*Review of Educational Research*
*Fall 1994, Vol. 64, No. 3, pp. 363–423*

# Reinforcement, Reward, and Intrinsic Motivation: A Meta-Analysis

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*This article reviews research on the effects of reinforcement/reward on intrinsic motivation. The main meta-analysis included 96 experimental studies that used between-groups designs to compare rewarded subjects to nonrewarded controls on four measures of intrinsic motivation. Results indicate that, overall, reward does not decrease intrinsic motivation. When interaction effects are examined, findings show that verbal praise produces an increase in intrinsic motivation. The only negative effect appears when expected tangible rewards are given to individuals simply for doing a task. Under this condition, there is a minimal negative effect on intrinsic motivation as measured by time spent on task following the removal of reward. A second analysis was conducted on five studies that used within-subject designs to evaluate the effects of reinforcement on intrinsic motivation; results suggest that reinforcement does not harm an individual's intrinsic motivation.*

Reinforcement theory has had a significant impact on education. Education professors routinely teach the basic elements of behavior theory. As a consequence, most classroom teachers have at least some rudimentary understanding of the principles of reinforcement. These principles are often used to promote learning and to motivate students. In recent years, however, there has been a growing concern over the application of reward systems in educational settings. Several researchers have presented evidence and argued that incentive systems based on reinforcement may have detrimental effects. The contention is that reinforcement may decrease an individual's intrinsic motivation to engage in a particular activity. To illustrate, if a child who enjoys drawing pictures is externally reinforced (e.g., with points or money) for drawing, the child may come to draw less once the reward is discontinued. In other words, one alleged effect of reinforcement is that it undermines intrinsic interest in a task.

The literature concerned with the effects of reinforcement on intrinsic motivation draws mainly from experimental investigations. In an article published in the *American Psychologist,* Schwartz (1990) cited the intrinsic motivation experiment of Lepper, Greene, and Nisbett (1973) and concluded that

This article is based on Judy Cameron's PhD dissertation. The research was supported by the Social Sciences and Humanities Research Council (SSHRC) in Canada. We thank Dr. W. Frank Epling and Dr. Steve Hunka for their helpful comments and suggestions.

> reinforcement has two effects. First, predictably it gains control of [an] activity, increasing its frequency. Second, . . . when reinforcement is later withdrawn, people engage in the activity even less than they did before reinforcement was introduced. (p. 10)

While several researchers agree with this conclusion (e.g., Kohn, 1993; Sutherland, 1993), others continue to favor the use of reinforcement principles in applied settings (e.g., Hopkins & Mawhinney, 1992). This is, obviously, an important issue. Incentive systems are often implemented (or not) in schools, industry, hospitals, and so forth on the basis of research findings and conclusions. The present article evaluates the literature concerned with the effects of reinforcement and reward on intrinsic motivation by a meta-analysis of the relevant experimental investigations.

Several researchers draw a distinction between intrinsic and extrinsic motivation. Intrinsically motivated behaviors are ones for which there is no apparent reward except the activity itself (Deci, 1975). Extrinsically motivated behaviors, on the other hand, refer to behaviors in which an external controlling variable can be readily identified. According to Deci (1975), intrinsic motivation is demonstrated when people engage in an activity for its own sake and not because of any extrinsic reward. The result of such behavior is an experience of interest and enjoyment; people feel competent and self-determining, and they perceive the locus of causality for their behavior to be internal. Intrinsically motivated behavior is seen to be innate and is said to result in creativity, flexibility, and spontaneity (Deci & Ryan, 1985). In contrast, extrinsically motivated actions are characterized by pressure and tension and result in low self-esteem and anxiety (Deci & Ryan, 1985).

A great deal of debate has surrounded the intrinsic/extrinsic distinction. Several critics (e.g., Guzzo, 1979; Scott, 1975) point out difficulties in identifying intrinsically motivated behaviors. Although many human behaviors appear to occur in the absence of any obvious or apparent extrinsic consequences, they may, in fact, be due to anticipated future benefits (Bandura, 1977) or intermittent reinforcement (Dickinson, 1989). From this perspective, intrinsically motivated behavior is simply behavior for which appropriate controlling stimuli have yet to be specified. In spite of these conceptual difficulties, other social scientists frequently accept the intrinsic/extrinsic distinction. In fact, a large body of research is concerned with the effects of extrinsic rewards and reinforcers on behavior that is thought to have been previously maintained by intrinsic motivation. The next section of this article presents a description of the early studies concerned with the effects of reward and reinforcement on intrinsic motivation, the various research designs used to further investigate the issue, the variables investigated, and major findings.

## THE EFFECTS OF REWARD AND REINFORCEMENT ON INTRINSIC MOTIVATION

The terms *reward* and *reinforcement* have frequently been used synonymously. Although this is the case, behavioral psychologists make an important distinction between the two terms. A reinforcer is an event that increases the frequency of the behavior it follows. A reward, however, is not defined by its effects on behavior. Rewards are stimuli that are assumed to be positive events, but they have not been shown to strengthen behavior. Incentive systems (e.g., classroom

token economies) may be based on reward or reinforcement and are designed to increase motivation. Because of these distinctions (between reward and reinforcement), this review separates those studies dealing with effects of reward from those concerned with the effects of reinforcement on intrinsic motivation.

## The Early Studies

The first laboratory investigations to test the effects of reward on intrinsic motivation were conducted by Deci (1971, 1972a, 1972b). In the first experiment (1971), 24 college students, fulfilling a course requirement, were presented with a puzzle-solving task (Soma, a commercial puzzle, produced by Parker Brothers, composed of seven different shapes that can be solved in a variety of ways). The Soma puzzle was chosen because it was believed that college students would be intrinsically interested in the task. The study was made up of three 1-hour sessions over a 3-day period. Twelve subjects were assigned to an experimental group; the other 12 to a control group. During each session, subjects were individually taken to a room and asked to work on the Soma puzzles in order to reproduce various configurations which were drawn on a piece of paper. Four puzzles were presented in a session, and subjects were given 13 minutes to solve each one. In the second session only, experimental subjects were told that they would receive $1.00 for each puzzle solved. Control subjects were offered no money.

In the middle of each session, the experimenter made an excuse to leave the room for 8 minutes. Subjects were told that they could do as they pleased. During these 8-minute periods, the experimenter observed the subjects through one-way glass and recorded the time that each subject spent engaged on the Soma task. The amount of time spent on the task during the free periods was taken to be the measure of intrinsic motivation, the dependent variable.

Deci hypothesized that reward (money) would interfere with subsequent intrinsic motivation and that subjects in the experimental group would spend less time on the task in the third session than they had in the first. He suggested that there would be a significant difference between the experimental and control subjects on this measure. Using a one-tailed $t$ test, Deci found the difference between the two groups to be significant at $p < .10$. The rewarded group spent less time on the task than the control group. Although social scientists do not generally accept results at $p > .05$ as significant, and although Deci (1971) noted the marginal nature of his result, the data have been taken as support for the hypothesis that

> If a person is engaged in some activity for reasons of intrinsic motivation, and if he begins to receive the external reward, money, for performing the activity, the degree to which he is intrinsically motivated to perform the activity decreases. (Deci, 1971, p. 108)

Deci's experiment is often cited as groundbreaking evidence for the negative effects of reinforcement on intrinsic motivation (e.g., Kohn, 1993). Given the distinction between reward and reinforcement, however, Deci's (1971) experiment, at most, demonstrates that rewards may have a negative impact on a person's interest in a task. Nonetheless, his study was the first to investigate an issue that was of prime concern to many psychologists. The experiment provided researchers with a way to measure intrinsic motivation and with a paradigm to investigate the negative effects of reward.

In another experiment, Deci (1971; Experiment 3) used the same experimental paradigm to investigate the effects of verbal reward. The reward contingency introduced in the second session was verbal praise, rather than money. During the second phase, subjects in the experimental group were told after each trial that their performance was very good or much better than average. Deci found that the reinforced group spent significantly more time on the task (difference scores between Session 3 and Session 1) than those who received no praise ($p < .05$). These results suggest that social rewards may increase the motivation to perform an activity.

One of the best known and most cited studies on the detrimental effects of reward on behavior is the work of Lepper, Greene, and Nisbett (1973). In this study, nursery school children were observed in a free-play period to determine their initial interest on an activity (drawing). Two observers sat behind a one-way glass and recorded the amount of time each child was engaged in the activity. Those children who spent the most time on the task were selected as subjects for the experiment. Three experimental conditions were employed. In the "expected-reward" condition, children were offered a "good-player" award, which they received for drawing with magic markers. Children in the "unexpected-reward" group received the award but were not promised it beforehand, and "no-reward" subjects did not expect or receive an award.

In a subsequent free-play session, those children who were promised an award (expected-reward subjects) spent significantly less time drawing than the other two groups. Furthermore, the expected-reward group spent less time drawing in the postexperimental session than they had in the initial session (preexperimental free-play session). The unexpected-reward and no-reward subjects showed slight increases in time on task from preexperimental to postexperimental sessions. Lepper et al. (1973) concluded that their results provided "empirical evidence of an undesirable consequence of the unnecessary use of extrinsic rewards," (p. 136).

However, those who received an unexpected reward spent more time on the task during the postexperimental free-play period than either the expected-reward or the control group. Because the unexpected- and expected-reward groups are both reward conditions, the conclusion that these results demonstrate the negative effects of reward may not be warranted. This is because reward was held constant in the unexpected-reward and expected-reward groups; what differed was promise or no promise. That is, the promises made or the instructions given could have produced these results. Nonetheless, the findings of Lepper et al.'s (1973) study are frequently cited in journal articles and introductory psychology textbooks as evidence that extrinsic rewards and reinforcement undermine intrinsic interest in a task.

The early studies by Deci (1971) and Lepper et al. (1973) have raised a number of issues and controversies that have generated considerable research. Some psychologists have claimed that the original findings provide evidence for the view that reinforcement decreases intrinsic motivation (e.g., Schwartz, 1990). Others recognize that not all types of reinforcement undermine intrinsic interest (e.g., Deci & Ryan, 1985). Still others argue that one must demonstrate that rewards are, in fact, reinforcers before any statements about the effects of reinforcement can be made (Feingold & Mahoney, 1975; Mawhinney, 1990). Several

researchers are cautious about equating *reward* with *reinforcement;* their focus has been to discover when and under what conditions reward is detrimental (Bates, 1979; Morgan, 1984). In order to address these issues, researchers have employed a variety of research paradigms.

## Between-Group Designs

Studies designed to assess the effects of reward on intrinsic motivation have been conducted using between-group designs. Typically, one of two methods is employed. The first method, referred to as a *before-after* design (Deci & Ryan, 1985), involves a three-session paradigm. In these studies, a baseline measure of intrinsic motivation on a particular task is taken. This entails measuring time on task in the absence of extrinsic reward, usually from a session of short duration (e.g., 10 minutes). Subjects are then assigned to a reward or no-reward (control) condition, and an intervention with extrinsic rewards is carried out. Following this, reward is withdrawn, and time on task is again measured. The procedure is identical for both groups except that control subjects do not experience the intervention in the second session. Mean differences in time on task between pre- and postintervention are calculated for each group, and the scores for the experimental and control subjects are then statistically compared. Any difference between the two groups is considered evidence of the effects of withdrawal of reward.

One advantage to the before-after procedure is that it allows the researcher to examine differences within groups from pre- to postexperimental sessions as well as differences between groups. In most studies of this type, however, only differences between groups are investigated. This is because the before-after procedure has generally been used to identify individuals who show an initial interest in a specific task; those people are then selected as subjects for the study. In such cases, differences between rewarded and nonrewarded subjects are usually measured in the after-reward session only.

Most researchers have used an *after-only* between-groups experimental design to assess the effects of rewards on intrinsic motivation. In this approach, no pretreatment measure of intrinsic interest is collected. In the typical experiment, subjects are presented with a task that is assumed to be intrinsically motivating—solving and assembling puzzles, drawing with felt-tipped pens, word games, and so on. Experimental subjects are rewarded with money or grades, candy, praise, good-player awards, and so forth for performing the activity. In some studies, the reward is delivered contingent on a certain level of performance on the task; in others, subjects are simply rewarded for participating in the task. Control subjects are not rewarded. The reward intervention is usually conducted over a 10-minute to 1-hour period. All groups are then observed during a nonreward period. This usually occurs immediately after the experimental session, although some researchers have observed subjects several weeks later. If experimental subjects spend less time on the task (during the postreward observation) than the controls, reinforcement/reward is said to undermine intrinsic motivation. The amount of time subjects spend on the task during the nonreward period is one of the major ways in which intrinsic motivation has been measured, and it is usually referred to as *free time* on task.

### Findings from the Group Design Studies

Generally, the results of the group design studies examining the main effects of rewards are conflicting. While some researchers have found that rewards lead to decreased time on the task relative to control groups (e.g., Deci, 1971; Fabes, 1987; Morgan, 1981), others report the opposite (e.g., Brennan & Glover, 1980; Deci, 1972a; Harackiewicz, Manderlink & Sansone, 1984). Some studies report no significant differences (e.g., Amabile, Hennessey, & Grossman, 1986; DeLoach, Griffith & LaBarba, 1983).

Not all studies use the free-time measure of intrinsic motivation. Other dependent variables have included self-reports of task enjoyment, interest, and satisfaction; performance during the free time period (number of puzzles/problems solved, number of drawings completed, etc.); and willingness to volunteer for future projects without reward. Overall, the results from studies employing these measures are conflicting and do not help to clarify the issue of whether reward leads to decreased intrinsic motivation.

A number of reviewers (e.g., Bates, 1979; Deci & Ryan, 1985; Dickinson, 1989; Morgan, 1984) have noted the contradictory nature of the findings and have attempted to identify the conditions under which extrinsic reward produces decrements in intrinsic motivation. Some of the conditions thought to be critical in determining the impact of rewards include the type of reward (tangible or verbal), reward expectancy (whether reward is expected—i.e., offered beforehand or received unexpectedly), and reward contingency (whether reward is delivered simply for performing the task or is contingent on some specified level of performance). Although this categorization system is useful, an examination of the literature within each category reveals conflicting results.

#### Type of Reward

When verbally praised subjects are compared to a control group, some researchers have found an increase in intrinsic motivation (e.g. Deci, 1971) while others report no significant differences (e.g., Orlick & Mosher, 1978). The same holds true when subjects receiving tangible rewards are compared to controls. While some results provide evidence for a decrease in intrinsic motivation following the receipt of a tangible reward (e.g., Danner & Lonkey, 1981), others indicate an increase (e.g., Rosenfield, Folger, & Adelman, 1980).[1]

#### Reward Expectancy

Comparisons between subjects who receive an unexpected tangible reward and subjects who receive no reward are also not clear cut. Some results indicate that unexpected-reward subjects show a decrease in intrinsic motivation (e.g., Orlick & Mosher, 1978); others have found no significant differences (e.g., Greene & Lepper, 1974). Experiments designed to investigate the effects of expected tangible rewards are also contradictory. Some studies, comparing subjects offered an expected reward to nonrewarded controls, show a negative effect of reward on intrinsic motivation (e.g., Deci, 1971; Lepper, Greene, & Nisbett, 1973). Others, however, demonstrate that expected-reward subjects show an increase in intrinsic motivation relative to controls (e.g., Brennan & Glover, 1980).

*Reward Contingency*

Morgan (1984) and Deci and Ryan (1985) suggest that reward contingency may play a critical role in determining the negative effects on intrinsic motivation. Again, however, results from such studies vary. When rewards are delivered contingent on some level of performance, some researchers have found a positive effect (e.g., Karniol & Ross, 1977); others report negative findings (e.g., Ryan, Mims, & Koestner, 1983). When rewards are delivered contingent on engagement in the task regardless of subjects' level of performance, an undermining effect has been found in some studies (e.g., Lepper, Greene & Nisbett, 1973; Morgan, 1983, Experiment 1). Others report no decrease in intrinsic motivation (e.g., Pittman, Emery & Boggiano, 1982).

## Within-Subject Designs

One of the criticisms of the group design research is that researchers employing such a design often refer to their reward manipulation as a reinforcement procedure. By definition, a reinforcer is an event that increases the frequency of the behavior it follows. In most studies on intrinsic motivation, researchers have not demonstrated that the events used as rewards increased the frequency of the behavior studied. In addition, critics (e.g., Feingold & Mahoney, 1975; Mawhinney, 1990) suggest that the measurement phases in the group design research are too brief to detect any temporal trends and transition states. In order to address these issues, a few studies have been conducted using a repeated measures, within-subject design.

In this paradigm, the amount of time subjects spend on a particular task is measured over a number of sessions. Reinforcement procedures are then implemented over a number of sessions. In the final phase, reinforcement is withdrawn, and time on task is again repeatedly measured. Intrinsic motivation is indexed as a difference in time on task between pre- and postreinforcement phases where differences are attributed to the external reinforcement.

In general, no substantial differences have been found when rate of performance and time on task in postreinforcement sessions are compared to pre-reinforcement phases (although, see Vasta & Stirpe, 1979).

The advantage of within-subjects designs is that the researcher can determine whether the rewards used are actual reinforcers—that is, whether behavior increases during the reinforcement phase. Statements can then be made about the effects of *reinforcement,* rather than *reward.* However, only a handful of studies have been conducted using this type of design.

Critics of within-subject research (e.g., Deci & Ryan, 1985) suggest that results from these designs are not generalizable because so few subjects are studied in any one experiment. A further criticism has to do with the lack of a control group. The argument is that in the within-subject designs there is no group that performs the activity without reinforcement; thus, one cannot know if there is an undermining effect relative to a control group. Finally, for these studies, the definition of a reinforcer is necessarily circular. That is, reward becomes reinforcement only after its effects are shown to increase behavior.

## THEORETICAL ACCOUNTS OF THE LITERATURE

Although the results of laboratory investigations into the effects of reward and reinforcement on intrinsic motivation appear contradictory and confusing, a general contention in many textbooks and journal articles is that reward and/or reinforcement is detrimental to an individual's intrinsic motivation (e.g., Kohn, 1993; McCullers, 1978; Schwartz, 1990; Zimbardo, 1988). In an attempt to account for the disparate outcomes, a few psychologists have offered theoretical explanations. Three major accounts are outlined below.

### The Overjustification Hypothesis

One explanation that has been put forth to account for the detrimental effects of reward is termed the *overjustification effect* (Lepper, Greene, & Nisbett, 1973). This hypothesis is largely based on attribution (Kelly, 1967) and self-perception (Bem, 1972) theories. A person's perceptions about the causes of behavior are hypothesized to influence future motivation and performance. In the presence of external controls, people attribute their behavior to an external agent; when this is removed, future motivation and performance decrease. Conversely, behavior is attributed to internal causes in the absence of obvious external controls. In this case, motivation and performance are not affected.

A decrease in intrinsic motivation following the withdrawal of a reward has been termed the overjustification effect because it is thought that an external reward provides overjustification for participating in an already attractive activity. Put another way, when individuals are rewarded for engaging in an already interesting activity, their perceptions shift from accounting for their behavior as self-initiated to accounting for it in terms of external rewards. That is, they are faced with too many reasons (justifications) for performing the activity, and the role of intrinsic motivation is discounted resulting in a decline in intrinsic motivation.

Lepper (1981) has suggested that extrinsic rewards lead to a decrease in intrinsic motivation when they allow perceptual shifts of causality. According to Lepper, this occurs when there is sufficient initial interest in an activity, when the extrinsic rewards are salient, and when rewards do not increase perceived competence.

### Cognitive Evaluation Theory

Deci and Ryan (1985) suggest that the overjustification hypothesis should not be considered a theory of motivation. They argue that self-attributions may affect intrinsic motivation, but they do not see them as necessary mediators. Instead, Deci and Ryan offer cognitive evaluation theory as an explanation for intrinsic motivation.

Cognitive evaluation theory is based on the assumption that people have innate needs for competence and self-determination. From this perspective, a person's intrinsic motivation is affected by changes in feelings of competence and self-determination. According to Deci and Ryan (1985), events facilitate or hinder feelings of competence and self-determination depending on their perceived informational, controlling, or amotivational significance. Events seen as informational indicate skill in performing a task; hence, competence is facilitated, which leads to increased intrinsic motivation. A controlling event is one perceived as

an attempt to determine behavior. This type of event diminishes an individual's self-determination and intrinsic motivation. An amotivational event provides negative feedback, indicating a lack of skill, which reduces one's competence and intrinsic motivation.

Cognitive evaluation theory focuses on a person's experiences of an activity. For this reason, Deci and Ryan (1985) emphasize the importance of self-report measures of task interest, satisfaction, and enjoyment as more indicative of intrinsic motivation than the free time-on-task measure.

According to cognitive evaluation theory, rewards are not always harmful. Verbal rewards may be informational and lead to an increase in intrinsic motivation. Tangible rewards, on the other hand, are seen as controlling when their delivery is stated before the reward period (expected rewards). This is because the cognitive evaluation process is believed to begin while the rewarded activity is occurring. Further, rewards promised to persons for engaging in a task without a performance criterion (referred to as *expected task contingent* rewards by Deci & Ryan, 1985) are controlling and decrease intrinsic motivation. Deci and Ryan suggest that rewards delivered to a person contingent on a specified level of performance are more complicated. This type of reward can be informational or controlling, but the difficulty is that its function can only be determined by how well a person performs in relation to the specified standard. If the individual performs well, the reward is informational, and, if performance is poor, it is controlling.

Rummel and Feinberg (1988) conducted a meta-analysis to assess cognitive evaluation theory. Subjects who received rewards that were defined to convey "controlling" information were compared to groups receiving other types of rewards or no reward. The dependent measure of intrinsic motivation was a combination of both free time-on-task measures and self-reports of satisfaction and task interest. Results provided support for cognitive evaluation theory. Rummel and Feinberg concluded that controlling, extrinsic rewards have detrimental effects on intrinsic motivation.

In Rummel and Feinberg's meta-analysis, rewards were defined as controlling after the fact. That is, when a reward was found to produce a negative effect, it was seen as controlling, and the study was selected for the analysis. This exemplifies the major difficulty with cognitive evaluation theory. Rewards are defined as controlling or informational after their effect on performance has been measured.

Although cognitive evaluation theory may account for the diverse findings of the effects of reward on intrinsic motivation, there are difficulties with this interpretation. One problem is that feelings of competence and self-determination are seen as causes of changes in intrinsic motivation, but they are not measured. They are assumed to be operating because behavior changes. In other words, the existence of competence, self-determination, and intrinsic motivation is inferred from the very behavior it supposedly causes. Rewards are defined as controlling if measures of intrinsic motivation decrease and informational when the dependent variable indexes an increase in motivation.

## Behavioral Accounts

An operant analysis of behavior involves consideration of a prior learning history and the *three-term contingency,* the $S^D$: $R \rightarrow S^r$ relationship. The three terms are: (a) discriminative stimulus ($S^D$) or setting event, (b) the response (R)

or behavior, and (c) contingent reinforcement ($S^r$). Flora (1990) has suggested that all of the empirical results of the intrinsic motivation research can be accounted for by considering the promised reward procedures (expected reward) as discriminative stimuli. That is, telling a person that he or she will receive a reward is a stimulus event that precedes the operant and, as such, is a discriminative stimulus rather than a reinforcer. From this perspective, if behavior is regulated by its consequences (i.e., reinforcement), no loss of intrinsic motivation is expected. When individuals who are engaged in a task are reinforced for doing the task, they will spend as much time on the activity as they originally did once the reinforcer is withdrawn. A behavioral view suggests that it is only when rewards function as discriminitive stimuli that one might expect to observe a decline in intrinsic motivation.

Although discriminitive stimuli are part of the three-term contingency and affect the probability of an operant, they can and do have very different effects from reinforcers. Task performance evoked by instructions and promises of reward ($S^D$s) can be influenced by a number of factors such as the subject's history with respect to whether promised rewards were actually received, the subject's verbal repertoire, the nature of prior exposure to the object being offered as the reward, and so on (Dickinson, 1989).

## SUMMARY

The overjustification effect, cognitive evaluation theory, and recent behavioral explanations each attempt to account for the disparate effects of reward and reinforcement on intrinsic motivation. Given the diverse findings reported in this literature, however, it is not clear at this point what effect reward or reinforcement has on intrinsic motivation. Reviewers on all sides of the issue tend to be highly critical of research designed outside of their own paradigm, and, more often than not, findings from studies in opposing camps are not considered relevant. For these reasons, the literature and its interpretations are still contentious. Because a substantial number of experimental studies have been carried out to assess the effects of reward and reinforcement on intrinsic motivation, one way to evaluate their effects is to conduct a meta-analysis.

## THE PRESENT META-ANALYSIS

The primary purpose of the present meta-analysis is to make a causal statement about the effects of extrinsic rewards and reinforcement on intrinsic motivation. This analysis should be useful in addressing a number of concerns. Of major importance is whether the bulk of evidence suggests that extrinsic rewards and/or reinforcement produce decrements in intrinsic motivation. If so, what is the size of the relationships being uncovered? Also, do different patterns emerge with different reward types (e.g., tangible, verbal rewards), reward expectancies (expected, unexpected), or reward contingencies (e.g., rewards delivered for engaging in a task, competing or solving a task, or meeting a specified level of performance)? In the following sections of this article, the research questions addressed in the present meta-analysis are outlined, the steps involved in conducting the meta-analysis are described, and the findings are presented and discussed.

## Research Questions

The following questions have been addressed in this meta-analysis:

1. *Overall, what is the effect of reward on intrinsic motivation?* In order to answer this question, a meta-analysis of the group design experiments was conducted. Subjects who received a tangible reward and/or an extrinsic verbal reward were compared to a nonrewarded control group. This analysis should shed light on the overall effects of reward on intrinsic motivation.

2. *What are the effects of specific features of reward on intrinsic motivation?* Several researchers note that reward interacts with other variables to produce increments or decrements in intrinsic motivation. That is, intrinsic motivation is affected differently by the type of reward implemented, the reward expectancy and the reward contingency. Specifically, researchers have investigated the following:

(a) the effect of reward type on intrinsic motivation (i.e., whether rewards are verbal or tangible),

(b) the effect of reward expectancy on intrinsic motivation (i.e., whether rewards are expected—promised and delivered to subjects or unexpected—delivered to subjects but not promised),

(c) the effect of reward contingency on intrinsic motivation (i.e., whether rewards are delivered to subjects for participating in an experimental session regardless of what they do, for engaging in a task, for completing or solving a task, or for attaining a specific level of performance).

All analyses performed on these features were conducted with group design studies in which a rewarded group was compared to a control group. These analyses should lead to a greater understanding of the specific conditions under which reward affects intrinsic motivation.

Although the present analyses present a breakdown of several features of reward, there are other moderator variables mentioned in the literature (e.g., salience of reward, task type, reward attractiveness, goals of individuals, etc.). These conditions may interact with reward to affect intrinsic motivation. Unfortunately, these variables appear in only one or two studies and are, thus, not amenable to a meta-analysis. At this point in time, placing emphasis on interaction effects that have few replications would not be beneficial to an understanding of reward and intrinsic motivation.

3. *Overall, what is the effect of reinforcement on intrinsic motivation?* One of the criticisms of the group designs has been that reward is frequently cited as synonymous with reinforcement, yet no evidence has been provided to indicate that the rewards used in group designs are actual reinforcers. In the single-subject, repeated measures designs, researchers have demonstrated that the rewards administered increased behavior and can be considered as reinforcers. For this reason, a separate analysis was conducted with the single-subject designs where subjects served as their own controls. This analysis should allow a more definitive statement to be made about the effects of reinforcement on intrinsic motivation.

# METHOD

## Selection of Studies

A basic list of studies was assembled by conducting a computer search of the psychological literature (PSYCH LIT) using *intrinsic motivation* as the search

term. The meta-analysis started with Deci (1971), and relevant articles published up to September 1991 were identified. Studies not listed on the computer database were identified through the bibliographies of review articles, chapters, books, and papers located in the original search.

Two sets of studies were collected (between-group designs and within-subject designs). The main analysis entailed assessing the overall effects of reward on intrinsic motivation from studies involving group designs. Criteria for including studies in the sample were:

(a) that the study involve an experimental manipulation of a reward condition and include a nonrewarded control group;

(b) that any characteristics of rewarded subjects be either held constant or varied but be represented identically for both rewarded and control groups; and

(c) that studies be published (no unpublished documents were collected) and written in English.[2]

In addition, only studies that measured intrinsic motivation as a dependent variable were included.

Intrinsic motivation has been measured as free time on task after withdrawal of reward; self-reports of task interest, satisfaction, and/or enjoyment; performance during the free time period (number of puzzles/problems solved, number of drawings completed, etc.); and subjects' willingness to participate in future projects without reward. One study which met the criteria was excluded (Boggiano & Ruble, 1979) because the statistical contrasts used in the article were not logical given the sample size of the study.[3] Other studies were omitted from the sample if some subjects in a reward condition were not actually given a reward (e.g., Pritchard, Campbell, & Campbell, 1977). The resulting sample consisted of 83 documents, reporting 96 independent studies.

A major criticism of the meta-analytic technique has been that researchers often lump different measures together. This has been referred to as the apples-and-oranges problem in that it is argued that logical conclusions cannot be drawn from comparisons of studies using different measures of the dependent variable (see Glass, McGaw, & Smith, 1981). In order to avoid this problem, separate analyses were conducted on the overall effect of reward for each measure of intrinsic motivation. Using this strategy, 61 studies compared a rewarded group to a control group on the free-time measure; 64 studies investigated the attitude (task interest, enjoyment, and satisfaction) measure; 11 studies assessed the willingness to volunteer for future studies without reward measure, and 12 studies measured performance during the free-time period.

In order to assess the impact of specific features of reward, further analyses were conducted with data from the 96 group design studies. In these analyses, subjects assigned to different types of rewards (tangible, verbal), reward expectancies (unexpected, expected), and reward contingencies were compared to nonrewarded control groups.

The second meta-analysis was conducted on studies that employed a within-subject, multiple-trials design. In this type of design, subjects served as their own controls. These experiments are conducted in three phases with a number of sessions in each phase. Baseline measures of intrinsic motivation are taken in the first phase; reinforcement procedures are then implemented over a number of sessions, and in the third phase reinforcement is withdrawn. Changes in

intrinsic motivation are measured as differences between the pre- and postreinforcement phase.

Single-subject studies were included in this analysis when a reinforcement effect was demonstrated (i.e., the rewards used showed an increase in behavior) and when baseline, reinforcement, and postreinforcement phases involved repeated measures. One study reporting a reinforcement effect was excluded (Vasta, Andrews, McLaughlin, Stirpe, & Comfort, 1978, Experiment 1) because the authors reported only one measure of behavior during the postreinforcement phase. Two studies used a repeated measures group design to assess the effects of reinforcement between and within groups (Greene, Sternberg & Lepper, 1976; Mynatt, Oakley, Arkkelin, Piccione, Margolis, & Arkkelin, 1978). Although subjects' performance in these studies was measured repeatedly as in the single-subject designs, only group effects were reported. In addition, the rewards used in these studies were not shown to be reinforcers for some of the rewarded groups. Thus, these two studies were not included in the meta-analysis of single-subject designs (Mynatt et al., 1978, are included in the meta-analysis of group designs because their study included a nonrewarded control group). In all, five studies were selected for the within-subject meta-analysis.

A list of studies included in the meta-analyses is presented in Appendix A.

## Coding of Studies

Once all relevant articles had been collected, each study was read and coded. The following general information was extracted from each report: (a) author(s), (b) date of publication, (c) publication source, (d) population sampled (children or adults), (e) sample size, (f) type of experimental design (before-after groups design, after-only groups design, or single-subject multiple-trial design), and (g) type of task used in the study.

The following aspects of the independent variable were also coded: (a) reward type (tangible or verbal), (b) reward expectancy (expected or unexpected) and (c) reward contingency. Reward contingency was coded according to Deci and Ryan's (1985) taxonomy. Task noncontingent rewards referred to rewards delivered to subjects for participating in an experimental session regardless of what they did in the session. The term *task contingent reward* was used to mean that a reward was given for actually doing the task and/or for completing or solving the task. Performance contingent rewards were defined as rewards delivered for achieving a specified level of performance. In addition to using Deci and Ryan's classification, contingency was also coded in accord with a behavioral perspective. Using operant definitions, rewards were defined as noncontingent or contingent. Noncontingent rewards referred to rewards delivered for participating in the study or engaging in the task regardless of any level of performance. Contingent rewards were defined as rewards dependent on performance (i.e., rewards given for completing a puzzle, solving a task, and/or attaining a specified level of performance).

Other characteristics of studies that were coded were: (a) type of dependent measure (e.g., free time on task, task interest, etc.), (b) whether experimenter was blind to conditions, and (c) whether experimenter was present or absent during the post-reward phase. As well, statistical information was recorded, and effect sizes were calculated from appropriate contrasts.

Descriptive characteristics and effect sizes of the reviewed studies are summarized in Appendix C.

## Intercoder Reliability

From the pool of relevant studies, 10 were randomly selected and independently coded by the second author. A standardized coding form[4] was created that allowed the second coder to extract information regarding independent variables (reward type, reward expectancy, reward contingency), dependent variables (measures of intrinsic motivation), sample sizes, type of task used in the study, and calculation of effect sizes for available contrasts. Reliability calculated as percentage agreement was 93.4%. For 6 of the 10 studies, agreement was 100%. Disagreements in the other four studies involved (a) miscommunication of formulas to use for calculating effect size (for two studies), (b) mislabeling of reward expectancy (in one study), and (c) a misreading of the number of subjects in a group (in one study). Disagreements were resolved through discussion and a more careful reading of the studies and coding criteria.

## Computation and Analysis of Effect Sizes

The procedures used in the meta-analysis of the group design studies followed those of Hedges and Olkin (1985). Meta-analysis is a statistical technique for aggregating the results of many experimental studies which compare two groups on a common dependent measure. Once the studies and groups to be compared are identified, the statistical result of each study is transformed into a measure called an effect size. An effect size is found by converting the findings from each study into a standard deviation unit. The effect size indicates the extent to which experimental and control groups differ in the means of a dependent variable at the end of a treatment phase. In its simplest form, the effect size calculated, $g$, is the difference between the means of the rewarded group and a nonrewarded control group divided by the pooled standard deviation of this difference. When means or standard deviations were not available from reports, effect size was calculated from $t$ tests, $F$ statistics, and $p$-level values (e.g., $p < .05$) by using Hedges and Becker's (1986) formulas. Formulas for calculating effect size are listed in Appendix B.

One problem that arises in conducting a meta-analysis is determining effect sizes from studies with limited information. In a few studies, for example, contrasts are simply reported as $t$ or $F < 1.00$. In such cases, effect size estimates were calculated by making $t$ or $F$ equal to a number between 0.01 and 1.00 chosen from a random numbers table. When results from a study were not reported or were reported as nonsignificant and when $t$ or $F$ values were not available but means and/or direction of means were known, a random number between 0.01 and the critical value of $t$ or $F$ at $p = .05$ was chosen to calculate an estimate of effect size. When results for an outcome measure were not reported or were reported as nonsignificant and when means and direction were unknown, the effect size for that measure was set at 0.00 (indicating exactly no difference between rewarded and nonrewarded groups). For each analysis, results were calculated with 0.00 values included and with 0.00 values omitted.

For several studies, more than one effect size was calculated. For example, if a single study contained two measures of intrinsic motivation (e.g., free time on

task, attitude) and two types of reward groups plus a control group (e.g., tangible reward, verbal reward), a total of four effect sizes was calculated (e.g., free time-tangible reward, free time-verbal reward, attitude-tangible reward, attitude-verbal reward).

In order to satisfy the independence assumption of meta-analytic statistics (Hedges & Olkin, 1985), only one effect size per study was entered into each analysis. When two or more effect sizes from one study were appropriate for a particular analysis, these effect sizes were averaged. To illustrate, for the estimate of the overall effect of reward on the free-time measure of intrinsic motivation, some studies assessed the effects of several types of rewards. If a single study, for example, contained two or more reward groups (e.g., expected reward, unexpected reward) and a control condition, the two effect sizes were averaged so that the study contributed only one effect size to the overall analysis of reward. For an analysis of the effects of expected reward on intrinsic motivation, only the one appropriate effect size from the study would be used. This strategy retained as much data as possible without violating the assumption of independence. Average effect sizes were obtained by weighting each $g$ index by the number of participants on which it was based (see Cooper, 1989).

As was previously mentioned, in the single-subject, repeated measure designs, there is no separate control group; subjects serve as their own controls. An increase or decrease in intrinsic motivation is indexed by a difference in the amount of time spent on the task between baseline and postreinforcement sessions. Effect sizes for these studies were calculated by subtracting the average time spent by all subjects in the baseline phase from the average time spent by all subjects in the postreinforcement phase. This number was then divided by the pooled standard deviation.

After all effect sizes were calculated, the analyses were run on the computer program *Meta* (Schwarzer, 1991). Results reported in this article are based on the weighted integration method (Hedges & Olkin, 1985). Using this technique, effect sizes $g$ are converted to $d$s by correcting them for bias ($g$ is an overestimation of the population effect size, particularly for small samples; see Hedges, 1981). To obtain an overall effect size, each effect size is weighted by the reciprocal of its variance, and the weighted $d$s are averaged. This procedure gives more weight to effect sizes that are more reliably estimated. Once mean effect sizes are calculated, 95% confidence intervals are constructed around the weighted mean.

In order to verify the accuracy of the computer program, one analysis (the overall effect of reward on free time) was hand calculated. All obtained values from the meta-analysis program and the hand calculations were identical within rounding error.

To determine whether each set of effect sizes in a sample shared a common effect size (i.e., was consistent across studies), a homogeneity statistic, $Q$, was calculated. $Q$ has an approximate chi-square distribution with $k-1$ degrees of freedom, where $k$ is the number of effect sizes (Hedges & Olkin, 1985). The null hypothesis is that the effect sizes are homogeneous (i.e., effect sizes in a given analysis are viewed as values sampled from a single population; variation in effect sizes among studies is merely due to sampling variation). For purposes of the present analyses, samples were considered homogeneous at $p > .01$.

When samples are not homogeneous, studies can be classified by characteristics, such that effect sizes within categories are homogeneous. This strategy was undertaken by examining the effects of different types of rewards, reward expectancies, and reward contingencies.

As a supplementary analysis, homogeneity was attained by removing outliers. That is, studies were omitted when they provided estimates that were inconsistent with those from other studies. Outliers in each data set were first identified using Tukey's (1977) procedure. These outliers were then omitted from the analysis. If homogeneity was still not attained, other studies that reduced the homogeneity statistic by the largest amount were removed. Hedges (1987) has pointed out that this is a common procedure in both the physical and social sciences. In one area of physics, for example, Hedges (1987) found that data from 40% of the available studies were omitted from calculations. For meta-analyses of psychological topics, Hedges (1987) notes that removal of up to 20% of the outliers in a group of heterogeneous effect sizes usually results in a high degree of homogeneity.

In an article in *Psychological Bulletin,* McGraw and Wong (1992) noted that one of the problems with effect size statistics (e.g., $d$) is that many readers of meta-analyses have difficulty interpreting the meaning and generalizability of findings. McGraw and Wong have introduced another way to look at effect size, by a statistic they call the *common language effect size* indicator (CL). CL refers to the probability that a score sampled from one distribution will be greater than a score sampled from some other distribution. McGraw and Wong suggest that CL is a useful way to talk about effect size because it is easily interpretable. They provide an example in which a sample of young adult men is compared to a sample of young adult women on the variable height. A CL of .92 indicates the probability of a male being taller than a female. Put another way, in any random pairing of young adult men and women, the male will be taller than the female 92 out of 100 times.

CL is calculated from means and standard deviations. Additionally, an effect size, $d$, can be converted to CL by multiplying $d$ by $1/\sqrt{2}$ or 0.707 to obtain a $Z$ value (K.O. McGraw, personal communication, April 24, 1992). The upper tail probability associated with this value corresponds to CL and can be calculated using the unit normal curve.

To test the robustness of the CL statistic, McGraw and Wong (1992) conducted a series of 118 tests (simulations) to determine the implications of violating the assumption that sample data come from populations of values that are normally distributed with equal variances. They found small discrepancies between the estimate of CL under the normality assumption and the estimate of CL when the normality assumption was violated in terms of skewness and kurtosis. The worst case discrepancy was 0.1 which occurred with a large violation of the equal variance assumption, considerable negative skewness, and a large violation of kurtosis. Given the robustness of CL and the ease with which it can be interpreted, results from the present analyses have also been expressed using the CL statistic.

The meta-analytic procedures used in the present review include: (a) the estimation of average effect sizes and 95% confidence intervals, (b) homogeneity analyses to determine whether effect sizes are drawn from the same population, (c) removal of outliers to attain homogeneity, and (d) conversion of average

effect sizes to the common language statistic (CL). Note that outliers are included and excluded in each analysis.

## RESULTS FROM GROUP DESIGNS

### The Overall Effect of Reward on Intrinsic Motivation

To assess the overall effect of reward on intrinsic motivation, descriptive and meta-analytic procedures were performed on each of the four different measures of intrinsic motivation (free time on task, attitude, performance during the free-time period; willingness to volunteer for future studies without reward). For each measure, negative effects represent a decrement in intrinsic motivation; positive effects indicate an increment.

#### *Direction of Effects*

The number of studies collected for each analysis of the overall effects of rewards on intrinsic motivation and the direction of their effects is presented in Table 1. On the free-time measure, the majority of studies showed that reward decreased intrinsic motivation. However, when intrinsic motivation was measured by attitude toward a task, performance during the free-time period, or willingness to volunteer for future studies without reward, more studies showed positive effects.

#### *Distribution of Effect Sizes*

Frequency distributions of the data are shown in Figure 1. Studies that found no significant differences but did not provide sufficient information to calculate effect sizes are not portrayed in the graphs.

When intrinsic motivation was measured as time on task following the removal of a reward (free time), effect sizes ranged from $-1.94$ to 1.06. The bulk of experiments found effects between $-0.59$ and 0.19. Using Tukey's (1977) procedure, one negative outlier was identified in the free-time data. This effect ($g = -1.94$) was calculated from a study conducted by Morgan (1983, Experiment 1). In this study, subjects who received an expected, task contingent (noncontingent), tangible reward were compared to no-reward control subjects. The large

TABLE 1
*Number of studies and direction of effects for reward versus control groups on four measures of intrinsic motivation*

| Number of studies | Free time | Attitude | Performance in free time | Willingness to volunteer |
|---|---|---|---|---|
| Showing a positive effect of reward | 22 | 31 | 6 | 6 |
| Showing a negative effect of reward | 34 | 15 | 4 | 4 |
| Showing no effect | 1 | 1 | — | — |
| With lack of sufficient information to calculate effects | 4 | 17 | 2 | 1 |
| Total | 61 | 64 | 12 | 11 |

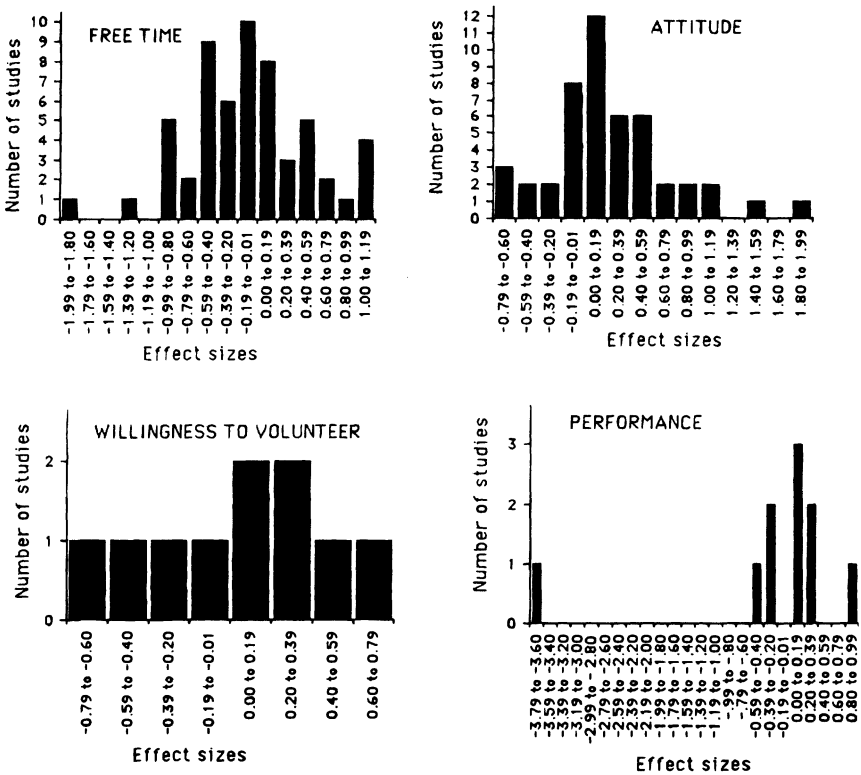


FIGURE 1. *Frequency distributions of effect sizes for overall reward versus control groups on four measures of intrinsic motivation*

negative effect could be due to the type of reward (tangible), the reward expectancy, and/or the reward contingency. All of these features are examined in further analyses. In addition, this study was somewhat different from other studies in that subjects who performed the activity for a reward were observed by other subjects. That is, subjects were offered a reward for engaging in an activity while their performance on the task was being watched. Thus, the large negative effect could be a result of an interaction of reward type, expectancy, contingency, and surveillance.

The attitude measure of intrinsic motivation refers to subjects' self-reports of task interest, enjoyment, and/or satisfaction. Effect sizes ranged from −0.69 to +1.98 with the majority of effects falling between −0.19 and +0.59. Two positive outliers in this data set come from studies conducted by Vallerand (1983) and Butler (1987). In both of these studies, extrinsic verbal reward is compared to a no-reward group. The effect of verbal reward on intrinsic motivation is investigated in a subsequent analysis.

Effect sizes on the performance measure ranged from −3.72 to +0.96; the median was +0.03. One large negative outlier (−3.72) comes from a study conducted by Deci (1971, Experiment 2). This study differed from others in that it was a field experiment where students working for a college newspaper were

paid to write headlines. Only eight subjects participated, and two subjects in the control group dropped out and were not included in the analysis.

On the willingness-to-volunteer measure, effect sizes ranged from −0.63 to +0.68. There were no outliers in this sample.

To establish whether the CL statistic (McGraw & Wong, 1992) could be used confidently in the analyses, the extent to which the free-time distribution of effect sizes deviated from normality was determined. Obtained values for skewness and kurtosis were −0.21 and 0.55, respectively (where normal skewness and kurtosis equal 0.00). McGraw and Wong tested the effect that violations from normality would have on CL. Based on their findings and the skewness and kurtosis values obtained here, in the meta-analysis of effect sizes for the free-time measure, one could expect, at worst, an underestimate of 0.02 and an overestimate of 0.04 for CL. Given this small discrepancy, the implication is that the CL statistic can be used and interpreted without any serious concern about violations of normality and homogeneity of variance.

### *Meta-Analysis of Effect Sizes*

The overall meta-analysis of effect sizes presented in Table 2 allows one to determine whether rewarded subjects showed less intrinsic motivation than nonrewarded subjects as measured by time on task following the removal of reward (free time); self-reports of task interest, satisfaction, and enjoyment (attitude); performance during the free-time period; and willingness to volunteer for future studies without reward.

For each measure of intrinsic motivation, an analysis was conducted which included all studies that provided sufficient information to calculate effect sizes (see "All known effects" in Table 2). When samples were not homogeneous, outliers were identified and removed using Tukey's (1977) procedure. If samples were still significantly heterogeneous, additional outliers were removed. Homogeneity was attained for the free-time and attitude measures by omitting approximately 20% of the effect sizes, a typical meta-analytic procedure. An examination of Table 2 indicates that the procedure of including and excluding outliers does not drastically alter mean effect sizes.

On the free-time measure, rewarded subjects showed less intrinsic motivation than nonrewarded controls (mean weighted $d = -0.04$), but this effect was not significant (i.e., the confidence interval included 0.00). When the mean effect of the homogeneous sample was converted to CL, results indicate that, given a sample of studies designed to investigate the effects of reward on time on task, 51 out of 100 studies would show that overall, rewarded subjects spend less time on the task than nonrewarded controls (assuming that all studies are of equal importance and have the same characteristics).

Results from the attitude measure indicate greater intrinsic motivation for rewarded subjects. This effect was small at 0.14 (from the homogeneous sample) but differed significantly from the value of 0.00 (i.e., the confidence interval did not include 0.00). The CL statistic was .54 and can be interpreted to mean that, in comparisons of rewarded to nonrewarded subjects, rewarded subjects will show a more positive attitude toward a task than nonrewarded subjects in 54 out of 100 studies. Rewarded subjects also showed a tendency to score higher on

TABLE 2
*Overall effect of reward versus control groups on four measures of intrinsic motivation*

| Analysis | *k* | Sample size | Mean weighted *d* | 95% CI for *d* | *Q* | CL |
|---|---|---|---|---|---|---|
| | | | Free time on task | | | |
| All known effects (zeros excluded) | 57 | 3539 | −0.06 | −0.13 to 0.01 | 225.51* | .48 |
| Outliers removed using Tukey's procedure (zeros excluded) | 56 | 3459 | −0.03 | −0.10 to 0.04 | 177.40* | .49 |
| Additional outliers removed (no zeros) | 44 | 2634 | −0.04 | −0.12 to 0.04 | 66.39 | .49 |
| All reports (zeros and outliers included) | 61 | 3858 | −0.06 | −0.12 to 0.01 | 225.80* | .48 |
| | | | Attitude | | | |
| All known effects (zeros excluded) | 47 | 3184 | +0.21 | 0.14 to 0.29 | 167.50* | .56 |
| Outliers removed using Tukey's procedure (zeros excluded) | 45 | 3034 | +0.17 | 0.09 to 0.24 | 110.70* | .55 |
| Additional outliers removed (no zeros) | 39 | 2680 | +0.14 | 0.06 to 0.22 | 58.03 | .54 |
| All reports (zeros and outliers included) | 64 | 4431 | +0.15 | 0.09 to 0.21 | 177.07* | .54 |
| | | | Performance during free time period | | | |
| All known effects (zeros excluded) | 10 | 575 | +0.08 | −0.09 to 0.25 | 27.90* | .52 |
| Outliers removed using Tukey's procedure (zeros excluded) | 9 | 569 | +0.09 | −0.08 to 0.26 | 21.63* | .52 |
| Additional outliers removed (no zeros) | 8 | 509 | −0.0004 | −0.18 to 0.18 | 11.73 | .50 |
| All reports (zeros and outliers included) | 12 | 770 | +0.06 | −0.09 to 0.21 | 28.07* | .52 |

TABLE 2
*Overall effect of reward versus control groups on four measures of intrinsic motivation—continued*

| Analysis | *k* | Sample size | Mean weighted *d* | 95% CI for *d* | *Q* | CL |
|---|---|---|---|---|---|---|
| | | | Willingness to volunteer | | | |
| All known effects (zeros excluded) | 10 | 561 | +0.05 | −0.12 to 0.23 | 17.38 | .52 |
| All reports (zeros and outliers included) | 11 | 609 | +0.05 | −0.12 to 0.22 | 17.42 | .52 |

*Note.* Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. *k* = number of effect sizes; sample size = sum of *n* in all studies; mean weighted *d* = mean of weighted effect sizes (weighted by sample size); CI = confidence interval; *Q* = homogeneity statistic for mean effect sizes; CL = common language effect size statistic.
*Significance indicates rejection of the hypothesis of homogeneity.
*$p < .01$.

performance measures and to volunteer for the future projects more than nonrewarded subjects, but these effects were not significant.

Studies that could not be represented with effect sizes were given a value of 0.00. When these studies were included in the overall analyses (see "All reports" in Table 2), the mean effect size for each measure was little changed.

Overall, the results show that reward does not significantly affect intrinsic motivation as measured by free time on task following removal of reward, by performance during the free-time period, or by subjects' willingness to volunteer for future projects without reward. When intrinsic motivation is measured by attitude toward a task, rewarded subjects report higher intrinsic motivation than nonrewarded subjects. It is important to point out that these main effect results should be viewed with caution. This is because many studies show interaction effects that are obscured when results are aggregated.

Previous reviewers (e.g., Deci & Ryan, 1985; Morgan, 1984) have suggested that reward type, reward expectancy, and reward contingency may influence the effect of reward on intrinsic motivation. In subsequent analyses, effect sizes have been partitioned into groups based on these characteristics in an attempt to test potential moderator variables and to establish homogeneity of variance.

## Interactions: Effect Size as a Function of Reward Characteristics[5]

In the following section, type of reward and its impact on effect size are presented. Studies are included that measured the effects of either verbal or tangible reward (e.g., money) on intrinsic motivation. The second part of this section involves an analysis of reward expectancy (i.e., expected and unexpected rewards). Finally, reward contingency is assessed. Specifically, the question here is whether effect size varies as a function of reward delivered for engaging in a

task, completing or solving a task, or achieving a certain level of performance. Studies that could not be represented as effect sizes due to lack of sufficient information are not included in further analyses presented in this article.[6]

### *Type of Reward*

The purpose of the present analyses is to assess the effects of different types of rewards (i.e., tangible and verbal) on intrinsic motivation. Because few studies assessed intrinsic motivation as a function of "performance during the free-time period" and "willingness to volunteer," no further analyses on these measures have been conducted.

Effect sizes for both types of reward on the free-time and attitude measures are presented in funnel distributions in Figure 2. Funnel graphs are used to plot effect size against sample size of the study. The advantage of a funnel display is that it capitalizes on a well-known statistical principle (Light & Pillemer, 1984). That is, the larger the sample, the closer the effect size will come to represent the true underlying population value; variability due to sampling error decreases. Conversely, smaller samples are more prone to sampling error and are likely to deviate considerably about the true mean. For these reasons, the distribution is expected to take the shape of an inverted funnel.

An inspection of the funnel distribution of effect sizes for the free-time measure indicates that, overall, larger samples tend to concentrate around zero; greater variation is evident with smaller samples. Verbal reward appears to produce a positive effect. Results of tangible reward suggest a negative effect. These differences suggest that, on the free-time measure, the effects of reward depend on the type of reward. On the attitude measure, positive effects emerge from both tangible and verbal reward studies; verbal reward appears to produce a slightly more positive effect. There is no indication of a publication bias because studies with small sample sizes and near zero effects are represented in the funnel distribution (for a discussion of this issue, see Light & Pillemer, 1984). Although it is not possible to rule out experimenter bias (Rosenthal, 1966), the funnel graphs demonstrate that sampling variability may account for the fact that some researchers find reward has a detrimental effect while others do not.

The results from the meta-analysis of the effects of reward type presented in Table 3 indicate that, when studies compared subjects who received a verbal reward (i.e., praise or positive feedback) to those who did not receive a reward, rewarded subjects demonstrated significantly higher intrinsic motivation as measured by both time on task and attitude. On the time measure, homogeneity was attained by removing one outlier. This extreme positive value (+1.61) was obtained from a study conducted in India (Tripathi & Agarwal, 1985). Because all other studies in this analysis came from North America, the large effect size may have been due to differences in the population studied.[7] Three outliers from studies measuring the effects of verbal reward were removed to achieve homogeneity on the attitude measure. Inspection of these outliers suggested that they did not differ in obvious ways from other studies in the sample except for their tendency to generate extreme values of effect size. From these analyses, one can estimate that the probability of a sample of verbally rewarded subjects' being more highly intrinsically motivated than nonrewarded subjects is 0.61 (CL) as measured by time on task and attitude toward task.

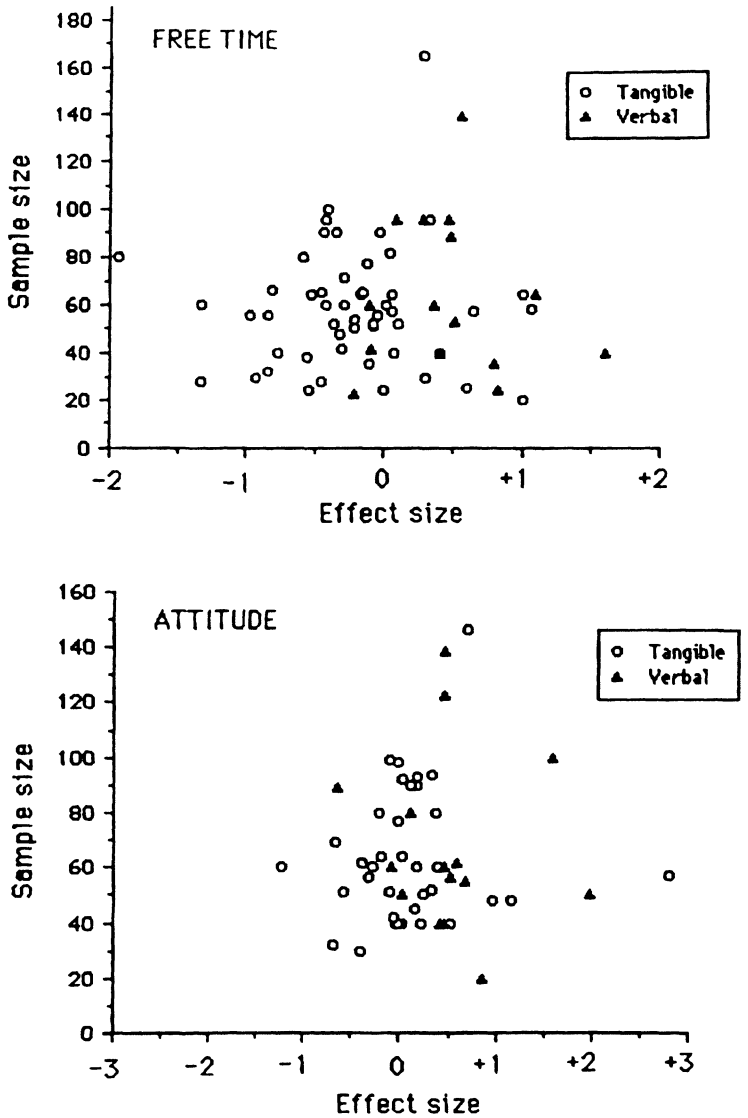


FIGURE 2. *Funnel distributions of effect sizes for tangible and verbal reward on two measures of intrinsic motivation*

Studies assessing the effects of tangible reward on intrinsic motivation show a decrease on the free-time measure as indicated by a negative mean effect size that differed significantly from 0.00. The CL statistic of .44 implies that subjects who receive a tangible reward will show a decrease in intrinsic motivation as measured by time on task in 56 out of 100 studies. The mean effect size on attitude for subjects given a tangible reward was positive, but once outliers were removed, the mean did not differ significantly from 0.00.

TABLE 3
*Effect size as a function of the type of reward delivered*

| Reward type | Analysis | *k* | Sample size | Mean weighted *d* | 95% CI for *d* | *Q* | CL |
|---|---|---|---|---|---|---|---|
| | | | Free time on task | | | | |
| Verbal | All known effects | 15 | 958 | +0.42 | 0.29 to 0.56 | 29.37* | .62 |
| Verbal | Outliers removed using Tukey's procedure | 14 | 918 | +0.38 | 0.25 to 0.52 | 18.96 | .61 |
| Tangible | All known effects | 51 | 2983 | −0.20 | −0.28 to −0.12 | 181.01* | .44 |
| Tangible | Outliers removed using Tukey's procedure | 47 | 2761 | −0.22 | −0.30 to −0.14 | 97.55* | .44 |
| Tangible | Additional outliers removed | 43 | 2591 | −0.21 | −0.29 to −0.13 | 63.53 | .44 |
| | | | Attitude | | | | |
| Verbal | All known effects | 15 | 1024 | +0.45 | 0.31 to 0.58 | 69.71* | .63 |
| Verbal | Outliers removed using Tukey's procedure | 13 | 874 | +0.30 | 0.15 to 0.43 | 26.75* | .58 |
| Verbal | Additional outliers removed | 12 | 785 | +0.39 | 0.24 to 0.53 | 8.73 | .61 |
| Tangible | All known effects | 37 | 2362 | +0.09 | 0.004 to 0.17 | 143.29* | .52 |
| Tangible | Outliers removed using Tukey's procedure | 33 | 2149 | +0.05 | −0.04 to 0.13 | 50.56 | .52 |

*Note.* Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. *k* = number of effect sizes; sample size = sum of *n* in all studies; mean weighted *d* = mean of weighted effect sizes (weighted by sample size); CI = confidence interval; *Q* = homogeneity statistic for mean effect sizes; CL = common language effect size statistic.
*Significance indicates rejection of the hypothesis of homogeneity.
*$p < .01$.

In summary, subjects rewarded with verbal praise or positive feedback show significantly greater intrinsic motivation than nonrewarded subjects. Those who receive a tangible reward evidence significantly less intrinsic motivation than nonrewarded subjects, as measured by time on task, but they do not differ in their reports of task interest or enjoyment.

The next step in the analysis involves a further breakdown of the effects of tangible reward. The goal is to identify variables that may moderate the effects of tangible reward on intrinsic motivation and to establish within-group homogeneity. One factor that may impact effect size is whether the rewards implemented in the studies were promised to subjects prior to the experimental sessions or whether they were received unexpectedly.

### Reward Expectancy

Within the intrinsic motivation literature, researchers draw a distinction between expected and unexpected reward. *Expected* rewards refer to a procedure whereby subjects are offered a reward prior to the experimental session and delivered the reward following the session. Subjects who receive an *unexpected* reward have not been promised the reward beforehand. These terms are generally used to describe procedures involving the administration of tangible rewards.

In most studies on verbal reward, praise was delivered unexpectedly and was not contingent on any specified level of performance. The few studies on verbal reward that did employ expected and/or contingency procedures did not produce effect sizes that deviated much from the mean effect size presented in Table 3. For this reason, no further subdivision of effect sizes from verbal reward studies was undertaken. The following analyses concern the effects of tangible reward. Results are displayed in Table 4.

Only six studies assessed the effects of unexpected tangible reward on the time measure of intrinsic motivation; five studies investigated attitude. The average effect sizes for unexpected tangible reward versus control groups on free time and attitude were slightly positive but did not differ from 0.00. These results indicate that subjects receiving an unexpected reward do not differ significantly from nonrewarded control subjects on measures of intrinsic motivation.

For the expected tangible reward versus control comparisons, expected reward subjects demonstrated significantly less intrinsic motivation on the free-time measure. On attitude, when homogeneity was attained, the two groups did not differ.

In the following section of this article, studies comparing expected, tangible reward groups to nonrewarded controls were further subdivided into groups based on reward contingency.

### Reward Contingency

In some studies, subjects were promised a tangible reward that was delivered for participating in the study or for engaging in a specific task. In other studies, a tangible reward was offered for solving a puzzle, completing a task, and/or attaining a certain level of performance. Rewards administered in these various ways have been labeled by Deci and Ryan (1985) as task noncontingent (rewards offered for participating in the study regardless of what subjects do), task contingent (rewards offered for engaging in a task, and/or completing or solving a task), and performance contingent (rewards offered for attaining a specified level of performance). Table 5 presents results from the meta-analysis of these comparisons.

Table 5 indicates that when subjects who are promised a tangible reward regardless of what they do in the study (task noncontingent) are compared to nonrewarded controls, no significant difference emerges on the free-time measure of intrinsic motivation. No analyses were conducted with this type of reward contingency on the attitude measure because only two studies of this type assessed attitude. Subjects who receive an expected tangible reward for doing, completing, or solving a task (task contingent) show significantly less intrinsic motivation than controls, as measured by time on task, once reward is withdrawn. On attitude,

TABLE 4
*Effect size as a function of reward expectancy for tangible reward versus control comparisons*

| Reward expectancy | Analysis | *k* | Sample size | Mean weighted *d* | 95% CI for *d* | *Q* | CL |
|---|---|---|---|---|---|---|---|
| | Free time on task: Tangible reward versus control | | | | | | |
| Unexpected | All known effects | 6 | 275 | +0.01 | −0.24 to 0.25 | 7.38 | .50 |
| Expected | All known effects | 50 | 2825 | −0.23 | −0.30 to −0.15 | 185.48* | .44 |
| Expected | Outliers removed using Tukey's procedure | 46 | 2603 | −0.25 | −0.33 to −0.17 | 101.36* | .43 |
| Expected | Additional outliers removed | 42 | 2408 | −0.25 | −0.33 to −0.16 | 64.78 | .43 |
| | Attitude: Tangible reward versus control | | | | | | |
| Unexpected | All known effects | 5 | 311 | +0.06 | −0.16 to 0.28 | 12.42 | .52 |
| Expected | All known effects | 35 | 2126 | +0.10 | 0.01 to 0.19 | 135.26* | .53 |
| Expected | Outliers removed using Tukey's procedure | 32 | 1961 | +0.07 | −0.02 to 0.16 | 50.48 | .52 |

*Note.* Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. *k* = number of effect sizes; sample size = sum of *n* in all studies; mean weighted *d* = mean of weighted effect sizes (weighted by sample size); CI = confidence interval; *Q* = homogeneity statistic for mean effect sizes; CL = common language effect size statistic.
*Significance indicates rejection of the hypothesis of homogeneity.
*$p < .01$.

they show less intrinsic motivation, but this difference is not significant. When rewards are delivered contingent on a certain level of performance, there is no significant effect on the free-time measure; subjects in this condition do, however, report a more positive attitude than controls.

Studies employing various reward contingencies were also categorized using behavioral definitions. Rewards delivered for participating in a study or for engaging in a task are referred to as *noncontingent* rewards. Rewards are called *contingent* when they are offered for solving a puzzle, completing a task, or reaching a specified level of performance. The results of this analysis are shown in Table 6. The findings indicate that, when *reward contingency* is defined behaviorally, subjects demonstrate a decrease in intrinsic motivation on the free-

TABLE 5

*Effect size as a function of reward contingency (as defined by Deci & Ryan, 1985) for expected tangible reward versus control comparisons*

| Reward contingency | Analysis | *k* | Sample size | Mean weighted *d* | 95% CI for *d* | *Q* | CL |
|---|---|---|---|---|---|---|---|
| Free time on task: Expected tangible reward versus control | | | | | | | |
| Task non-contingent | All known effects | 6 | 225 | +0.55 | +0.27 to 0.83 | 20.02* | .65 |
| Task non-contingent | Outliers removed | 4 | 124 | +0.10 | −0.26 to 0.45 | 1.86 | .53 |
| Task contingent | All known effects | 45 | 2257 | −0.32 | −0.41 to −0.24 | 130.90* | .41 |
| Task contingent | Outliers removed using Tukey's procedure | 44 | 2177 | −0.28 | −0.37 to −0.19 | 94.99* | .42 |
| Task contingent | Additional outliers removed | 40 | 2015 | −0.23 | −0.32 to −0.14 | 62.08* | .44 |
| Performance contingent | All known effects | 10 | 484 | −0.12 | −0.31 to 0.06 | 26.22* | .47 |
| Performance contingent | Outliers removed using Tukey's procedure | 8 | 439 | −0.13 | −0.34 to 0.06 | 17.83 | .46 |
| Attitude: Expected tangible reward versus Control | | | | | | | |
| Task contingent | All known effects | 21 | 1217 | −0.07 | −0.18 to 0.05 | 53.75* | .48 |
| Task contingent | Outliers removed using Tukey's procedure | 20 | 1157 | −0.01 | −0.13 to 0.10 | 36.24* | .49 |
| Task contingent | Additional outliers removed | 19 | 1058 | −0.08 | −0.20 to 0.04 | 21.76 | .48 |
| Performance contingent | All known effects | 14 | 819 | +0.38 | 0.24 to 0.52 | 70.03* | .61 |
| Performance contingent | Outliers removed using Tukey's procedure | 13 | 762 | +0.29 | 0.14 to 0.43 | 27.35* | .58 |
| Performance contingent | Additional outliers removed | 11 | 682 | +0.19 | 0.04 to 0.35 | 11.54 | .55 |

*Note.* Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. *k* = number of effect sizes; sample size = sum of *n* in all studies; Mean weighted *d* = mean of weighted effect sizes (weighted by sample size); CI = confidence interval; *Q* = homogeneity statistic for mean effect sizes; CL = common language effect size statistic.

*Significance indicates rejection of the hypothesis of homogeneity.

*$p < .01$.

No effect size was calculated for the attitude measure of task noncontingent rewards because there were only two studies that fit in this category.

TABLE 6
*Effect size as a function of reward contingency (as defined behaviorally) for expected tangible reward versus control comparisons*

| Reward contingency | Analysis | $k$ | Sample size | Mean weighted $d$ | 95% CI for $d$ | $Q$ | CL |
|---|---|---|---|---|---|---|---|
| | Free time on task: Expected tangible reward versus control | | | | | | |
| Contingent | All known effects | 18 | 906 | −0.12 | −0.26 to 0.01 | 37.44* | .47 |
| Contingent | Outliers removed | 16 | 861 | −0.13 | −0.26 to 0.01 | 29.06 | .46 |
| Non-contingent | All known effects | 40 | 2017 | −0.27 | −0.35 to −0.18 | 167.05* | .42 |
| Non-contingent | Outliers removed using Tukey's procedure | 38 | 1894 | −0.26 | −0.35 to −0.16 | 100.86* | .43 |
| Non-contingent | Additional outliers removed | 34 | 1728 | −0.26 | −0.36 to −0.16 | 54.66 | .43 |
| | Attitude: Expected tangible reward versus control | | | | | | |
| Contingent | All known effects | 20 | 1224 | +0.24 | 0.12 to 0.36 | 88.64* | .57 |
| Contingent | Outliers removed using Tukey's procedure | 17 | 1087 | +0.11 | −0.01 to 0.23 | 22.24 | .53 |
| Non-contingent | All known effects | 17 | 913 | −0.04 | −0.17 to 0.09 | 50.14* | .49 |
| Non-contingent | Outliers removed using Tukey's procedure | 16 | 853 | +0.03 | −0.10 to 0.17 | 31.52* | .49 |
| Non-contingent | Additional outliers removed | 15 | 833 | +0.05 | −0.08 to 0.19 | 27.91 | .48 |

*Note.* Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. $k$ = number of effect sizes; sample size = sum of $n$ in all studies; Mean weighted $d$ = mean of weighted effect sizes (weighted by sample size); CI= confidence interval; $Q$ = homogeneity statistic for mean effect sizes; CL = common language effect size statistic.
*Significance indicates rejection of the hypothesis of homogeneity.
*$p < .01$.

time measure when expected tangible rewards are not contingent on successful performance. On the attitude measure, noncontingent rewards produce no significant effect. Rewards contingent on successful performance do not produce significant effects on either the free-time or attitude measures.

The major difference between a behavioral classification of contingency and Deci and Ryan's categorization system concerns those studies where subjects are given a reward for completing or solving a task. The first experiment conducted by Deci (1971) is an example of a study coded as *task contingent* using Deci and Ryan's categories and *contingent* using a behavioral framework. In this study, subjects were paid money for each puzzle they solved. Deci and Ryan classified such reward procedures as task contingent because the rewards were not contingent on how well subjects performed relative to some standard. From a behavioral

perspective, however, completion or solution of a task is seen as dependent on successful performance; these studies were labeled contingent. Thus, performance contingent rewards as defined by Deci and Ryan (1985) include only those studies where subjects are offered a reward for attaining a certain level of performance; using a behavioral definition, studies coded as contingent include both rewards that are contingent on completing or solving a task and rewards that are contingent on reaching a specified level of performance. Because these two types of reward contingencies may have opposite effects on intrinsic motivation, a separate analysis was conducted on studies in which reward was delivered for completing or solving a task. Results given in Table 7 show no significant differences between rewarded and control groups on the free-time or attitude measures for this type of reward contingency. These findings suggest that contingent rewards (which include performance contingent rewards), as defined behaviorally, do not harm intrinsic motivation.

### Summary of Results From Group Designs

A summary of the various analyses conducted on the group design studies and the major findings is given in Figure 3.[8]

When all types of reward are aggregated, overall, the results indicate that reward does not negatively affect intrinsic motivation on any of the four measures (free time on task once reward is withdrawn, self-reports of attitude, performance during the free-time measure, willingness to volunteer for future studies without reward). When rewards are subdivided into reward type (verbal, tangible), reward expectancy (expected, unexpected), and reward contingency, the findings demonstrate that people who receive a verbal reward spend more time on a task once the reward is withdrawn; they also show more interest and enjoyment than nonrewarded persons.

Tangible reward produces no decrement in intrinsic motivation when it is received unexpectedly. Expected tangible rewards produce differing effects depending on the manner in which they are administered. Individuals who receive an expected reward for solving or completing a task or for achieving a specific

TABLE 7
*Effect size as a function of rewards contingent on task completion or solution for expected tangible reward versus control comparisons*

| Measure | *k* | Sample size | Mean weighted *d* | 95% CI for *d* | *Q* | CL |
|---|---|---|---|---|---|---|
| Free time | 8 | 423 | −0.12 | −0.32 to 0.08 | 11.21 | .47 |
| Attitude | 6 | 405 | −0.05 | −0.25 to 0.14 | 6.89 | .48 |

*Note.* Negative effect sizes indicate a decrease in intrinsic motivation for reward/reinforcement groups; positive effect sizes indicate an increase. *k* = number of effect sizes; sample size = sum of *n* in all studies; Mean weighted *d* = mean of weighted effect sizes (weighted by sample size); CI = confidence interval; *Q* = homogeneity statistic for mean effect sizes; CL = common language effect size statistic.
*Significance indicates rejection of the hypothesis of homogeneity.
*$p < .01$.

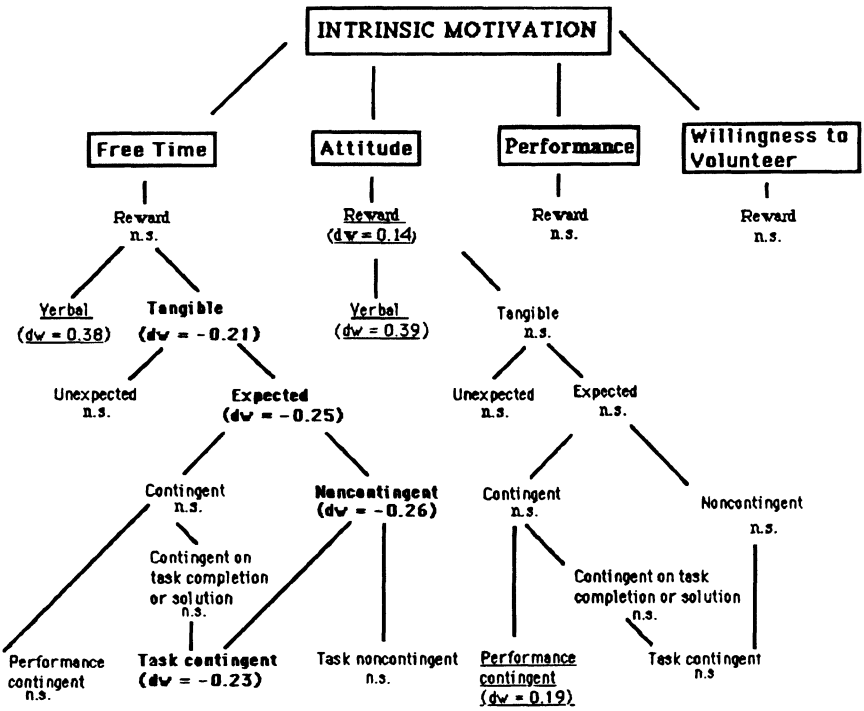


FIGURE 3. *A summary of the meta-analysis of the effects of reward versus control groups on intrinsic motivation*

*Note.* dw = mean weighted effect size (based on homogeneous samples); n.s. = not significant; analyses in regular type indicate no effect; analyses in bold indicate a negative effect; underlined analyses indicate a positive effect. When no dw is reported, there was no significant effect. No analyses were conducted on the attitude measure for task noncontingent reward because only two studies assessed this measure.

level of performance do not spend less time on a task than controls once the reward is withdrawn. They do, however, report more interest, satisfaction, and enjoyment of the task when the reward is given for a certain level of performance.

The detrimental effects of reward appear when rewards are offered to people simply for engaging in a task, independent of successful performance. Under these conditions, once the reward is removed, individuals spend less time on the task than controls; they do not, however, report a less favorable attitude toward the task.

## RESULTS FROM SINGLE-SUBJECT DESIGNS

To determine the effects of reinforcement on intrinsic motivation, an analysis was conducted on effect sizes from single-subject, repeated measures designs where the rewards used were shown to be reinforcers for each subject in the study. That is, rewards were shown to increase behavior during a reinforcement phase. An increase or decrease in intrinsic motivation was measured as a difference between behavior during the pre- and postreinforcement phases. Five studies

contributed an effect size to this analysis. Four studies showed that subjects spent more time on the task during the postreinforcement phase than the baseline phase. One study (Vasta & Stirpe, 1979) showed a decrease in time on task immediately following the removal of reward but an increase in time when intrinsic motivation was measured 2 weeks later. To make this analysis comparable to the analysis of group design studies, however, only differences between the immediate postreinforcement phase and baseline were analyzed.

The average effect size and confidence interval for this analysis was +0.34 (−0.28, 0.96) indicating no significant change in intrinsic motivation from baseline to postreinforcement phases. Effect sizes were homogeneous ($Q = 2.96$, $df = 4$). These results suggest that reinforcement does not alter people's intrinsic motivation.

As noted previously, two studies used a between- and within-group repeated measures design to assess the effects of reinforcement on intrinsic motivation (Greene, Sternberg, & Lepper, 1976; Mynatt, Oakley, Arkkelin, Piccione, Margolis, & Arkkelin, 1978). Although these studies did not meet the criteria for inclusion in the meta-analysis of within-subject designs, it is possible to assess the within-group effects for reward conditions that were comparable in both studies. Both Greene et al. (1976) and Mynatt et al. (1978) included a group of subjects rewarded for playing with activities that they had spent the most time with during baseline phases (high interest condition) and a group that was rewarded for playing with activities they had spent the least time with during baseline (low interest condition). In terms of the high interest conditions, Mynatt et al. did not find a reinforcement effect but reported a decrease in intrinsic motivation from baseline to postreward phases. Greene et al. reported a reinforcement effect for the high interest group and a decrease in intrinsic motivation between baseline and postreinforcement sessions. It is difficult to draw conclusions from only two studies. Nonetheless, because a decline in intrinsic motivation occurred with or without a reinforcement effect, it may be that reinforcement is not the critical variable. Both studies reported a reinforcement effect for the low interest conditions, but there was no change in intrinsic motivation from baseline to postreinforcement phases. Again, conclusions based on two studies are tenuous. One interpretation, however, is that the time spent on low interest activities was so low that a decline in intrinsic motivation could not be detected. Alternatively, reinforcement does not interrupt intrinsic motivation for low interest activities.

## DISCUSSION

A major contention in education and psychology is that rewards and reinforcement negatively impact a person's intrinsic motivation. The view is that, if people are reinforced or rewarded for activities they already spend time on and enjoy, they will be less motivated to engage in the activity than they were prior to the introduction of reward, once the reward is no longer forthcoming. In other words, rewards and reinforcement are said to decrease people's intrinsic motivation.

Over the past 20 years, dozens of studies have been conducted to investigate this issue. The primary objective of this article was to assess the research findings by conducting a meta-analysis of results from experiments on the effects of reward and reinforcement on intrinsic motivation. What follows is a discussion of the results obtained from the meta-analysis.

The vast majority of studies have assessed the effects of reward on intrinsic motivation by using group designs. Rewarded subjects are compared to nonrewarded controls. Intrinsic motivation is measured by differences between groups on attitude, time spent on a task following the removal of reward (free time), performance during the free-time period, and willingness to volunteer for future studies without reward. The main meta-analysis reported in this article was conducted on results from these studies. This analysis concerned assessing the overall effects of reward on intrinsic motivation as well as the effects of a number of reward characteristics. The results suggest that in the laboratory, overall, reward does not negatively impact intrinsic motivation on any of the four measures analyzed here.

A separate analysis was conducted using single-subject, repeated measures designs. A few researchers employed this type of design to evaluate the effects of reinforcement on intrinsic motivation. The rewards used in these studies were shown to be reinforcers, and intrinsic motivation was indexed as differences in subjects' behavior between pre- and postreinforcement sessions. Results from the meta-analysis indicate no effect of reinforcement on intrinsic motivation. That is, the evidence suggests that reinforcement does not decrease a person's intrinsic motivation to engage in an activity.

In terms of rewards and extrinsic reinforcement, our overall findings suggest that there is no detrimental effect on intrinsic motivation. These findings are based on laboratory experiments, but a similar conclusion was reached by Workman and Williams (1980) in their review of the effects of extrinsic rewards on intrinsic motivation in the classroom. Generally, on task behavior, Workman and Williams found that external reinforcement increased and maintained intrinsic motivation for prolonged periods (up to 12 months). Thus, it no longer seems appropriate to argue against the use of incentive systems in applied settings.

The findings from both experimental and applied research run contrary to the views expressed by many psychologists and educators (e.g., Deci & Ryan, 1985; Kohn, 1993; Levine & Fasnacht, 1974; Schwartz, 1990). For example, Deci and Ryan (1987) state that:

> *In general* [italics added], rewards have been found to undermine intrinsic motivation. When people received rewards for working on an interesting activity, they tended to display less interest in and willingness to work on that activity after the termination of the rewards than did people who had worked on the activity without receiving a reward. (p.1026)

Results from the present meta-analysis suggest that this statement is erroneous. The findings indicate that, in general, rewarded people are not less willing to work on activities and they do not display a less favorable attitude toward tasks than people who do not receive rewards.

When rewards are broken down into reward type, expectancy, and contingency, results indicate that, on the free-time measure, verbal reward produces an increase in intrinsic motivation; tangible rewards produce no effect when they are delivered unexpectedly, and they are not detrimental when they are expected and contingent on level of performance or completing or solving a task. Expected tangible rewards produce a decrease in intrinsic motivation as measured by free time on task when they are given to individuals simply for engaging in an activity. On

the attitude measure, verbal reward produces an increase in intrinsic motivation, and tangible rewards do not lead to a decrease in intrinsic motivation under any conditions. An increase in intrinsic motivation is shown on the attitude measure when individuals are offered a reward for performing to a set of standards. Thus, the present results suggest that rewards are detrimental only under a highly specified set of circumstances. That is, when subjects are offered a tangible reward (expected) that is delivered regardless of level of performance, they spend less time on a task than control subjects once the reward is removed. The same condition has no effect on attitude.

Given these results, why is it that one commonly finds general statements condemning reinforcement and/or reward in journal articles and introductory textbooks? The present meta-analysis makes it clear how circumscribed the negative effect of reward really is. One possibility is that terms such as *tangible, expected, unexpected, contingent* and *noncontingent* become very confusing to a reader sorting through this literature. Consider, at its simplest, a study investigating the effects of expected reward on intrinsic motivation. Suppose the results showed a negative effect for expected reward. When discussing findings, do the researchers talk about the negative effects of the promise of reward or about the negative effects of reward, in general? There is no doubt that conclusions reached from such studies are often made about reward or reinforcement in general, not promise of reward. This has led to a great deal of misunderstanding about the overall effects of reward and reinforcement on intrinsic motivation. Even an informed reader can have difficulty keeping in mind what a particular study is investigating. It may be for this reason that rewards are often equated with reinforcers and, overall, have come to be seen as harmful. It is hoped that the present meta-analysis has helped to clarify the issue.

## Theoretical Implications

How do results from the present meta-analysis fit in with the various theories that have been formulated to account for the negative effects of rewards on intrinsic motivation?

Advocates of cognitive evaluation theory (e.g., Deci & Ryan, 1985) would probably not have difficulty reconciling results from the free-time measure of intrinsic motivation. According to cognitive evaluation theory, competence and self-determination underlie intrinsic motivation. Rewards can facilitate or hinder competence and self-determination depending on whether they are perceived as informational, controlling, or amotivational. From this perspective, results from the meta-analysis would suggest that verbal rewards increase a person's intrinsic motivation because of their informational value. Verbal praise would be seen to lead an individual to feel competent in performing a task; hence, intrinsic motivation would increase. Because the cognitive evaluation process is said to take place while the rewarded activity is occurring, unexpected rewards would not alter a person's intrinsic motivation. On the other hand, rewards offered to people for participating in a task, in spite of how well they perform, would be perceived as controlling and would decrease intrinsic motivation.

The problem for cognitive evaluation theory arises when one considers results from the attitude measure of intrinsic motivation. Deci and Ryan (1985) suggest that interest, enjoyment, and satisfaction are central emotions that accompany

intrinsic motivation. A person's experience of an activity is a focal point of cognitive evaluation theory. In other words, cognitive evaluation theory depends on an internal attitude change that is later expressed behaviorally as time on task. Results from the present meta-analysis indicate that reward does not negatively affect attitude. Individuals who receive verbal praise report greater interest than nonrewarded people. Tangible rewards produce no change in attitude when they are given for doing, completing, or solving a task; a positive effect is evident when rewards are contingent on a specified level of performance.

One way of mitigating the findings for cognitive evaluation theory is to question the reliability of the attitude measure. In many studies, the attitude measure was obtained from a single-item Likert scale. An additional problem is that the questions designed to assess attitude toward the task may have been unable to separate subjects' liking of the reward from their liking of the task. If the attitude measures are unreliable, they will fail to reflect true differences between rewarded and nonrewarded groups. This may be one way to handle the puzzling results; however, it also suggests that there has been no test of the major mediator proposed by the theory.

The problem of operationalizing the construct of intrinsic motivation was recently addressed in a meta-analysis by Wiersma (1992).[9] Results from Wiersma's study depended on whether intrinsic motivation was operationalized as a free-time measure or as a task performance during rewarded period measure. Free-time measures showed a decline in intrinsic motivation; performance measures showed an increase. As noted, in the present analyses, results from the attitude measure do not coincide with the free-time measure. Additionally, measures of intrinsic motivation as performance during free time or as willingness to volunteer for future studies do not clarify the issue of operationalization of intrinsic motivation.

Given the lack of covariation among the measures, it seems appropriate to devote further research to clarifying the concept of intrinsic motivation and to developing suitable measures. A different solution is offered by Rigby, Deci, Patrick, and Ryan (1992) who suggest that attention be directed toward the concept of self-determination rather than a pursuit of the intrinsic/extrinsic dichotomy. Others concur but suggest that researchers should focus on goal definitions (Sansone & Morgan, 1992). A final alternative would be to agree that constructs such as self-determination, goal definition, and intrinsic motivation are scientifically unclear and that it would be more appropriate to deal with the effects of reward and reinforcement on behavior (e.g., Bandura, 1977, 1986; Dickinson, 1989). Such a course of action would mean abandoning cognitive evaluation theory.

Another theoretical explanation that has been proposed to account for the effects of rewards on intrinsic motivation is the *overjustification* effect (Lepper, Greene, & Nisbett, 1973). The view is that people's perceptions about the causes of their behavior influence future motivation. Rewards lead to a decrease in intrinsic motivation when people's perceptions shift from accounting for their behavior as self-initiated to accounting for it in terms of external reward. Because the present analysis did not evaluate subjects' perceptions about the causes of their behavior, it is impossible to determine whether overjustification explains

the results. Further research that measures subjects' attributions to internal and external factors is warranted.

Finally, how would the findings of the meta-analysis be interpreted from a behavioral perspective? The results from single-subject designs indicate that reinforcement does not produce decrements in intrinsic motivation. This finding is compatible with a behavioral view. That is, behaviorists maintain that behavior returns to baseline after reinforcement is withdrawn. If the rewards used in the groups' design studies are reinforcers, one would expect behavior to eventually return to baseline. Research designed to investigate the effects of reward on intrinsic motivation has typically measured time on task for a brief 8- to 10-minute period, immediately following the removal of reward. Thus, if verbal praise were a reinforcer, one might interpret the positive effect as a carryover of the reinforcement procedure. Another interpretation is that the positive effect is the result of an extinction burst. That is, when reinforcement is first withdrawn, the immediate, short-term effect is that rate of response increases. After a period of time, behavior would return to baseline. In terms of the negative effect of expected, noncontingent, tangible reward, some writers (e.g., Dickinson, 1989; Flora, 1990) have suggested that such a reward procedure does not represent a reinforcement contingency. The promise of a reward is seen by behaviorists as a discriminative stimulus ($S^D$), and the negative effect is understood as the result of a bribe. A difficulty with this interpretation is that it does not account for findings from other conditions where promise of reward does not produce a negative effect. Further research is necessary to determine when and under what conditions promises of rewards function as bribes. Our data suggest that promises linked to noncontingent reward may function as bribes rather than as positive incentives.

## Practical Implications

The present findings suggest that verbal praise and positive feedback enhance people's intrinsic interest. This is an important finding. Most social interaction in business, education, and clinical settings involves verbal feedback from managers, teachers, and therapists. When praise and other forms of positive feedback are given and later removed, people continue to show intrinsic interest in their work. In contrast to recent claims made by Kohn (1993, p. 55), verbal praise is an extrinsic motivator that positively alters attitudes and behavior.

Rewards can have a negative impact on intrinsic motivation when they are offered to people for engaging in a task without consideration of any standard of performance. In a classroom, this might occur if a teacher promised students tangible rewards simply for doing an activity. For example, a teacher who promises stars or other awards to students for spending time doing math problems may undermine intrinsic motivation. In such a case, one could expect rewarded individuals to enjoy the task as much as those who are not offered an incentive. But, they may spend less time on the activity in a study period when the reward is no longer forthcoming. According to our results, this would not occur if the teacher used the same rewards but made them contingent on successful completion of the problems.

Overall, the present review suggests that teachers have no reason to resist implementing incentive systems in the classroom. This conclusion is based on

our findings, which show that verbal praise enhances intrinsic motivation and that other rewards and reinforcement leave intrinsic motivation largely unaffected. A small negative effect occurs when tangible rewards are promised without regard to a standard of performance. Under this circumstance, the promise of reward may act as a bribe. Importantly, on a practical level, the implication is that reward offered in educational and other settings should be delivered contingent on performance.

## Notes

[1] Although there was an overall positive effect of tangible reward on intrinsic motivation, Rosenfield et al.(1980) also found that rewards that did not indicate ability led to less intrinsic interest.

[2] In addition to studies reported in English, five relevant Japanese experiments were identified by the CD-ROM search. The information in the abstracts was not adequate to code the findings. Therefore, these studies are not included in the meta-analysis.

[3] Boggiano and Ruble (1979) reported that 147 children participated in the study. There were two reward conditions (task contingent, performance contingent) and a nonrewarded control group. The contrast for the control versus task-contingent reward groups on the free-time measure is reported as $t(130) = 2.0$, $p < .05$; the contrast for the control versus performance-contingent reward groups is reported as $t(130) = 1.16$, n.s.

[4] A copy of the coding form is available on request from the first author.

[5] A list of the experiments included in each interaction is available on request from the first author.

[6] Further analyses which include studies that index effect size as 0.00 are available in Cameron (1992).

[7] The present review does not assess cultural differences in the impact of reward on intrinsic motivation. However, it is interesting to note that, although the study from India (Tripathi & Agarwal, 1985) shows an extreme positive value for the effect of verbal praise on the free-time measure, the direction of the result is consistent with the North American studies.

[8] A few researchers have assessed the effects of expected tangible rewards on intrinsic motivation relative to unexpected tangible rewards (e.g., Enzle & Ross, 1978; Fazio, 1981; Lepper & Greene, 1975). Other researchers have conducted studies comparing expected noncontingent reward groups to expected contingent reward groups (e.g., Farr, 1976; Phillips & Lord, 1980; Pinder, 1976). Such studies concern direct comparisons between the two types of reward expectancies (expected versus unexpected) and the two types of reward contingencies (noncontingent versus contingent) without reference to a nonrewarded control group. Results from meta-analyses conducted on these comparisons and a list of studies included in such analyses can be obtained in Cameron (1992). One significant effect emerged from these analyses; subjects who received an expected tangible reward showed less intrinsic motivation on the free-time measure than subjects who received an unexpected tangible reward. The average effect size and confidence interval for this comparison was $-0.26$ ($-0.45$, $-0.06$).

[9] Wiersma (1992) reported results of a meta-analysis of 23 experiments on reward and intrinsic motivation. These studies make up a subset of those analyzed in the present article. Effect sizes from Wiersma's study were not always based on a comparison of a reward condition to a no-reward condition. This makes it impossible to directly compare our findings with those of Wiersma.

## APPENDIX A

*Studies included in the meta-analysis of group designs*


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Deci, E. L. (1972b). The effects of contingent and noncontingent rewards and controls on intrinsic motivation. *Organizational Behavior and Human Performance, 8,* 217–229.

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## APPENDIX B

*Formulas for calculating effect size, g*

1.

$$g = \frac{X_E - X_C}{S_p}$$

where

$X_E$ = mean of experimental group
$X_C$ = mean of control group
$S_p$ = pooled standard deviation

$$S_p^2 = \frac{(n_E - 1)S_E^2 + (n_C - 1)S_C^2}{n_E + n_C - 2}$$

where

$S_p^2$ = pooled variance
$S_E^2$ = variance of experimental group
$S_C^2$ = variance of control group
$n_E$ = sample size of experimental group
$n_C$ = sample size of control group

2.

$$g = t\sqrt{\frac{2}{n}}$$ for equal *n*s; $n$ = sample size of each group

3.

$$g = t\sqrt{\frac{1}{n_E} + \frac{1}{n_C}}$$ for unequal *n*s

4.

$$g = \sqrt{F}\sqrt{\frac{n_E + n_C}{n_E n_C}}$$

## APPENDIX C

*Characteristics of studies included in the meta-analysis*

| Author(s) | Journal | Design | Subjects | Task | Reward type | Expect-ancy | Contin-gency | Dep. measure | *N* exp. | *N* control | Effect size (*g*)[ab] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Deci (1971) Exp. 1 | JPSP | B/A | Adults | Soma | T | E | Cont, TC | Free time | 12 | 12 | −0.54 |
| Deci (1971) Exp. 1 | JPSP | B/A | Adults | Soma | T | E | Cont, TC | Attitude | 12 | 12 | 0.00[a] |
| Deci (1971) Exp. 2 | JPSP | Field study | Adults | Writing headlines | T | E | Cont. TC | Performance | 4 | 2 | −3.72 |
| Deci (1971) Exp. 3 | JPSP | B/A | Adults | Soma | V | U | | Free time | 12 | 12 | +0.82 |
| Deci (1971) Exp. 3 | JPSP | B/A | Adults | Soma | V | U | | Attitude | 12 | 12 | 0.00[a] |
| Kruglanski et al. (1971) | J of Pers. | A/O | 15–16 yrs | Creativity & recall | T | E | Not, TC | Attitude | 16 | 16 | −0.69 |
| Kruglanski et al. (1971) | J of Pers. | A/O | 15–16 yrs | Creativity & recall | T | E | Not, TC | Volunteer | 16 | 16 | −0.63 |
| Deci (1972a) | JPSP | A/O | Adults | Soma | V | U | | Free time | 48 | 48 | +0.29 |
| Deci (1972a) | JPSP | A/O | Adults | Soma | T | E | Cont, TC | Free time | 32 | 32 | +0.75 |
| Deci (1972a) | JPSP | A/O | Adults | Soma | T | E | Cont, TC | Free time | 32 | 32 | −0.10 |
| Deci (1972b) | Org Beh & Hum Perf | A/O | Adults | Soma | T | E | Not, NC | Free time | 24 | 16 | +0.08[b] |
| Kruglanski et al. (1972) | J. Exp. Soc Psych | A/O | Children | 5 games | T | U | | Attitude | 36 | 33 | −0.66 |
| Lepper et al. (1973) | JPSP | B/A | Children | Drawing | T | E | Not, TC | Free time | 18 | 15 | −0.72 |
| Lepper et al. (1973) | JPSP | B/A | Children | Drawing | T | U | | Free time | 18 | 15 | +0.57[b] |
| Greene, Lepper (1974) | Child dev | A/O | Children | Drawing | T | E | Not, TC | Free time | 15 | 15 | −0.70 |
| Greene, Lepper (1974) | Child dev | A/O | Children | Drawing | T | U | | Free time | 13 | 15 | +0.06 |

APPENDIX C—*continued*

*Characteristics of studies included in the meta-analysis*

| Author(s) | Journal | Design | Subjects | Task | Reward type | Expect-ancy | Contin-gency | Dep. measure | *N* exp. | *N* control | Effect size (*g*)[ab] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Greene, Lepper (1974) | Child dev | A/O | Children | Drawing | T | U | | Free time | 13 | 15 | +0.22 |
| Ross (1975) Exp. 1 | JPSP | A/O | Children | Playing drum | T | E | Not, TC | Free time | 20 | 20 | −0.54 |
| Ross (1975) Exp. 1 | JPSP | A/O | Children | Playing drum | T | E | Not, TC | Free time | 20 | 20 | +0.56 |
| Ross (1975) Exp. 2 | JPSP | A/O | Children | Drum | T | E | Not, TC | Free time | 52 | 14 | −0.81 |
| Taub, Dollinger (1975) | J of Pers | A/O | Children | Coding | T | E | Cont, PC | Attitude | 124 | 124 | 0.00[a] |
| Kruglanski et al. (1975) Exp. 1 | JPSP | A/O | 14–15-yr.-olds | 2 tasks | T | E | Cont, PC | Attitude | 24 | 24 | +1.15 |
| Kruglanski et al. (1975) Exp. 2 | JPSP | A/O | 15–16-yr.-olds | 2 tasks | T | E | Cont, PC | Attitude | 40 | 40 | +0.39 |
| Reiss, Sushinski (1975) | JPSP | A/O | Children | Listening to songs | T | E | Not, TC | Free time | 16 | 16 | −0.84 |
| Salanick (1975) | Org Beh & Hum Perf | A/O | Adults | Train game | T | E | Cont, PC | Free time | 38 | 39 | −0.12[b] |
| Salanick (1975) | Org Beh & Hum Perf | A/O | Adults | Train game | T | E | Cont, PC | Attitude | 38 | 39 | −0.01[b] |
| Hamner, Foster (1975) | Org Beh & Hum Perf | A/O | Adults | Scoring questions | T | E | Not, NC | Attitude | 31 | 30 | −0.23 |
| Hamner, Foster (1975) | Org Beh & Hum Perf | A/O | Adults | Scoring questions | T | E | Cont, TC | Attitude | 37 | 30 | +0.19 |
| Calder, Staw (1975) | JPSP | A/O | Adults | Puzzles | T | E | Not, TC | Attitude | 20 | 20 | +0.22[b] |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Calder, Staw (1975) | JPSP | A/O | Adults | Puzzles | T | E | Not, TC | Volunteer | 20 | 20 | +0.28 |
| Feingold, Mahoney (1975) | Behavior Therapy | SS Repeated measures | Children | Dot-to-dot connections | T | E | Cont | # of connections | 5 | — | +0.34 |
| Anderson et al. (1976) | JPSP | B/A | Children | Drawing | V | U | | Free time | 18 | 46 | +1.07 |
| Anderson et al. (1976) | JPSP | B/A | Children | Drawing | T | E | Not, TC | Free time | 36 | 46 | +0.04 |
| Arnold (1976) | Org Beh & Hum Perf | Multiple trials | Adults | Computer game | T | E | Not, TC | Attitude | 17 | 36 | 0.00[a] |
| Arnold (1976) | Org Beh & Hum Perf | Multiple trials | Adults | Computer game | T | E | Not, TC | Volunteer | 17 | 36 | +0.02 |
| Ross et al. (1976) | JPSP | A/O | Children | Drawing | T | E | Not, TC | Free time | 12 | 12 | −0.64 |
| Ross et al. (1976) | JPSP | A/O | Children | Drawing | T | E | Not, NC | Free time | 12 | 12 | +0.44 |
| Shapira (1976) | JPSP | A/O | Adults | Soma | T | E | Cont, PC | Attitude | 30 | 30 | +0.41[b] |
| Swann, Pittman (1977) Exp. 1 | Child Dev | A/O | Children | Drawings | T | E | Not, NC | Free time | 20 | 20 | −0.21[b] |
| Swann, Pittman (1977) Exp. 1 | Child Dev | A/O | Children | Drawing | T | E | Not, NC | Free time | 20 | 20 | −0.78[b] |
| Swann, Pittman (1977) Exp. 2 | Child Dev | A/O | Children | Drawing | T | E | Not, TC | Free time | 39 | 26 | −0.15[b] |
| Karniol, Ross (1977) | Child Dev | A/O | Children | Slide show | T | E | Not, TC | Free time | 17 | 20 | −0.04 |
| Karniol, Ross (1977) | Child Dev | A/O | Children | Slide show | T | E | Cont, PC | Free time | 20 | 20 | +0.15 |
| Pittmann et al. (1977) | Per & Soc Psy Bull | A/O | Adults | Gravitation | T | E | Cont, PC | Attitude | 60 | 20 | −0.20 |
| Mynatt et al. (1978) | Cog Ther & Res | B/A mult. trials | Children | Educ games | T | E | Not, TC | Free time | 10 | 10 | +1.01 |
| Weiner, Mander (1978) | Mot & Emotion | A/O | Adults | Decoding cartoons | T | E | Not, TC | Free time | 30 | 30 | −0.34 |
| Weiner, Mander (1978) | Mot & Emotion | A/O | Adults | Decoding cartoons | T | E | Cont, PC | Free time | 30 | 30 | −0.54 |

APPENDIX C—*continued*

*Characteristics of studies included in the meta-analysis*

| Author(s) | Journal | Design | Subjects | Task | Reward type | Expect-ancy | Contin-gency | Dep. measure | *N* exp. | *N* control | Effect size (*g*)[ab] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Weiner, Mander (1978) | Mot & Emotion | A/O | Adults | Decoding cartoons | T | E | Not, TC | Attitude | 30 | 30 | 0.00[a] |
| Weiner, Mander (1978) | Mot & Emotion | A/O | Adults | Decoding cartoons | T | E | Cont, PC | Attitude | 30 | 30 | 0.00[a] |
| Weiner, Mander (1978) | Mot & Emotion | A/O | Adults | Decoding cartoons | T | E | Not, TC | Performance | 30 | 30 | −0.39[b] |
| Weiner, Mander (1978) | Mot & Emotion | A/O | Adults | Decoding cartoons | T | E | Cont, PC | Performance | 30 | 30 | −0.39[b] |
| Orlick, Mosher (1978) | Int J. of Sport Psy | B/A | Children | Stabilometer | T | E | Cont, TC | Free time | 14 | 12 | −0.34 |
| Orlick, Mosher (1978) | Int J. of Sport Psy | B/A | Children | Stabilometer | T | U | | Free time | 12 | 12 | −0.82 |
| Orlick, Mosher (1978) | Int J. of Sport Psy | B/A | Children | Stabilometer | V | U | | Free time | 11 | 12 | −0.22 |
| Smith, Pittman (1978) | JPSP | A/O | Adults | Labyrinth | T | E | Cont, TC | Attitude | 66 | 33 | −0.10[b] |
| Smith, Pittman (1978) | JPSP | A/O | Adults | Labyrinth | T | E | Cont, TC | Performance | 66 | 33 | 0.00[a] |
| Dollinger, Thelan (1978) | JPSP | A/O | Children | Mazes | T & V | E | Both | Attitude | 48 | 12 | 0.00[a] |
| Davidson, Bucher (1978) | Behavior Therapy | SS Repeated measures | Children | Playing with clown | T | E | Not | # of responses | 3 | — | +1.83 |
| Vasta et al. (1978) | J of School Psych | SS Repeated measures | Children | Coloring | T & V | U | | Time | 6 | — | +0.74 |
| Arkes (1979) | Mot & Emotion | A/O | Adults | Soma | T | E | Cont, TC | Free time | 32 | 32 | −0.16 |
| Arkes (1979) | Mot & Emotion | A/O | Adults | Soma | T | E | Cont, TC | Attitude | 32 | 32 | +0.03 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Loveland, Olley (1979) | Child Dev | A/O | Children | Drawing | T | E | Not, TC | Free time | 12 | 12 | 0.00[a] |
| Harackiewicz (1979) | JPSP | B/A | 16-yr.-olds | Hidden puzzles | V | U | | Attitude | 31 | 31 | +0.59 |
| Harackiewicz (1979) | JPSP | B/A | 16-yr.-olds | Hidden puzzles | T | E | Not, TC | Attitude | 31 | 31 | −0.38 |
| McLoyd (1979) | Child Dev | A/O | Children | Reading books | T | E | Cont, TC | Free time | 36 | 18 | −0.22 |
| McLoyd (1979) | Child Dev | A/O | Children | Reading books | T | E | Cont, TC | Performance | 36 | 18 | −0.40 |
| Wimperis, Farr (1979) | J. Applied Soc Psych | A/O | Adults | Erector sets | T | E | Not, TC | Attitude | 16 | 16 | +0.56 |
| Wimperis, Farr (1979) | J. Applied Soc Psych | A/O | Adults | Erector sets | T | E | Cont, PC | Attitude | 16 | 16 | +1.36 |
| Wimperis, Farr (1979) | J. Applied Soc Psych | A/O | Adults | Erector sets | T | E | Both | Volunteer | 32 | 16 | +0.69 |
| Weinberg, Jackson (1979) | Research Quarterly | A/O | Adults | Stabilometer | T | E | Cont, PC | Attitude | 40 | 40 | 0.00[a] |
| McGraw, McCullers (1979) | J Exp Soc Psych | A/O | Adults | Water jar problem | T | E | Cont, PC | Attitude | 20 | 20 | −0.04 |
| McGraw, McCullers (1979) | J Exp Soc Psych | A/O | Adults | Water jar problem | T | E | Cont, PC | Volunteer | 18 | 17 | −0.43[b] |
| Vasta, Stirpe (1979) | Behavior Mod | SS Repeated measures | Children | Math problems | T | E | Not | Time | 4 | — | −0.46 |
| Brennan, Glover (1980) | Soc Beh & Pers | B/A | Adults | Soma | T | E | Not, NC | Free time | 19 | 39 | +1.06 |
| Weiner (1980) | J of Soc Psych | A/O | Adults | Anagrams | T | E | Cont, PC | Attitude | 24 | 24 | 0.00[a] |
| Weiner (1980) | J of Soc Psych | A/O | Adults | Anagrams | T | E | Cont, PC | Volunteer | 24 | 24 | 0.00[a] |
| Weiner (1980) | J of Soc Psych | A/O | Adults | Anagrams | T | E | Cont, PC | Performance | 24 | 24 | +0.35 |

APPENDIX C—*continued*

*Characteristics of studies included in the meta-analysis*

| Author(s) | Journal | Design | Subjects | Task | Reward type | Expect-ancy | Contin-gency | Dep. measure | *N* exp. | *N* control | Effect size (*g*)[ab] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rosenfield et al. (1980) | JPSP | A/O | Adults | Ad Lib | V | E | | Free time | 30 | 59 | +0.48 |
| Rosenfield et al. (1980) | JPSP | A/O | Adults | Ad Lib | V | E | | Attitude | 30 | 59 | −0.64 |
| Rosenfield et al. (1980) | JPSP | A/O | Adults | Ad Lib | V | E | | Volunteer | 30 | 59 | −0.76 |
| Rosenfield et al. (1980) | JPSP | A/O | Adults | Ad Lib | T | E | Cont, PC | Free time | 30 | 27 | +0.65 |
| Rosenfield et al. (1980) | JPSP | A/O | Adults | Ad Lib | T | E | Cont, PC | Attitude | 30 | 27 | +2.80 |
| Rosenfield et al. (1980) | JPSP | A/O | Adults | Ad Lib | T | E | Cont, PC | Volunteer | 30 | 27 | +0.27 |
| Staw et al. (1980) | J of Pers | A/O | Adults | Puzzles | T | E | Not, TC | Attitude | 47 | 46 | +0.19 |
| Staw et al. (1980) | J of Pers | A/O | Adults | Puzzles | T | E | | Volunteer | 47 | 46 | +0.34 |
| Williams (1980) | JPSP | B/A | Children | 4 games | T | E | Not, TC | Free time | 24 | 24 | −0.32 |
| Williams (1980) | JPSP | B/A | Children | 4 games | T | E | Not, TC | Attitude | 24 | 24 | 0.00[a] |
| Daniel, Esser (1980) | J Applied Psych | A/O | Adults | Puzzles | T | E | Cont, TC | Free time | 32 | 32 | −0.52 |
| Daniel, Esser (1980) | J Applied Psych | A/O | Adults | Puzzles | T | E | Cont, TC | Attitude | 32 | 32 | −0.19[b] |
| Daniel, Esser (1980) | J Applied Psych | A/O | Adults | Puzzles | T | E | Cont, TC | Volunteer | 32 | 32 | +0.08 |
| Morgan (1981) Exp. 1 | JPSP | A/O | Children | Puzzles | T | E | Not, TC | Free time | 27 | 27 | −0.98 |
| Morgan (1981) Exp. 1 | JPSP | A/O | Children | Puzzles | T | E | Not, TC | Attitude | 27 | 27 | −0.31 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Morgan (1981) Exp. 2 | JPSP | A/O | Children | Puzzles | T | E | Not, TC | Free time | 20 | 20 | −0.77 |
| Morgan (1981) Exp. 2 | JPSP | A/O | Children | Puzzles | T | E | Not, TC | Attitude | 20 | 20 | +0.04 |
| Brockner, Vasta (1981) | J of Res in Pers | A/O | Adults | Soma | T | E | Cont, TC | Free time | 26 | 26 | −0.37 |
| Brockner, Vasta (1981) | J of Res in Pers | A/O | Adults | Soma | T | E | Cont, TC | Attitude | 25 | 26 | −0.58 |
| Pittman et al. (1980) | Pers & Soc Psych Bull | A/O | Adults | Soma | V | U | | Free time | 24 | 12 | +0.80 |
| Shanab et al. (1981) | J of Soc Psych | A/O | Adults | Soma | V | U | | Free time | 20 | 20 | +0.64 |
| Shanab et al. (1981) | J of Soc Psych | A/O | Adults | Soma | V | U | | Attitude | 20 | 20 | +0.43 |
| Danner, Lonkey (1981) | Child Dev | A/O | Children | Class inclusion | T | E | Not, TC | Free time | 30 | 30 | −1.33 |
| Danner, Lonkey (1981) | Child Dev | A/O | Children | Class inclusion | T | E | Not, TC | Attitude | 30 | 30 | −1.23 |
| Danner, Lonkey (1981) | Child Dev | A/O | Children | Class inclusion | V | U | | Free time | 30 | 30 | −0.10 |
| Danner, Lonkey (1981) | Child Dev | A/O | Children | Class inclusion | V | U | | Attitude | 30 | 30 | −0.08 |
| Boal, Cummings (1981) | Org Beh & Hum Perf | Field study | Adults | Coding data | T | E | Not, NC | Free time | 21 | 22 | +1.64 |
| Boal, Cummings (1981) | Org Beh & Hum Perf | Field study | Adults | Coding data | T | E | Cont, TC | Free time | 21 | 22 | +0.38 |
| Luyten, Lens (1981) | Mot & Emotion | A/O | Adults | Wood models | T | E | Not, TC | Free time | 10 | 10 | −0.96 |
| Luyten, Lens (1981) | Mot & Emotion | A/O | Adults | Wood models | T | E | Not, TC | Attitude | 10 | 10 | −0.88 |
| Luyten, Lens (1981) | Mot & Emotion | A/O | Adults | Wood models | T | E | Not, TC | Volunteer | 10 | 10 | −1.15 |
| Luyten, Lens (1981) | Mot & Emotion | A/O | Adults | Wood models | T | E | Cont, PC | Free time | 10 | 10 | −0.91 |

APPENDIX C—*continued*

*Characteristics of studies included in the meta-analysis*

| Author(s) | Journal | Design | Subjects | Task | Reward type | Expect-ancy | Contin-gency | Dep. measure | *N* exp. | *N* control | Effect size *(g)*[ab] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Luyten, Lens (1981) | Mot & Emotion | A/O | Adults | Wood models | T | E | Cont, PC | Attitude | 10 | 10 | +0.08 |
| Luyten, Lens (1981) | Mot & Emotion | A/O | Adults | Wood models | T | E | Cont, PC | Volunteer | 10 | 10 | +1.08 |
| Fabes et al. (1981) | Am. J Psych | A/O | Adults | Algorithms heuristic tasks | T | E | All | Performance | 57 | 19 | −0.53 |
| Boggiano et al. (1982) | Social Cognition | A/O | Children | Hidden pictures | T | E | Not, TC | Free time | 81 | 84 | +0.28 |
| Zinser et al. (1982) | J General Psych | A/O | Children | Hidden pictures | V | U | | Free time | 64 | 32 | +0.08 |
| Porac, Meindl (1982) | Org Beh & Hum Perf | A/O | Adults | Soma | T | E | Not, TC | Free time | 40 | 20 | −0.21 |
| Earn (1982) | J of Pers | A/O | Adults | Anagrams | T | E | Not, TC | Free time | 40 | 20 | −0.28 |
| Earn (1982) | J of Pers | A/O | Adults | Anagrams | T | E | Not, TC | Attitude | 40 | 20 | +0.18 |
| Pittman et al. (1982) Exp. 1 | JPSP | A/O | Children | Matching games | T | E | Not, NC | Free time | 10 | 10 | +0.37 |
| Pittman et al. (1982) Exp. 1 | JPSP | A/O | Children | Matching games | T | E | Not, TC | Free time | 10 | 10 | +0.25 |
| Pittman et al. (1982) Exp. 1 | JPSP | A/O | Children | Matching games | T | E | Not, TC | Attitude | 20 | 10 | 0.00[a] |
| Pittman et al. (1982) Exp. 2 | JPSP | A/O | Children | Drawing | T | E | Not, TC | Free time | 28 | 28 | −0.05 |
| Pallack et al. (1982) | Child Dev | A/O | Children | Drawing | V | U | | Free time | 14 | 12 | −0.48 |
| Pallack et al. (1982) | Child Dev | A/O | Children | Drawing | V | E | | Free time | 14 | 12 | +0.32 |
| Pallack et al. (1982) | Child Dev | A/O | Children | Drawing | T | U | | Free time | 15 | 12 | −0.44 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Pallack et al. (1982) | Child Dev | A/O | Children | Drawing | T | E | | Free time | 15 | 12 | −0.16 |
| Crino, White (1982) | J Management | A/O | Adults | Puzzles | V | U | | Attitude | 20 | 10 | +0.01 |
| Crino, White (1982) | J Management | A/O | Adults | Puzzles | V | U | | Volunteer | 20 | 10 | +0.49 |
| Crino, White (1982) | J Management | A/O | Adults | Puzzles | V | U | | Attitude | 20 | 10 | +0.07 |
| Crino, White (1982) | J Management | A/O | Adults | Puzzles | V | U | | Volunteer | 20 | 10 | +0.64 |
| Ogilvie, Prior (1982) | Aust & N.Z. J Dev. Dis. | B/A | Children | Drawing | T | E | Not, TC | Free time | 26 | 26 | −0.08 |
| Boggiano, Hertel (1983) | Social Cognition | A/O | Adults | Memory task | T | U | | Attitude | 46 | 46 | +.0.02 |
| Ryan et al. (1983) | JPSP | A/O | Adults | Hidden puzzles | T | E | Cont, PC | Free time | 32 | 32 | −0.46 |
| Ryan et al. (1983) | JPSP | A/O | Adults | Hidden puzzles | T | E | Cont, PC | Attitude | 32 | 32 | 0.00[a] |
| Ryan et al. (1983) | JPSP | A/O | Adults | Hidden puzzles | T | E | Not, TC | Free time | 16 | 16 | −0.35 |
| Ryan et al. (1983) | JPSP | A/O | Adults | Hidden puzzles | T | E | Not, TC | Attitude | 16 | 16 | 0.00[a] |
| Ryan et al. (1983) | JPSP | A/O | Adults | Hidden puzzles | V | E | | Free time | 64 | 32 | +0.47 |
| Ryan et al. (1983) | JPSP | A/O | Adults | Hidden puzzles | V | E | | Attitude | 64 | 32 | 0.00[a] |
| Morgan (1983) Exp. 1 | Child Dev | A/O | Children | Puzzles | T | E | Not, TC | Free time | 40 | 40 | −1.94 |
| Morgan (1983) Exp. 1 | Child Dev | A/O | Children | Puzzles | T | E | Not, TC | Attitude | 40 | 20 | −0.27[b] |
| Morgan (1983) Exp. 2 | Child Dev | A/O | Children | Puzzles | T | E | Not, TC | Free time | 40 | 40 | −0.59 |
| Morgan (1983) Exp. 2 | Child Dev | A/O | Children | Puzzles | T | E | Not, TC | Attitude | 20 | 20 | 0.00 |
| Vallerand (1983) | J Sport Psych | A/O | Children | Slideshow game | V | E | | Attitude | 40 | 10 | +1.98 |

APPENDIX C—*continued*

*Characteristics of studies included in the meta-analysis*

| Author(s) | Journal | Design | Subjects | Task | Reward type | Expect-ancy | Contin-gency | Dep. measure | *N* exp. | *N* control | Effect size (*g*)[ab] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DeLoach et al. (1983) | Bull Psych Society | B/A | Children | Connect dots | T | E | Not, TC | Free time | 26 | 26 | 0.00[a] |
| Blanck et al. (1984) | Sex Roles | A/O | Adults | Word game | V | U | | Free time | 70 | 69 | +0.56 |
| Blanck et al. (1984) | Sex Roles | A/O | Adults | Word game | V | U | | Attitude | 70 | 69 | +0.46 |
| Sarafino (1984) | Br. J Dev Psych | A/O | Children | Riddles | T | E | Not, TC | Free time | 85 | 15 | −0.41 |
| Sarafino (1984) | Br. J Dev Psych | A/O | Children | Riddles | T | | Not, TC | Attitude | 85 | 15 | 0.00[a] |
| Harackiewicz et al. (1984) | J Exp. Psych | A/O | 16-yr.-olds | Hidden puzzles | T | E | Cont, PC | Attitude | 47 | 47 | +0.33 |
| Griffith et al. (1984) | Bull Psych Society | A/O | Children | Reading books | T | E | Not, TC | Free time | 64 | 32 | 0.00[a] |
| Griffith et al. (1984) | Bull Psych Society | A/O | Children | Reading books | T | E | Not, TC | Performance | 64 | 32 | 0.00[a] |
| Pretty, Seligman (1984) Exp. 1 | JPSP | B/A | Adults | Soma | T | E | Not, TC | Free time | 30 | 30 | −0.75 |
| Pretty, Seligman (1984) Exp. 1 | JPSP | B/A | Adults | Soma | T | E | Not, TC | Attitude | 30 | 30 | −0.05 |
| Pretty, Seligman (1984) Exp. 1 | JPSP | B/A | Adults | Soma | T | U | | Free time | 30 | 30 | +0.06 |
| Pretty, Seligman (1984) Exp. 1 | JPSP | B/A | Adults | Soma | T | U | | Attitude | 30 | 30 | +0.42 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Pretty, Seligman (1984) Exp. 1 | JPSP | B/A | Adults | Soma | V | U | | Free time | 30 | 30 | +0.35 |
| Pretty, Seligman (1984) Exp. 1 | JPSP | B/A | Adults | Soma | V | U | | Attitude | 30 | 30 | +0.46 |
| Pretty, Seligman (1984) Exp. 2 | JPSP | B/A | Adults | Soma | T | E | Not, TC | Free time | 30 | 30 | −0.13 |
| Pretty, Seligman (1984) Exp. 2 | JPSP | B/A | Adults | Soma | T | E | Not, TC | Attitude | 30 | 30 | −0.16 |
| Pretty, Seligman (1984) Exp. 2 | JPSP | B/A | Adults | Soma | T | U | | Free time | 30 | 30 | +0.06 |
| Pretty, Seligman (1984) Exp. 2 | JPSP | B/A | Adults | Soma | T | U | | Attitude | 30 | 30 | +0.38 |
| Harackiewicz et al. (1984) Exp. 1 | JPSP | B/A | Adults | Pinball | T | E | Cont, PC | Free time | 32 | 32 | +0.07 |
| Harackiewicz et al. (1984) Exp. 1 | JPSP | B/A | Adults | Pinball | T | E | Cont, PC | Attitude | 32 | 32 | +0.03 |
| Harackiewicz et al. (1984) Exp. 1 | JPSP | B/A | Adults | Pinball | T | E | Cont, PC | Performance | 32 | 32 | +0.16 |
| Harackiewicz et al. (1984) Exp. 2 | JPSP | B/A | Adults | Pinball | T | E | Cont, PC | Attitude | 15 | 15 | +0.18 |
| Harackiewicz et al. (1984) Exp. 2 | JPSP | B/A | Adults | Pinball | T | E | Cont, PC | Performance | 15 | 15 | −0.43 |

APPENDIX C—*continued*

*Characteristics of studies included in the meta-analysis*

| Author(s) | Journal | Design | Subjects | Task | Reward type | Expect-ancy | Contin-gency | Dep. measure | *N* exp. | *N* control | Effect size (*g*)[ab] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Harackiewicz et al. (1984) Exp. 2 | JPSP | B/A | Adults | Pinball | T | U | | Attitude | 15 | 15 | +0.15 |
| Harackiewicz et al. (1984) Exp. 2 | JPSP | B/A | Adults | Pinball | T | U | | Performance | 15 | 15 | +0.44 |
| Harackiewicz et al. (1984) Exp. 3 | JPSP | B/A | Adults | Pinball | T | E | Cont, PC | Attitude | 26 | 26 | +0.32 |
| Harackiewicz et al. (1984) Exp. 3 | JPSP | B/A | Adults | Pinball | T | E | Cont, PC | Performance | 26 | 26 | +0.04 |
| Vallerand, Reid (1984) | J Sport Psych | B/A | Adults | Stabilometer | V | E | | Attitude | 28 | 28 | +0.53[b] |
| Arnold (1985) | Acad. Man. J. | B/A | Adults | Computer game | T | E | Both | Attitude | 26 | 16 | −0.04 |
| Boggiano et al. (1985) | Social Cognition | A/O | Children | Puzzles | T | E | Not, TC | Free time | 26 | 13 | −0.79 |
| Boggiano et al. (1985) | Social Cognition | A/O | Children | Puzzles | T | E | Cont, PC | Free time | 26 | 13 | −0.10 |
| Freedman, Phillips (1985) | Org Beh & Hum Dec P | A/O | Adults | Proof reading | T | E | Not, TC | Attitude | 52 | 47 | +0.75 |
| Freedman, Phillips (1985) | Org Beh & Hum Dec P | A/O | Adults | Proof reading | T | E | Cont, PC | Attitude | 47 | 47 | +0.68 |
| Tripathi, Agarwal (1985) | Psych Studies | A/O | Adults | Puzzles | T | E | Not, TC | Free time | 20 | 20 | +0.41 |
| Tripathi, Agarwal (1985) | Psych Studies | A/O | Adults | Puzzles | T | E | Not, TC | Attitude | 20 | 20 | +0.54 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tripathi, Agarwal (1985) | Psych Studies | A/O | Adults | Puzzles | T | E | Not, TC | Performance | 20 | 20 | +0.54 |
| Tripathi, Agarwal (1985) | Psych Studies | A/O | Adults | Puzzles | V | E | | Free time | 20 | 20 | +1.61 |
| Tripathi, Agarwal (1985) | Psych Studies | A/O | Adults | Puzzles | V | E | | Attitude | 20 | 20 | +0.48 |
| Tripathi, Agarwal (1985) | Psych Studies | A/O | Adults | Puzzles | V | E | | Performance | 20 | 20 | +0.54 |
| Sansone (1986) Exp. 1 | JPSP | A/O | Adults | Identify names | V | U | | Attitude | 44 | 11 | +0.68 |
| Amabile et al. (1986) Exp.1 | JPSP | A/O | Children | 3 tasks | T | E | Not, TC | Free time | 56 | 57 | 0.00[a] |
| Amabile et al. (1986) Exp. 1 | JPSP | A/O | Children | 3 tasks | T | E | Not, TC | Attitude | 56 | 57 | 0.00[a] |
| Amabile et al. (1986) Exp.3 | JPSP | A/O | Adults | 3 tasks | T | E | Not, TC | Attitude | 30 | 30 | 0.00[a] |
| Harackiewicz et al. (1987) | JPSP | A/O | 16-yr.-olds | Puzzles | T | E | Cont, PC | Attitude | 24 | 27 | −0.10 |
| Hom (1987) Exp. 1 | Pers & Soc Psych Bull | A/O | Adults | Pursuit rotor task | T | ? | Not | Free time | 26 | 26 | +0.11[b] |
| Hom (1987) Exp. 1 | Pers & Soc Psych Bull | A/O | Adults | Pursuit rotor task | T | ? | Not | Attitude | 26 | 26 | 0.00[a] |
| Hom (1987) Exp. 2 | Pers & Soc Psych Bull | A/O | Adults | Solving anagrams | V | ? | ? | Performance | 28 | 28 | −0.37 |
| Fabes (1987) Exp. 1 | J of Psych | A/O | Children | Block building | T | E | Not, TC | Free time | 18 | 19 | −0.82 |
| Fabes (1987) Exp. 1 | J of Psych | A/O | Children | Block building | T | E | Cont, PC | Free time | 19 | 19 | −0.87 |
| Fabes (1987) Exp. 2 | J of Psych | A/O | Children | Block building | T | E | Not, TC | Free time | 14 | 14 | −0.45 |

APPENDIX C—*continued*

*Characteristics of studies included in the meta-analysis*

| Author(s) | Journal | Design | Subjects | Task | Reward type | Expect-ancy | Contin-gency | Dep. measure | *N* exp. | *N* control | Effect size (*g*)[ab] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Koestner et al. (1987) | JPSP | A/O | Adults | Hidden puzzles | V | U | | Free time | 35 | 18 | +0.51 |
| Koestner et al. (1987) | JPSP | A/O | Adults | Hidden puzzles | V | U | | Attitude | 35 | 18 | 0.00[a] |
| Butler (1987) | J Ed Psych | A/O | Children | Problem solving | V | U | | Attitude | 50 | 50 | +1.59 |
| Butler (1987) | J Ed Psych | A/O | Children | Problem solving | V | U | | Performance | 50 | 50 | +0.39 |
| Tripathi, Agarwal (1988) | J Gen Psych | A/O | Adults | Problem solving | T | E | Not, TC | Free time | 20 | 10 | +0.03 |
| Tripathi, Agarwal (1988) | J Gen Psych | A/O | Adults | Problem solving | T | E | Cont, PC | Free time | 20 | 10 | +1.18 |
| Tripathi, Agarwal (1988) | J Gen Psych | A/O | Adults | Problem solving | T | E | Both | Attitude | 40 | 10 | +0.26[b] |
| Fabes et al. (1988) | Mot & Emotion | A/O | Children | Beanbag game | T | E | Not, TC | Free time | 14 | 14 | −1.34 |
| Sansone (1989) | J Exp Soc Psych | A/O | Adults | Identify names | V | U | | Attitude | 82 | 41 | +0.46 |
| Sansone et al. (1989) | JPSP | A/O | Adults | Computer games | V | U | | Attitude | 40 | 40 | +0.12 |
| Anderson, Rodin (1989) | J App Soc Psych | A/O | Adults | Brain teasers | V | U | | Attitude | 10 | 10 | +0.90 |
| Mawhinney et al. (1989) | J Org Beh Management | SS Repeated measures | Adults | Video game | T | E | Not | Time | 3 | — | +0.15 |
| Wicker et al. (1990) | J of Psych | A/O | Adults | Think Tac Toe | T | E | Not, TC | Free time | 29 | 29 | 0.00[a] |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wicker et al. (1990) | J of Psych | A/O | Adults | Think Tac Toe | T | E | Not, TC | Attitude | 29 | 29 | 0.00[a] |

*Notes.*
Design: B/A = before-after groups design, A/O = after-only groups design, SS = single-subject design
Reward type: T = tangible, V = verbal
Reward expectancy: E = expected, U = unexpected
Reward contingency: cont = contingent, not = not contingent; NC = nontask contingent, TC = task contingent, PC = performance contingent
[a]indicates effect sizes given a value of zero (nonsignificant results with no report of means or direction of means)
[b]indicates estimated effect sizes
JPSP = Journal of Personality and Social Psychology
J of Pers = Journal of Personality
Org Beh & Hum Perf = Organizational Behavior and Human Performance
J Exp Soc Psych = Journal of Experimental Social Psychology
Child Dev = Child Development
Per & Soc Psy Bull = Personality and Social Psychology Bulletin
Cog Ther & Res = Cognitive Therapy and Research
Mot & Emotion = Motivation and Emotion
Int J of Sport Psy = International Journal of Sport Psychology
J of School Psych = Journal of School Psychology
J Applied Soc Psych = Journal of Applied Social Psychology
Behavior Mod = Behavior Modification
Soc Beh & Pers = Social Behavior and Personality
J of Soc Psych = Journal of Social Psychology
J Applied Psych = Journal of Applied Psychology
J of Res Pers = Journal of Research in Personality
J General Psych = Journal of General Psychology
J Management = Journal of Management
Aust & N.Z. J Dev Dis = Australia and New Zealand Journal of Developmental Disabilities
J Sport Psych = Journal of Sport Psychology
Bull Psych Society = Bulletin of the Psychonomic Society
Br J Dev Psych = British Journal of Developmental Psychology
J Exp Psych = Journal of Experimental Psychology
Acad Man J = Academy of Management Journal
Org Beh & Hum Dec P = Organizational Behavior and Human Decision Processes
Psych Studies = Psychological Studies
J Org Beh Management = Journal of Organizational Behavior Management

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Received July 22, 1993
Revision received January 28, 1994
Accepted February 7, 1994