University of Alberta

Do Performance Standards and Task Difficulty Moderate the Effects of Rewards on Intrinsic Motivation?

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 Master of Education

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"The criterion of congruence with reality should have been sharpened-sharpened into the insistence that theories be examined for their implications for observable behavior. Not only were such implications not sought and tested, but there was a tendency, when there appeared to be a threat of an empirical test, to reformulate the theory to make the test ineffective."

G. J. Stigler

Dedication

For my parents, who have always provided me with the best they can.

獻給我親愛的父母親:

感謝他們對我向來竭盡所能的付出

Abstract

This study tested the validity of various theoretical accounts of the effects of rewards on intrinsic motivation by examining the question: Do rewards produce different effects if the standard is varied (constant vs. progressive) and if task difficulty is varied (easy vs. more difficult)? Seventy-seven undergraduate university students participated in the study. Intrinsic motivation was indexed by a combination of behavioral and attitudinal measures. In addition, other measures such as task interest, perceived competence, and self-determination were taken throughout the study. The results indicated that measures of intrinsic motivation were enhanced when rewards were tied to high effort on a task. The findings also indicated that rewards enhanced interest, self-determination, and self-efficacy. These findings are discussed in relation to cognitive evaluation theory, the overjustification hypothesis, social learning theory, and the learned industriousness model. The results do not provide support for cognitive evaluation theory or the overjustification hypothesis. Instead, the findings are more in accord with social learning theory and the learned industriousness model.

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Table of Contents

List of Tables

List of Figures

Chapter 1
INTRODUCTION

Throughout the past three decades, many books and articles have been written about how rewards can undermine an individual's intrinsic motivation (e.g., Deci, 1975; Deci, Koestner & Ryan, 1999; Deci & Ryan, 1985; Kohn, 1993; Lepper, Greene, & Nisbett, 1973). Numerous researchers have cited experimental studies in education and social psychology as evidence that rewards should not be used in educational settings. The concern is that giving students rewards to perform an activity may lead them to spend time on the activity but once the rewards are removed, the students' motivation and interest in the task will decline. Rewards are said to be controlling and to undermine peoples' perceptions of competence, self-determination, and intrinsic motivation (Deci et al., 1999).

Since the 1970's, dozens of experiments have examined the effects of rewards on intrinsic motivation. Over the past few years, a number of meta-analyses have been conducted on the experimental studies. Some researchers continue to argue that negative effects of reward are pervasive (Deci et al., 1999); others have shown that negative effects are limited. In the most recent meta-analysis on the topic, Cameron, Banko, and Pierce (2001) demonstrate that when studies are organized according to the actual procedures used in the experiments, rather than by a theoretical orientation (e.g., cognitive evaluation theory), negative, positive, and no effects of reward are detected. Cameron et al. found negative effects of rewards in studies where the rewards were tangible, signified failure, and were loosely tied to performance standards. On the other hand, positive effects were found for verbal praise and for tangible rewards that were offered for meeting specified performance standards.

In most of the studies that show positive effects of tangible rewards on intrinsic motivation (e.g., Eisenberger, Rhoades, & Cameron, 1999; Harackiewicz, Manderlink, & Sansone, 1984), experimental participants are offered a reward to meet or exceed a certain score on a task, or to do better than a specified norm (e.g., exceed 50% of others who have done the task). To date, few studies have examined the effects of rewards on measures of intrinsic motivation when the rewards are offered for achieving increasingly higher standards of performance (mastery). In addition, little research has been conducted to assess the effects on intrinsic motivation of rewarding high versus low task difficulty. The purpose of the present study was to determine how rewards affect students' motivation and performance when the rewards are tied to mastery of performance and to task difficulty.

The Typical Rewards and Intrinsic Motivation Experiment

Deci (1971) was the first to experimentally assess the effects of reward on intrinsic motivation. Since Deci's initial study, over 150 experiments have used a similar between-groups design to investigate the topic. In a typical study, participants are presented with a purportedly interesting task (e.g., solving and assembling puzzles, drawing with magic markers, playing word games). Rewards are either tangible (e.g., money, candy, or gold stars) or verbal (e.g., praise, approval, or positive feedback). In addition, the rewards may be offered beforehand (expected reward) or presented unexpectedly after the activity (unexpected reward). In some experiments, reward is offered simply for doing an activity; in other studies the rewards are given for completing a task or for each puzzle/unit solved. In a number of experiments, the rewards are offered for meeting or exceeding a specific standard.

Participants in a control condition engage in the activity without receiving a reward. The reward intervention is usually conducted over a 10-minute to 1-hour period. Rewarded and non-rewarded groups are then observed during a non-reward period (anywhere from 2 minutes to one hour) in which participants are free to continue performing the target task or to engage in some alternative activity. The time participants spend on the target activity during this non-reward phase (free time), their performance on the task during the free-choice period, and self-reported task interest are used as measures of intrinsic motivation. If rewarded participants spend less free time on the activity, perform at a lower level, or express less task interest than non-rewarded participants, reward is said to undermine intrinsic motivation.

Theoretical Interpretations of Rewards and Intrinsic Motivation

Several theories and hypotheses have been postulated to account for the effects of rewards on intrinsic motivation. For purposes of the present study, four theoretical orientations are examined: cognitive evaluation theory (Deci et al., 1999), the overjustification hypothesis (Lepper et al., 1973), social learning theory (Bandura, 1986), and the learned industriousness model (Eisenberger, 1992).

According to cognitive evaluation theory (CET) intrinsic motivation is affected by changes in perceptions of competence and self-determination (Deci et al., 1999). According to CET, rewards are most harmful when they are tangible and offered before people engage in an activity (expected reward). When rewards are offered for doing a task, completing a task, or for meeting a performance standard, the claim is that people experience the reward as controlling and their self-determination decreases. When rewards are tied to performance, the reward may serve to increase feelings of competence because the reward serves as informational feedback. However, the controlling function of reward is expected to be stronger than the feedback function; thus, rewards based on performance are expected to reduce self-determination and to lead to decreases in intrinsic motivation.

A similar prediction is made by overjustification theory (Lepper, Greene, & Nisbett, 1973). Rewards linked to performance are said to decrease intrinsic motivation by altering people's perceptions of locus of control. People rewarded will come to attribute their behavior to external forces (rewards) rather than internal ones (intrinsic motivation). Hence, overjustification theory predicts that when the external causes are removed, the reason for doing the task is lost. That is, rewards result in detrimental effects on intrinsic motivation.

From both of these perspectives, when a reward is offered to individuals to achieve high standards on a task, or to do a difficult task, the reward will be perceived as more controlling than reward for low standard and low task difficulty. The more reward is perceived as controlling, the more an individual's intrinsic motivation will decrease. The prediction from both cognitive evaluation theory and the overjustification hypothesis is that the termination of rewards is expected to create the greatest detrimental effect in situations where the highest standard is required and where the task is relatively difficult.

In contrast to the predictions of CET and the overjustification hypothesis, Bandura's (1986, 1997) social learning theory claims that high performance attainment results in high motivation levels by enhancing an individual's sense of self-efficacy. Social learning theorists are interested in how reward contingencies affect perceived competence and self-efficacy. From a social learning perspective, rewarding the attainment of performance standards and/or task difficulty are mediated by cognitive processes involving personal standards and self-efficacy. When rewards are linked to successful attainment of challenging performance standards (mastery), the prediction is that a person's feelings of competence and self-efficacy will be enhanced; this, in turn, will lead to increases in performance and motivation.

Eisenberger's (1992) "learned industriousness" theory also suggests that rewards can be beneficial. According to the theory, when individuals are rewarded for high cognitive effort (i.e., on a difficult task), they are conditioned to further their efforts even when the reward is withdrawn. From this perspective, reward procedures alter task interest and performance through the conditioning of sensations of effort.

Thus, from a social learning orientation and from the viewpoint of learned industriousness, rewards linked to mastery and task challenge should increase intrinsic motivation. Drawing on both Bandura's (1986) and Eisenberger's (1992) theories, rewarding high performance standards and rewarding high task difficulty should combine to enhance intrinsic motivation.

Purpose of the Present Study

The present study was designed to assess the effects of rewarding the attainment of constant versus progressively demanding performance standards as well as the effects of rewarding participants for engaging in a task of low versus high difficulty. A major purpose of the present experiment was to evaluate the adequacy of different theoretical accounts of how reward contingencies affect intrinsic motivation.

As indicated, CET and the overjustification hypothesis predict that rewards tied to performance will decrease measures of intrinsic motivation. From a CET perspective, rewarded participants will feel controlled by the reward. Although rewards tied to performance attainment may signify competence, reduced perceptions of self-determination are expected to override feelings of competence and the overall result will be less task interest, lower performance, and reduced time on the task once the rewards are withdrawn. The overjustification hypothesis suggests that rewards will disrupt measures of intrinsic motivation by shifting perceptions of causation from internal to external. Opposite predictions are made by social learning theory and the learned industriousness model, which predict that rewards tied to achieving high standards and exerting high effort will lead to increased interest and performance. From a social learning perspective, rewards tied to mastery will enhance measures of intrinsic motivation through the process of increased self-efficacy and personal standards. From a learned industriousness perspective, performance-based rewards will enhance task interest and performance through the conditioning of sensations of effort.

The predictions of the various theories were tested in the present study. The study followed the basic procedures of the typical reward and intrinsic motivation experiment. Participants engaged in a problem-solving task. Behavioral measures of intrinsic motivation included free time on the task in a free-choice period when rewards were removed, performance on the task during the free choice session, and questionnaire measures of task interest. An additional behavioral measure not included in other studies on rewards and intrinsic motivation was performance on a test (after rewards were withdrawn). Throughout the experiment, measures of task interest, perceptions of task challenge, competence, self-determination, internal versus external locus of causality, self-efficacy, personal standards, levels of anxiety, and whether rewarded participants felt controlled by reward, were taken.

Chapter 2
LITERATURE REVIEW

The present study was designed to investigate the effects of rewards offered for engaging in a task of high or low difficulty, and the effects of rewards offered for meeting either constant or progressive levels of performance standards, on students' intrinsic motivation. This chapter provides a review of the research on the effects of rewards on intrinsic motivation. Four different theories (CET, overjustification theory, social learning theory, and the learned industriousness model) that provide accounts for how rewards affect people's intrinsic motivation are described. Studies on rewards and intrinsic motivation that are relevant to each of the theories are reviewed. Finally, the research questions for the present study are introduced.

Types of Studies on Rewards and Intrinsic Motivation

In research on the effects of rewards on intrinsic motivation, the between-group design is the dominant research paradigm. In a simple between-group design, participants are randomly assigned to one of two groups – an experimental group and a control group. Both groups are asked to engage in a task (e.g., drawing, solving puzzles, etc.). The two groups do not differ from each other except that the experimental group receives rewards in the treatment phase, whereas the control group does not.

Following the treatment phase, both groups are observed during a free-choice period. During the free-choice period, no rewards are offered to either group. The time spent on the task during the free-choice phase and/or performance on the task during the free-choice period is compared between the groups. Any differences in time on task or performance are attributed to the effects of rewards. If the experimental group spends less time on the task during the free-choice session or performs at a lower level than the control group, rewards are said to decrease intrinsic motivation. An additional typical measure of intrinsic motivation is participants' self-reports of task interest.

Past researchers have used either high or low interest tasks to investigate the effects of rewards. Attention has also been paid to the effects of verbal versus tangible rewards. Verbal rewards include praise and positive comments; tangible rewards include candies, pizzas, bonuses, good player awards, money, and so on. Rewards given to participants can be either expected or unexpected: Expected rewards are promised to participants before they engage in the task; unexpected rewards are presented to participants only after they finish the task. Researchers are particularly interested in the effects of rewards that are tied to various contingencies: (a) reward offered for participating in the study, (b) for engaging in the task, (c) for completing the task, (d) for each unit/puzzle solved, (e) for meeting certain performance standards, or (f) for exceeding the performance of others.

Findings on rewards and intrinsic motivation. Since 1971, approximately 150 experiments (between-group designs) have been conducted to investigate the effects of rewards on intrinsic motivation. The findings have been mixed – positive, negative, and no effects of rewards have been found. Several researchers have attempted to integrate the findings by using the technique of meta-analysis (Cameron & Pierce, 1994; Cameron et al., 2001; Deci et al., 1999; Eisenberger & Cameron, 1996).

Although there are some differences in the conclusions reached by the different meta-analyses, there are several areas of agreement among these reviews. In each of the meta-analyses to date, the researchers have found that verbal praise and positive feedback lead to increases in measures of intrinsic motivation (free-choice behavior and self-reported task interest). Tangible rewards are found to have different effects depending on whether they are promised to participants beforehand (expected) or not promised but delivered after participants perform the experimental task (unexpected). In each of the meta-analyses to date, unexpected rewards do not affect measures of intrinsic motivation. In addition, when the rewards are tangible, expected, and unrelated to task behavior (non-contingent), there are no significant effects on intrinsic motivation. Each of the meta-analyses has also found negative effects of reward under the following combination of conditions: when the experimental tasks are of high initial interest to participants, when the rewards are tangible, when the rewards are expected (offered beforehand), and when the rewards are given simply for doing an activity (labeled "engagement contingent" by Deci et al., 1999).

The meta-analytic reviews differ in their analyses of expected tangible rewards (on high interest tasks) for what Deci et al. (1999) refer to as completion-contingent and performance-contingent rewards. In Deci et al.'s meta-analysis, studies were categorized according to cognitive evaluation theory. "Completion-contingent" rewards were those offered and given for completing a task or for solving problems and "performance-contingent" rewards were defined as those "offered dependent upon the participants' level of performance" (Deci et al, 1999; p. 636). In the "performance-contingent" category, Deci et al. included studies where the rewards were offered for doing well, for each unit/problem solved, for meeting or exceeding a criterion, and for meeting or exceeding the performance levels of others. Deci et al. found negative effects on intrinsic motivation for both completion-contingent and performance-contingent rewards. Based on these findings, they argued that negative effects of reward are pervasive.

Cameron et al. (2001) showed that by organizing studies according to cognitive evaluation theory, Deci et al. (1999) collapsed across distinct reward procedures and were able to obtain pervasive negative effects. Specifically, they showed that Deci et al.'s categories "completion-contingent" and "performance-contingent" pooled a number of different reward procedures that produced different effects on measures of intrinsic motivation. When the studies were organized according to the actual procedures used in the experiments, Cameron et al.'s findings showed that no negative effects are obtained when the rewards are linked to success or when the rewards are offered for meeting a specific performance criterion or for exceeding others. In fact, when rewards are linked to a performance standard and participants are able to meet the standard, the results show positive effects of reward.

In terms of what Deci et al. (1999) labeled "performance-contingent" rewards, Cameron et al. (2001) divided this class into four subclasses: rewards offered for each unit solved, rewards offered for doing well, rewards offered for surpassing a score, and rewards offered for exceeding others. When rewards are offered for doing well, Cameron et al. found a negative effect on free-choice intrinsic motivation. They argued that these types of rewards are not specifically tied to performance. That is, a specific standard of performance was not made explicit.

However, when the rewards are offered for success or for meeting an explicit standard of performance, Cameron et al. (2001) found either no effects or positive effects. Specifically, positive effects were found on both the free-choice and self-report measures of intrinsic motivation in studies where rewards were offered for surpassing others' performance (achieving higher than 80% of others who had done the task). When rewards were offered for attaining or exceeding a specific score, no effect was found on the free-choice measure, but a positive effect was detected on self-reports of task interest.

These results suggest that when rewards are linked to a specific performance standard, people's intrinsic motivation may be enhanced.

When rewards are linked to meeting a performance standard. Because the present study is, in part, concerned with the effects of rewards offered for attaining a specific performance standard, it is important to closely examine studies that have used this type of reward contingency. In this section, studies in which rewards were linked to meeting or exceeding a specific performance standard are reviewed.

Table 2.1 presents studies where the rewards were offered for meeting or surpassing the performance levels of others. In each of these studies, the researchers claimed that the task was of high initial interest to participants. In addition, for each study, the rewards were tangible and offered beforehand (expected). Table 2.1 describes what the type of reward was used (e.g., money, movie pass, etc.), what was required of the participants in order to receive the reward (e.g., exceed 50% of others), and whether participants received maximum (M) or less (L) than maximum reward. In studies of less than maximum reward, participants did not meet the requirement and did not receive the entire reward. When participants met the requirement, they were given the maximum reward.

Table 2.1 also indicates the type of control group used in each study. Eisenberger, Pierce, and Cameron (1999) noted that there were two possible types of control groups used in these studies. In some, the rewarded group was compared to a control group that received the same evaluation and feedback (complete control). For example, in some studies, all participants were told that they had attained the required performance standard and that they had achieved "an excellent level of performance." The only difference between the rewarded and non-rewarded groups was that the former received the reward upon task completion, whereas the non-rewarded groups did not. Thus, the non-rewarded groups in this type of study were considered to be a "complete control" condition.

In other studies, the rewarded group was compared to a control group that was simply told to do the task; no performance requirement was given and no feedback evaluation was given (partial control). For example, in Luyten and Len's (1981) study, rewarded participants were offered a reward to complete the task faster than 50% of others. The control group, on the other hand was simply asked to do the task. The rewarded participants, therefore, received performance evaluation via their receipt of rewards, whereas the non-rewarded ones received no evaluation feedback. Thus, the difference between the two groups was presence or absence of evaluation feedback as well as presence or absence of reward. Because there were two variables compared at the same time, the two factors were confounded in this type of study and the non-rewarded groups were considered "partial controls."

Table 2.1 shows the direction of the effects of rewards on the main measures of intrinsic motivation for each of the studies. Intrinsic motivation measures included time spent on the task during a free-choice period (free time), performance on the task during the free-choice period, and/or self-reported task interest. On each of these measures, the rewarded group was compared to the non-rewarded control condition. In Table 2.1, a negative effect (-) indicates that the rewarded group spent less time, performed at a lower level, or reported less task interest than the control group. A positive effect (+) indicates higher intrinsic motivation for the rewarded group and a zero effect (0) indicates no differences between the groups.

Table 2.1.

Rewards Offered for Meeting or Exceeding Others

Study	Task	Requirement	Reward	L/M	Control	Direction of Effects FT	Pf	SR
Eisenberger, Rhoades, & Cameron, (1999) Exp.1	Find the Difference game	> 80%	$3.00	M	Complete	+	N/a	+
Harackiewicz (1979)	Nina puzzles	> 50%	2 pens and a notebook	M	Partial	N/a	N/a	-
Harackiewicz & Manderlink (1984)	Word and Nina puzzles	> 50%*	Fast food gift certificate	M	Partial	N/a	N/a	+
Harackiewicz et al. (1984) Exp. 1	Pinball game	> 50% or > 80%	Movie pass	M	Partial	+	+	+
					Complete	+	+	+
Harackiewicz et al. (1984) Exp. 2	Pinball game	> 80%	Movie pass	M	Partial	N/a	-	-
Harackiewicz et al. (1984) Exp. 3	Pinball game	>80%**	Movie pass	M	Complete	N/a	+	+
					Partial	N/a	+	+
Harackiewicz et al. (1987)	Paper and pencil word game	>50%***	Movie pass	M	Complete	N/a	N/a	+
					Partial	N/a	N/a	-
Karniol & Ross (1977)	Slide show game	> 50%*	2 candies	L/M	Complete	+	N/a	N/a
Luyten & Lens (1981)	Wooden cubes	> 50%	60 BF (appro. $2)	L	Partial	-	N/a	+
Rosenfield et al. (1980)	Crossword game	> 85%	$1.75	L/M	Complete	+	N/a	+
Salancik (1975)	Slot-car race	> 50%	$2	M	Complete	-	N/a	+
Tripathi & Agarwal (1988)	Algorithmic or Heuristic tasks	≥ usual university students.*	A pen	M	Partial	+	N/a	+
Weinberg & Jackson (1979)	Stabilometer balancing task	> 70%	$1	L/M	Partial	N/a	N/a	0

Note. L/M = participants received less than maximum amount of reward/ maximum amount of reward; FT = free-time measure; P = free-choice performance; SR = self-reported task interest, liking, or enjoyment; + = a positive effect of reward; - = a negative effect of reward; 0 = assignment of a zero effect size for studies reporting nonsignificant findings without enough detail to examine the direction of the effect; N/a = the measure was not available in that study.

* Indicated the scores/norms were specified in the instruction in these studies.

** In this study, the norm was specified to only half of the participants in the instruction.

*** In this study, the participants received the norm in the feedback.

In the studies presented in Table 2.1, seven employed complete control groups. Out of the seven, five examined the effects of reward on free time. Only one of these five studies found a detrimental effect (Salancik, 1975); the other four showed positive effects. Six studies with complete control groups assessed self-reported task interest; all six found positive effects. Only two studies employed performance measures and both reported positive results (Harackiewicz et al. Exp.1 & 3, 1984).

Among the nine studies where a partial control group was in use, only three employed the free time measure. Of these three, two found positive effects (Harackiewicz et al., Exp.1, 1984; Tipathi & Agarwal, 1988), and one found a detrimental effect. It is worth noting, however, that in this particular study (Luyten & Lens, 1981), participants did not receive the full amount of reward because the specified standard had not been completely met. In terms of performance in the free-choice period, only studies by Harackiewicz et al. (1984) employed this measure and the results were mixed. In Experiment 1 and Experiment 3, Harackiewicz et al. (1984) found positive effects but in Experiment 2, the researchers found a negative effect. In terms of the self-reports, five studies found positive effects on task interest and three found a negative effect. Finally, no effect on task interest was found in one study (Weinberg & Jackson, 1979).

Table 2.2 presents studies where the rewards were offered for meeting or exceeding a specific standard or a score. When rewards were offered for achieving a specific standard, Cameron et al.'s (2001) meta-analysis found an enhancement on self-reported task interest measures but no effect on the free time measure. Only three studies in this category employed complete control groups; one found a detrimental effect of reward on the self-report measure (Harackiewicz, Abrahams, & Wageman, 1987), and two found incremental effects (Eisenberger, Rhoades, & Cameron, Exp. 1, 1999; Kruglanski et al., Exp. 2, 1975). In addition, a positive effect on free time was found by Eisenberger, Rhoades, and Cameron (1999); this was the only study that examined the effects on free-time with a complete control group. No studies in this category analyzed performance measures during the free-choice period.

Table 2.2.

Rewards Offered for Meeting a Specific Standard or Surpassing a Score

Study	Task	Requirement	Reward	L/M	Control	Direction of Effects FT	P	SR
Boggiano & Ruble (1979)	Hidden pictures game	≥ 3 out of 8	2 candies	M	Partial	-	N/a	N/a
Eisenberger, Rhoades, & Cameron (1999) Exp.1	Find the Difference game	= 4 out of 6	$ 3.00	M	Complete	+	N/a	+
Harackiewicz et al. (1987)	Paper and pencil word game	> 19 words	Movie pass	M	Partial	N/a	N/a	+
					Complete	N/a	N/a	-
Kruglanski et al. (1975) Exp. 2	Stock market or athletics game	Vary on each transaction	2.00 IL	M	Complete	N/a	N/a	+
Pittman et al. (1977)	Gravitation Game	Dropping the ball into holes with different value points	Win either $.05 to $0.25 on each trial	L	Partial	-	-	-
Smith & Pittman (1978)	Labyrinth ball rolling game	To roll a steel ball as far as possible	Win either $.05 to $0.25 on each trial	L	Partial	-	-	0
Tripathi (1991)	Picture puzzles, figure tests, and anagrams	≥ 9 out of 18 marks	A pen	M	Partial	0	0	0

Note. L/M = participants received less than maximum amount of reward/ maximum amount of reward; FT = free-time measure; P = free-choice performance; SR = self-reported task interest, liking, or enjoyment; + = a positive effect of reward; - = a negative effect of reward; 0 = assignment of a zero effect size for studies reporting nonsignificant findings without enough detail to examine the direction of the effect; N/a = the measure was not available in that study.

With regard to the five studies that employed partial control groups in this category, four studies assessed the free time measure; none found incremental effects on free time, three found detrimental effects (Boggiano & Ruble, 1979; Pittman, Cooper & Smith, 1977; Smith & Pittman, 1978), and one detected no effect (Tripathi, 1991). On performance measures, both Pittman et al. and Smith and Pittman found negative effects whereas Tripathi reported no effect. In terms of self-reports, Pittman et al. found a detrimental effect, whereas Tripathi and Smith and Pittman found no effect. An incremental effect on task interest was found in Harackiewicz et al.'s (1987) study.

Tables 2.1 and 2.2 indicate that few studies using rewards based on meeting a specific performance criterion employed complete control groups. In addition, a few studies did not deliver the maximum reward to participants. Also, in each of the studies where rewards were linked to performance, the difficulty of the task remained constant and the performance standard was constant. No studies to date have examined the effects of rewards offered for meeting increasingly challenging standards or for meeting the standard on an easy versus a difficult task. In addition, in all of the studies reviewed here, the rewards were administered only once and then withdrawn.

The present study was designed to extend the research on the effects of rewards offered for meeting specific performance requirements. Specifically, the study was concerned with whether rewards produce different effects if the standard is varied (constant versus progressive) and if the task difficulty is varied (low versus high). To avoid the confound produced in studies that used partial control groups, the control groups in the present study were required to meet the same standards as rewarded groups but were not offered a reward. To ensure that participants received maximum reward, they could work on the task until they met the standard. In addition, a multiple-trials procedure was used in which rewards were administered three times. Finally, to determine the immediate effects of rewards, participants were given a test prior to the free-choice period.

Theoretical Perspectives of Rewards and Intrinsic Motivation

Several competing theories have been put forth to account for the effects of reward on intrinsic motivation. This section describes cognitive evaluation theory, the overjustification hypothesis, social learning theory, and the learned industriousness model. Studies on rewards and intrinsic motivation pertinent to each of these theories are discussed. Finally, the four theories and their predictions on the effects of rewards are summarized.

Cognitive evaluation theory (CET). According to cognitive evaluation theory (Deci, 1975), every reward has a controlling aspect as well as an informational aspect. The controlling aspect of reward is activated by shifting a person's locus of causality of behavior from internal to external. The informational aspect of reward is initiated by satisfying the feelings of competence and self-determination to the person receiving the reward. Whether intrinsic motivation will increase or decrease depends on the relative salience of the controlling and informational aspects of the reward.

Deci (1975, p. 142) posits that the controlling aspect of monetary reward is salient, especially when the reward is offered before engaging in the activity. This is because the expectancy for reward will lead a person to think that s/he is doing the activity for the reward (Deci, Cascio, & Krusell, 1975). Therefore, for expected monetary rewards, the controlling aspect will always outweigh the informational one. Thus, drawing from CET, when monetary reward is offered for performing an intrinsically interesting task, the reward will decrease a person's intrinsic motivation by decreasing perceived self-determination.

According to an early version of CET (Deci & Ryan, 1985), when rewards are tied to a specific performance level, they should be experienced as more controlling than when rewards are not linked to performance standards. When rewards are offered for meeting an absolute criterion, they pose even more restrictions than when rewards are offered for meeting a vague performance level. Thus, rewards offered for meeting a performance standard should be perceived as the most controlling. Because of the salient controlling aspect, perceived competence is also expected to decrease when monetary reward is offered. Thus, CET predicts the greatest decrease in intrinsic motivation for performance-contingent rewards – with the most severe detriment for rewards offered for meeting an absolute criterion, followed by rewards offered for completing a task, and by rewards offered simply for engaging in a task.

In a revision to their theory, Deci et al. (1999) continue to argue that performance contingent rewards will be the most controlling. However, when rewards are linked to performance, Deci et al. have recognized that the reward may signify competence on the task. Nonetheless, decreased self-determination is expected to override any increases in feelings of competence, and thus, this type of reward contingency is predicted to decrease intrinsic motivation.

Several studies have been conducted to test CET. Ryan, Mims, and Koestner (1983) found that when intrinsic motivation was measured by free time, rewards offered for doing well on a task had a significant undermining effect. Their findings also indicated that a controlling instruction decreased intrinsic motivation when compared to positive informational instruction. Boggiano and Ruble (1979) also provided some support for the CET proposition related to perceived competence. They found that for children aged 9 to 11, competence information had an incremental effect on free-time and incompetence information had a detrimental effect.

However, to further evaluate the validity of CET, measures for perceived competence, self-determination, and locus of causality are needed. Boal and Cummings (1981) offered one of most complete assessments of CET. In their field study, self-reported measures of the controlling and informational aspects of rewards, external locus of causality, perceived competence, and self-determination were obtained. Boal and Cummings' study took place in a work environment and intrinsic motivation was measured by how late people arrived at work, how long their breaks were, and how early they left work. Boal and Cummings found that workers who were given non-contingent pay increases showed higher intrinsic motivation than those who were not given any pay increases, and those who received performance-contingent pay increases rated the reward as significantly more informational. Moreover, both performance-contingent and non-contingent rewards did not decrease the workers' feelings of competence and self-determination. These findings contradict the predictions of CET.

Results from other studies measuring perceived competence and self-determination also do not favor CET. Eisenberger, Pierce, and Cameron (1999) reviewed studies on rewards and intrinsic motivation that included measures of perceived self-determination. Contrary to the predictions of CET, the researchers found that rewards offered for doing, completing, or meeting a performance criterion often increased people's perceived self-determination. Other researchers have found that rewards either increase (Eisenberger, Rhoades, & Cameron, 1999) or have no effect (Arnold, 1985; Harackiewicz & Manderlink, 1984) on measures of perceived competence.

It appears that, at present, the evidence does not support the prediction made by CET that performance-contingent rewards create the greatest detrimental effect on intrinsic motivation. Because intrinsic motivation may be affected by rewards but not by the direct influences of perceived competence, self-determination, or locus of control, it is possible that the processes at work may not be the ones suggested by CET. Instead, it may be that performance-contingent rewards enhance intrinsic motivation by processes not accounted for by CET. Before examining theories that predict positive effects of performance-contingent rewards, the next section deals with another theory, the overjustification hypothesis that makes predictions similar to CET.

The overjustification hypothesis. Predictions similar to cognitive evaluation theory are also made by the overjustification hypothesis (Lepper et al., 1973). From this theoretical position, intrinsic motivation is influenced by whether or not people attribute their behavior to internal or external forces. When individuals like what they are doing, they will attribute their behavior to internal causes. If they are offered a reward to engage in a task, they will now have another reason (the reward) for their behavior (an external source of motivation).

The overjustification hypothesis draws on the discounting principle (Kelley, 1973), which suggests that when individuals are rewarded for their behavior, they will discount internal reasons as the cause of their behavior and instead they will instead attribute their behavior to the external reward. When a reward is offered for an interesting activity, people will change their attributions for behavior from internal causes to external causes. As a result, when the rewards are withdrawn, a person's intrinsic motivation will decline. According to the overjustification hypothesis, rewards will be most detrimental when there is high initial interest in an activity, when the rewards are tangible and expected (offered beforehand), and when the rewards are salient.

Although in a discussion of the overjustification hypothesis, Lepper, Keavney, and Drake (1996) suggested that some rewards can convey competence, the overall predictions for decreases in intrinsic motivation are the same as for cognitive evaluation theory. That is, when rewards are tangible, expected, and given for doing a task, completing a task, or for meeting a performance standard, the prediction is that people's intrinsic motivation will decline.

As with CET, the findings of the studies designed to test the overjustification hypothesis are mixed. The processes assumed by the overjustification hypothesis have not been experimentally demonstrated. To date, only a few studies have directly examined the role of locus of causality in mediating the effect of rewards on intrinsic motivation. Pittman, Cooper, and Smith (1977) directly manipulated the causal attributions of the participants by providing them with either external or internal cues. In their study, participants were offered various amounts of rewards according to their performance in a gravitation game; they were hooked to electrodes that monitored their physiological responses. During the experimental session, participants who received the external cue were told that their response patterns indicated that they were interested in the reward, whereas participants who received the internal cue were told that their response patterns indicated they were genuinely interested in the game. Although self-perceptions of how hard they had tried did not significantly differ in each condition, when rewards were offered, participants given the internal cue played more trials than the no-cue participants, who in turn played more than the external cue participants. Thus, this study showed that shifting one's locus of causality could produce the overjusification effect. However, it did not show that the receipt of a reward could shift the locus of causality from internal to external.

In a similar study, Weiner (1980) found that when participants were told that the solving of anagrams depended on chance (external control), the rewarded group solved significantly more puzzles in the free time period than those non-rewarded. However, when participants were told that performance depended on ability (internal control), the non-rewarded group solved slightly more than the rewarded participants. That is, the detrimental effect of reward was only found in the rewarded group given an internal attribution. What this study showed was that when people are given an internal attribution, rewards led to lower intrinsic motivation. But, again, the study did not show whether the offer of reward will shift a person's locus of causality from internal to external.

A study by Salancik (1975) directly examined this issue. Salancik found that good performers were more likely to attribute their performance to their skills and strategy (internal) than poor performers. However, rewards were not found to produce less internal attribution. Other researchers have also not found significant differences on measures of locus of causality between rewarded and non-rewarded groups (Calder & Staw 1975; Weinberg & Jackson, 1979). Since both CET and overjustification hypothesis have been unable to satisfactorily account for the effects of rewards on intrinsic motivation, I now turn to other theories that provide differing views on these issues.

Social leaning theory. A different perspective on how rewards affect motivation and performance is offered by social learning theory (Bandura, 1986). Of central importance is the concept of self-efficacy. Self-efficacy refers to one's self-appraisal of how well one can perform under specific circumstances based on perceptions of competence, task difficulty, and external aids or constraints. A strong sense of self-efficacy on a task can lead to greater exertion of effort, greater perseverance, and more skillful performance.

In addition, one's personal standards function in a similar manner. A person with high personal standards sets goals with higher degrees of difficulty and strives for higher levels of performance. According to Bandura (1986), personal standards contribute to self-efficacy by providing a sense of satisfaction when a challenging task is accomplished. Rewards, also, can promote self-efficacy because the attainment of rewards provides satisfaction to the performer.

Reward contingencies that enhance perceived competence or self-efficacy are expected to increase interest and performance of an activity. Social learning theory predicts that rewards tied to level of performance and rewards given for mastery (i.e., achieving relatively challenging behavioral standards) enhance self-efficacy to the extent that a person is able to attain the performance standard (i.e., succeed). The receipt of the reward signifies a person's competence and validates one's sense of self-efficacy. Greater self-efficacy leads to higher interest in a task and to more time spent on the activity.

Therefore, unlike the previously discussed theories, social learning theory predicts that rewards tied to performance enhance intrinsic motivation by promoting self-efficacy.

From this perspective, people rewarded for successful completion of challenging tasks should experience greater levels of perceived competence and have a greater enhancement of personal standards and self-efficacy, which in turn, should result in a higher level of intrinsic motivation.

The bulk of studies on rewards and intrinsic motivation have not been designed specifically to test social learning theory. However, the studies presented in Tables 2.1 and 2.2 linked rewards to performance and could be evaluated from the perspective of social learning theory. Most of the studies presented in the tables show positive effects of rewards on measures of intrinsic motivation, thus offering support to Bandura's theory. Further support comes from work by Schunk (1983) who found that when rewards were tied to performance, the level of self-efficacy was significantly enhanced when compared to non-contingent rewards and to no reward.

The learned industriousness model. The next theory to be considered is Eisenberger's (1992) learned industriousness model. This theory was not formulated to account for the effects of rewards on intrinsic motivation. However, some of the predictions of the model may be relevant to the effects of rewards based on performance.

According to Eisenberger (1992), when individuals are rewarded after exerting high cognitive effort, they are conditioned to further their efforts even when the reward is withdrawn. That is, once a person has been rewarded to exert effort, that individual will exert effort on future tasks. When rewards are offered for meeting high levels of performance, the achievement of high performance standards acquires a secondary reward value. The attainment of rewards not only provides satisfaction but also a sense of competence. In addition, prior positive experience with tasks of high difficulty and high standards should lead to a preference for challenge, which, in turn, should enhance one's self-determination. From this perspective, reward procedures based on high difficulty and high performance standards will enhance task interest and performance through the conditioning of sensations of effort.

Thus, from a social learning orientation and from the viewpoint of learned industriousness, rewards linked to mastery and effort should increase intrinsic motivation. Drawing on both Bandura's (1986) and Eisenberger's (1992) theories, rewarding high performance standards and high task difficulty should combine to enhance intrinsic motivation.

The Present Study and The Research Questions

The present experiment was designed to extend previous research on the effects of rewards linked to a performance criterion. Specifically, the experiment investigated the effects of rewards based on task difficulty (high vs. low) and performance standards (constant vs. progressive) on intrinsic motivation. A major goal of this study was to test the adequacy of cognitive evaluation theory, the overjustification hypothesis, social learning theory, and the learned industriousness model as accounts for how reward contingencies affect interest and performance.

In terms of theoretical predictions, CET and the overjustification hypothesis both predict that rewards will be experienced as controlling and will lead to reduced intrinsic motivation. From both of these perspectives, intrinsic motivation should be the lowest when the receipt of reward is contingent upon meeting a progressively demanding performance standard and when the task is relatively difficult. Under these conditions, CET and the overjustification account predict that the rewards will be experienced as controlling, that the participants' perceptions of self-determination will be reduced, and that the locus of causality will be seen as external rather than internal. In terms of participants' feelings of competence, it is possible that rewards may signify competence. However, the reduction in perceived self-determination should override any increases in feelings of competence, and the net result will be a decrease in task interest, task performance, and time spent on the task once the rewards are removed.

In contrast, social learning theory and the learned industriousness model predict that intrinsic motivation should be higher in rewarded groups than in non-rewarded groups. More specifically, the greatest enhancement of intrinsic motivation is expected in the rewarded, high task difficulty, progressive performance group. From a social learning perspective (Bandura, 1986), rewarding the attainment of performance standards and/or task difficulty is mediated by cognitive processes involving competence, personal standards, and self-efficacy. From a learned industriousness perspective (Eisenberger, 1992), both reward procedures should alter task interest and performance through the conditioning of sensations of effort.

In order to test the predictions made by the various theories, the present research was designed to address the following questions:

What are the effects of rewards on the following dependent variables, and will the effects of rewards on these variables be affected by different performance standards and different levels of task difficulties?

1. Intrinsic motivation;
2. Test performance;
3. Perceived competence;
4. Self-determination;
5. Locus of causality;
6. Self-efficacy;
7. Personal standards;
8. Perceived task challenge; and
9. Anxiety.

Chapter 3
METHOD

Overview

The purpose of the present study was to examine the effects of rewards on students' motivation and performance when the rewards were tied to mastery of performance and to effort on a task. An additional goal was to test the adequacy of various theoretical accounts of reward effects. The study was a 2 X 2 X 2 between-groups factorial design. There were two levels of task difficulty (high, low), two levels of performance standard (constant, progressive), and two levels of reward (reward, no reward). Participants were undergraduate education students. Students enrolled in an introductory educational psychology course were randomly assigned to one of the eight conditions. Each participant was asked to engage in a "Find the Difference" task on a computer. The task involved two cartoons that were the same except for six differences. The object of the task was to find differences by comparing the pictures. This task originally appeared in local newspapers under the title "Hocus-Focus". Previous research has found this task to be of high interest to university students (Eisenberger, Rhoades, & Cameron, 1999).

The experiment involved three phases: a) learning, in which each participant was asked to do three sets of five Find the Difference problems; b) testing, in which all participants were given a test of five Find the Difference problems; and c) free-choice period, in which all participants were given an 8-minute free-choice period where they could do more Find the Difference problems or engage in an alternate activity. Throughout the study, participants were given questionnaire items designed to assess task interest, perceived task challenge, levels of anxiety, perceptions of competence, feelings of self-determination, self-efficacy, effort, and personal standards.

Design

The design was a 2 X 2 X 2 factorial experiment (two levels of task difficulty, two levels of performance standard, and two levels of reward). Task effort was manipulated by varying task difficulty. In the high effort condition, students were required to find four out of six possible differences in each of the "Find the Difference" problems presented during the learning phase. Participants in the low effort condition were required to find two of six differences.

The second variable, performance standard involved a constant standard or a progressive standard. All participants completed three sets of five problems in the learning phase. In the constant standard condition, students were required to successfully pass three of the five problems in each set before moving on. In the progressive condition, students were required to successfully pass one of the five problems in the first set, three of five in the second set, and five of five in the third set.

The third variable, reward, had two levels (reward, no reward). In the reward conditions, participants were offered $2.00 for passing each set of problems and were rewarded after they passed the set; thus, they were rewarded a total of $6.00 after they completed the three sets. The money was given to the participants following the learning phase and prior to the test phase. Participants in the no-reward control condition were not offered a reward. After the experiment was completed and all measures were collected, no-reward participants were paid $6.00.

<u>Participants</u>

Seventy-seven undergraduate students were recruited from an introductory educational psychology class (67 females, 10 males) at the University of Alberta. Two researchers went to the class, introduced themselves, and asked students if they would volunteer for a study on problem solving. Students were told that they would receive a 2-point bonus on their final exam for the course if they agreed to participate. Each participant was given a recruitment and consent form (see Appendix A). The consent form ensured participants of confidentiality and that they were free to withdraw from the study at any time. No information about monetary rewards was disclosed at the time of recruitment.

Volunteers signed up for a time slot of one-hour; the experiment took place over a three-week period. Participants were randomly assigned to one of eight experimental conditions. Four participants were omitted from the final data analysis. In one case in the progressive reward, low effort condition, the reward failed to appear on the computer screen when the participant passed the set. In another case in the progressive, non-reward, low effort condition, the second set of questionnaires (QA2, QB2) was not administered until after the test. In the progressive, reward, high effort group, one participant started the test without letting the experimenter know, and another participant could not finish the program due to an unexpected computer error. Thus, the final data set was made up of a total of 73 participants. The number of participants in each condition is presented in Table 3.1.

Table 3.1.

The Number of Participants in Each Experimental Condition (N=73)

	High effort	Low effort
Progressive standard		
Reward	9	9
No-reward	9	9
Constant standard		
Reward	9	10
No-reward	9	9

Materials and Apparatus

The study was conducted on Macintosh computers; the "Find the Difference" task was programmed for the Macintosh. Find the Difference involves two cartoons that are the same except for six differences. The object of the task is to find differences by comparing the pictures. One hundred Find the Difference items were stored in the program. The program was set up so that each participant was presented with an example of the task. Following the example, participants worked through the learning, testing, and free-choice phases. Data were collected on the computer at each phase. During the free-choice session, two magazines (Time and Newsweek) were placed on the desk at the computer station. Other materials included questionnaires to measure task interest, challenge, self-efficacy, perceptions of competence, and self-determination. A copy of each of the questionnaires is presented in Appendix B.

Procedure

The study followed the basic procedures used in a typical experiment on rewards and intrinsic motivation. The study took place in a computer laboratory and was run by two experimenters (both females). The computer lab contained twenty computer stations. Each session lasted approximately one hour. In each session, the number of participants varied from one to four. When there was more than one participant in a session, each participant was seated at a station far from any other participant so that they could not see each other.

Before each session began, the experimenters activated the program for each designated computer. When a participant arrived, s/he was greeted by one of the experimenters and told to sit at one of the computer stations that was activated. The experimenter then followed a script that is presented in Appendix C. Participants were told that the study involved learning and puzzle solving and that the computer would take them through an example of the puzzle-solving task. Participants were told to take their time and that there was no time limit.

Example problem. The program began with an example of a "Find the Difference" problem; the example was designed to familiarize the participants with the task. The same example was shown to all participants. To illustrate how to do the task, the computer screen showed two cartoons. Participants were given instructions on the screen and told to drag the difference from the top picture to the appropriate place in the bottom picture. If participants succeeded in dragging the item to the correct place, a green circle appeared around the difference in each picture. If they clicked the wrong item, they were not able to drag it and the computer made an annoying sound. If they dragged the correct item but did not place it on the appropriate place, an annoying sound was made and the item was returned to its original place.

To help participants find the second difference, the screen again showed a red arrow pointing to the differences. Participants were again instructed to drag the difference from the top picture to the bottom one. The participants were then instructed to find the other four differences. Hints were available on a "Help" button. Once all six differences were found, the participant could repeat the example or call the experimenter. The experimenter then administered the first set of questionnaires (QA1 and QB1) designed to assess task interest, perceived competence, task challenge, anxiety level, self-determination, self-efficacy and personal standards.

Learning phase. After the questionnaires were completed, the experimenter activated the learning phase of the program. Participants were told that the learning phase was made up of three sets of five "Find the Difference" problems and that there was no time limit. Participants were told to follow the instructions on the screen.

In the learning phase, the problems were randomly generated by the computer from a bank of 95 problems. The instructions on the screen explained to the participants that there were five problems in a set and that there were six differences in each problem. All participants were given six tries to find differences. Those in the low difficulty condition could move on to the next problem after finding two differences in each problem; in the high difficulty condition, participants were required to find four differences. In the constant standard condition, participants were required to successfully complete three problems in each set; in the progressive standard condition, participants were required to successfully solve one problem in the first set, three in the second, and five in the third set. In the reward conditions, participants were told (on the screen) that they would receive $2.00 for each set they successfully passed. Participants in the no reward conditions were not offered a reward.

Throughout the learning phase, on the left side of the screen, information about scores was displayed. Specifically, participants could see which set they were on, how many problems they needed to pass, how many problems they had already passed, how many clicks were done correctly, and how many incorrect responses they had made. When a participant correctly found a difference (dragged the correct item from the top to the bottom picture), the item was circled in green. In addition, in the corner of the screen, the number of correct drags was indicated. When a participant made an incorrect drag, the computer made an annoying sound, the item returned to its original place, and the number of incorrect drags was indicated on the left side of the screen.

Once participants had passed a set, the screen informed them that they had met the requirements and could move on to the next set. For the reward groups, the screen informed them they had earned $2.00 and coins were shown dropping into a container that made a clinking sound.

After the participants had completed all three sets, the program paused and the experimenter was called. Participants in the reward condition were given $6.00. All participants were then given a second set of questionnaires (QA2, QB2, QC2). The questionnaires QA2 and QB2 included the same set of items as the first set of questionnaires (QA1 and QB1) but in a different order. Again, the questions were designed to measure task interest, perceived competence, perceived challenge, anxiety level, self-determination, self-efficacy and personal standards. The questionnaire, QC2, used Likert scales to assess task enjoyment, feelings of being controlled, attributions about performance, and self-evaluations. Reward participants answered an additional questionnaire (QD2) that assessed their feelings about receiving reward.

Testing phase. Once the questionnaires were completed, the participants were told that there would be a short test. The experimenter then activated the computer. Participants were told on the screen that they would be given five problems and that they should try to find as many differences as they could. They were given 30 seconds for each problem.

The problems presented in the testing phase were predetermined and had not appeared in the learning phase. All participants were given the same five problems but in a different order. When participants began the test, the time elapsed was shown on the right hand side of the screen. No feedback was given on the computer during the phase.

Free-choice phase. Following the test, participants were told that it would take a few minutes for the computer to analyze their data. They were asked to wait in case there were any problems. Participants were told that during the waiting period they could do some more "Find the Difference" problems or read some magazines. Instructions on the computer also indicated that they could do more of the task, read magazines, or just sit and wait. They were told to click an "OK" button after they had read the instructions. The "OK" button activated a timer that allowed the program to be available for eight minutes. After participants clicked "OK", they were given two magazines (recent issues of Time and Newsweek). The computer screen asked if they would like to do more problems. If they clicked on yes, more find the difference problems were presented. These problems were randomly drawn from the set of 100 problems (they included items used in the learning and testing phases).

During the free-choice phase, there was a "Pause" button and a "Resume" button on the screen. If participants wished to discontinue problem solving, they were instructed to click on the pause button. The task was then darkened on the screen disallowing any further responses. If participants wished to continue problem solving, they were instructed to click on the resume button. Thus, participants could solve problems or pause the task at any time during this waiting period. After eight minutes, the screen indicated that the study was over. Participants were thanked. The experimenter asked the participants to complete a final questionnaire (QE3) that assessed task enjoyment, self-evaluation, and self-determination. Participants were also asked whether they formed any specific ideas about the study and how these ideas might have affected their performance.

At the end of the session, each participant was thanked and was asked not to discuss the study with others. Non-rewarded participants were given $6.00. When the entire study was completed, participants were given a debriefing session and information about the study was distributed (see Appendix D).

Dependent Variables

Several measures (behavioral and questionnaire) were taken at various times throughout the study. In terms of questionnaires, following exposure to the example task, all participants responded to two questionnaires (QA1 and QB1). The first half of QA1 was made up of seven items and was designed to assess task interest and perceived task challenge. The second half was made up of nine items and was designed to assess perceived competence, self-determination, and feelings of anxiety. All of the items on QA1 were on semantic differential scales. QB1 was designed to assess initial self-efficacy and personal standards.

Following the learning phase, and after rewarded participants received payment, all participants again responded to questionnaires. At this time, they were given QA2 and QB2; these questionnaires were identical to QA1 and QB1. Participants were also given another questionnaire, QC2, at this time. QC2 measured task interest, perceived competence, self-determination, and locus of causality on 7-point Likert scales. Also, rewarded participants completed an extra questionnaire, QD2, which assessed how they felt about receiving money.

After filling out the questionnaires, all participants were given a test. Their performance on the test was assessed as the number of correct. The free-choice period followed the test and the time participants spent on the task during this period as well as their performance on the task were measured. After the free-choice session, all participants were given a final questionnaire (QE3) that measured task enjoyment, perceived competence, and self-determination on 7-point Likert scales. Two open-ended items on QE3 assessed the success of the manipulation and participants' suspiciousness.

Factor analyses for questionnaire A1. Two separate factor analyses were performed on the 16 semantic differential items on QA1. The first seven items were designed to measure task interest and perceived task challenge; the next nine items were designed to measure perceived competence, self-determination, and feelings of anxiety. A Varimax Rotated Factor was conducted, and items loading .618 or greater on a factor were considered to be salient for that factor. For the first seven items, two factors were extracted, accounting for 71% of the variance. The two factors were labeled "task interest" and "task challenge" (see Table 3.2). For the next nine items, two factors were extracted, accounting for 71% of the variance. However, in order that different theoretical models could be tested, one of the factors was further divided into two. The three factors were labeled "anxiety," "perceived self-determination," and "perceived competence." Overall, on QA1, there were five factors as shown in Table 3.2.

Table 3.2.

The Five Factors Extracted from the 16 Items Using Factor Analysis

Factors	Questionnaire Items
	The first 7 items on QA1
Task interest	Boring/Interesting
	Dull/Exciting
	Unpleasant/Enjoyable
	Tedious/Entertaining
Perceived Challenge	Challenging/Not challenging
	Simple/Complex
	Easy/Difficult
	The next 9 items QA1
Perceived Competence	Incompetent/Competent
	Confident/Unsure
	Capable/Unable
[a]Self-determination	Free/Constrained
	Intimidated/At ease
	Overwhelmed/Easy going
	Pressured/Self-controlled
[a]Anxiety	Calm/Anxious
	Nervous/Relaxed

Note. [a]These two factors were not distinguished by the Varimax Rotate Factor Analysis but were separated by their implications on theoretical importance.

Table 3.3 provides the correlation matrices and Cronbach's alpha values for the items with each factor. Overall, the Cronbach alpha for each factor was high, reflecting psychometrically acceptable internal consistency. In addition, moderate to high levels of inter-correlations (rs > .44) were found, and high levels of significance were achieved. Thus, the grouping of the items into five composite variables was statistically supported.

Table 3.3.

Correlation Matrices and Cronbach's Alphas for QA1 (N = 73)

Variables	1	2	3
Perceived Challenge (α = .87)			
1. Challenging			
2. Complex	.63**		
3. Difficult	.68**	.81**	
Task Interest (α = .78)			
1. Interesting			
2. Exciting	.60**		
3. Enjoyable	.30*	.54**	
4. Entertaining	.41**	.51**	.52**
Perceived Competence (α = .86)			
1. Competent			
2. Confident	.63**		
3. Capable	.67**	.74**	
Self-determination (α = .83)			
1. Free			
2. At ease	.44**		
3. Easy going	.44**	.65**	
4. Self-controlled	.50**	.69**	.73**
Anxiety (α = .69)			
1. Anxious			
2. Nervous	.54**		

Note. *$p < .05$. **$p < .01$.

Questionnaires A2 and B2, identical to QA1and QB1, respectively, were administered after the learning phase (after the reward phase and before the test). The items on QA2 were grouped using the same factors as identified in the factor analysis of QA1. Appendix E presents the post-learning measures and means and standard deviations for each dependent variable.

In terms of the semantic differential scales on QA1 and QA2, a composite score was calculated for each factor by averaging the sum of the individual items. Scores on individual items were assigned a minimum of –2 to a maximum of +2. The mid-point for the compound score was 0, the maximum score was +2, and the minimum score was –2 for each of these factors. Scores above the mid-point represented positive connotations; scores below the mid-point represented negative connotations (e.g. for boring/interesting, interesting was coded +2 and boring was coded -2.) For two items, calm/anxious and nervous/relaxed, "anxious" was coded +2, calm was coded -2, relaxed was coded –2, and nervous was coded +2.

In terms of the measures of self-efficacy (QB1), the composite score was the average of the degrees of certainty on finding different number of differences. The maximum score was 100% indicating an absolute certainty of finding all 6 differences within 30 seconds; the minimum score was 0% indicating a minimum level of certainty of finding all 6 differences within 30 seconds. For personal standards, the maximum score for personal standard was six indicating finding all 6 differences in each problem was personally satisfying; the minimum was one indicating finding only one difference was personally satisfying.

Factor analysis for questionnaire C2. Task enjoyment, perceived competence, self-determination, and attributions of performance were also measured after the learning phase using an alternative form of questionnaire, 7-point Likert scales (QC2). In addition, QC2 assessed participants' locus of causality for their performance. A Vairmax rotated factor analysis was conducted for the 14 Likert scales on this questionnaire. Items loading .618 or greater on the major factor and no greater than .305 on other factors were considered to be salient for that factor. Three items had loadings less than .618 were eliminated from further analysis. They were: (a) I wanted to do well to please the researcher; and (b) I was concerned about my performance being evaluated, and (c) I was motivated to perform well at the Find the Difference game. Five factors were extracted, accounting for 68% of the variance. These items were further grouped into five variables representing "self-determination," "perceived competence," "task enjoyment," "internal causality," and "external causality."

Table 3.4 provides correlation matrixes within each variable.

Table 3.4.

Correlation Matrix for Each Factor on QC2 (N = 73)

Factors	1	2	3
	External		
1. Time			
2. Situation	.58**		
3. Feedback	.52**	.52**	
	Perceived Competence		
1. Performance			
2. Competence	.74**		
3. Not luck	.24*	.45**	
	Enjoyment		
1. Game enjoyment			
2. Interest	.47**		
	Internal		
1. Effort	.42**		
2. Skill			
	Self-determination		
1. Choice (QB2)			

Note. *$p < .05$. **$p < .01$.

As Table 3.4 shows, all the inter-correlations were statistically significant and there were mostly moderate to high inter-correlations within each variable, indicating that the items grouped under each variable were statistically correlated. The composite score for each variable was calculated by averaging the item scores within that variable. The composite scores ranged from 1 (not at all, very little, or very poorly) to 7 (very much, or very much) and a higher value indicated a higher level measured for that variable.

Descriptions of the Dependent Measures

The following describes each of the dependent measures assessed in this study.

Intrinsic motivation. A number of measures, both behavioral and attitudinal, were used. Following the conventions in this research area, the main behavioral measures of intrinsic motivation were time spent on the task during the free-choice period (free-time) and performance on the task during the free-choice period. Another widely used measure in the research area is self-reported task interest/enjoyment. Task interest was assessed by: (a) the composite score from the semantic differential scales on QA1, (b) the same scales on QA2; (c) the composite score from the 7-point Likert scales on QC2; and (d) one 7-point Likert scale item on QE3. A high score on task interest or task enjoyment indicated a high level of self-reported intrinsic motivation.

Test performance. An additional behavioral measure, not typically used in studies on rewards and motivation, included performance during the test phase. Performance was measured as number correct on the test.

Perceived competence. Perceived competence was assessed four times over the study with (a) a composite score from the semantic differential scales on QA1, (b) and from QA2, (c) the composite score from the seven-point Likert scales on QC2, and (d) one 7-point Likert scale item on QE3. A high score indicated a high level of perceived competence.

Self-determination. Perceived self-determination was measured in three ways: (a) semantic differential scales on QA1 and QA2; (b) 7-point Likert scales on QC2; and (c) one 7-point Likert scale item on QE3. Again, a high score indicated a high level of self-determination.

Locus of causality. Internal locus of causality was assessed by asking participants to rate on 7-point Likert scales the degree to which they felt their performance was due to: effort, skills, and interest (QC2). A high score indicated a high level of internal locus of causality. External locus of causality was assessed by participants' ratings of time pressure, pressure from the situation, feedback from the researcher and, whether their performance was due to luck or chance (QC2). A high score indicated a high level of external locus of causality.

Self-efficacy. Self-efficacy measures were taken after the example before the learning phase (QB1) as well as after the learning phase and before the test (QB2). The items on QB1 and QB2 were identical. Levels of self-efficacy were indicated by eleven-point scales ranging from 0% to 100% (Schunk, 1983; Schunk, 1984). Participants were asked, "on a Find the Difference problem, how confident are you that, in 30 seconds, you will be able to find: one out of six differences, two out of six differences, three out of six differences...six out of six differences." Participants rated their degree of certainty by circling the degree of certainty at each level. The overall score for self-efficacy was calculated by adding up the individual scores at each level, and then dividing by six. A high score indicated a high level of self-efficacy.

Personal standards. Personal standards were assessed twice (QB1 and QB2) using the same item. Participants were asked to fill in a blank for the question: "on the next Find the Difference game, I would feel personally satisfied if I could find ____ differences in 30 seconds." A high score indicated a high level of personal standard.

Perceived task challenge. Perceived task challenge was measured by the composite scores from the semantic differential scales on QA1 and QA2. Also, a high score indicated a high level of perceived task challenge.

Anxiety. Anxiety was assessed by the composite scores from the semantic differential sales on QA1 and QA2. A high score indicated a high level of anxiety.

Attitudes towards rewards. A questionnaire (QD2) regarding attitudes toward rewards was only given to the rewarded participants in order to assess the controlling, informational, distracting and motivational aspects of rewards.

The participants were to rate on a scale from 1 (not at all) to 7 (very much) how much they felt controlled and pressured by the money, whether they enjoyed receiving money, whether the money distracted them or served as useful feedback, and whether the money motivated them.

Statistical Analyses

One analysis involved the manipulation checks. Two questions were designed to assess the effectiveness of the manipulation and participants' suspicions about the study.

If the answers indicated that the manipulation was ineffective, or that the performance or responses of the participants were affected by her/his suspicion, the data of that participant was discarded.

Initial attitudes (QA1 and QB1) were then analyzed with three-way ANOVAs to determine whether random assignment was successful and to evaluate participants' attitudes prior to engaging in the task. Following this analysis, each of the research questions presented at the end of chapter two was addressed.

A Multivariate Analysis of Variance was conducted for the effects of rewards on measures of intrinsic motivation (free time, free-choice performance, and task enjoyment on QE3). When the multivariate test was significant, a procedure suggested by Wilkinson (1975) was used to locate the dependent measure that had the greatest contribution. In this approach, successive MANOVAs were performed with one dependent measure left out each time. Then, the multivariate F values were examined to determine which one of these measures contributed the most to the multivariate effect. Once that dependent measure was located, the means pattern were examined to interpret the overall multivariate result for that variable.

Separate three-way ANOVAs were performed for other analyses pertinent to the research questions. All data were entered by the first experimenter and double checked by a second experimenter.

Chapter 4
RESULTS

In this chapter the results from the experiment are presented. The chapter begins with an assessment of the manipulation checks; specifically, the goal was to determine whether participants were suspicious of the experimental manipulations and whether they formed any ideas about the study that may have affected their performance. The next analysis involved assessing initial levels of task interest, perceived competence, self-determination, challenge, and anxiety; the purpose was to determine the initial equivalence of the groups. Finally, the results for each of the research questions are presented.

Preliminary Analyses

Manipulation Checks

Two items in the last questionnaire (QE3) were used to check on suspicion and to evaluate the adequacy of the experimental manipulations. The first item asked if the participants had formed any specific ideas about the purpose of the study during the experiment. On a three-point scale ranging from 0 to 2, the ideas were coded "none, vague, or close." None of the participants guessed the hypotheses correctly, albeit three of them were suspicious about the purpose of the free-choice period (about 4%). To determine the impact of such suspicion, analyses were performed for the unsuspicious participants only ($N = 70$) on all the data. Overall, the results were not altered to any degree by the inclusion of the suspicious participants. Therefore, all results are reported for $N = 73$.

The second part of the questionnaire asked participants whether their ideas about the study affected their performance. The majority of the participants (73%) stated that their performance was not affected. Among those whose performance was affected, the most frequent comment was that they felt as though they were being timed and this had put pressure on them (62%). The rest indicated that their ideas had positively affected their performance in various ways (pleasing the researcher, enjoying the challenge, etc.). None of the participants thought that their ideas had any major impact on their performance.

Initial Equivalence of Groups

Separate 2 X 2 X 2 Analyses of Variance were conducted for the five composite variables created from the 16 items on QE3: task interest, perceived competence, self-determination, perceived challenge, and anxiety, and for the two measures on QB1: self-efficacy and personal standards.

For task interest, perceived competence, self-determination, calmness, self-efficacy, and personal standards, there were no significant main effects and no interaction effects. Because there were no systematic differences between the groups on any of these measures, the implication is that random assignment was successful. The means and standard deviations for these dependent variables are presented in Appendix F.

The findings indicated that on initial attitudes, participants generally felt that the game was interesting ($M = 0.68$, $SD = 0.64$). Participants perceived themselves as competent ($M= 1.30$, $SD = 0.70$), self-determined ($M = 1.10$, $SD = 0.72$), and calm ($M = -0.99$, $SD = 0.72$). In addition, they also had a high level of self-efficacy and personal standards ($M = .74$, $SD = .18$; and $M = 4.38$, $SD = 0.98$, respectively).

On task challenge, participants perceived the game to be not so challenging ($M = -0.52$, $SD = 0.91$). The results of the three-way ANOVA indicated that there was one three-way interaction effect on perceived task challenge, $F(1, 65) = 9.74$, $p = .003$. For the constant standard groups, the non-rewarded, low difficulty group had the highest rating for perceived challenge, whereas the rewarded, low difficulty group had the lowest rating. However, for the progressive standard groups, the rewarded, low difficulty had the highest rating, whereas the rewarded, high difficulty group had the lowest. Because this interaction effect occurred before the participants received any treatments, complete random assignment was not achieved on this measure. However, there was no evidence that such a trend was due to systematic differences between the conditions. It is believed that such an occurrence was due to random error.

The Effects of Rewards, Performance Standards, and Task Difficulty

The next section presents the analyses pertinent to each research question raised in chapter two. For means and standard deviations for the following analyses, see Appendix G.

Effects on Intrinsic Motivation

The major question addressed in this study was "what are the effects of rewards on performance standards, and are these effects altered by different levels of performance standard and task difficulty?" In accord with the conventions in this research area, intrinsic motivation was assessed with several behavioral and self-report measures. Behavioral measures included free time on the task in the free-choice period and performance (number correct responses) on the task during the free-choice period. Self-report measures of intrinsic motivation were assessed by questionnaires QA1, QA2, QC2, and QE3. Questionnaire A2 was made up of the same items as QA1 (four items made up task interest) and was administered after the learning phase and prior to the test. Questionnaire C2 also had questions designed to assess task interest and was also administered after the learning phase and before the test. The questions were on 7-point Likert scales. Questionnaire E3 was given after the free-choice session; there was one 7-point Likert scale item on task enjoyment.

For the present study the following analyses were conducted on measures of intrinsic motivation:

1. A MANOVA on amount of time spent doing the task and performance in the free-choice period, and reported task enjoyment (QE3). Because these measures were taken after the test phase, they were grouped together as a composite index of intrinsic motivation.

2. A three-way ANOVA on self-reported task interest change scores. Specially, changes between initial task interest (QA1) and task interest (QA2) after the learning and reward phase (prior to the test) were assessed.

3. A three-way ANOVA on the task interest scores on QC2 (the 7-point Likert scales). QC2 was administered at the same time as QA2 (after the learning phase and before the test.)

Free time spent on task, free-choice performance, and task enjoyment. In the first analysis of the effects of rewards on intrinsic motivation, free time, free-choice performance, and self-reported task enjoyment measured after the free-choice period were analyzed with a MANOVA. The MANOVA test indicated no main effects, but it detected an interaction effect of difficulty and reward that reached marginal significance [Pillai's $V = 0.11$, $F(3, 62) = 2.54$, $p = .064$].

Given this finding, the Wilkinson procedure was used to examine the differential contribution of the three different measures (Wilkinson, 1975). The procedure involved removing one measure at a time and comparing the changes in the multivariate F values of the remaining measures. Leaving out free time, next free-choice performance, and last self-reported task interest (QE3), the multivariate F values were $F(2, 63) = 0.91$, $F(2, 63) = 0.49$, and $F(2, 63) = 1.82$, respectively. By comparing the F values, it was evident that free-choice performance made the greatest contribution to the multivariate test. Hence, the means pattern on free-choice performance was used to interpret the multivariate test results. Figure 4.1 shows this interaction effect on free-choice performance.

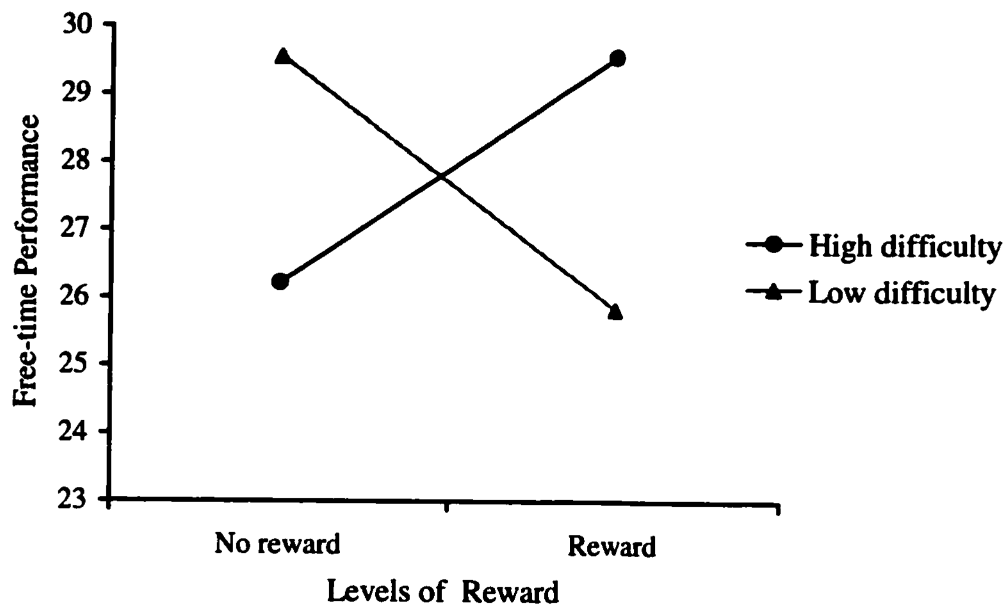


Figure 4.1. The interaction effect of reward and task difficulty on free-choice performance.

Figure 4.1 indicates that among the high difficulty groups, rewarded participants out-performed non-rewarded participants on performance in the free-choice period ($M = 29.56$, $SD = 20.12$ vs. $M = 26.22$, $SD = 15.90$, respectively); however, for the low difficulty groups, the non-rewarded participants performed better than the rewarded group ($M = 29.56$, $SD = 16.53$ vs. $M = 25.83$, $SD = 15.21$, respectively). From an inspection of the pattern of findings, the overall multivariate test result indicated that when participants were rewarded after completing a difficult task, they sustained a higher level of intrinsic motivation than those who completed an easy task. However, when participants were not rewarded, performing a difficult task resulted in a lower level of intrinsic motivation than performing an easy task.

Changes in task interest from pre-learning phase to post-learning phase. An ANOVA performed on the change scores between QA1 and QA2 revealed a significant main effect of reward, $F(1, 65) = 4.55$, $p = .037$. However, when the suspicious participants (N = 3) were excluded from the analysis, the effect of reward on changes in task interest became only moderately significant, $F(1, 62) = 3.63$, $p = .061$. There were no other main effects and no interaction effects.

These results indicated that rewarded participants ($M = 0.39$, $SD = 0.57$) had a significantly higher increase in task interest than the non-rewarded ones ($M = 0.10$, $SD = 0.56$). That is, rewards enhanced participants' task interest.

Task interest measured after the learning phase on QC2. Another self-reported task interest measure was assessed on QC2. The results of the ANOVA revealed no significant main effects. A significant interaction effect of standard by difficulty was found, $F(1, 65) = 6.39$, $p = 0.014$). Figure 4.2 shows this interaction.

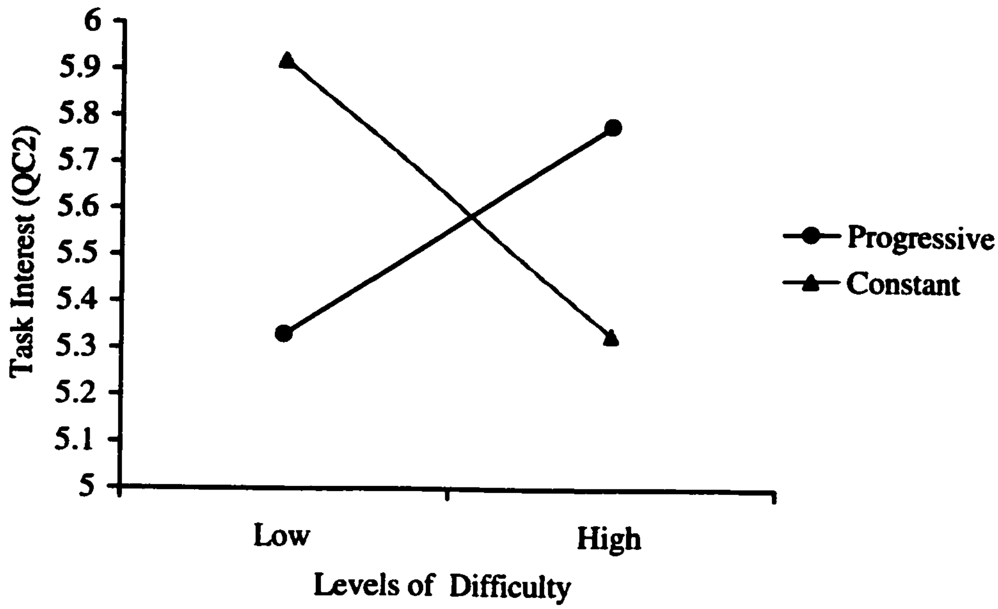


Figure 4.2. The interaction effect of standard by task difficulty on task interest (QC2).

As shown in Table 4.2, for the constant conditions, the low difficulty group (M = 5.92, SD = 0.84) reported a higher level of task interest on QC2 than the high difficulty group (M = 5.33, SD = 1.15), whereas for the progressive conditions, the high difficulty group (M = 5.78, SD = 0.71) reported a higher level of task interest on QC2 than the low difficulty group (M = 5.33, SD = 0.77). Participants in the constant standard conditions reported a moderately higher level of task enjoyment than those in the progressive condition. That is, overall, participants in the constant, low difficulty group had the highest task interest immediately after the learning phase, and those in the progressive, high difficulty group had the second highest level of task interest. However, participants in the constant, high difficulty group and those in the progressive, low difficulty group had the lowest levels of task interest after the learning phase.

The Effects of Rewards on Test Performance

The next research question was "what are the effects of rewards based on performance standards and effort on test performance?" A separate ANOVA was conducted in order to address this question. There were no significant main effects, but the results indicated that there was a significant interaction effect of reward and difficulty, $F(1, 65) = 4.66$, $p = .035$. Figure 4.3 portrays this interaction.

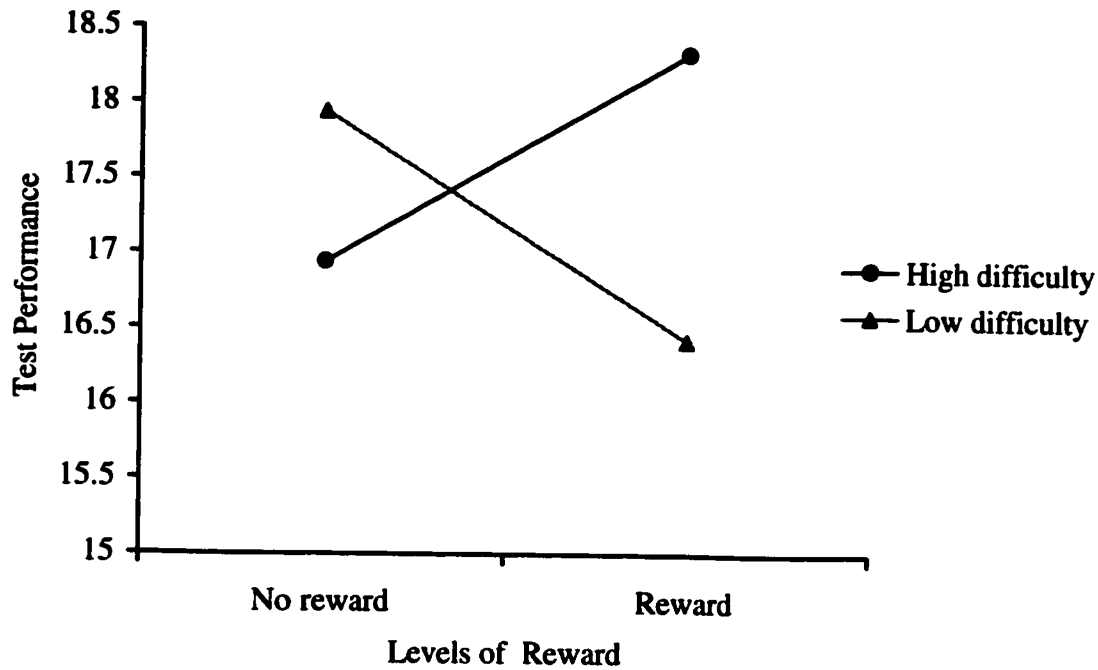


Figure 4.3. The interaction effect of reward by task difficulty on test performance.

As shown in Figure 4.3, when a high difficulty task was assigned, the rewarded participants ($M = 18.33$, $SD = 1.94$) performed better on the test than those who were not rewarded ($M = 16.94$, $SD = 3.04$). However, when a low difficulty task was assigned, the non-rewarded participants ($M = 17.94$, $SD = 2.69$) performed better than those who were rewarded ($M = 16.42$, $SD = 3.39$).

Note that the rewarded, high difficulty group performed the best of all groups, whereas, the rewarded, low difficulty group performed the worst. In other words, when participants were rewarded on a high difficult task, they out-performed any other groups on a test. However, when participants were rewarded after a low difficulty task, their performance was the lowest.

The Effects of Rewards on Perceived Competence

The present study was also concerned with the moderating effects of performance standards and task difficulty on feelings of competence when participants were rewarded. As with intrinsic motivation, perceived competence was assessed after the learning phase (prior to the test) on QA2 with semantic differential scales identical to QA1, and on QC2 (7-point Likert scales). Perceived competence was also assessed after the free-choice period on QE3 (one item on a Likert scale). Separate ANOVAs were performed for each of the measures.

Changes in perceived competence from pre-learning phase to post-learning phase. Change scores in perceived competence between QA1 and QA2 were calculated. The ANOVA revealed a significant main effect of difficulty, $F(1, 64) = 5.44$, $p = .023$. There were no other significant main effects or interaction effects.

The results indicated that low difficulty groups ($M = 0.40$, $SD = 0.74$) showed a higher increase in perceived competence than the high difficulty groups ($M = 0.02$, $SD = 0.75$). In other words, a higher level of increased perceived competence was found in the low difficulty group.

Perceived competence measured after the learning phase on QC2. A separate ANOVA was conducted on the self-report measure of competence on QC2 and a similar result to the change scores was obtained. There was a significant main effect of difficulty, $F(1,65) = 5.07$, $p = .03$; there were no other significant main effects and interaction effects.

The results revealed that the low difficulty group ($M = 6.37$, $SD = 0.67$) had a higher rating of perceived competence than the high difficulty group ($M = 5.89$, $SD = 1.06$). That is, the low difficulty group had a higher level of perceived competence immediately after the learning phase as compared to the high difficulty group.

Perceived competence measured after the free-choice period. An ANOVA was performed for the one item assessing perceived competence after the free-choice session. There were no significant main effects. Only the interaction effect of standard and reward was significant, $F(1, 64) = 5.06$, $p = .03$. Figure 4.4 portrays this interaction.

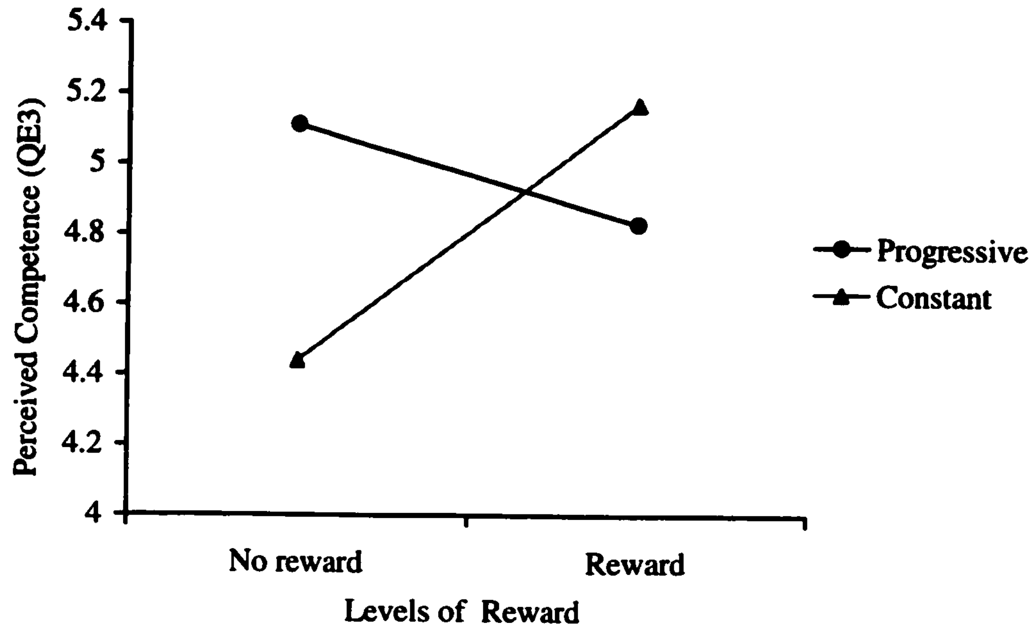


Figure 4.4.

The interaction effect of reward by standard on perceived competence (QE3).

As Figure 4.4 shows, for the constant condition, the rewarded participants (M = 5.11, SD = 1.10) had a higher level of perceived competence after the free-choice period than the non-rewarded participants (M = 4.44, SD = 0.92), but for the progressive condition, the non-rewarded participants (M = 5.11, SD = 0.90) had a higher level of perceived competence than rewarded ones (M = 4.83, SD = 0.79).

Effects on Self-determination

Another question addressed in this research was "do rewards based on performance standards (constant versus progressive) and effort (high/low task difficulty) enhance or reduce feelings of self-determination? Similar to task interest and perceived competence, the experimental effect on self-determination was assessed over three times with different measures.

Changes in self-determination from pre-learning phase to post-learning phase. Change scores for self-determination were calculated (difference between QA2 and QA1) and an ANOVA was performed. The main effect of reward was significant, $F(1, 65) = 4.25$, $p = .043$. There were no other significant main effects and no interaction effects.

The results indicated the rewarded participants (M = 0.25, SD = 0.67) had a higher increase in self-determination than the non-rewarded participants (M = -0.06, SD = 0.57). In other words, reward had a positive effect on participants' perceived self-determination.

Perceived self-determination measured after the learning phase on QC2. An ANOVA was conducted for the self-determination measure on QC2 and there were no significant main effects and no interaction effects.

Perceived self-determination measured after the free-choice period. An ANOVA was conducted for the self-determination measure that was administered after the free-choice session. The results indicated no main or interaction effects. A closer examination revealed that responses on QC2 were identical to those on QE3, indicating participants' levels of self-determination were not altered by the administration of the test and the free-choice period.

The Effects on Locus of Causality

Do reward based on performance standards and effort alter participants' locus of causality from internal to external causes? Two separate ANOVAs were performed on the internal and external locus of causality scales. There were no significant main effects and no interaction effects found for either style of attribution. In other words, receipt of reward based on performance standard and difficulty did not alter participants' locus of causality compared to the control groups. Overall, all participants reported a significantly greater degree of internal causality than external, $t(1,72) = 14.40$, $p = .000$ (M = 5.66, SD = 0.93 vs. M = 2.58, SD = 1.52).

Effects on Self-efficacy

In terms of self-efficacy, the question was: how do rewards based on performance standards (constant versus progressive) and effort (high/low task difficulty) affect participants' self-efficacy? The present study assessed participants' level of self-efficacy twice: before the learning phase (QB1) and after the learning phase (QB2). Any changes in self-efficacy were attributed to the experimental treatments received in the learning phase. The results of the ANOVA conducted on the change scores indicated a main effect of reward, $F(1, 65) = 3.97$, $p < .05$. Rewarded participants (M = 5%, SD = 9%) reported a higher increase in self-efficacy level than non-reward participants (M = 1%, SD = 9%).

That is, reward had a positive effect on participants' self-efficacy. There were no other main effects and no interaction effects on measures of self-efficacy.

Effects on Personal Standards

In terms of personal standards, the question was: how do rewards based on performance standards and effort affect participants' personal standards?

In the present study, personal standards were assessed along with self-efficacy, and changes in personal standard between QB1 and QB2 were calculated in the same way. A three-way ANOVA revealed no significant main effects. The interaction effect of standard by reward was marginally significant, $F(1, 64) = 2.78$, $p = .10$. Figure 4.5 depicts this interaction effect.

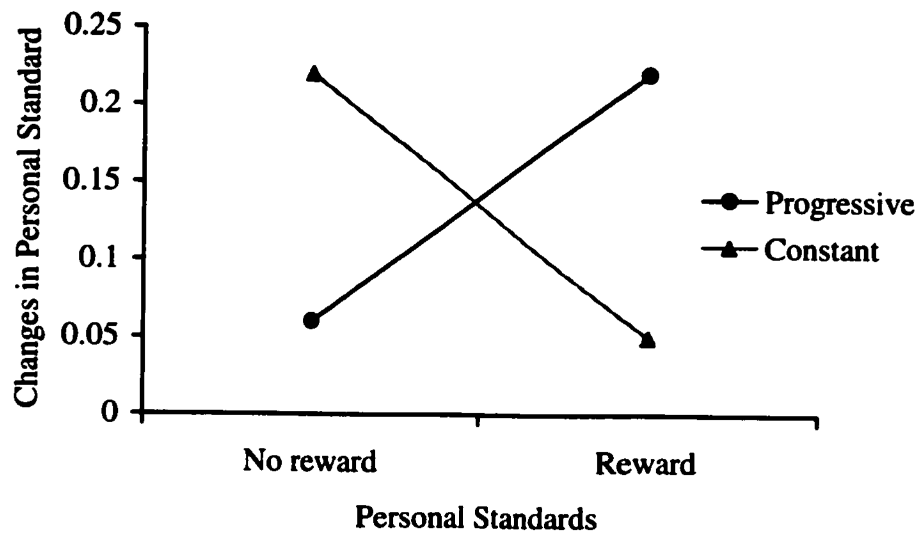


Figure 4.5. The interaction effect of reward by standard on changes in personal standard.

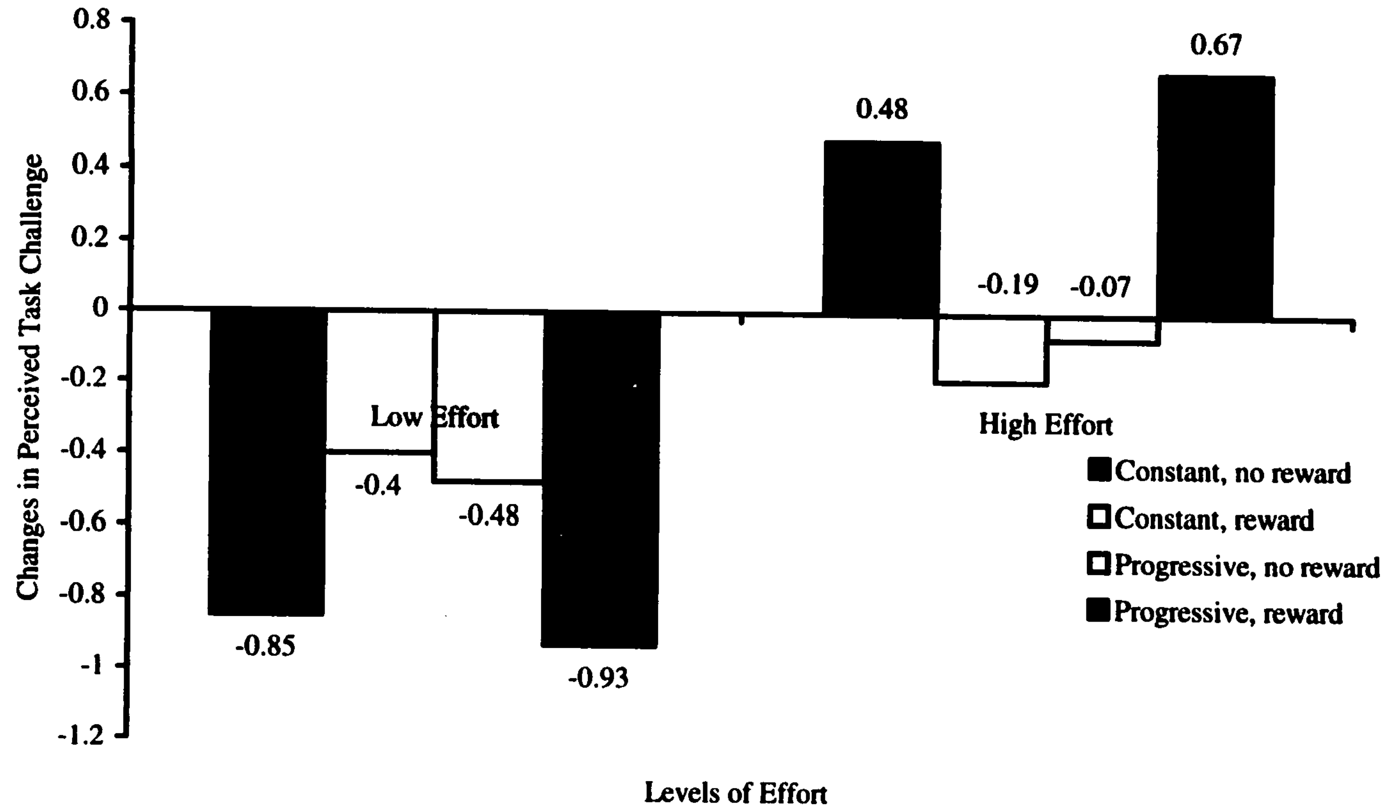
As Figure 4.5 shows, for the progressive condition, participants had higher increases in personal standard when rewarded ($M = 0.22$, $SD = 0.81$) than non-rewarded ($M = 0.06$, $SD = 0.66$); however, the effect of reward was reversed for the constant condition: participants had lower increases when rewarded ($M = 0.05$, $SD = 0.62$) than non-rewarded ($M = 0.22$, $SD = 0.65$).

Effects on Perceived Task Challenge

Another research question addressed how rewards based on performance standards and effort affected participants' perceived task challenge.

An ANOVA was conducted for the changes in perceived task challenge (QA2-QA1). There was a significant main effect of difficulty, $F(1, 65) = 12.88$, $p = .001$, and a significant three-way interaction effect of difficulty, reward, and standards, $F(1, 65) = 5.43$, $p = .023$. Other main effects and interaction effects were not significant.

Although the main effect of difficulty was significant, its importance is minor because of the significant three-way interaction. Figure 4.6 portrays this interaction.



<u>Figure 4.6.</u>

The Interaction Effect on Changes in Perceived Challenge.

As Figure 4.6 depicts, increase perceived challenge was found for only two groups. Both of these groups were in the high difficulty condition. The rewarded, progressive group (M = 0.67, SD = 0.97) had a slightly greater increase in perceived challenge than the non-rewarded, constant group (M = 0.48, SD = 1.13).

Figure 4.6 shows that except for the two groups in the high difficulty condition, all other groups had reduced levels of perceived challenge. A closer examination of Figure 4.6 reveals that the constant, no reward groups and the progressive, reward groups had the greatest decreases under the low difficulty condition and the greatest increases under the high difficulty condition (Ms = -0.85 and -0.93 vs. Ms = 0.48 and 0.67, respectively). That is, difficulty had opposite effects for these two conditions: the Find the Difference task became more or less challenging depending on the difficulty requirement.

On the other hand, for the constant, reward group and the progressive, no reward group, the difficulty conditions did not have opposite effects. Both groups in the low difficulty conditions (Ms = -0.40 and -0.48, respectively) had moderate levels of reduction in perceived challenge. However, both groups in the high difficulty condition (Ms = -0.19 and -0.07, respectively) had only marginal decreases in perceived challenge. In other words, the high difficulty requirement sustained the game's challenge for the constant, reward and progressive, no reward groups.

Effects on Anxiety

Participants' anxiety levels were also of interest in the present study. How do rewards based on performance standards and difficulty affect participants' anxiety? An ANOVA was performed for the changes of calmness levels between QA2 and QA1. The results indicated that there were no significant main effects and no interaction effects for this variable. That is, receipt of reward based on performance standard and difficulty did not affect the calmness levels of the participants. In general, participants reported that they felt calm (M = 0.99, SD = 0.72).

Attitudes toward Rewards

The rewarded participants were given a set of seven-point Likert scales (QD2) designed to assess the controlling, motivational, and informational aspects proposed by CET theorists.

Overall, the scores for the negative aspects of reward were geared toward the low end. In other words, the reward was not perceived as controlling (M = 1.86, SD = 1.48); it was not perceived as creating pressure (M = 1.86, SD = 1.42); it was not detrimental to participants' interest toward the game (M = 2.11, SD = 1.58); and it was not experienced as distracting (M = 1.51, SD = 0.93). On the other hand, the participants expressed a high level of enjoyment toward the reward (M = 5.89, SD = 1.56), and they found that the reward was somewhat informational (M = 3.57, SD = 2.19) and motivational (M = 3.68, SD = 2.31).

Chapter 5
DISCUSSION

The present study was designed to assess the effects of rewards based on performance standards and task difficulty on university students' intrinsic motivation. One goal of the study was to evaluate the findings in light of different theoretical explanations for the effect of rewards. In this chapter, the major findings are summarized, the results are interpreted in terms of four different theoretical orientations, and practical implications of the findings are discussed. Finally, the chapter ends with a discussion of limitations of the present study and some suggestions for future research.

A Summary of the Major Findings

The results from the present study are summarized in Table 5.1. The table presents the effects of rewards based on performance standards and difficulty on measures of intrinsic motivation as well as several self-report measures taken at different times throughout the study. Significant effects are marked with asterisks.

Table 5.1.

Main and Interaction Effects on the Dependent Measures

Dependent measures	Main effect	Interaction effect
Intrinsic motivation		
1. Free-time, free-choice performance, and task enjoyment (QE3)	--	Difficulty x Reward*
2. Task interest change scores (QA2-QA1)	Reward**	--
3. Task interest (QC2)	--	Difficulty x Standard**
Test performance	--	Difficulty x Reward**
Perceived competence		
1. Change scores (QA2-QA1)	Difficulty**	--
2. QC2	Difficulty**	--
3. QE3	--	Standard x Reward**
Self-determination		
1. Change scores (QA2-QA1)	Reward**	--
2. QC2	--	--
3. QE3	--	--
Locus of causality (QC2)		
1. External locus	--	--
2. Internal locus	--	--
Self-efficacy change scores (QB2-QB1)	Reward**	--
Personal standards change scores (QB2-QB1)	--	Standard x Reward*
Perceived challenge change scores (QA2-QA1)	Difficulty**	Three-way Interaction**
Anxiety change scores (QA2-QA1)	--	--

Note. *$p < .10$; **$p < .05$. Dashed lines indicated that there were no significant effects. Change scores were calculated by subtracting scores on questionnaires administered prior to the learning phase from scores on those administered after the learning phase. Questionnaire C2 was administered after QA2 and QB2, before the test. Questionnaire E3 was administered after the free-choice period.

Intrinsic motivation. As shown in Table 5.1, when intrinsic motivation was measured with free time, free-choice performance and task enjoyment (QE3), there were no significant main effects on the MANOVA test. However, there was a marginally significant interaction effect of difficulty by reward on these measures ($p < .10$). Because free-choice performance contributed the greatest weight on the F values, the means pattern of free-choice performance was used to interpret the interaction. The findings indicated a higher level of intrinsic motivation when participants were rewarded after a high difficulty task, and a lower level when participants were rewarded after a low difficulty task. These results suggest that when people are given rewards to work at a relatively difficult task (i.e., high difficulty), their intrinsic motivation is enhanced once the rewards are no longer forthcoming. On the other hand, reward after working at a relatively easy task leads to low levels of intrinsic motivation.

Table 5.1 indicates a significant main effect of reward on the task interest change scores from pre-learning phase to post-learning phase (QA2-QA1). There were no other significant main effects or interaction effects. This findings show that rewards enhanced participants' task interest; that is, those who were rewarded showed a greater increase in task interest from the pre- to post-learning phase when compared to non-rewarded participants. When task interest was measured with Likert-scale measures after the learning phase (QC2), Table 5.1 shows that there was a significant interaction effect of difficulty by standard. An inspection of the means showed that the progressive, high difficulty group and the constant, low difficulty group reported an equally high level of task interest. The progressive, low difficulty group and the constant, high difficulty group, however, reported relatively low levels of task interest.

Test performance. As shown in Table 5.1, there were no significant main effects for the test performance measure, but there was a significant interaction effect of difficulty by reward. This finding mirrored the interaction effect on the combined measure of intrinsic motivation (free time, free-choice performance, and task enjoyment.) Best test performance was found in groups where participants were rewarded to exert high difficulty, or where they were required to exert low difficulty but were not rewarded.

Perceived competence. Table 5.1 indicates a significant main effect of difficulty for change scores on perceived competence (QA2-QA1); no other main effects or interaction effects were significant. In terms of the main effect of difficulty, the low difficulty group had greater increase in perceived competence than the high difficulty group. The same effect was found on the measure of perceived competence taken after the learning phase; the low difficulty group reported a higher level of perceived competence than the high difficulty group. One way to interpret this finding is to look at what was required in the high versus low difficulty conditions. Participants in the high difficulty condition were required to find four differences in each problem before moving on whereas low difficulty participants only had to find two. Those in the high difficulty group made more errors and had to spend more time completing each problem. This difference could account for the finding that those in the high difficulty condition reported lower feelings of competence.

Table 5.1 indicates that for perceived competence measured after the free-choice period (QE3), there were no significant main effects but there was a significant interaction effect of standard and reward. For the constant standard groups, rewards enhanced participants' feelings of competence; however, for the progressive standard groups, the non-rewarded participants had a slightly higher level of perceived competence than the rewarded ones.

Self-determination. On the change scores for self-determination from pre-reward phase to post-reward phase (QA2-QA1), there was a significant main effect of reward, but there were no other significant main effects or interaction effects. The rewarded participants showed a greater increase in self-determination than the non-rewarded participants. However, there were no group differences on the 7-point Likert scale measures of self-determination measured after the learning phase (QC2). Also, no main or interaction effects were significant on the QC2 measure. Table 5.1 shows that for self-determination measured after the free-choice period (QE3), no main or interaction effects were significant.

Locus of causality. As shown in Table 5.1, there were no main effects or interaction effects for locus of causality measured after the learning phase with 7-point Likert scales. The rewarded participants did not perceive higher levels of external causality or lower levels of internal causality relative to the non-rewarded ones. Overall, participants reported a higher level of internal causality than external causality.

Self-efficacy. Table 5.1 indicates a significant main effect of reward on changes in levels of self-efficacy from pre-learning phase to post-learning phase (QB2-QB1). The findings indicate that the rewarded participants' levels of self-efficacy were enhanced to a greater extend than were the non-rewarded participants.

Personal standards. As shown in Table 5.1, there were no significant main effects on changes in personal standards (QB2-QB1), but there was a marginally significant interaction effect of standard by reward. The trend indicates that the progressive, rewarded group and the constant, non-rewarded group had an equally high level of increase in personal standard. On the other hand, the progressive, non-rewarded group had a slightly higher increase of personal standard than the constant, no-reward group.

Perceived task challenge. As shown in Table 5.1, there was a significant main effect of difficulty and a significant three-way interaction effect for changes in perceived task challenge (QA2-QA1). In general, perceived task challenge decreased after the learning phase, except for the constant, non-rewarded group and the progressive, rewarded group in the high difficulty condition. In addition, groups in the low difficulty condition had the greatest decrease in perceived challenge.

Anxiety. Table 5.1 indicates that there were no significant main effects and no interaction effects for changes in anxiety (QA2-QA1). That is, the experimental conditions did not alter participants' anxiety.

Attitudes towards rewards. Overall, the rewarded participants did not perceive reward as controlling, distracting, as creating pressure, or as detrimental to their interest toward the game. On the other hand, the participants expressed a high level of enjoyment toward the reward, and they found that the reward was somewhat informational and motivational.

Predictions from Various Theories and the Findings of the Present Study

Predictions from CET. CET postulates that perceived competence may increase when rewards are offered for meeting a specific performance standard. However, the theory also assumes that the detrimental effect of receiving rewards on self-determination will override any incremental effects on perceived competence. Thus, CET predicts that intrinsic motivation should decrease when rewards are offered. The findings of the present study do not confirm CET's predictions.

Overall, in the present study, rewards did not decrease intrinsic motivation. Instead, the findings show that when rewards are offered after a high difficulty task, intrinsic motivation is enhanced. Only when rewards are offered after a low difficulty task is there evidence of a decrease in intrinsic motivation. These findings run contrary to the predictions of CET; CET predicts that rewards tied to high effort should decrease people's intrinsic motivation.

Also, contrary to the predictions of CET, rewarded participants showed a higher increase in task interest and self-determination than non-rewarded participants. In other words, the offer and receipt of reward did not lower participants' task interest and self-determination as predicted by CET.

In addition, contrary to CET, measures of perceived competence during and after the learning phase were not associated with levels of rewards but were associated with effort/task difficulty. The low task difficulty requirement enhanced participants' levels of perceived competence more than the high task difficulty requirement. However, it was found that when competence was measured after the free-choice period, rewards enhanced feelings of competence only when the task did not convey competence information (i.e., in the constant performance condition). When the task itself signified high competence (i.e., in the progressive performance condition), rewards did not enhance participants' feelings of competence.

Predictions from the overjustification hypothesis. The overjustification hypothesis assumes that when rewards are offered for an intrinsically interesting task, a person will cease to attribute her behavior to an internal cause, and the motive for the behavior will become external (the receipt of rewards). Therefore, similar to CET, the overjustification hypothesis predicts detrimental effects of rewards on intrinsic motivation due to the shifting of locus of causality from internal to external sources as well as to a decrease in self-determination. Contrary to this hypothesis, the findings from the present study indicate that rewards did not decrease participants' intrinsic motivation; rewards were found to enhance participants' task interest and self-determination. Additionally, rewards did not alter participants' locus of causality.

Predictions from social learning theory. Social learning theory predicts that when rewards are tied to a high performance level and when participants succeed at the task, intrinsic motivation is enhanced through a process of increased perceived competence, self-efficacy, and personal standard. In terms of intrinsic motivation, the findings of the present study showed that participants' intrinsic motivation was most enhanced when they were rewarded for high effort. This finding partially supports social learning theory in that high effort can be considered part of performance level. The findings also indicated that rewards enhanced participants' task interest and rewards had incremental effects on self-efficacy during the learning phase.

In terms of perceived competence, the prediction from social learning theory is partially supported. Rewards were not associated with perceived competence during the learning phase and after the learning phase. When perceived competence was measured after the free-choice period, rewards sustained the level of perceived competence of the constant group to the same level as the progressive standard group without rewards. Rewarding progressive performance did not have such an incremental effect, however.

In terms of personal standards, the present study found a marginally significant interaction effect of standard by reward, again offering partial support to social learning theory. Rewards tied to progressive standards produced a greater level of increase than rewards tied to progressive standards alone. This level of increase was also evident when rewards were not offered for meeting constant standards.

<u>Predictions from the learned industriousness model.</u> The learned industriousness model posits that exerting high cognitive effort can acquire secondary reward properties if such effort is rewarded. Hence, the theory predicts that rewards offered for exerting high effort will enhance intrinsic motivation, whereas rewards offered for exerting low effort will decrease intrinsic motivation. The present study offers some support for this model. A marginally significant interaction of effort by rewards was revealed on intrinsic motivation assessed with free time, free-choice performance, and task enjoyment (QE3). The pattern of means indicated that intrinsic motivation increased when a high difficulty task was rewarded and intrinsic motivation decreased when a task of low difficulty was rewarded. From the perspective of learned industriousness, a more difficult task requires high effort. Thus the findings may suggest that rewarding a task of high difficulty is comparable to rewarding high effort.

<u>Interpretations</u>

The present study allowed for a clearer but more complex picture of the effects of rewards, standards, and difficulty to surface by (a) implementing baseline measures of the variables against which to evaluate changes resulting from the receipt of rewards for levels of standard and difficulty, and (b) monitoring the effects on pertinent dependent measures at different points of time throughout the study. The divergent results on measures before the test and after the free-choice period suggest that changes in the internal states of participants may be a function of time.

In accord with the predictions of social learning theory, findings from the present study demonstrate that rewards tied to high effort enhanced self-determination, self-efficacy, and task interest. In addition, when rewards were offered for mastery there were greater increments in personal standards relative to rewards offered for meeting a constant standard. Although this finding was only marginally significant ($p < .10$), the findings are suggestive; if a larger sample were used, it is likely that significant results at the .05 level might be obtained.

The predictions of the learned industriousness model also received partial support in the present study. The trend indicates that rewards offered after high difficulty task enhance intrinsic motivation, whereas rewards offered after low difficult task undermine it. It is worth noting that the same interaction effect was significant on the test performance measure.

The findings do not support the predictions of CET and the overjustification hypothesis. Intrinsic motivation did not decrease due to reward. In addition, the results from measures, designed to assess feelings about receiving reward (QD2, which was given to rewarded participants only), also did not support CET or the overjustification hypothesis. Both of these theoretical accounts suggest that rewards will be experienced as controlling. Descriptive analyses from this study revealed that rewards were not seen as controlling, as distracting, or as creating pressure. Nor did the receipt of reward result in higher perceptions of external control. Instead, participants reported that the rewards were informational and motivational, and that they enjoyed receiving the rewards. The present study also did not reveal a direct relationship between perceived competence and intrinsic motivation in the free-choice period. This suggests that high levels of perceived competence may not be associated with high levels of intrinsic motivation as assumed by cognitive evaluation theorists.

In short, CET and the overjustification hypothesis are unable to account for the findings of the current study. Social learning theory and the learned industriousness model appear to be more viable in accounting for the effects of rewards based on performance standards and effort.

It is interesting to note that the task used in this study was not rated as very challenging by any of the groups. Although participants found the task to be of high interest, they did not rate it above the mid-point for task challenge. Over the course of the learning phase, most of the participants showed a decrease in their perceptions of how challenging the task was. This suggests that as they became more familiar with the task and more competent at it, it was no longer seen as challenging.

Implications for Education

The present study furthers our understanding of the effects of rewards offered for attaining various performance standards and for exerting different levels of cognitive effort, particularly for those who are interested in the optimal use of rewards in education settings. Despite the prevalent view that rewards are harmful to intrinsic motivation, the current findings suggest that rewarding students for attaining task requirements during the process has positive effects on task interest, self-efficacy and self-determination. In addition, the concern that rewards will lead to an external attribution of causality seems to be unwarranted.

Based on the current findings, the receipt of reward after a low difficulty task will undermine intrinsic motivation and performance. Hence, reward should not be implemented in such cases. However, the use of rewards in education is justified. This study demonstrated that rewarding high cognitive effort will result in high levels of performance, but rewarding low cognitive effort leads to lower levels of performance relative to non-rewards. Therefore, rewards should be used when a high difficulty task is accomplished.

For educators who want to develop a sense of competency in students through their experiences in learning, they can either implement a task that demands progressive performance standards or reward students for completing a task that only requires constant levels of performance. Results from this study suggest that these types of reward contingency will lead to higher levels of perceived competence upon successful mastery. Teachers can also accompany rewards with a task that requires only constant levels of performance standards. In this case, the receipt of rewards signifies competence in accomplishing a task that otherwise does not convey competence information.

In short, despite the claims of some theorists and educators that rewards are necessarily harmful, this study shows that rewards can be either beneficial or detrimental depending on the contingency set up by educators. When administered appropriately, rewards enhance intrinsic motivation and performance of students. With precautions, use of rewards can lead to positive results.

Limitations

One issue in the present study concerns the divergent effects that were detected on questionnaires at the post-learning phase (QC2) and after the free-choice phase (QE3) for perceived competence. One possibility for this difference is that participants' feelings of competence may have been altered by processes unexamined during the free-choice period. Another possibility is that the use of a single Likert item (QE3) provided a relatively less valid test than the use of several items as was done with QC2. However, the present study lacks empirical evidence to support these speculations.

Another issue is that there was a significant reward effect of self-determination found on the change score measure (QA2-QA1), whereas there were no significant effects found on the QC2 and QE3 measures. The different significance levels between the change scores and the Likert scales (QC2 and QE3) may be attributed to the fact that both QC2 and QE3 had only a single item on a 7-point Likert scale, whereas the change scores calculated from several semantic differential items may be a more sensitive measure.

Directions for Future Studies

One important issue rarely discussed in the reward and intrinsic motivation literature concerns the free-time measure and performance during the free-choice period. A close examination of the data obtained in the free-choice period reveals that the free-time and the free-choice performance measures had a high covariation ($r = .87$, $p < .01$), and that the distributions on these two measures were both bimodal, resulting in large within-group variances.

In the present study, the behavior of participants during the free-choice period was predominantly an "all or nothing" response, with only five participants engaged in the task between 100 and 400 seconds. That is, the majority of participants either engaged in the task for the entire period, or they engaged in the alternative activity without re-engaging in the task. Free-choice performance also showed the same large within group variances. In fact, the resulting large within-group variances are not uncommon in this research literature (see Deci, 1971; Harackiewicz, Manderlink, & Sansone, Exp. 1, 1984; Harackiewicz, 1979; Luyten & Lens, 1981; Rosenfield, Folger, & Adelman, 1980). This issue has been largely ignored in this literature (although see McMullin and Steffen, 1982).

The non-normality on the free-time measure and free-choice performance suggests that the operationalization of these measures as continuous variables may be inappropriate. The fact that large variances can contribute to non-significant results may be the reason for the marginally significant interaction effect of reward and difficulty on the MANOVA test of intrinsic motivation. The implication is that free-choice behavioral measures of intrinsic motivation may lack the sensitivity to detect significant effects. In contrast, the test performance measures (number of correct on a test) revealed the same interaction effect of reward by difficulty, but reached the .05 level of significance. Given the inherent disadvantage of the free-time and free-choice performance measures, and given that the test performance measure provided a more sensitive test of the effects of rewards, a direction for future research is to use test performance as an index of intrinsic motivation.

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APPENDIX A

Educational Psychology 200 -- Two (2) Mark Bonus on Final Exam

We are currently recruiting participants for a study that concerns learning and puzzle-solving. Volunteers will be asked to participate in a puzzle-solving game of visual perception called "FIND THE DIFFERENCE". The game is on computer and involves finding differences between two very similar cartoons. 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, Dr. Carbonaro will give you a two (2) mark bonus on your final exam.

Investigators:

Dr. Judy Cameron	Department of Educational Psychology	492-0177
Sylvia So	Dept. of EDPY	Email: ksso@ualberta.ca
Kama Jamieson	Dept. of EDPY	Email: kama@ualberta.ca

Time commitment: approximately 1 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: ________________

Please leave your contact information below:

Name: ____

Phone: ____

Email: ____

Best time to contact you: ____________________________

APPENDIX B

QA1

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

After reading the instructions on how to do Find the Difference problems, I find the task to be:

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

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

After reading the instructions on the Find the Difference game, I feel:

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

QB1

On a Find a Difference problem, how confident are you that, in 30 seconds, you will be able to find:

Number of differences	**Circle the degree of certainty at each level out of 6**										
1 out of 6	0	10	20	30	40	50	60	70	80	90	100%
2 out of 6	0	10	20	30	40	50	60	70	80	90	100%
3 out of 6	0	10	20	30	40	50	60	70	80	90	100%
4 out of 6	0	10	20	30	40	50	60	70	80	90	100%
5 out of 6	0	10	20	30	40	50	60	70	80	90	100%
6 out of 6	0	10	20	30	40	50	60	70	80	90	100%

Please complete the sentence with a number ranging from 1 to 6.

On a Find the Difference problem, I would feel personally satisfied if I could find ____ differences in 30 seconds.

QA2

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

I found the Find the Difference game to be:

Challenging	__	__	__	__	__	not challenging
complex	__	__	__	__	__	simple
exciting	__	__	__	__	__	dull
tedious	__	__	__	__	__	entertaining
interesting	__	__	__	__	__	boring
unpleasant	__	__	__	__	__	enjoyable
easy	__	__	__	__	__	difficult

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

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

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

QB2

On a Find a Difference problem, how confident are you that, in 30 seconds, you will be able to find:

Number of differences	Circle the degree of certainty at each level out of 6									
1 out of 6	0 10	20	30	40	50	60	70	80	90	100%
2 out of 6	0 10	20	30	40	50	60	70	80	90	100%
3 out of 6	0 10	20	30	40	50	60	70	80	90	100%
4 out of 6	0 10	20	30	40	50	60	70	80	90	100%
5 out of 6	0 10	20	30	40	50	60	70	80	90	100%
6 out of 6	0 10	20	30	40	50	60	70	80	90	100%

Please complete the sentence with a number ranging from 1 to 6.

On a Find the Difference problem, I would feel personally satisfied if I could find ____ differences in 30 seconds.

QC2

Please circle a response for each statement according to the following scale:
1 = Not at all **7 = Very much**

1. I enjoyed playing the Find the Difference game.

   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 was concerned about my performance being evaluated.

   1 2 3 4 5 6 7

4. I was motivated to perform well at the Find the Difference game.

   1 2 3 4 5 6 7

5. My performance on the Find the Difference game 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 or chance	1	2	3	4	5	6	7

6. How poorly or well did you do on the Find the Difference game?

   very poorly 1 2 3 4 5 6 7 very well

7. How competent do you feel about playing the Find the Difference game?

   not at all 1 2 3 4 5 6 7 very much

8. How much choice did you have as to whether or not to do the Find the Difference problems?

   very little 1 2 3 4 5 6 7 very much

QD2

Some people enjoy getting money for doing these problems. Other people don't. Please circle a response for each of the statements below according to the following scale:

1 = Not at all 7 = 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. The money provided me with useful feedback to evaluate my performance.

   1 2 3 4 5 6 7

5. Receiving money distracted my attention from the task.

   1 2 3 4 5 6 7

6. Receiving money motivated me to perform well on the Find the Difference game..

   1 2 3 4 5 6 7

7. Receiving money made me feel less interested in doing the Find the Difference game.

   1 2 3 4 5 6 7

QE3

1. How enjoyable do you find the Find the Difference game?

not at all 1 2 3 4 5 6 7 very much

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

very little 1 2 3 4 5 6 7 very much

3. How poorly or well did you do on the Find the Difference game?

very poorly 1 2 3 4 5 6 7 very well

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

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

APPENDIX C

Script

The experimenter arrives to the lab and restarts the computer stations. When participants come in, the experiment will greet the participants, **"Are you here for the study?"** and lead each of them to a computer station. **"Have a seat. We will begin as soon as everyone is ready."**

When all participants are seated, an experimenter will go to the front and say: **"This study is about learning and puzzle solving. The puzzle you will be doing is called "Find the Difference." The instruction on the computer is going to take you through the example. There is no time limit, so take your time. Once you get started, please pay attention only to your own computer. We have different things going on different stations. So, ignore any sounds and so on you may hear from other computers and focus on the task you are given. When you finish the example, please call me. "**

The experimenter goes over to each of the stations to start the program and say: **"You can begin."**

When the participants finish the examples, they will call the experimenter. The experimenter then come to the participant and give out the first questionnaire-QA1, QB1- saying, **"please complete this questionnaire for me. Call me when you are done."**

The experimenter will go to another desk so that participants are not disturbed. When the experimenter is called, she will collect the questionnaire and say, **"The following is a learning phase. There are three sets of problems. The instructions**

will be on the screen, please read them carefully. There is no time limit. When you finish all three sets, please call me."

Only in the reward condition when the experimenter is called, she will go over and give out the reward ($6) and say, **"You can keep the money."**

For all participants, the experimenter will give out another questionnaire-QA2, QB2, QC2, (QD2)-to the participants and say, **"Please fill this out for me. Call me when you are done. "**

Upon being called, the experimenter will collect the questionnaire and say, **"There will be a short test. The instructions will be on the screen, please read them carefully.**

The experimenter will stay with the participants until they read the instruction. The experimenter will ask, **"Do you understand?"**

If the participant answers NO, the experimenter will say, **"Please read again carefully."**

If the participant says YES, the experiment will say, **"When you finish the test, please call me. Now, are you all set?"**

When the participant is ready, and the experimenter keys in the password and hit enter, **"ok. GO!"**

When being called, the experimenter will come back with some magazines and say, **"Now it will take a few minutes for the computer to analyze your data. Please wait here in case something did not work. During this time you can play some more Find the Difference games or look at these magazines.** (Take magazines out from the envelope and hand them to the participant) **If you are not playing the game, please press the "pause" button. When you want to continue on the problems, you can**

press the "resume" button. Please do not leave the room. Once the data is ready, the computer will let you know. Then call me."

The experimenter keys in the password and the free time instructions will appear. After reading the instruction the participants will click "OK" on the screen, which starts an eight-minute free choice period in the computer. During this period, participants are not allowed to leave their seats, but they can choose to do more Hocus-Focus or to read the magazines. When the eight minutes are up, the screen will tell the participants to call the experimenter. The experimenter then returns with another questionnaire QE3 for the participants to fill out, **"Please complete this questionnaire for me."**

After the questionnaire is completed, the experimenter walks out with the participant. At this point, non-rewarded participants are given the $6.00 reward; all participants are asked to sign a Non-disclosure form and a petty cash form. Finally, the experimenter will thank the participants and say, **"when the study is completed, we will come to your class to tell you about it."**

APPENDIX D

To: Research participants in the "find the Difference" study

Thank you for participating in our research. In this particular study, we were interested in the effects of performance standards, task difficulty, and the offer of rewards on people's motivation and performance. Each participant was randomly assigned to one of eight conditions. Half of the participants were offered money to solve Find the Difference problems; the other half were not offered money but were paid at the end of the session. In terms of task difficulty, half the participants had to find two differences in each problem and half had to find four differences. In addition, half of the participants were asked to solve three problems in each of three sets of the task; the other half were asked to solve 1, 3, and 5 problems over the three sets of puzzles.

Specifically, our research was designed to assess whether offers of reward, task difficulty, and different performance standards would affect performance on a test, time spent on the puzzles during a free choice period, and self reports of task interest, task difficulty, challenge, and anxiety, etc.

Presently, we are analyzing the results. If you are interested in the findings, you can contact Dr. Judy Cameron at 492-0177 or by email: judy.cameron@ualberta.ca

APPENDIX E

Table E1.

The Effect of Reward, Effort, and Standard on Task Interest and Perceived Challenge

Task Interest at the Post-learning Phase (QA2)

Performance Standards	Low difficulty		High difficulty	
	M	SD	M	SD
	Task interest			
Progressive				
Reward	1.00	0.71	1.17	0.56
No reward	0.69	0.53	0.97	0.76
Constant				
Reward	0.98	0.53	1.06	0.84
No reward	1.08	0.81	0.50	0.93
	Perceived challenge			
Progressive				
Reward	-0.93	0.88	-0.63	0.86
No reward	-1.04	0.86	-0.26	0.92
Constant				
Reward	-1.20	0.86	-0.63	0.75
No reward	-1.00	1.20	-0.19	0.93

Table E2.

The Effect of Reward, Effort, and Standard on Perceived Competence, Self-determination and Anxiety at the Post-learning Phase (QA2)

Performance Standards	Low difficulty		High difficulty	
	M	SD	M	SD
	Perceived Competence			
Progressive				
Reward	1.70	0.42	1.59	0.43
No reward	1.56	0.53	1.11	1.12
Constant				
Reward	1.67	0.44	1.56	0.53
No reward	1.52	0.53	1.19	0.73
	Self-determination			
Progressive				
Reward	1.22	0.46	1.36	0.85
No reward	1.08	0.57	1.06	0.92
Constant				
Reward	1.35	0.70	1.25	0.66
No reward	1.31	0.63	1.08	0.93
	Anxiety			
Progressive				
Reward	-1.17	0.71	-1.28	1.15
No reward	-1.39	0.65	-0.83	1.41
Constant				
Reward	-1.40	0.84	-1.00	1.00
No reward	-1.39	0.70	-1.11	1.02

Table E3.

The Effect of Reward, Effort, and Standards on Self-efficacy and Personal Standards at the Post-learning Phase (QB2)

Performance Standards	Low difficulty		High difficulty	
	M	SD	M	SD
	Self-efficacy			
Progressive				
Reward	85%	12%	81%	21%
No reward	77%	9%	75%	17%
Constant				
Reward	80%	17%	69%	25%
No reward	75%	20%	72%	16%
	Personal standards			
Progressive				
Reward	4.67	1.00	4.56	1.01
No reward	4.38	0.92	4.44	1.13
Constant				
Reward	4.50	1.18	4.11	1.05
No reward	4.56	0.73	4.56	1.24

APPENDIX F

Table F1.

Means Table for Initial Equivalence of Groups on Task Interest and Perceived Challenge (QA1)

Performance Standards	Low difficulty		High difficulty	
	M	SD	M	SD
	Task interest			
Progressive				
Reward	0.64	0.85	0.67	0.64
No reward	0.61	0.60	0.89	0.55
Constant				
Reward	0.68	0.47	0.64	0.65
No reward	0.78	0.55	0.56	0.90
	Perceived challenge			
Progressive				
Reward	0.00	1.05	-1.30	0.70
No reward	-0.56	0.78	-0.19	0.84
Constant				
Reward	-0.80	0.72	-0.44	0.65
No reward	-0.15	0.87	-0.67	1.21

Table F2.

Means Table for the Initial Equivalence of Groups on Perceived Competence, Self-determination and Anxiety (QA1)

Performance Standards	Low difficulty M	Low difficulty SD	High difficulty M	High difficulty SD
		Perceived Competence		
Progressive				
Reward	1.11	0.85	1.59	0.76
No reward	1.26	0.64	1.33	0.53
Constant				
Reward	1.23	0.75	1.30	0.59
No reward	1.26	0.62	1.30	0.95
		Self-determination		
Progressive				
Reward	1.08	0.65	1.14	0.76
No reward	1.31	0.53	1.17	0.76
Constant				
Reward	1.05	0.74	0.81	0.72
No reward	1.14	0.78	1.14	0.96
		Anxiety		
Progressive				
Reward	-0.67	0.83	-1.33	1.03
No reward	-1.00	0.79	-0.83	0.71
Constant				
Reward	-0.95	1.04	-0.72	1.03
No reward	-1.33	0.75	-1.11	1.14

Table F3.

Means Table for the Initial Equivalence of Groups on Self-efficacy and Personal Standard (QB1)

Performance Standards	Low difficulty M	Low difficulty SD	High difficulty M	High difficulty SD
	Self-efficacy			
Progressive				
Reward	76%	15%	76%	27%
No reward	77%	10%	76%	15%
Constant				
Reward	76%	18%	65%	23%
No reward	72%	21%	69%	17%
	Personal standard			
Progressive				
Reward	4.44	0.88	4.33	0.71
No reward	4.44	0.88	4.44	1.13
Constant				
Reward	4.60	1.35	4.11	1.05
No reward	4.33	0.87	4.33	1.12

APPENDIX G

Table G1.

The Effect of Reward, Effort, and Standard on Free-time, Free-choice Performance, and Task Enjoyment (QE3)

Performance Standards	Low difficulty		High difficulty	
	M	SD	M	SD
	Free-time			
Progressive				
Reward	393	152	397	153
No reward	336	203	406	153
Constant				
Reward	309	230	311	229
No reward	374	178	310	232
	Free-choice performance			
Progressive				
Reward	30.44	12.59	33.44	17.53
No reward	26.33	17.03	30.00	14.47
Constant				
Reward	21.22	16.88	25.67	22.78
No reward	32.78	16.35	22.44	17.19
	Task enjoyment (QE3)			
Progressive				
Reward	6.00	0.87	6.33	0.71
No reward	5.67	0.50	5.67	0.87
Constant				
Reward	5.78	0.83	5.89	0.78
No reward	6.11	0.93	5.44	1.01

Table G2.

The Effect of Reward, Effort, and Standard on Changes in Task Interest (QA2-QA1)

	High difficulty		Low difficulty	
Performance Standards	M	SD	M	SD
Progressive				
Reward	0.50	0.82	0.36	0.71
No reward	0.08	0.43	0.08	0.47
Constant				
Reward	0.42	0.31	0.30	0.39
No reward	-0.06	0.74	0.31	0.60

Table G3.

The Effect of Reward, Effort, and Standard on Task Interest (QC2)

	High difficulty		Low difficulty	
Performance Standards	M	SD	M	SD
Progressive				
Reward	5.89	0.78	5.56	0.81
No reward	5.67	0.66	5.11	0.70
Constant				
Reward	5.72	1.00	5.85	0.67
No reward	4.94	1.21	6.00	1.03

Table G4.

The Effect of Reward, Effort, and Standard on Test Performance

Performance Standards	Low difficulty		High difficulty	
	M	SD	M	SD
Progressive				
Reward	16.67	3.57	17.67	2.24
No reward	18.33	2.12	17.44	3.71
Constant				
Reward	16.20	3.39	19.00	1.41
No reward	17.56	3.24	16.44	2.30

Table G5.

The Effect of Reward, Effort, and Standard on Perceived Competence

Performance Standards	Low difficulty		High difficulty	
	M	SD	M	SD
	After free-time (QE3)			
Progressive				
Reward	4.78	1.09	4.89	0.33
No reward	5.44	0.53	4.78	1.09
Constant				
Reward	5.22	0.97	5.11	1.27
No reward	4.56	0.73	4.33	1.12
	Changes due to treatments (QA2-QA1)			
Progressive				
Reward	0.59	0.95	0.00	0.60
No reward	0.30	0.66	-0.22	1.03
Constant				
Reward	0.43	0.65	0.26	0.46
No reward	0.26	0.74	-0.11	0.82
	Before free-time (QC2)			
Progressive				
Reward	6.33	0.75	6.19	0.77
No reward	6.22	0.67	5.89	1.24
Constant				
Reward	6.57	0.69	6.00	0.80
No reward	6.33	0.67	5.48	1.37

Table G6.

The Effect of Reward, Effort, and Standard on Self-determination

Performance Standards	Low difficulty		High difficulty	
	M	SD	M	SD
	After free-time (QE3)			
Progressive				
Reward	5.22	1.48	5.78	1.20
No reward	5.11	1.69	5.11	2.20
Constant				
Reward	5.22	1.39	6.22	0.97
No reward	5.11	2.20	5.11	1.90
	Changes due to treatments (QA2-QA1)			
Progressive				
Reward	0.14	0.53	0.22	0.78
No reward	-0.22	0.36	-0.11	0.61
Constant				
Reward	0.30	0.52	0.44	0.88
No reward	0.17	0.79	-0.06	0.43
	Before free-time (QC2)			
Progressive				
Reward	5.22	1.48	5.78	1.20
No reward	5.11	1.69	5.11	2.20
Constant				
Reward	5.22	1.39	6.22	0.97
No reward	5.11	2.20	5.11	1.90

Table G7.

The Effect of Reward, Effort, and Standard on Locus of Causality

Performance Standards	Low difficulty		High difficulty	
	M	SD	M	SD
	External			
Progressive				
Reward	2.33	1.25	2.70	1.89
No reward	2.70	1.31	2.26	1.13
Constant				
Reward	2.70	1.43	2.11	0.90
No reward	3.33	1.83	2.52	2.28
	Internal			
Progressive				
Reward	6.00	0.75	5.78	0.79
No reward	5.28	0.87	5.72	0.79
Constant				
Reward	5.55	1.12	5.44	0.92
No reward	5.94	0.63	5.56	1.42

Table G8.

The Effect of Reward, Effort, and Standard on Changes in Self-efficacy (%) (QB2-QB1)

Performance Standards	Low difficulty M	Low difficulty SD	High difficulty M	High difficulty SD
Progressive				
Reward	9%	10%	5%	10%
No reward	-1%	10%	-1%	12%
Constant				
Reward	4%	10%	4%	8%
No reward	2%	10%	3%	7%

Table G9.

The Effect of Reward, Effort, and Standard on Changes in Personal Standards (QB2-QB1)

Performance Standards	Low difficulty M	Low difficulty SD	High difficulty M	High difficulty SD
Progressive				
Reward	0.22	0.67	0.22	0.97
No reward	-0.13	0.83	0.00	0.50
Constant				
Reward	-0.10	0.74	0.00	0.50
No reward	0.22	0.67	0.22	0.67

Table G10.

The Effect of Reward, Effort, and Standard Changes in Perceived Challenge (QA2-QA1)

	Low difficulty		High difficulty	
Performance Standards	M	SD	M	SD
Progressive				
Reward	-0.93	0.86	0.67	0.97
No reward	-0.48	0.90	-0.07	0.95
Constant				
Reward	-0.40	0.93	-0.19	0.94
No reward	-0.85	1.58	0.48	1.13

Table G11.

The Effect of Reward, Effort, and Standard on Changes in Anxiety (QA2-QA1)

	Low difficulty		High difficulty	
Performance Standards	M	SD	M	SD
Progressive				
Reward	-0.50	0.56	0.06	1.01
No reward	-0.39	0.60	-0.00	1.25
Constant				
Reward	-0.45	0.80	-0.28	1.09
No reward	-0.06	0.63	-0.00	0.79