Achievement-Based Rewards and Intrinsic Motivation: A Test of Cognitive Mediators

Judy Cameron, W. David Pierce, Katherine M. Banko, and Amber Gear
University of Alberta

This study assessed how rewards impacted intrinsic motivation when students were rewarded for achievement while learning an activity, for performing at a specific level on a test, or for both. Undergraduate university students engaged in a problem-solving activity. The design was a 2 × 2 factorial with 2 levels of reward in a learning phase (reward for achievement, no reward) and 2 levels of reward in a test phase (reward for achievement, no reward). Intrinsic motivation was measured as time spent on the experimental task and ratings of task interest during a free-choice period. A major finding was that achievement-based rewards during learning or testing increased participants' intrinsic motivation. A path analysis indicated that 2 processes (perceived competence and interest–internal attribution) mediated the positive effects of achievement-based rewards in learning and testing on intrinsic motivation. Findings are discussed in terms of the cognitive evaluation, attribution, and social–cognitive theories.

Keywords: rewards, intrinsic motivation, cognitive processes, path analysis

The use of rewards and incentives in educational settings as a way to improve student performance and motivation is an issue that has generated controversy. On one side of the debate are those who argue that rewards are detrimental (e.g., Deci, Koestner, & Ryan, 1999, 2001; Kohn, 1993). From this perspective, rewards are seen as effective in getting people to perform an activity, but once the rewards are no longer available, people's intrinsic motivation to engage in activities is undermined. On the other side of the debate are researchers who claim that negative effects of reward are limited and that rewards can be used to increase motivation and performance (e.g., Cameron, 2001; Cameron, Banko, & Pierce, 2001; Cameron & Pierce, 1994; Dickinson, 1989; Eisenberger & Cameron, 1996; Flora & Flora, 1999).

Today, the debate has moved beyond the question of whether rewards are inherently harmful or beneficial. Instead, researchers recognize that the effects of reward depend on the types of rewards used, the reward contingency, how rewards are allocated, and the context in which rewards are administered. Recent research has focused on identifying the moderating conditions under which external incentives are most effective and on factors that need to be considered when designing a successful incentive program (Cameron & Pierce, 2002; Sansone & Harackiewicz, 2000). The present study assesses how rewards impact intrinsic motivation when students are rewarded for achievement while learning an activity, for performing at a specific level on a test, or for both. The study is also designed to test various theoretical accounts of reward effects; the goal is to determine what cognitive processes mediate the effects of achievement-based rewards on people's intrinsic motivation.

Much of our understanding of the reward process comes from experimental research on the topic. Since 1971, over 150 experiments have been conducted to investigate how rewards affect people's intrinsic motivation. In a typical study (e.g., see Deci, 1971; Lepper, Greene, & Nisbett, 1973), participants (children or college students) are presented with an interesting task (puzzle solving, drawing, word games, etc.). An experimental group is offered a reward (praise, money, gold stars, etc.) for doing the task; participants in a control condition engage in the activity without receiving a reward. Rewarded and nonrewarded participants are then observed during a free-choice period without reward in which they are free to continue performing the experimental task or to engage in an alternate activity (e.g., reading magazines). The time participants spend on the target activity during the free-choice period, their performance on the task during the free-choice period, and ratings of task interest are used as measures of intrinsic motivation. If rewarded participants spend less free time on the activity, perform at a lower level, and express less task interest than nonrewarded participants, reward is said to undermine intrinsic motivation.

Meta-analytic reviews of studies of rewards and intrinsic motivation have identified several conditions under which rewards can be used to maintain or enhance intrinsic motivation (see Cameron et al., 2001; Deci et al., 1999). Specifically, rewards have been found to increase motivation and performance on tasks that are of low initial interest. On high interest tasks, positive effects of
reward are obtained when participants are verbally praised for their work, when tangible rewards are presented in an informational manner, when rewards signify competence at an activity, and when the rewards are offered and given for achieving performance standards or goals.

For the present study, of particular interest are experiments that show how rewards affect intrinsic motivation when they are tied to achieving set performance standards. Research has shown that intrinsic motivation increases when participants are offered and given rewards for meeting absolute or normative standards on activities (e.g., Eisenberger, Rhoades, & Cameron, 1999; Harackiewicz & Manderlink, 1984; Harackiewicz, Manderlink, & Sanzone, 1984; Pierce, Cameron, Banko, & So, 2003). In Eisenberger, Rhoades, and Cameron’s (1999) study, experimental participants were offered a reward (money) to meet or exceed a certain score on a task (absolute standard) during a learning phase or to do better than others (normative standard). These groups were compared with nonrewarded control groups on task enjoyment and free time on task following the withdrawal of reward. The results indicated that participants in reward conditions had higher levels of intrinsic motivation than did those in nonreward groups, suggesting that rewards based on exceeding a criterion or norm have positive effects.

A recent experiment by Pierce et al. (2003) examined how rewards affected people’s intrinsic motivation when the rewards were tied to meeting increasingly demanding performance standards (progressive) versus an unchanging standard (constant). A major result was that participants in the progressive reward condition showed higher intrinsic motivation than did those in the constant reward condition and the nonrewarded control groups. This result indicates that linking rewards to achievement of challenging standards (or to mastery) may also be an effective way to increase people’s intrinsic motivation. On the basis of these findings, several practical and theoretical questions have emerged that are addressed by the present experiment.

Practical Considerations

To date, experiments on rewards and intrinsic motivation have focused on how rewards tied to learning an activity affect subsequent interest and performance. In educational settings, achievement-based rewards are usually given to students for test performance rather than during learning sessions. Thus, an issue of practical interest concerns the effects of rewarding individuals for test performance. Teachers, parents, and award committees frequently offer rewards (praise, money, recognition, plaques, etc.) to students for achieving certain standards on tests or for outperforming others. Rewarding individuals for test performance and its effect on intrinsic motivation has yet to be experimentally studied.

A second practical issue concerns the transfer of intrinsic motivation from one activity to another. In past experiments on rewards and intrinsic motivation, intrinsic motivation is indexed by participants’ performance on the experimental task, time spent on the task in a free-choice session, and self-reports of task liking. No studies have assessed whether intrinsic motivation for one type of activity transfers to other activities. One possibility is that when students enjoy a specific activity, such as arithmetic, they will also come to enjoy other areas of mathematics. More generally, the more similar activities are, the more likely it is that interest for one will spread to others. The issue of transfer of intrinsic motivation from one task to a more general category of activities (e.g., from reading a specific book to general interest in reading) is clearly a major goal of education.

It is also important to note that in most experiments on rewards and motivation, the rewards are offered and delivered during the learning phase on a one-time basis rather than over a series of trials. In educational environments, when students are learning new material, teachers usually present rewards over a period of time and allocate the reward on the basis of students’ proficiency.

In order to address these issues and in an attempt to more closely mirror what goes on in the classroom, the present study tests the effects of rewards on intrinsic motivation when the rewards are given over a series of trials in a learning phase, for achievement on a test, or both. The study also investigates how rewarding achievement on a specific problem-solving task affects intrinsic motivation for other different problem-solving activities.

Theoretical Considerations

Cognitive Evaluation Theory

The present research is designed to test several theories that explain how rewards affect intrinsic motivation when the rewards are tied to achievement. Cognitive evaluation theory (CET) offers one theoretical account of the effects of rewards on intrinsic motivation (Deci et al., 1999). CET has typically focused on negative effects of rewards; however, there are circumstances in which CET points to possible positive effects. Specifically, Deci et al. discussed the controlling versus informational aspects of rewards. Rewards that are closely tied to performance standards are said to be perceived as controlling. Offering rewards for meeting performance standards will lead individuals to feel pressured and will convey to them that they are expected to perform up to the experimenter’s standards. Such rewards will undermine perceptions of self-determination (autonomy), leading to a reduction in intrinsic motivation. On the other hand, rewards linked to achievement can also provide information about competence that affects the cognitive evaluation process (Deci et al., 1999, pp. 628–629). When people succeed at attaining a performance standard, the rewards convey information about performance that is positively evaluated by the individual; this evaluation leads to greater perceived competence and may offset some of the controlling aspects of rewards, thereby leading to enhanced intrinsic motivation. Thus, for CET, the critical processes that have been proposed to mediate the effects of performance-based rewards on intrinsic motivation are perceived autonomy and perceived competence.

Specifically, CET predicts that rewards given for achievement will reduce autonomy but enhance perceived competence in both testing and learning situations. According to CET, greater perceived competence will lead to higher intrinsic motivation when the rewards are perceived as informational. In contrast, decreased perceptions of autonomy will lead to lower intrinsic motivation when the rewards are perceived as controlling. For CET, “it is the relative salience of the competence-relevant versus controlling aspects of a performance-contingent reward that determines its effects on intrinsic motivation” (Ryan & Deci, 2000b, p. 27).

A stronger form of CET’s autonomy–competence hypothesis was formulated by Ryan and Deci (2000a) when they stated that
“feelings of competence will not enhance intrinsic motivation unless accompanied by a sense of autonomy or, in attributional terms, by an internal perceived locus of causality. . . . Thus, according to CET, people must not only experience competence or efficacy, they must also experience their behavior as self-determined for intrinsic motivation to be in evidence” (p. 70). Stated this way, rewards can enhance intrinsic motivation through competence only if the rewards are not perceived as controlling. Because rewards invariably have a controlling aspect, from the point of view of the strong version of CET, they may enhance perceived competence but will not increase intrinsic motivation. To summarize, the strong CET hypothesis predicts that achievement-based rewards will decrease intrinsic motivation; the weak form of this hypothesis allows rewards to enhance intrinsic motivation through increased competence even though autonomy is reduced.

In an experiment on autonomy and intrinsic motivation, Ryan, Mims, and Koestner (1983) varied the context in which performance-contingent rewards were delivered to emphasize the informational versus controlling dimension. When the context of the reward was informational (i.e., participants were offered a reward for doing well), intrinsic motivation increased relative to a non-reward control group; when the context of reward was controlling (i.e., participants were offered a reward to perform up to the researcher’s standards), intrinsic motivation declined. However, there was no effect of either reward procedure on measures of autonomy. This suggests that rewards may enhance or reduce intrinsic motivation without changes in autonomy.

Eisenberger, Pierce, and Cameron (1999) reviewed several studies that measured the effects of rewards on autonomy and intrinsic motivation. Overall, they found that rewards increased perceptions of autonomy (self-determination) and intrinsic motivation. Eisenberger, Pierce, and Cameron suggested that in contrast to the view put forward by CET, rewards based on performance increase perceived self-determination by conveying freedom of action to the reward recipient, not control over performance. In a test of this hypothesis, Eisenberger, Rhoades, and Cameron (1999) found that performance-contingent rewards increased perceived self-determination, and self-determination was found to significantly mediate the impact of rewards on task-enjoyment intrinsic motivation. These findings indicate that under certain conditions, rewards can increase perceptions of autonomy that in turn lead to higher intrinsic motivation.

Houlfort, Koestner, Joussemet, Nantel-Vivier, and Lekes (2002) have suggested a way to rectify the discrepancy between the research evidence and the predictions made by CET concerning the central role of autonomy. Self-determination (autonomy) is typically assessed with questionnaire items in which participants indicate whether they feel they have a choice in performing the experimental task. According to Houlfort et al., this type of question assesses only one type of autonomy—decisional autonomy. Decisional autonomy refers to one’s opportunity to engage in options; it does not deal with the affective or phenomenological experience of autonomy. The studies reviewed by Eisenberger, Pierce, and Cameron (1999) used measures of decisional autonomy. Houlfort et al. argued that it is affective autonomy (the feeling of being free and relaxed vs. coerced and pressured) that is critical to the negative impact of rewards on intrinsic motivation. That is, rewards may enhance decisional autonomy, but people may still feel pressured or coerced.

Two studies were conducted by Houlfort et al. (2002) to assess the effects of performance-based rewards on measures of affective autonomy, decisional autonomy, and intrinsic motivation. In Experiment 1, Houlfort et al. replicated the procedures of the early study by Ryan et al. (1983) by varying the informational versus controlling delivery of rewards. In contrast to Ryan et al., the informational–controlling manipulation did not result in changes in intrinsic motivation; rewards in general did not affect intrinsic motivation measures. In Study 2, the controlling versus informational context was not varied, and the performance-based rewards led to an unexpected increase in intrinsic motivation (task enjoyment). In both experiments, Houlfort et al. found that rewards had a negative effect on affective autonomy and no impact on decisional autonomy; however, affective autonomy was not correlated with measures of intrinsic motivation. In summary, the evidence suggests that the relationships among performance-based rewards, affective autonomy, decisional autonomy, and intrinsic motivation remain unresolved at the theoretical level.

**Attribution and Intrinsic Motivation**

Another explanation of the effects of rewards on intrinsic motivation comes from attribution theory and the overjustification hypothesis (Lepper et al., 1973). As with CET, the focus has been on negative effects of rewards; rewards are said to decrease intrinsic motivation by altering people’s attributions of causation for their behavior. When rewards are offered for performing an activity, people are said to discount the internal causes of their actions (e.g., interest, effort, skill, ability) and to view their behavior as externally motivated. Heightened attributions of control by external factors lead to low levels of personal autonomy, resulting in a loss of intrinsic motivation (Lepper & Henderlong, 2000). At the same time, however, rewards for achievement may convey information about one’s ability, mastery, or competence. Perceptions of high competence enhance intrinsic motivation. This is most likely when rewards are given for successful performance on an activity. Thus, rewards given for achievement may increase perceptions of competence as well as perceptions of external control. Lepper and Henderlong suggested that the effects of such rewards on intrinsic motivation will depend on the relative magnitude of these two competing processes.

Only a few researchers have assessed the impact of performance-based rewards on participants’ attributions of performance (external vs. internal factors); the results are mixed. Rewards have been found to have no effects on external–internal attributions of performance (Arnold, 1985; Weinberg & Jackson, 1979) or to lead participants to attribute their behavior less to internal factors than nonrewarded participants do (Brockner & Vasta, 1981). Wimperis and Farr (1979) found that participants who received rewards based on performance made attributions to both internal and external factors. These results suggest that rewards may not lead individuals to attribute their behavior to only a single source of causation; instead, it is possible that receiving rewards for a successful accomplishment may induce both internal and external
attributions. Notably, the links among attributions, competence, and intrinsic motivation remain unexplored at the research level.

**Social–Cognitive Theory**

Social–cognitive theory (Bandura, 1986, 1997) deals with situations in which individuals extract personal standards from reward contingencies. From this perspective, rewards given for achievement result in high personal standards. Attainment of high personal standards leads to task involvement (interest), positive evaluations of performance, and increased self-efficacy or competence. As in CET and attribution theory, greater perceptions of competence or efficacy are linked to higher intrinsic motivation (see Harackiewicz & Sansone [2000] for another theoretical analysis based on competence). An important distinction between social–cognitive theory and other approaches is that achievement-based rewards can lead directly to greater involvement and interest, a view supported by Hidi (2000). Hidi suggested that external factors, such as rewards, can lead a person to have interest in a specific activity (e.g., arithmetic). Specific interest can eventually contribute to more general involvement in a subject area (e.g., mathematics) and to overall intrinsic motivation. Social–cognitive theory proposes that rewards for achieving challenging performance standards are likely to act as positive feedback leading to high task interest and involvement, high personal evaluations of performance, and increased competence; these processes in turn increase intrinsic motivation. Unlike CET and the attribution approach, social–cognitive theory does not emphasize the mediating role of autonomy for the effects of rewards on intrinsic motivation.

Several researchers have assessed the relationship between rewards given for achieving a performance standard, competence, and intrinsic motivation. A few studies have shown that the receipt of a reward for meeting a performance standard enhances competence relative to a no-reward condition (Dollinger & Thelen, 1978; Freedman & Phillips, 1985; Houlfort et al., 2002). Eisenberger, Rhoades, and Cameron (1999) showed that perceived competence partially mediated the effects of rewards based on meeting an absolute standard on task enjoyment but not on the free time measure of intrinsic motivation.

**The Present Study**

In the present study, we assessed the impact of achievement-based rewards offered to participants in a learning phase, a test session, or both. On the basis of recent research by Pierce et al. (2003), rewards in the learning phase were tied to achieving a progressively challenging standard (solving three, four, and five problems over three trials). Rewards in the test phase were given for meeting an absolute standard of performance. Given the findings of past research, both types of rewards were expected to enhance measures of intrinsic motivation. On the basis of theoretical accounts, we further expected that enhanced intrinsic motivation would be mediated by changes in performance evaluation, task involvement or interest, competence, decisional autonomy, and internal attributions. On the basis of CET and attribution theory, we expected that participants would also attribute their behavior to external factors and that measures of affective autonomy would be reduced by the reward procedures.

**Method**

**Participants and Design**

Participants (N = 119) were university students participating for credit in their introductory psychology course. The experiment was a 2 x 2 factorial design with two levels of reward during learning (reward and no reward) and two levels of reward during testing (reward and no reward). Students were randomly assigned to one of four conditions: reward during learning and testing (LTR; n = 32), reward during learning and no reward during testing (LR; n = 28), reward during testing and no reward during learning (TR; n = 30), and no reward during learning and testing (NR; n = 29). The sample sizes are unequal because of a loss of participants from equipment failure (2 in the LR group) and refusal to participate in the study (1 in the NR group). Two new participants were randomly assigned to the LTR condition, mistakenly, and not to the LR condition. For one participant in the NR condition, the videotape malfunctioned; thus, for the free-time measures, N = 118.

**Procedure**

Participants were run through the experimental protocol on an individual basis. When they arrived at the laboratory, participants were taken to an experimental room and seated at a table. All participants were informed that the session was being videotaped. They were also told that the study concerned learning and puzzle solving, and they were asked to sign a form that ensured their anonymity and informed consent. Next, participants were shown an example of the experimental activity—find the difference (FTD). The object of FTD is to find differences between two cartoons. Each person was shown how to find a difference between the top and bottom cartoon. Participants were then told that there were six differences for each problem and were asked to use a marker to circle other differences that they could find in the example. Previous research has found this task to be of high interest and challenge to university students (Eisenberger, Rhoades, & Cameron, 1999; Pierce et al., 2003). Within each FTD problem, finding the first three differences is relatively easy; finding more than three differences is challenging because the remaining differences are subtle and hard to detect.

**Learning phase.** During the learning phase, participants were asked to work on three sets of three FTD puzzles for a total of nine puzzles. All participants were required to find three differences on each puzzle in the first set, four differences on each puzzle in the second set, and five differences on each puzzle in the third set. Participants had to find the required number of differences before they could move on to the next trial; those who did not meet the criterion were asked to continue to find differences. No time limit was set, and the order of the puzzles was counterbalanced over participants. Participants in the LR and LTR groups were offered and given money for meeting the criterion on each trial. They received $1.00 for finding the differences required on the first trial, $3.00 for the differences on the second trial, and $6.00 for the differences on the third trial. Participants in the NR and TR conditions were not offered and did not receive money for finding differences on any of the trials during the learning phase.

Following the learning phase, participants completed a questionnaire that assessed task interest, competence, and perceptions of affective autonomy. The questionnaire also asked participants to rate their reasons for doing the task, whether they attributed their performance to internal or external factors, their perceptions of how well they did on the puzzles during the learning phase (performance evaluation), and whether they had a choice to do the puzzles (decisional autonomy). Participants in reward conditions completed an additional set of items that asked them to rate their feelings about receiving money.

**Test phase.** After completing the questionnaire measures, participants...
were asked if they would like to complete a 3-min test (no participants refused). The test contained 10 new FTD puzzles that were stapled together in a booklet. The order of the puzzles was the same for each participant, and participants could go back and forth trying to find as many differences as possible.

Participants were given bogus information about how others have performed on the test. They were told that people’s scores generally fall into one of three categories: individuals either find fewer than 15 differences, between 15 and 20 differences, or more than 20 differences. Participants in the TR and LTR conditions were offered $1.00 for finding fewer than 15 differences, $3.00 for finding between 15 and 20 differences, and $5.00 for finding more than 20 differences. Those in the NR and LR conditions were not offered or given money. Following the test, the experimenter pretended to calculate a test score, and all participants were told they had found more than 20 differences (prior pilot testing indicated that college students could find over 20 differences in a 3-min period). Those in the reward conditions were given $5.00.

Following the test, participants completed a questionnaire that included the same measures (in a different order) used in the questionnaires administered following the learning phase (i.e., task interest, perceptions of competence, affective autonomy, reasons for doing the task, attributions of performance, perceptions of how well they did on the test, and attitudes toward receiving reward).

**Free-choice phase.** A free-choice period followed the test. Across all conditions, participants were told that the experimenter had to go upstairs and get more questionnaires for the study. Participants were given more FTD puzzles, two magazines (Time and Newsweek), and a booklet of other puzzles (e.g., crosswords, word searches, find-the-hidden-figures puzzles); they were told that they could do whatever they wanted but were asked not to leave the room until the experimenter returned. The experimenter left the room and returned 8 min later. The time participants spent on FTD puzzles and total time spent on puzzles were used as behavioral measures of intrinsic motivation. Participants were given a final questionnaire that assessed task-interest intrinsic motivation on the FTD task and on puzzle solving in general. Finally, all participants were debriefed, and those in the no-reward conditions were given $10.00 for participation.

**Dependent Measures**

**Bipolar measures.** The dependent measures for FTD task interest and general interest in puzzle solving for the learning, testing, and free-choice phases were composed of four bipolar items (interesting–boring, exciting–dull, enjoyable–unpleasant, and entertaining–tedious), each measured on a 7-point scale and later coded 3, 2, 1, 0, −1, −2, −3. For each item, the first descriptor in the pair was coded with positive numbers. The four items were summed to create a composite Task Interest Scale (reliability: α = .88). Three 7-point bipolar items were used to measure perceived competence (confident–unsure, competent–incompetent, capable–unable; α = .81).

We constructed a scale called Affective Autonomy similar to one described in Houlfort et al. (2002). In the Houlfort et al. study, Affective Autonomy was composed of items in which participants rated whether they felt relaxed, pressured, tense, nervous, or anxious. In the present study, Affective Autonomy was made up of six bipolar items (at ease–intimidated, easy-going/overwhelmed, self-controlled/pressured, free–constrained, calm–anxious, relaxed–nervous). A factor analysis of the six items confirmed that all loaded on the single dimension of affective autonomy. Factor loadings ranged from .58 (free–constrained) to .87 (relaxed–nervous) with a reliability of .87.

**Likert measures.** To test the attribution–overjustification approach, we used items commonly cited by researchers in the field (see Arnold, 1985; Brockner & Vasta, 1981; Weinberg & Jackson, 1979; Wimperis & Farr, 1979). On 7-point Likert scales ranging from 1 (not at all) to 7 (very much), participants rated how much they attributed their performance on the puzzles to external and/or internal factors (situational pressure, time pressure, feedback from the researcher, concern about performance evaluation, wanting to please the researcher, effort, energy, interest, enjoyment, luck). Participants evaluated their performance by rating how well they thought they did on the FTD puzzles (1 = very poorly, 7 = very well) and by how competent they felt (1 = not at all competent, 7 = extremely competent). They also rated how much choice they had to do the puzzles (1 = very little, 7 = very much).

We factor analyzed the Likert measures by using a principal component analysis with varimax rotation. Five factors were identified with eigenvalues greater than 1 that accounted for 70% of the common variance. The extracted dimensions were labeled as “external attribution” (18.5% variance), “internal attribution (effort)” (14.6% variance), “performance evaluation” (14.5% variance), “internal attribution (interest)” (14.3% variance), and “decisional autonomy” (8.1% variance). The items and their factor loadings are presented in Table 1. The table indicates that each of the items that made up a single dimension loaded high on that factor (> .60) and low on all other factors (< .30). Three items—“I was concerned about my performance being evaluated,” “I wanted to do well to please the re-

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>External attribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My performance on the task was due to time pressure.</td>
<td>.850</td>
<td>.026</td>
<td>−.123</td>
<td>.036</td>
<td>−.084</td>
</tr>
<tr>
<td>My performance was due to situational pressure.</td>
<td>.795</td>
<td>.172</td>
<td>−.081</td>
<td>−.246</td>
<td>.067</td>
</tr>
<tr>
<td>My performance was due to feedback from the researcher.</td>
<td>.637</td>
<td>.121</td>
<td>.022</td>
<td>.241</td>
<td>−.094</td>
</tr>
<tr>
<td>Internal attribution (effort)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I put effort into solving the FTD puzzles.</td>
<td>.071</td>
<td>.873</td>
<td>.088</td>
<td>.084</td>
<td>.041</td>
</tr>
<tr>
<td>I put energy into solving the FTD puzzles.</td>
<td>.170</td>
<td>.839</td>
<td>.032</td>
<td>.173</td>
<td>−.211</td>
</tr>
<tr>
<td>Performance evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How poorly or well did you do on the FTD puzzles?</td>
<td>.081</td>
<td>.011</td>
<td>.868</td>
<td>.017</td>
<td>.125</td>
</tr>
<tr>
<td>How competent did you feel about the FTD puzzles?</td>
<td>−.129</td>
<td>.066</td>
<td>.840</td>
<td>.114</td>
<td>.072</td>
</tr>
<tr>
<td>Internal attribution (interest)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My performance on the task was due to my own interest.</td>
<td>−.019</td>
<td>−.055</td>
<td>.175</td>
<td>.895</td>
<td>−.036</td>
</tr>
<tr>
<td>I enjoyed doing the FTD puzzles.</td>
<td>.076</td>
<td>.114</td>
<td>−.058</td>
<td>.868</td>
<td>.127</td>
</tr>
<tr>
<td>Decisional autonomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much choice did you have to do the FTD puzzles?</td>
<td>−.073</td>
<td>−.035</td>
<td>.104</td>
<td>.082</td>
<td>.906</td>
</tr>
</tbody>
</table>

*Note.* FTD = find the difference.
searcher,” and “My performance was due to luck”—had high loadings on more than one factor (> .30) and were not retained for further analyses. The reliability indexes for the scales were as follows: external attribution, α = .72; internal attribution—effort, α = .79; performance evaluation, α = .75; and internal attribution—interest, α = .79. The item “I enjoyed doing the FTD puzzles” is not an obvious attribution measure. However, the factor analysis indicated that it loaded highly with attribution of interest, and thus, the item was retained.

In addition, participants in reward conditions rated how they felt about receiving the money. Responses to 7-point scales ranging from 1 (not at all) to 7 (very much) measured how much participants felt (a) controlled by the money, (b) enjoyment from receiving it, (c) pressed from receiving it, (d) that the money provided performance feedback, (e) that the money distracted attention from the task, (f) that the money motivated them to perform well, and (g) that the money decreased their interest in the task.

**Performance measures.** Performance measures were obtained for the learning and test phases. During learning, performance was measured as time taken to find the required number of differences and the number of errors made. Performance on the test was measured as number of correct differences found, number of errors, and number of pictures attempted by participants.

**Intrinsic motivation measures.** Intrinsic motivation measures were obtained during the free-choice period. Intrinsic motivation for FTD puzzles was assessed with the typical measures used in experiments on this topic—time spent on the FTD puzzles during the free-choice period and questionnaire measures of FTD task interest. Previous studies on rewards and intrinsic motivation have most often used single items to assess task interest; items have varied over studies (e.g., task liking; enjoyment; whether participants find the task entertaining, boring, exciting, etc.). In the present study, the four bipolar items (interesting–boring, exciting–dull, enjoyable–unpleasant, and entertaining–tedious) used in the learning and test phase questionnaires were used to assess FTD intrinsic motivation. Intrinsic motivation for puzzle solving in general was indexed by total time on puzzles (FTD and other puzzles) and four bipolar items assessing general puzzle-solving interest. Measures of time spent on magazines and on other activities (e.g., sitting and looking around) were also obtained.

**Statistical Analyses**

For the analysis of intrinsic motivation for the FTD task, we used multivariate analysis of variance (MANOVA) that included the four task-interest items and time on FTD during the free-choice phase. A multivariate approach treated the five measures as indicators of the intrinsic motivation construct and assessed the impact of rewards on this latent variable. In addition, univariate tests following a MANOVA allowed for comparison of our findings with those of other researchers. MANOVA was also used to assess intrinsic motivation for puzzle solving in general. For analyses on the effects of rewards on questionnaire measures taken after the learning and test phases, univariate analyses of variance (ANOVA) were conducted on each of the composite measures (e.g., interest, affective autonomy, competence). All statistical tests were conducted by using SPSS Version 11.5. Multivariate tests were based on Wilk’s lambda. Effect size statistics of eta squared (η²) are reported following each test of significance (the values of eta squared were calculated by using the corrected total sums of squares for ANOVA based on the general linear model). Eta squared provides the proportionate reduction in error for a given independent variable. Cohen’s d values are also reported with the means for each measure of intrinsic motivation. Values of less than .20 are considered small, values of .50 are considered medium, and values greater than .80 are considered large (Cohen, 1988).

**Results**

**Intrinsic Motivation: Time and Interest in the Free-Choice Phase**

To provide an overall test of the effects of rewards during learning and testing on FTD intrinsic motivation, we performed a 2 × 2 MANOVA by using free time on the task and the four FTD bipolar free-choice interest measures as dependent variables. There was a significant multivariate effect of reward for testing on FTD intrinsic motivation, $F(5, 110) = 3.36, p = .007$; a marginally significant multivariate effect of reward during learning, $F(5, 110) = 1.99, p = .086$; and no significant interaction, $F(5, 110) = 0.54, ns$.

Table 2 shows the means, standard deviations, and effect sizes for the five measures of FTD intrinsic motivation. We conducted univariate tests on each of these measures. On the free-time measure, there was a significant main effect of reward for learning, $F(1, 114) = 5.19, p = .025$; a significant main effect of reward for testing, $F(1, 114) = 5.82, p = .017$; but no interaction effect, $F(1, 114) = 1.76, ns$. Inspection of Table 2 indicates that participants who were rewarded during learning or testing spent more time on the FTD puzzles than those who did not receive rewards. That is, rewards increased free-time intrinsic motivation for FTD puzzles; the size of effects was small to moderate.

On task-interest measures, Table 2 shows that participants who received rewards for achievement during learning rated FTD puzzles as more interesting, exciting, enjoyable, and entertaining than did nonrewarded participants. Effect sizes were small (ranging from $d = .13$ to .36). Univariate tests indicated a significant effect of reward for learning on the entertaining–tedious item, $F(1, 114) = 3.96, p = .049$. Table 2 shows that rewards for test performance also increased participants’ ratings on each of the task-interest items (effect sizes ranged from $d = .17$ to .49). Univariate tests showed that there was a significant effect of reward for testing on the exciting–dull item, $F(1, 114) = 4.82, p = .030$; and the entertaining–tedious item, $F(1, 114) = 7.05, p = .009$. There were no significant univariate interaction effects.

**Rewards and Generalized Intrinsic Motivation**

A major question addressed in this research was whether reward for solving FTD problems enhances intrinsic motivation for puzzle solving in general. A MANOVA on total time spent on puzzles (FTD puzzles and other puzzles) in the free-choice period and general puzzle-solving interest indicated a significant main effect of reward in learning, $F(5, 110) = 2.63, p = .028$; no main effect of reward in testing, $F(5, 110) = 0.84, ns$; and no interaction, $F(5, 110) = 0.98, ns$. Univariate tests revealed a significant effect of reward during learning on total time on puzzles, $F(1, 114) = 11.70, p = .001$, η² = .09. Participants who received rewards for achievement during the learning phase spent more time (seconds) overall on puzzle solving ($M = 336.8, SD = 150.1$) than did nonrewarded controls ($M = 223.9, SD = 204.9$). There were no other significant main or interaction effects on total time on puzzles or general puzzle-solving interest.

Further analysis indicated that nonrewarded participants spent more free time reading magazines ($M = 235.1, SD = 200.6$) than did those who had received a reward during learning ($M = 115.8, SD = 144.7$), $F(1, 114) = 13.74, p = .001$. This finding suggests
that rewards during learning partially enhanced time spent on puzzles by reducing time spent on other nonrelated activities (e.g., reading magazines).

**Analyses of Measures for the Learning Phase**

**Performance.** Performance during the learning phase was measured as total time to solve the three sets of puzzles and total number of errors made. Univariate ANOVAs showed that there were no significant differences between the rewarded group and the nonrewarded control, indicating that offering a reward for puzzle solving did not affect performance during this phase.

**Interest, competence, and affective autonomy.** In terms of bipolar questionnaire measures, ANOVAs were conducted with reward for learning versus no reward (control group) on each of the composite measures (task interest: 4 items; competence: 3 items; and autonomy: 6 items). On task interest, there was a statistically significant effect of reward, $F(1, 117) = 6.94, p = .01, \eta^2 = .056$. Participants who were rewarded during the learning phase reported greater task interest ($M = 1.16, SD = 1.09$) than did nonrewarded participants ($M = 0.65, SD = 1.01$). On measures of perceived competence and affective autonomy, there were no significant differences between rewarded and nonrewarded participants.

**Attributions, performance evaluation, and decisional autonomy.** Following the learning phase, participants also responded to several questionnaire items (measured on 7-point Likert scales) in which they indicated their reasons for doing the task (internal and external attributions), evaluated their own performance, and indicated whether they had choice in doing the task (decisional autonomy).

An ANOVA of the External Attribution Scale (whether performance was due to situational pressure, time pressure, and feedback from the researcher) showed a significant main effect of reward, $F(1, 117) = 4.38, p = .039, \eta^2 = .036$. Rewarded participants attributed their performance more to external factors ($M = 3.18, SD = 1.42$) than did nonrewarded participants ($M = 2.67, SD = 1.29$).

An ANOVA of the Performance Evaluation Scale (how well participants thought they performed, how competent they felt) showed an effect of reward that approached significance, $F(1, 117) = 3.34, p = .06, \eta^2 = .029$. Rewarded participants evaluated their performance as better and reported greater competence ($M = 3.41, SD = .63$) than did nonrewarded participants ($M = 3.14, SD = .86$). There were no significant effects of reward on internal attributions (interest or effort) or decisional autonomy.

**Ratings of monetary reward.** Participants in the learning reward condition were asked to rate the monetary reward in terms of control, enjoyment, pressure, feedback, distraction, motivation, and interest on 7-point Likert scales ($\alpha = .78$). One-sample $t$ tests were conducted comparing the observed means against a hypothesized value of 4 (neutral value on the 7-point scale). Because there were seven items that were tested, the level of significance was changed from .05 to .007 for each test, by using a Bonferroni correction (Shaffer, 1995). Five of the seven items were significantly different from neutral when the corrected alpha was used. Specifically, participants in the reward condition did not feel controlled by the money ($M = 2.9, SD = 1.9$), $t(59) = -4.65$; pressured by the money ($M = 2.8, SD = 1.9$), $t(59) = -4.72$; or distracted by the money ($M = 2.2, SD = 1.6$), $t(59) = -8.94$.  

---

**Table 2**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Learning Reward</th>
<th>Learning No Reward</th>
<th>Testing Reward</th>
<th>Testing No Reward</th>
<th>Means (on 7-point Likert scale)</th>
<th>$t$</th>
<th>$p$</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reward</td>
<td>No reward</td>
<td>Reward</td>
<td>No reward</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$M = 131.9$</td>
<td>$M = 72.9$</td>
<td>$M = 131.9$</td>
<td>$M = 70.8$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$SD = 128.9$</td>
<td>$SD = 154.1$</td>
<td>$SD = 154.1$</td>
<td>$SD = 115.7$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Means for the free time measure are based on seconds. Means for questionnaire measures could range from 1 to 7.
Participants indicated that the money did not take away their interest ($M = 2.0, SD = 1.3$), $t(59) = −11.94$; instead, they reported that they enjoyed receiving the money ($M = 5.2, SD = 1.7$), $t(59) = 5.45$. Overall, the offer of payment did not lead participants to feel controlled or to lose interest in the task.

**Summary.** In sum, following the learning phase, participants who had received monetary rewards for meeting increasingly challenging performance standards on an FTD task reported greater task interest than did nonrewarded controls. Rewarded participants also attributed their performance more to external factors than did nonrewarded participants. In addition, rewarded participants evaluated their performance more positively than did those who did not receive rewards. In terms of attitudes toward receiving rewards, participants indicated that receiving money did not take away their interest in the task and that they did not feel pressured, distracted, or controlled by the rewards. Measures of autonomy (affective and decisional), competence, and internal attributions of interest and effort did not vary across conditions.

**Analyses of Measures for the Test Phase**

For test performance and questionnaire measures following the test, we used a 2 x 2 factorial design with two levels of reward during learning (reward or no reward) and two levels of reward during testing (reward or no reward).

**Performance.** There were no significant main or interaction effects in the number of correct differences found on the FTD test, number of errors made, or number of FTD pictures that were attempted. Overall, participants on average found 33.2 correct differences, worked on 8.2 pictures, and had less than one error on the 3-min test.

**Interest, competence, and affective autonomy.** On the Task Interest Scale, a 2 x 2 ANOVA failed to reveal any significant main effects or interaction effect of rewards during learning and/or testing. An ANOVA of the Competence Scale yielded a significant main effect of reward during testing, $F(1, 115) = 11.05, p = .001, \eta^2 = .088$. There were no significant main effects of rewards during learning and no interaction effect. Participants who received a reward for test performance evaluated their performance as better ($M = 5.8, SD = 0.77$) than did participants who did not receive a reward for test performance ($M = 5.3, SD = 0.85$). There were no significant main or interaction effects on the item that assessed decisional autonomy.

**Ratings of monetary reward.** Participants who were rewarded for test performance rated the monetary reward in terms of control, enjoyment, pressure, feedback, distraction, motivation, and interest on 7-point Likert scales ($\alpha = .80$). As in the results for the learning phase, we analyzed these data by using one-sample t tests comparing the observed means against a hypothesized value of 4 (neutral). Again we changed the significance level from .05 to .007 for each test by using a Bonferroni correction. Six of the seven items were significantly different from neutral when the corrected alpha was used. Specifically, participants who received a reward in the test phase were motivated to perform well on FTD by the money ($M = 4.9, SD = 1.9$), $t(61) = 3.42$; enjoyed receiving the money ($M = 5.6, SD = 1.6$), $t(61) = 7.84$; did not feel controlled by the money ($M = 2.9, SD = 1.7$), $t(61) = −4.41$; were not distracted by the money ($M = 2.3, SD = 1.4$), $t(61) = −9.03$; did not feel less interested in FTD by receiving money ($M = 3.18, SD = 1.5$), $t(61) = −4.44$; and did not feel pressured by the money ($M = 3.3, SD = 1.8$), $t(61) = −3.18$. There was no significant effect for the item “The money provided me with useful feedback to evaluate my performance.”

**Summary.** Results on questionnaire measures following the test phase are summarized as follows. Participants who received rewards for achieving a specific standard on the test evaluated their performance and rated their competence as higher than those who did not receive rewards for test performance. Participants rewarded in the test phase also attributed their performance more to internal causes (interest) than did nonrewarded participants. Rewards in the test phase did not lead participants to feel controlled, distracted, or pressured; receiving money did not make participants less interested in the task, and they reported that they enjoyed receiving the reward. The findings further indicated that, following the test, participants who had received a reward for performance in the learning phases attributed their performance more to interest than did those who received no rewards. They also reported lower feelings of affective autonomy than did nonrewarded participants.

**Path Models of Rewards, Cognitions, and Intrinsic Motivation**

A major aim of the present study was to determine whether the cognitive processes proposed by various theoretical accounts mediate the effects of rewards on intrinsic motivation. Because there were significant main effects of rewards in learning and rewards in testing on intrinsic motivation measures and no significant interaction effects, we were able to construct two separate models. One model assessed the cognitive processes that mediate the effects of
rewards given for achievement in the learning phase on measures of intrinsic motivation (time on FTD during the free-choice phase and the composite measure of free-choice FTD task interest); the second model showed how cognitive processes mediate the effects of rewards given for test performance on intrinsic motivation measures.

**A path model of the effects of rewards in learning on intrinsic motivation.** To model the effects of rewards on intrinsic motivation, cognitive measures were based on the composite scales described in the Method and Results sections (e.g., task interest included four items, external attribution included three items, and so on). To construct the path model for rewards in learning, we began with cognitive measures that were affected by rewards after learning (Time 1). Specifically, rewards for learning had a significant effect on external attribution and task interest. Rewards affected performance evaluation, but the effect was not statistically significant. The performance evaluation measure, however, was maintained in the model because of its importance to social-cognitive theory.

The next step involved an inspection of the simple correlations among the three cognitive measures affected by reward at Time 1 (task interest, performance evaluation, and external attribution) and measures taken after testing (Time 2). Table 3 presents the correlation matrix of these measures. Following the recommendations of Baron and Kenny (1986) and Judd and Kenny (1981), the pattern of correlations was examined to determine (a) which measures at Time 2 were related to the Time 1 measures and (b) which Time 2 measures were related to the intrinsic motivation measures (Time 3). Only measures that met these criteria were included in building a model. For example, performance evaluation (Time 1) is significantly correlated with perceived competence ($r = .32$), and competence is related to task-interest intrinsic motivation ($r = .29$). The measures included at Time 2 were affective autonomy, perceived competence, task interest, and internal attribution (interest).

We used AMOS software (Arbuckle, 2003) and maximum-likelihood estimation to calculate the path model. After running the initial model, we removed paths with nonsignificant coefficients. For example, the path between affective autonomy and free-time intrinsic motivation had a nonsignificant coefficient ($-0.04$) and was trimmed from the model. Because affective autonomy was not directly related to intrinsic motivation measures and perceived competence was, we included a path between affective autonomy and perceived competence. This path was also included because of its theoretical importance; that is, from the perspective of CET, competence and a sense of autonomy contribute to changes in intrinsic motivation (Ryan & Deci, 2000a, p. 70). In a study by Levesque, Stanek, Zuehlke, and Ryan (2004, p. 71), a path model testing self-determination theory showed autonomy impacting perceived competence to affect the dependent variable (well-being). We tested this link in our path analysis of rewards and intrinsic motivation. We also tested the possibility that perceived competence affected autonomy to impact intrinsic motivation; however, the model fit was weak, and autonomy did not significantly affect intrinsic motivation (free time or task interest).

Before the model was trimmed, internal attribution at Time 2 (interest) was found to have no significant direct effect on either measure of intrinsic motivation. On the basis of a consideration of attribution theory, we postulated a link between internal attribution and task interest at Time 2. Because internal attribution and interest were measured at the same time, the causal relation between these measures could go in either direction. On the basis of goodness-of-fit indexes, the direction of causation was from internal attributions to task interest.

Finally, we included significant correlations among the error terms to help improve the fit of the path model. Only error terms that were statistically significant were retained. The results of the final path model are presented in Figure 1. The model was considered an adequate fit, $\chi^2(29) = 47.2, p = .02$. Goodness-of-fit indexes supported this conclusion; the root-mean-square error of approximation (RMSEA) was .073 (Gierl & Rogers [1996] have suggested that values of RMSEA less than .08 indicate a reasonable fit of the model). Other goodness-of-fit indexes were above the acceptable level of .90 (Bentler, 1990; Jöreskog & Sörbom, 1996).

**Table 3**

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive measures at Time 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Task interest</td>
<td>$-0.02$</td>
<td>$-0.01$</td>
<td>$0.69^*$</td>
<td>$-0.13$</td>
<td>$0.07$</td>
<td>$0.01$</td>
<td>$0.08$</td>
<td>$0.59^*$</td>
<td>$0.04$</td>
<td>$0.07$</td>
<td>$0.15$</td>
<td>$0.55^*$</td>
<td></td>
</tr>
<tr>
<td>2. Performance evaluation</td>
<td>$-0.14$</td>
<td>$0.03$</td>
<td>$0.32^*$</td>
<td>$-0.08$</td>
<td>$0.32^*$</td>
<td>$0.16$</td>
<td>$0.09$</td>
<td>$0.28^*$</td>
<td>$0.23^*$</td>
<td>$0.04$</td>
<td>$-0.02$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. External attribution</td>
<td>$-0.09$</td>
<td>$-0.13$</td>
<td>$0.49^*$</td>
<td>$-0.37^*$</td>
<td>$-0.44^*$</td>
<td>$-0.09$</td>
<td>$0.17$</td>
<td>$-0.10$</td>
<td>$0.23^*$</td>
<td></td>
<td>$-0.08$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive measures at Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Task interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Performance evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. External attribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Competence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Affective autonomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Internal attribution (interest)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Internal attribution (effort)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Decisional autonomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic motivation measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Time on FTD task</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. FTD task interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* FTD = find the difference.

* $p < .05$
As noted previously, a model where the direction of causation is reversed for the task interest and internal attribution variables produced a less adequate fit, $\chi^2(29, N = XXX) = 52.8, p = .004$, RMSEA > .08.

Of particular interest are the cognitive measures that mediate the effects of rewards on intrinsic motivation. In path-analytic terms, these are indirect effects. Baron and Kenny (1986) pointed out that correlations are not sufficient to determine mediation; mediation occurs when there is a reduction of the effect of the initial variable on the outcome after controlling for the mediator (indirect effect). Sobel (1982) provided a test statistic that is used to test mediation from path models. After a path model has been constructed, mediation can be established by using the regression weights of the paths ($a \rightarrow b$) and the relevant standard errors ($S_a$ and $S_b$). The Sobel test of mediation is given by dividing the product of the regression weights $a$ and $b$ by the square root of $b^2S_a^2 + a^2S_b^2$. The Sobel test statistic is treated as a $Z$ test (i.e., values larger than 1.96 are significant at the .05 level).

The Sobel (1982) test statistic was calculated for each path to determine which variables in Figure 1 mediated the relationships between reward and intrinsic motivation measures. The results of the mediation analyses are presented in Table 4. Comparing Table 4 and Figure 1, it is apparent that rewards affected external attribution and that external attribution affected free-time intrinsic motivation, but external attribution was only a weak mediator of this relationship. The most important role of external attribution was its function as a significant mediator of rewards on affective autonomy. Participants who received rewards attributed their performance more to external factors than did nonrewarded participants, and this attribution lowered feelings of affective autonomy. Reductions in autonomy, however, did not directly affect either measure of intrinsic motivation. Rather, affective autonomy was positively related to perceived competence that in turn positively mediated the effects on task-interest intrinsic motivation. The absence of a direct effect of affective autonomy on intrinsic motivation measures could imply that autonomy works as a moderator variable with limited mediation effects. Further experimental research that manipulates autonomy would help to clarify this issue.

A second major mediation process involved performance evaluation as a weak mediator of rewards on perceived competence. It is important to note that perceived competence had a significant indirect positive effect on the relationship between performance evaluation and task-interest intrinsic motivation. A final mediation process involved the effects of rewards on task interest and the
subsequent effects of task interest on internal attribution and intrinsic motivation. Task interest at Time 1 was a significant mediator of rewards on task interest at Time 2 and on internal attribution of performance. Task interest at Time 2 mediated the effects of task interest after learning and internal attributions on task interest during the free-choice period. In other words, rewards enhanced task interest, which subsequently had an impact on intrinsic motivation.

A path model of the effects of rewards in testing on intrinsic motivation. To construct the path model for the effects of rewards for test performance on intrinsic motivation, we began with the measures affected by rewards during testing and inspected the correlations between these measures and the two measures of intrinsic motivation. Rewards for test performance significantly affected performance evaluation and perceived competence. Neither of these potential mediators was significantly correlated with free-time intrinsic motivation. Thus, we were unable to construct a mediation model for the free-time measure; instead, rewards for test performance had a direct effect on time spent on the FTD task.

Perceived competence and internal attribution (interest) were significantly correlated with task-interest intrinsic motivation and were included in the model. Because of its importance to social-cognitive theory and its relatively strong relationship to perceived competence, performance evaluation was included in the model as a potential mediator of rewards in testing on competence. It is important to note that the model could have related rewards directly to perceived competence, but the performance evaluation route is theoretically more informative.

The trimmed model presented in Figure 2 was not as adequate a fit as the reward-learning model in Figure 1. Some goodness-of-fit measures indicated a weak fit, $\chi^2(6) = 17.02, p = .01$, RMSEA = .12; other measures supported the adequacy of the model (normative fit index = .99, comparative fit index = .99). Mediation tests indicated that performance evaluation significantly mediated the effect of rewards on competence ($Z = 3.06, p = .002$), and competence significantly mediated the relationship between performance evaluation and free-choice task interest ($Z = 2.30, p = .02$). Internal attribution of performance to interest was a weak mediator of the effects of rewards on task-interest intrinsic motivation ($Z = 1.76, p = .08$).

Discussion

A major finding from the present experiment is that when rewards were given for achievement on the puzzle-solving activity either during learning or after testing, individuals spent more time on the activity and reported greater task interest than did nonrewarded participants during a free-choice period. That is, achievement-based rewards increased intrinsic motivation for the target activity. These results are in accord with other recent research that has shown that when individuals are rewarded for achieving an absolute, normative, or graded level of performance, intrinsic motivation is enhanced (Eisenberger, Rhoades, & Cameron, 1999; Houlifort et al., 2002, Experiment 2; Pierce et al., 2003). In the present study, the effects of rewards in the learning and test phases were additive. One implication is that if students are given rewards for successful accomplishments during learning or on a test, each reward contingency will independently enhance students’ intrinsic motivation.

An important question in this study that has not been addressed in previous research is whether intrinsic motivation for a specific performance (FTD puzzle solving) would transfer to the more general category of activity (puzzle solving). The results indicated that participants who were rewarded for achieving increasingly challenging performance standards on the FTD task during the learning phase spent more free time on puzzle solving (FTD and other puzzles) than did nonrewarded controls. Rewards for achievement had the effect of reducing off-task behavior and keeping participants focused on puzzle-solving activities.

Practical Implications

On a practical level, results from the present study suggest that achievement-based rewards can promote intrinsic motivation for a specific task and, at the same time, enhance general interest in the category of activities that are being rewarded. An implication of these findings for educators is that if students are rewarded for successfully solving a particular type of problem (e.g., multiplication or division problems), the students’ motivation to engage in other types of similar problems (arithmetic or mathematics) will be enhanced.
It is important to note that in the present study, rewards were given for successful achievement, and procedures ensured that all participants succeeded. In everyday classroom settings, there is a graded level of success indicated by marks whereby some students achieve at the highest level and others achieve at a lower level. Under these conditions, those who do not receive the highest grades may become discouraged. Even students who have achieved a high level of success can lose motivation when adults praise their abilities and the students are subsequently exposed to failure (see Mueller & Dweck, 1998). A similar effect could occur when students are rewarded for meeting a normative standard on a test but later experience failure on other tests. One way to avoid possible negative effects is to ensure that students have met a given criterion of performance before they take tests.

Another practical issue concerns the classroom as a social setting where teachers evaluate students and students compare themselves with others. Social comparison processes based on rewards and teacher evaluations influence students’ assessments of their own academic abilities. For some students, this process may result in beliefs of low ability that negatively impact intrinsic motivation. Future experiments could examine the role of social comparison processes for intrinsic motivation when rewards are given in group settings.

The present research was concerned with individualized instruction and feedback and applies to situations in which students work at their own pace and move on when they have mastered units of the course material. Some schools in Canada have adopted such a system whereby teachers prepare an individualized educational plan for each student. The plan outlines objectives for achievement on the basis of the skill level of the student; students work toward achieving their individualized goals and move on to more challenging material at their own pace. Results from the present study suggest that rewards may enhance students’ intrinsic motivation under these conditions. On the other hand, individualized instruction is not typical of most educational settings in North America, and our findings may have limited generalizability.

Our study was designed to investigate rewards and intrinsic motivation under conditions of initial high task interest. We used the FTD puzzle-solving task because other researchers have found it to be interesting to university students (Eisenberger, Rhoades, & Cameron, 1999; Houlfort et al., 2002). Although participants usually find the task interesting, it is important to note that interest may be circumscribed to the experimental situation. That is, the university students did not have a large investment in the activity, and their interest in puzzle solving may not have extended beyond the laboratory. Renninger (2000) indicated that interest can become more ingrained when people form cognitions to support their involvement in a task. To extend the reward and intrinsic motivation research beyond the laboratory, it is necessary to conduct further studies using activities in which participants have greater investment.

**Theoretical Implications**

The present study sought to test theoretical accounts of reward effects and to assess the cognitive processes that mediate the effects of achievement-based rewards on intrinsic motivation measures. CET postulates that rewards based on meeting performance standards are experienced as controlling, decrease feelings of affective autonomy, and reduce intrinsic motivation. At the same time, performance-based rewards may indicate task ability and heighten perceptions of competence leading to increased intrinsic motivation. Actual levels of intrinsic motivation depend on the relative weight of these two alternative processes. In a stronger...
version of the CET hypothesis, affective autonomy determines perceptions of competence; thus, rewards would enhance intrinsic motivation only if they had positive effects on affective autonomy.

From an attribution perspective, performance-based rewards lead individuals to attribute their performance to external rather than internal factors; attributions to external sources lower feelings of affective autonomy and decrease intrinsic motivation. As with CET, attribution theory predicts that performance-based rewards may also increase perceived competence, and it is the relative magnitude of competence affirmation and autonomy reduction that determines the overall level of intrinsic motivation.

Social–cognitive theory emphasizes the role of perceived competence and self-efficacy as enhancing intrinsic motivation. Although reward contingencies may be experienced as controlling, it is the self-efficacy enhancement that is central from a social–cognitive viewpoint. Rewards given for graded achievement are predicted to increase task involvement, enhance positive evaluations of performance, and heighten perceived competence. From a social–cognitive view, perceptions of competence mediate the effects of achievement-based rewards on intrinsic motivation.

Results from the present study offer some support for each of these theories; at the same time, some findings are problematic for CET and attribution theory. In this regard, participants who were rewarded for achievement in learning and testing did not find the rewards controlling. The evidence from assessments of participants’ judgments of rewards in learning and testing indicated that the rewards did not make participants feel controlled, pressured, or distracted. Participants were not less interested in the task, and they reported that they enjoyed receiving rewards. In defense of CET, one possibility is that participants did not find the rewards of sufficient value to instill feelings of control and distraction; further research could clarify how the value of reward is related to perceptions of control. Another procedure that may have weakened the perception of control was the choice given to participants to take the test. This is not typical of educational settings and limits the extension of the findings to classroom testing environments.

Nonetheless, the findings show that when rewards are given for successful achievement and when individuals can choose to test their skills, the rewards are not seen as controlling. In fact, when people succeed at meeting a graded level of performance or exceed a standard on a test, rewards are perceived in a positive light possibly because of information feedback and the competence enhancement process.

Another difficulty for CET is that rewards in learning and testing did not directly alter feelings of autonomy. In addition, affective autonomy did not directly impact measures of intrinsic motivation. However, rewarded participants did attribute their performance more to external factors (pressure, feedback from the researcher) than did nonrewarded participants (see Figure 1). External attributions lowered feelings of autonomy, and affective autonomy was positively related to perceived competence. These processes are in accord with both CET and attribution theory; low feelings of autonomy induced by an external locus of causality (attribution to external factors) would push down perceptions of competence that would lead to decreased intrinsic motivation. Path analysis confirmed the causal process of rewards’ negative effect on intrinsic motivation through an external attribution and autonomy route. In the present study, however, rewards led to an overall increase in intrinsic motivation. Similar results were reported by Houlfort et al. (2002), who found that children rewarded for doing well on a task reported greater task-interest intrinsic motivation but lower affective autonomy than did nonrewarded children; measures of autonomy and intrinsic motivation were not related. Taken together, results from Houlfort et al. and the present study suggest that the causal role of affective autonomy in CET and the link among rewards, affective autonomy, and intrinsic motivation need further clarification at the theoretical level.

As shown in Figure 1, two processes were working to increase task-interest intrinsic motivation. One process through which rewards enhanced intrinsic motivation involved perceived competence. Previous research has shown that receiving a reward for meeting a performance standard increases feelings of competence (Dollinger & Thelan, 1978; Eisenberger, Rhoades, & Cameron, 1999; Freedman & Phillips, 1985; Houlfort et al., 2002). In addition, each of the theories we examined stipulates that performance-based rewards can enhance perceptions of competence in some manner. According to social–cognitive theory, rewarding individuals for achievement results in high self-evaluations of performance; perceived competence in turn increases intrinsic motivation. In accord with social–cognitive theory and previous research, the present study showed that rewards for achievement in learning and testing did enhance performance evaluations that increased perceived competence (see Figures 1 and 2). Furthermore, as expected, perceived competence mediated the effects of rewards in learning and testing on task-interest intrinsic motivation.

Rewards for achievement in learning were also found to directly increase task interest following the learning phase. According to our path analysis, task interest resulted in greater attribution of performance to internal causes; this attribution to internal sources led to further task interest, which led to a positive impact on intrinsic motivation (interest) following the free-choice period. Rewards in testing led directly to internal attributions that increased task-interest intrinsic motivation.

There are several ways to interpret these relationships. One interpretation follows the work of Hidi (2000), who suggested that rewards can lead individuals to become interested in an activity. Initial interest affects subsequent interest that in turn leads to overall intrinsic motivation in activities. The findings are also in accord with Bandura’s (1986) view that achievement-based rewards lead to task involvement; task interest in the present study may reflect task involvement. Another interpretation is that as interest increases, people see themselves as motivated by personal (internal) causes or as self-determined. The relationship between task interest and internal attributions may reflect the role of self-determination in building intrinsic motivation.

Overall, the results show that two processes (perceived competence and interest–internal attribution) mediated the positive effects of achievement-based rewards in learning and testing on task-interest intrinsic motivation. In terms of rewards for learning, these two processes had positive effects that were greater than the negative effect produced through affective autonomy.

Findings from the present study can be compared with those from Eisenberger, Rhoades, and Cameron (1999), who conducted a path analysis that showed that feelings of self-determination (labeled “decisional autonomy” in the present experiment) and perceived competence mediated positive effects of performance-based rewards on task-interest intrinsic motivation. In the present analyses, decisional autonomy was positively correlated with task-
interest intrinsic motivation, but the relationship was not statistically significant. In accord with Eisenberger, Rhoades, and Cameron, perceived competence was found to be a mediator of the effects of rewards on task-interest intrinsic motivation.

It is interesting to note that in Eisenberger, Rhoades, and Cameron’s (1999) study, competence and self-determination were found to mediate the effects of rewards on task-interest intrinsic motivation but not on free-time intrinsic motivation. In the present experiment, perceived competence and interest or internal attribution mediated reward effects on task-interest intrinsic motivation but not on free time. One possible reason for these findings is that free time on task may not be a uniform measure of intrinsic motivation. On the one hand, in Eisenberger, Rhoades, and Cameron (1999) and in the present study, small but statistically significant correlations were found between the free-time and task-interest measures of intrinsic motivation, suggesting that they share some degree of conceptual uniformity. On the other hand, in the present experiment, rewards during learning led participants to attribute their behavior to external factors that in turn led to more free time on the task. Although this relationship was weak, it does suggest the possibility that the free time measure may involve extrinsic as well as intrinsic motivation.

This possibility is in accord with Ryan, Koestner, and Deci (1991), who found that free time spent on an activity was a problematic measure, reflecting factors other than intrinsic motivation. In the Ryan et al. study, participants spent free time on an activity to improve performance and to enhance their self-worth rather than because they enjoyed the activity (intrinsic motivation). Under these conditions, the free-time measure did not indicate intrinsic motivation. When time spent on an activity and self-reports of interest and enjoyment strongly correlate, free time is a more adequate indicator of the intrinsic motivation construct. What is needed are measures of intrinsic motivation that consistently covary with manipulations presumed to affect the construct and not with other procedures designed to change external motives or motives to improve performance and self-worth.

Conclusion

The present experiment shows that giving rewards for successful achievement on an activity leads individuals to express high task interest and to be motivated to perform the activity and other similar tasks in the future. The study also shows that rewards can activate processes that involve both internal and external sources of motivation. The findings suggest that external and internal motivations may combine additively to affect overall motivation for an activity. Further research that investigates the effects of performance-based rewards on both extrinsic and intrinsic motivation—and the cognitive processes that mediate reward effects on these two sources of motivation—is warranted.

References


Received May 13, 2004
Revision received June 3, 2005
Accepted June 9, 2005