemanding
complex	__	__	__	__	__	__	__	simple

In general, I find puzzle solving activities:

exciting	__	__	__	__	__	__	__	dull
enjoyable	__	__	__	__	__	__	__	unpleasant
tedious	__	__	__	__	__	__	__	entertaining
boring	__	__	__	__	__	__	__	interesting

Participant # ______________ **Q9**

1) During the experiment, did you form any specific ideas about the purpose of this study?

____

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2) How did your ideas about the purpose of the study affect your performance?

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This study has been reviewed and approved by the Faculties of Education and Extension Research Ethics Board (EE REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EE REB at (780) 492-3751

Oral Debriefing

For debriefing, you'll need: $10 bill & 1 toonie, "money received" form, and non-disclosure form.

Now that we're done, I am going to explain what this study was about. If you have any questions, you can ask me.

In this study, we're interested in the effects of task difficulty and rewards on task performance and on liking for the task. Some of the people in the study are offered money to do the puzzles and some are not. So, to be fair, we are paying everyone money for being in the study. (*If the participant was in the two groups that were not rewarded, they are given $12.00—a toonie and a $10 bill. If the participant was in either of the two rewarded groups, their toonies are exchanged for a $10 bill*). I'm just going to exchange your toonies for a $10 bill.

Could you please sign this form that indicates that you received the money (*make sure they sign the "money received" form indicating they got the money for their participation in the study*). Also, in order to get good results, we are asking that you please do not tell anyone what has happened here today, and especially do not say anything about the money. Could you please sign this non-disclosure form that indicates that you won't tell anyone about the study (*make sure they sign non-disclosure form*).

This is what we did to examine this issue. We brought you in here, and you and all the other participants worked on the same task that required you to circle differences between two pictures. Half of the participants in this study are offered money for finding differences and half of you are not. This was one of the independent variables in the study; whether you were offered an external incentive or not to work on the task. It is called an independent variable because it was something we manipulated, or varied between participants. Another of our independent variables was level of task difficulty. Of the participants who were rewarded, half were offered money for finding only a few differences (they were rewarded for an easy task); the other half were offered the same amount of money for finding many differences (they were rewarded for a difficult task). Our third independent variable in this study was whether or not you completed a timed test. That is, half of the participants did a timed test and half did not.

Near the end of the experiment, I told you that I had to leave to set up the next participant in the study and I left you alone for ten minutes. So, intrinsic motivation was our dependent variable in the study. We measured that by the amount of time you spent on the puzzles once I left the room. The reason I didn't tell you this is because I wanted to see if people would continue to work on the task after they had received a reward for doing it in the learning phase. I also wanted to see if there would be a difference in time spent doing more puzzles if participants had been rewarded for doing an easy task versus doing a difficult task.

At each stage of the study, questionnaires were administered to assess task interest, task difficulty, levels of effort, perceived competence, autonomy, and attitudes toward receiving a reward. I'm sorry I couldn't tell you everything that was going on here, but if people come into these experiments knowing exactly what the study was about, they often try to be good subjects and give us the responses we are looking for. In a study, that is called demand characteristics. If people do come in with expectations, it will invalidate our results. Again, please do not let other people know what I am doing in this study, because if people come in with expectations, or they think they will be rewarded, this study will be ruined.

If you would like to ask more questions about the study, please let me know. If you think of questions you want to ask, please contact us. Thanks.