Review of Educational Research
Spring 2001, Vol. 71, No. 1, pp. 1–27

Extrinsic Rewards and Intrinsic Motivation in Education: Reconsidered Once Again

Edward L. Deci
University of Rochester
Richard Koestner
McGill University
Richard M. Ryan
University of Rochester

The finding that extrinsic rewards can undermine intrinsic motivation has been highly controversial since it first appeared (Deci, 1971). A meta-analysis published in this journal (Cameron & Pierce, 1994) concluded that the undermining effect was minimal and largely inconsequential for educational policy. However, a more recent meta-analysis (Deci, Koestner, & Ryan, 1999) showed that the Cameron and Pierce meta-analysis was seriously flawed and that its conclusions were incorrect. This article briefly reviews the results of the more recent meta-analysis, which showed that tangible rewards do indeed have a substantial undermining effect. The meta-analysis provided strong support for cognitive evaluation theory (Deci & Ryan, 1980), which Cameron and Pierce had advocated abandoning. The results are briefly discussed in terms of their relevance for educational practice.

Gold stars, best-student awards, honor roles, pizzas for reading, and other reward-focused incentive systems have long been part of the currency of schools. Typically intended to motivate or reinforce student learning, such techniques have been widely advocated by some educators, although, in recent years, a few commentators have questioned their widespread use. The controversy has been prompted in part by psychological research that has demonstrated negative effects of extrinsic rewards on students' intrinsic motivation to learn. Some studies have suggested that, rather than always being positive motivators, rewards can at times undermine rather than enhance self-motivation, curiosity, interest, and persistence at learning tasks. Because of the widespread use of rewards in schools, a careful summary of reward effects on intrinsic motivation would seem to be of considerable importance for educators.

Accordingly, in the Fall 1994 issue of *Review of Educational Research*, Cameron and Pierce (1994) presented a meta-analysis of extrinsic reward effects on intrinsic motivation, concluding that, overall, rewards do not decrease intrinsic motivation. Implicitly acknowledging that intrinsic motivation is important for learning and adjustment in educational settings (see, e.g., Ryan & La Guardia, 1999), Cameron and Pierce nonetheless stated that "teachers have no reason to resist implementing incentive systems in the classroom" (p. 397). They also advocated abandoning Deci and Ryan's (1980) cognitive evaluation theory (CET), which had initially been formulated to explain both positive and negative reward effects on intrinsic motivation.

In the Spring 1996 issue of *RER*, three commentaries were published (Kohn, 1996; Lepper, Keavney, & Drake, 1996; Ryan & Deci, 1996) arguing that Cameron and Pierce's meta-analysis was flawed and that its conclusions were unwarranted. In that same issue, Cameron and Pierce (1996) responded to the commentaries by claiming that, rather than reanalyzing the data, the authors of the three commentaries had suggested "that the findings are invalid due to intentional bias, deliberate misrepresentation, and inept analysis" (p. 39). Subtitling their response "Protests and Accusations Do Not Alter the Results," Cameron and Pierce stated that any meaningful criticism of their article would have to include a reanalysis of the data. Subsequent to that interchange, Eisenberger and Cameron (1996) published an article in the *American Psychologist* summarizing the Cameron and Pierce (1994) meta-analysis and claiming that the so-called undermining of intrinsic motivation by extrinsic rewards, which they said had become accepted as reality, was in fact largely a myth.

We do not claim that there was "intentional bias" or "deliberate misrepresentation" in either the Cameron and Pierce (1994) meta-analysis or the Eisenberger and Cameron (1996) article, but we do believe, as Ryan and Deci argued in 1996, that Cameron and Pierce used some inappropriate procedures and made numerous errors in their meta-analysis. Therefore, because we believe the problems with their meta-analysis made their conclusions invalid, because we agree that a useful critique of their article must involve reanalysis of the data, and because the issue of reward effects on intrinsic motivation is extremely important for educators, we performed a new meta-analysis of reward effects on intrinsic motivation (Deci, Koestner, & Ryan, 1999). Our meta-analysis included 128 experiments, organized so as to provide a test of CET, much as Cameron and Pierce had done. The new meta-analysis, which we summarize in this article, showed that, in fact, tangible rewards do significantly and substantially undermine intrinsic motivation. The meta-analysis provided strong support for CET and made clear that there is indeed reason for teachers to exercise great care when using reward-based incentive systems.

The new meta-analysis was published in *Psychological Bulletin* (Deci et al., 1999). Included in that article was an appendix table (here reproduced with permission as Table 1a) listing every study in the meta-analysis and explaining exactly where errors were made by Cameron and Pierce, how our meta-analysis corrected their errors, and what studies were included in ours that had been overlooked or omitted by them. The table allows interested readers to see for themselves exactly how it is that Cameron and Pierce's meta-analysis and our meta-analysis arrived at such different conclusions.

In the seven years since the publication of Cameron and Pierce's (1994) article, academics, school administrators, and classroom teachers from many countries have spoken to us about the article, making it clear that the conclusions of the article had been widely disseminated and that the issue of reward effects is of considerable interest to educators around the world. Given the great importance of this issue for education, then, the current article is intended to set the record straight for the many readers of *RER*. In this article, we provide a brief description of CET, because it has guided much of the research in the field. This is followed by a summary of the methods and results of our meta-analysis and, finally, a discussion of the relevance of the results for education.

Cognitive Evaluation Theory

CET proposes that underlying intrinsic motivation are the innate psychological needs for competence and self-determination. According to the theory, the effects on intrinsic motivation of external events such as the offering of rewards, the delivery of evaluations, the setting of deadlines, and other motivational inputs are a function of how these events influence a person's perceptions of competence and self-determination. Events that decrease perceived self-determination (i.e., that lead to a more external perceived locus of causality) will undermine intrinsic motivation, whereas those that increase perceived self-determination (i.e., that lead to a more internal perceived locus of causality) will enhance intrinsic motivation. Furthermore, events that increase perceived competence will enhance intrinsic motivation so long as they are accompanied by perceived self-determination (e.g., Ryan, 1982), and those that decrease perceived competence will diminish intrinsic motivation. Finally, rewards (and other external events) have two aspects. The *informational* aspect conveys self-determined competence and thus enhances intrinsic motivation. In contrast, the *controlling* aspect prompts an external perceived locus of causality (i.e., low perceived self-determination) and thus undermines intrinsic motivation.

As noted, CET applies not only to reward effects but to the effects of various other external factors such as evaluations (Smith, 1975), deadlines (Amabile, DeJong, & Lepper, 1976), competition (Deci, Betley, Kahle, Abrams, & Porac, 1981), and externally imposed goals (Mossholder, 1980), as well as to the general climate of classrooms, schools, and other interpersonal settings (e.g., Deci, Connell, & Ryan, 1989; Deci, Schwartz, Sheinman, & Ryan, 1981). In this article, however, we focus only on CET as an explanation for reward effects.

In making predictions about reward effects on intrinsic motivation, CET analyzes the type of reward and the type of reward contingency to determine whether the reward is likely to be experienced as informational or controlling. The theory acknowledges that in some cases both the informational and controlling aspects will be somewhat salient, so, in those situations, additional factors are taken into account in making predictions. We begin our discussion of CET's reward-effect predictions by distinguishing between verbal rewards and tangible rewards, considering verbal rewards first and then moving on to tangible rewards.

Verbal Rewards

Although we do not usually use the term *verbal rewards*, preferring instead to speak of "positive feedback," we do use that term here in order to include the positive-feedback studies within the general category of reward effects. Verbal rewards typically contain explicit positive performance feedback, so CET predicts that they are likely to enhance perceived competence and thus enhance intrinsic motivation. In the meta-analysis, we tested the hypothesis that verbal rewards would enhance intrinsic motivation.

Nonetheless, verbal rewards can have a significant controlling aspect leading people to engage in behaviors specifically to gain praise, so verbal rewards have the potential to undermine intrinsic motivation. The theory therefore suggests that the interpersonal context within which positive feedback is administered can influence whether it will be interpreted as informational or controlling. As used here, the term *interpersonal context* refers to the social ambience of settings, such as classrooms, as they influence people's experience of self-determination (Deci & Ryan, 1991). When studied in laboratory experiments, the interpersonal climate is usually manipulated in terms of the interpersonal style used by the experimenter when providing the feedback (e.g., Ryan, 1982; Ryan, Mims, & Koestner, 1983). An interpersonal context is considered controlling to the extent that people feel pressured by it to think, feel, or behave in particular ways. Verbal rewards administered within such a context are thus more likely to be experienced as controlling rather than informational. For example, CET suggests that if a teacher uses an interpersonal style intended to make students do what he or she wants them to, verbal rewards administered by that teacher are likely to be experienced as controlling. In a supplemental meta-analysis involving five studies, we tested the prediction that controlling positive feedback would lead to less intrinsic motivation than informational positive feedback.

Tangible Rewards

Unlike verbal rewards, tangible rewards are frequently offered to people as an inducement to engage in a behavior in which they might not otherwise engage. Thus, according to CET, tangible rewards will tend to be experienced as controlling, and as a result they will tend to decrease intrinsic motivation. The meta-analysis tested the hypothesis that, overall, tangible rewards would decrease intrinsic motivation.

In order for tangible rewards to be experienced as controlling, however, people would need to be engaging in the behavior for the rewards; that is, they would need to expect that the behavior would lead to the rewards. If tangible rewards are given unexpectedly to people after they have finished a task, the rewards are less likely to be experienced as the reason for doing the task and are thus less likely to be detrimental to intrinsic motivation. The meta-analysis tested the hypothesis that unexpected tangible rewards would not undermine intrinsic motivation, whereas expected tangible rewards would.

Expected tangible rewards can be administered through various contingencies; that is, they can be made contingent upon different aspects of task-related behavior. In making more refined predictions about the effects of expected tangible rewards on intrinsic motivation, CET takes account of task contingency. Ryan et al. (1983) specified three types of reward contingencies: *task-noncontingent* rewards, which do not require engaging in the activity per se but are instead given for some other reason such as simply participating in the experiment; *task-contingent* rewards, which require doing or completing the target activity; and *performance-contingent* rewards, which require performing the activity well, matching a standard of excellence, or surpassing a specified criterion (e.g., doing better than half of the other participants).

A further distinction has been made between task-contingent rewards that specifically require completing the target task (herein referred to as *completion-contingent* rewards) and those that require engaging in the activity but do not require completing it (herein referred to as *engagement-contingent* rewards). We (e.g., Deci & Ryan, 1985) have considered the completion-contingent and engagement-contingent rewards to constitute the single category of task-contingent rewards because the effects of these two reward contingencies have seemed to be remarkably similar; however, we separated them for this meta-analysis in order to evaluate whether the effects of completion-contingent and engagement-contingent rewards are, in fact, the same.

Because task-noncontingent rewards do not require doing, completing, or doing well at the target task, there is no reason to expect these rewards to be experienced as either informational or controlling with respect to the task. Accordingly, the meta-analysis tested the hypothesis that intrinsic motivation would not be affected by these rewards.

Engagement-contingent rewards specifically require that people work on the task, so the rewards are likely to be experienced as controlling the task behavior. Because these rewards carry little or no competence affirmation, they are unlikely to increase perceived competence, and thus there will be nothing to counteract the negative effects of the control. Thus, the meta-analysis tested the hypothesis that engagement-contingent rewards would undermine intrinsic motivation.

Completion-contingent rewards require that people complete the task to obtain the rewards, so the rewards are likely to be experienced as even more controlling than engagement-contingent rewards. However, with completion-contingent rewards, receipt of the rewards conveys competence if the task required skill and the person had a normative sense of what constitutes good performance on the task. To the extent that the rewards do represent competence affirmation, this implicit positive feedback could offset some of the control. Still, averaged across different types of tasks, the competence-affirming aspect of completion-contingent rewards is not expected to be strong relative to the controlling aspect, so we tested the hypothesis that completion-contingent rewards would undermine intrinsic motivation at a level roughly comparable to that of engagement-contingent rewards. Parenthetically, because the category of task-contingent rewards is composed of engagement-contingent and completion-contingent rewards, we also expected this larger category to yield significant undermining of intrinsic motivation.

Finally, performance-contingent rewards are linked to people's performance, so there is even stronger control. People have to meet a standard to maximize rewards, and thus there is a strong tendency for these rewards to undermine intrinsic motivation. However, performance-contingent rewards can also convey substantial positive competence information when a person receives a level of reward that signifies excellent performance. In those cases, there would be a tendency for performance-contingent rewards to affirm competence and, thus, to offset some of the negative effects of control. In the meta-analysis, we tested the hypothesis that performance-contingent rewards would undermine intrinsic motivation, but we also expected that other factors would influence the effects of these rewards on intrinsic motivation. One such factor is whether or not the level of reward implies excellent performance. Thus, we examined the hypothesis that performance-contingent rewards would be more undermining of intrinsic motivation if the rewards did not convey high-quality performance.

Another factor that is expected to influence the effects of performance-contingent rewards is the interpersonal context (as was the case with verbal rewards). If the interpersonal climate within which these rewards are administered is demanding and controlling, the rewards are expected to be more undermining of intrinsic motivation.

Although few studies have manipulated the interpersonal context of performance-contingent rewards, Ryan et al. (1983) compared a performance-contingent rewards group in which the rewards were administered in a relatively controlling manner and one in which they were administered in a relatively non-controlling manner. As predicted, the controlling administration of performance-contingent rewards led to undermining of intrinsic motivation relative to the noncontrolling administration. In terms of education, this is a particularly important finding because it suggests that when rewards are used in the classroom, it is important that the climate of the classroom be supportive rather than controlling so that the students will be less likely to experience the rewards as controlling.

Method

Our meta-analytic strategy (Deci et al., 1999) involved a hierarchical approach in which the results of 128 experiments were examined in two separate meta-analyses. The first involved 101 of the studies that had used a free-choice behavioral measure of intrinsic motivation, and the second involved 84 of the studies that had used self-reported interest as a dependent variable. In a hierarchical meta-analysis, one begins with the most general category and reports the composite effect size. If the set of effects is heterogeneous, then one proceeds to differentiate the overall category into meaningful subcategories in an attempt to achieve homogeneity of effects within the subcategories. Thus, in both meta-analyses (i.e., with the two dependent measures), we began by calculating the effects of all rewards on intrinsic motivation and then systematically differentiated the reward conditions. Only after we had exhausted all possible moderator variables did we discard outliers to create homogeneity within subcategories. Using this approach, we ended up discarding only about 4% of the effects as outliers, whereas Cameron and Pierce (1994) had discarded approximately 20% of the effects as outliers.

In the differentiation, studies were first separated into those that examined verbal rewards versus those that examined tangible rewards. Then tangible rewards, which have been extensively studied, were analyzed as follows. The effects of rewards that were unexpected versus expected were examined separately. Studies of expected tangible rewards were then separated into four groups, depending on what the rewards were contingent upon. The groups were as follows: task noncontingent (rewards that did not explicitly require working on a task), engagement contingent (rewards that did require working on the task), completion contingent (rewards that required finishing a task), and performance contingent (rewards contingent upon a specified level of performance at a task). As described subsequently, because the performance-contingent reward effects on the free-choice measure were heterogeneous, that category was further differentiated. Finally, in categories in which the effect sizes were heterogeneous after all theoretically based differentiations had been completed, we compared the effects of the reward types on schoolchildren versus college students, an issue that had not been considered previously but emerged from an inspection of the data and seemed very important in terms of the educational relevance of the results.

Inclusion criteria for studies that spanned the period 1971 to 1996 were the following. First, because intrinsic motivation is pertinent to tasks that people experience as interesting and because the field of inquiry has always been defined in terms of reward effects on intrinsic motivation for interesting tasks, we included only studies or conditions within studies if the target task was at least moderately interesting (i.e., if it either was not defined a priori as a boring task by the experimenter or did not have a prereward interest rating below the midpoint of the scale). In contrast, Cameron and Pierce (1994) had aggregated across boring and interesting tasks without even addressing the issue in their article. Second, the analyses included only studies that assessed intrinsic motivation after the rewards had been clearly terminated, because while the reward is in effect participants' behavior reflects a mix of intrinsic and extrinsic motivation. Cameron and Pierce, however, included assessments which they called intrinsic motivation but which had been taken while the reward contingency was still in effect. Third, studies were included only if they had an appropriate no-reward control group. Cameron and Pierce had made numerous comparisons based on questionable selections of control groups, at times even using inappropriate control groups when appropriate ones were available.

In conducting the meta-analyses, we used Cohen's *d* as the measure of effect size. It reflects the difference between the means of two groups divided by the pooled within-group standard deviations, adjusted for sample size (Hedges & Olkin, 1985). The mean of the control group was subtracted from the mean of the rewards group, so a negative *d* reflects an "undermining effect," whereas a positive *d* reflects an "enhancement effect."

Means, standard deviations, *t* tests, *F* tests, and sample sizes were used to calculate *d* values. For any study in which insufficient data were provided to calculate an effect size, we assigned an effect of $d = 0.00$, and we included those imputed values in all analyses. All effect-size computations and summary analyses were done with DSTAT (Johnson, 1993), a meta-analytic software program. Each calculation of a composite effect size is accompanied by a 95% confidence interval (CI) (for additional methodological details, see Deci et al., 1999).

Results

Effects of All Rewards

Although the early discussions of extrinsic reward effects on intrinsic motivation (e.g., deCharms, 1968) tended to consider extrinsic rewards as a unitary concept, even the very first investigations of this issue differentiated the concept. Deci (1971, 1972b) distinguished between tangible rewards and verbal rewards (i.e., positive feedback), reporting that tangible rewards decreased intrinsic motivation, while verbal rewards increased it. Furthermore, Deci (1972a) differentiated task-contingent rewards from task-noncontingent rewards, finding that task-contingent rewards decreased intrinsic motivation but task-noncontingent rewards did not, and Lepper, Greene, and Nisbett (1973) distinguished between rewards that were expected and those that were unexpected, finding that expected rewards decreased intrinsic motivation but unexpected rewards did not.

Accordingly, given that different rewards and different reward contingencies seem to have different effects on intrinsic motivation, aggregating across all types of rewards meta-analytically is, in a sense, a meaningless endeavor, because the outcome will depend primarily on how many studies of each type of reward or reward contingency are included in the meta-analysis (Ryan & Deci, 1996). Nonetheless, because Cameron and Pierce (1994) calculated the effect of all rewards on intrinsic motivation in their meta-analysis, we also calculated it for comparative purposes. The effect of all types of rewards across all relevant studies revealed significant undermining for the free-choice behavioral measure of intrinsic motivation ($k = 101$; $d = -0.24$; CI = –0.29, –0.19),[1] although the overall effect for the self-report measure was not significant. These and other major results are summarized in Table 1.

As already mentioned, we expected that all rewards would not affect intrinsic motivation in a uniform way, and thus we both expected and found that the set of effects for the all-rewards category was heterogeneous. Consequently, we proceeded with more differentiated analyses of specific types of rewards, based on both theoretical and empirical considerations. We first separated studies of verbal rewards from those of tangible rewards.

TABLE 1
Major results of the meta-analysis of the effects of extrinsic rewards on free-choice intrinsic motivation and self-reported interest, shown as Cohen's composite d, *with* k *effects included*

	Free-choice behavior		Self-reported interest	
	d	*k*	*d*	*k*
All rewards	−0.24*	101	0.04	84
Verbal rewards	0.33*	21	0.31*	21[a]
College	0.43*	14[a]		
Children	0.11	7[a]		
Tangible rewards	−0.34*	92	−0.07*	70
Unexpected	0.01	9[a]	0.05	5[a]
Expected	−0.36*	92	−0.07*	69
Task noncontingent	−0.14	7[a]	0.21	5[a]
Engagement contingent	−0.40*	55	−0.15*	35[a]
College	−0.21*	12[a]		
Children	−0.43*	39[a]		
Completion contingent	−0.44*	19[a]	−0.17*	13[a]
Performance contingent	−0.28*	32	−0.01	29[a]
Maximal reward	−0.15*	18[a]		
Not maximum reward	−0.88*	6[a]		
Positive feedback control	−0.20*	10[a]		
Negative feedback control	−0.03	3[a]		

[a] These categories were not further differentiated and are homogeneous. Some of the studies used to determine the overall composite effect size (i.e., for all rewards) in each meta-analysis had multiple reward conditions, so the sums of the numbers of effect sizes in the most differentiated categories of each meta-analysis are greater than the numbers in the all-rewards category. There were 150 effect sizes in the most differentiated categories for the free-choice analyses, of which 6 were removed as outliers, and there were 114 effect sizes in the most differentiated categories of the self-report analyses, of which 6 were removed as outliers.
* Significant at $p < .05$ or greater.

Verbal Rewards (Positive Feedback)

We first tested the CET prediction that, on average, verbal rewards would enhance intrinsic motivation. Twenty-one studies examined the effects of verbal rewards on free-choice intrinsic motivation, and 21 examined its effects on self-reports of interest. Results indicated that verbal rewards enhanced intrinsic motivation: for the behavioral measure, $d = 0.33$ (CI = 0.18, 0.43), and for self-reports, $d = 0.31$ (CI = 0.19, 0.44).

However, there are two important caveats to this general finding. First, because the set of effect sizes for verbal-reward effects on free-choice behavior was heterogeneous, we inspected the studies to determine whether there was any obvious pattern in the results. We noticed that the effects of verbal rewards on schoolchildren appeared to be different from the effects on college students, so we conducted separate analyses for schoolchildren and college students. It turned out that verbal rewards enhanced free-choice intrinsic motivation for college students ($k = 14$; $d = 0.43$; CI = 0.27, 0.58) but not for children ($k = 7$; $d = 0.11$; CI = −0.11, 0.34), a point that is very important when thinking about educational practices.

Second, CET has emphasized that although positive feedback can enhance intrinsic motivation, it can actually undermine intrinsic motivation if it is administered with a controlling interpersonal style. Five studies examined the administration of verbal rewards with an informational versus controlling interpersonal style, so we did a supplemental analysis of these studies. The results indicated, as hypothesized, that although informationally administered verbal rewards enhanced intrinsic motivation ($d = 0.66$; CI = 0.28, 1.03), controllingly administered verbal rewards undermined intrinsic motivation ($d = -0.44$; CI = −0.82, −0.07).

To summarize, research indicates that verbal rewards (i.e., positive feedback) tend to have an enhancing effect on intrinsic motivation; however, verbal rewards are less likely to have a positive effect for children than for older individuals. Furthermore, verbal rewards can even have a negative effect on intrinsic motivation if the interpersonal context within which they are administered is controlling rather than informational.

Tangible Rewards

Next, we tested the CET prediction that, overall, tangible rewards (including material rewards, such as money and prizes, and symbolic rewards, such as trophies and good player awards) would decrease intrinsic motivation, because tangible rewards are frequently used to persuade people to do things they would not otherwise do, that is, to control their behavior. The meta-analysis included 92 tangible reward studies with a free-choice measure and 70 with a self-report measure. As predicted by CET, results indicated that, on average, tangible rewards significantly undermined both free-choice intrinsic motivation ($d = -.34$; CI = −0.39, −0.28) and self-reported interest ($d = -0.07$; CI = −0.13, −0.01). Of course, we have regularly argued that a full understanding of the effects of tangible rewards requires a consideration of additional factors such as reward contingency and interpersonal context, but these results do highlight the general risks associated with the use of tangible rewards as a motivator.

Because age effects had emerged for verbal rewards, we also compared the effects of tangible rewards in studies of children versus college students. This revealed that even though tangible rewards significantly undermined intrinsic motivation for both groups, the undermining effect was significantly greater for children than for college students on both behavioral and self-report measures of intrinsic motivation. The real-world implications of this pattern of results are extremely important. There is great concern about children's motivation for schoolwork, as well as for other behaviors such as sports, art, and prosocial activities, and a study conducted by Boggiano, Barrett, Weiher, McClelland, and Lusk (1987) indicated that adults tend to view salient extrinsic rewards as an effective motivational strategy for promoting these behaviors in children. However, the age-effect analyses indicate that, although tangible rewards may control immediate behaviors, they have negative consequences for subsequent interest, persistence, and preference for challenge, especially for children. In summary, the age effects that emerged from our meta-analysis indicate that tangible rewards have a more negative effect on children than on college students and that verbal rewards have a less positive effect on children than on college students.

Unexpected Rewards and Task-Noncontingent Rewards

We next tested the CET prediction that unexpected rewards would not be detrimental to intrinsic motivation, whereas expected rewards would. The reasoning was that if people are not doing a task in order to get a reward, they are not likely to experience their task behavior as being controlled by the reward. The meta-analysis supported the hypothesis. Nine studies of free-choice behavior revealed no undermining ($d = 0.01$; CI = –0.20, 0.22), and five studies of self-reported interest revealed similar results ($d = 0.05$; CI = –0.19, 0.29).

In contrast, analyses of expected rewards did yield undermining for both free-choice behavior ($k = 92$; $d = -0.36$; CI = –0.42, –0.30) and self-reported interest ($k = 69$; $d = -0.07$; CI = –0.13, –0.01). It is interesting in this regard to note that verbal rewards are generally unexpected, and that may be one of the reasons they do not typically have a negative effect on intrinsic motivation.

According to CET, rewards not requiring task engagement should be unlikely to affect intrinsic motivation for the task because the rewards are not given for doing the task. Although relatively few studies of task-noncontingent rewards have been done, the meta-analysis revealed no evidence that these rewards significantly affected either measure of intrinsic motivation ($k = 7$; $d = -0.14$; CI = –0.39, 0.11, for free-choice behavior and $k = 5$; $d = 0.21$; CI = –0.08, 0.50, for self-reported interest).

Engagement-Contingent Rewards

Engagement-contingent rewards are offered explicitly for engaging in an activity. When children were told they would get a good player award for working on an art activity (Lepper et al., 1973), the reward was engagement contingent. Similarly, when college students were told they would receive a reward if they performed a hidden-figures activity, the reward was engagement contingent (Ryan et al., 1983). In neither case was there a performance requirement: Participants did not have to finish the task or do well on it; they simply had to work on it. More studies have used engagement-contingent rewards than any other reward contingency, and that is particularly true for studies of children. Results of the meta-analyses confirmed that engagement-contingent rewards significantly diminished intrinsic motivation measured in both ways ($k = 55$; $d = -0.40$; CI = −0.48, −0.32, for free-choice and $k = 35$; $d = -0.15$; CI = −0.25, −0.06, for self-reports). Furthermore, the undermining on the free-choice measure, while significant for both children and college students, was significantly stronger for children than for college students. The strength of the undermining on self-reports did not differ for the two groups.

Completion-Contingent Rewards

The first study of reward effects on intrinsic motivation in humans (Deci, 1971) employed completion-contingent rewards. In it, participants were offered $1 for each of four puzzles they completed within a specified amount of time. As already mentioned, the pressure associated with the completion-contingent rewards was greater than that associated with engagement-contingent rewards, but we expected this to be offset somewhat by the implicit competence affirmation provided by the reward. Overall, we predicted an undermining effect for this category of rewards comparable to that for engagement-contingent rewards (Ryan et al., 1983).

Twenty studies examined completion-contingent reward effects on free-choice behavior, and 15 examined effects on self-reports. Analyses revealed that completion-contingent rewards significantly undermined intrinsic motivation for both dependent measures. Because the effects for these rewards on free-choice behavior were heterogeneous and there were no age effects, we had to remove one outlier to achieve homogeneity. With the outlier removed, the results were as follows: $k = 19$; $d = -0.44$; CI = −0.59, −0.30. For self-reports, the effects were also heterogeneous, and again there were no age effects; thus, we had to remove two outliers. With these outliers removed, we also found significant undermining by the completion-contingent rewards ($k = 13$; $d = -0.17$; CI = −0.33, −0.00, for self-reports).[2] As expected, the effects of engagement-contingent and completion-contingent rewards were virtually identical.

Task-Contingent Rewards

In the first taxonomy of reward contingencies, Ryan et al. (1983) included task-contingent rewards, and Cameron and Pierce included the category in their meta-analysis. Because the task-contingent reward category is simply the aggregate of engagement-contingent rewards and completion-contingent rewards, this category is redundant. However, for comparative purposes, we mention it here. Task-contingent rewards undermined intrinsic motivation assessed with both measures ($k = 74$; $d = -0.39$; CI = −0.46, −0.32, for free choice and $k = 48$; $d = -0.12$; CI = −0.20, −0.04, for self-reports). Again, the undermining tended to be worse for children.

Performance-Contingent Rewards

From the standpoint of CET, performance-contingent rewards are the most interesting type of tangible rewards. Performance-contingent rewards were defined by Ryan et al. (1983) as rewards given explicitly for doing well at a task or for performing up to a specified standard. Examples of performance-contingency studies include the Ryan et al. study, in which all participants in the performance-contingent-rewards condition received $3 for "having done well at the activity," and the Harackiewicz, Manderlink, and Sansone (1984) study, in which participants received a reward because they were said to have performed better than 80% of other participants.

According to CET, performance-contingent rewards have the potential to affect intrinsic motivation in two ways, one quite positive and one quite negative. Performance-contingent rewards can maintain or enhance intrinsic motivation if the receiver of the reward interprets it informationally, as an affirmation of competence. Yet, because performance-contingent rewards are often used as a vehicle to control not only what the person does but how well he or she does it, such rewards can easily be experienced as very controlling, thus undermining intrinsic motivation. According to CET, it is the relative salience of the informational versus controlling aspects of performance-contingent rewards which determines their ultimate effect on intrinsic motivation.

In most experiments examining performance-contingent rewards, all participants receive rewards as if they had done very well (which, of course, does not happen in the real world). Therefore, these studies do not address the effects of receiving only partial rewards or no rewards under performance contingencies, a circumstance that is more common in the real world and would undoubtedly diminish both perceived competence and perceived self-determination and accordingly have a very negative effect on intrinsic motivation. There can thus be little doubt that research on the effects of performance-contingent rewards markedly underestimates the negative effects of this type of reward, since it has focused largely on people who succeed at the contingency. In contrast, a real-world contingency in which only those achieving above the 80th percentile receive a reward, if veridically applied, would mean that 80% of participants would end up getting no reward and, implicitly, receiving negative competence feedback.

The meta-analyses for the overall effects of performance-contingent rewards included 32 studies with a free-choice measure and 30 with a self-report measure. Performance-contingent rewards significantly undermined free-choice behavior ($d = -0.28$, CI = -0.38, -0.18), whereas results for the self-report studies were not significant. We did not do further analyses of studies with the self-report measure because the set of effects was homogeneous with only one outlier removed. However, the effects for the free-choice measure were quite heterogeneous. Consequently, we separated the effects into four categories based on the following two considerations.

First, different studies of performance-contingent rewards have used different control groups; specifically, some have used control groups in which participants received neither rewards nor feedback, whereas others have used control groups in which participants received no rewards but did receive the same feedback conveyed by the rewards to the participants who received rewards. In this latter instance, for example, if the rewards were given for doing better than 80% of the participants, participants in a no-reward control group that received feedback would have been told that they did better than 80% of the participants.

To examine the *combined* effects of performance-contingent rewards and the feedback inherent within them, one would compare the rewards condition with a no-rewards, no-feedback condition. On the other hand, to examine the effects of the rewards per se, independent of the feedback conveyed by them, one would compare the rewards group with a no-rewards group that received comparable feedback.

Second, although the definition of performance-contingent rewards used in the majority of studies involves giving rewards to all participants as if they had performed well, some studies gave rewards in a way that conveyed to some or all of the participants that they had not performed well. These participants got less than the maximum available rewards, thus indicating that their competence was not optimal. For example, in a study conducted by Rosenfield, Folger, and Adelman (1980) that involved a feedback control group, rewarded participants got a small reward for performing in the bottom 15% of all participants, and the corresponding control group received the comparable "negative" feedback without the reward. Clearly, this and other such studies are quite different from the more typical studies of performance-contingent rewards in which all participants receive the same maximum reward for having done well.

Studies involving different types of control groups and different levels of performance were aggregated without comment by Cameron and Pierce (1994). In our meta-analysis, however, because performance-contingent reward effects were not homogeneous, we examined four categories of performance-contingent rewards rather than simply discarding outliers as Cameron and Pierce had done. The four categories were as follows: effects involving no-feedback control groups in which everyone received the maximum possible rewards, effects involving no-feedback control groups in which all participants did not receive the maximum possible rewards, effects involving comparable-feedback control groups in which all participants received positive feedback, and effects involving comparable-feedback control groups in which all participants received negative feedback.

With the free-choice measure, for studies that compared no-feedback control groups and participants who received the maximum possible rewards, there was significant undermining ($k = 18$; $d = -0.15$; CI = –0.31, –0.00).[2] For studies with no-feedback control groups in which all participants did not receive the maximum possible rewards, there was also significant undermining ($k = 6$; $d = -0.88$; CI = –1.12, –0.65). The same was true for studies with comparable-feedback control groups in which everyone received positive feedback ($k = 10$; $d = -0.20$; CI = –0.37, –0.03). However, for the three studies with comparable-feedback control groups in which participants received negative feedback, there was not a significant effect for reward versus no reward.

The group in which at least some participants got less than the maximum possible rewards and the control group received no feedback stands out and deserves special mention. This represents the type of performance-contingent rewards that one would typically find in the real world, in that here rewards are a direct function of performance. Those who perform best get the largest rewards, and those who perform less well get smaller rewards or no rewards. The analysis showed that this type of reward had the largest undermining effect of any category used in the entire meta-analysis ($d = -0.88$), indicating clearly that rewarding people as a direct function of performance runs a very serious risk of negatively affecting their intrinsic motivation.

Summary of the Primary Analyses

To summarize the primary findings from the meta-analyses, when free-choice behavior was used as the dependent measure, all rewards, all tangible rewards, all expected rewards, engagement-contingent rewards, completion-contingent rewards, task-contingent rewards, and performance-contingent rewards significantly undermined intrinsic motivation. Only verbal rewards enhanced intrinsic motivation in general, but verbal rewards did undermine intrinsic motivation if they were given with a controlling interpersonal style. The undermining of intrinsic motivation by tangible rewards was worse for children than for college students, and the enhancement by verbal rewards was weaker for children than for college students. The most damaging reward contingency was the commonly used one of performance-contingent rewards in which not all participants receive maximum rewards.

When self-reported interest served as the dependent measure, all tangible rewards, all expected rewards, engagement-contingent rewards, completion-contingent rewards, and task-contingent rewards significantly undermined intrinsic motivation. Verbal rewards enhanced self-reported interest.

Supplemental Analyses

To further clarify the limiting conditions and moderator effects of rewards, we performed two supplemental analyses. First, to determine whether the undermining of intrinsic motivation is simply a transitory phenomenon, we examined the effects of tangible rewards on the free-choice behavior of children, dividing the studies into three groups: those for which intrinsic motivation was assessed immediately after the reward was terminated, those for which it was assessed a few days later, and those for which it was assessed at least a week later. Analyses indicated that timing of the dependent measure did not affect the results. For all three groups, the composite effect sizes were between –0.40 and –0.53, all statistically significant. If anything, the undermining was strongest in the studies in which the measure was taken at least a week after the rewards were given.

Second, although our primary meta-analyses included only studies for which the target activity was initially interesting, whereas Cameron and Pierce collapsed across interesting and dull tasks without analyzing task effects, we conducted a set of analyses to consider this issue empirically. In our first analysis, we included data from the dull-task conditions and repeated the overall meta-analysis. For the free-choice analyses, every undermining effect that had appeared when only initially interesting tasks were included also appeared after the dull-task conditions were added in; for the self-report analyses, all except one of the effects that had indicated significant undermining when only interesting tasks were used were again significant when the dull-task conditions were included. The one exception for self-report studies was that the inclusion of the dull-task data led the undermining of self-reported interest in the completion-contingent condition to drop to nonsignificance.

In our second analysis, we examined the 13 studies that had included both interesting and dull tasks, assessing the effects of tangible rewards separately for interesting and dull tasks. For the 11 studies with a free-choice measure, results indicated a large undermining by rewards in the interesting-task conditions ($d = -0.68$; CI = –0.89, –0.47) but not in the dull-task conditions ($d = 0.18$; CI = –0.03, 0.39). For 5 studies with self-reports, there was also significant undermining with the interesting task ($d = -0.37$; CI = –0.67, –0.07) but not the dull task ($d = 0.10$; CI = –0.09, 0.40).

In summary, it is clear that rewards do not undermine people's intrinsic motivation for dull tasks because there is little or no intrinsic motivation to be undermined. But neither do rewards enhance intrinsic motivation for such tasks. From our perspective (see, e.g., Ryan & Deci, 2000; Ryan & Stiller, 1991), the issue of promoting self-regulation of uninteresting activities is addressed with the concept of internalization rather than reward effects on intrinsic motivation. In other words, if a task is dull and boring, the issue is not whether the rewards will lead people to find the task intrinsically interesting because rewards do not add interest value to the task itself. Rather, the issue is how to facilitate people's understanding the importance of the activity to themselves and thus internalizing its regulation so they will be self-motivated to perform it.

Summary and Conclusions

To summarize, results of the meta-analysis make clear that the undermining of intrinsic motivation by tangible rewards is indeed a significant issue. Whereas verbal rewards tended to enhance intrinsic motivation (although not for children and not when the rewards were given controllingly) and neither unexpected tangible rewards nor task-noncontingent tangible rewards affected intrinsic motivation, expected tangible rewards did significantly and substantially undermine intrinsic motivation, and this effect was quite robust. Furthermore, the undermining was especially strong for children. Tangible rewards—both material rewards, such as pizza parties for reading books, and symbolic rewards, such as good student awards—are widely advocated by many educators and are used in many classrooms, yet the evidence suggests that these rewards tend to undermine intrinsic motivation for the rewarded activity. Because the undermining of intrinsic motivation by tangible rewards was especially strong for school-aged children, and because studies have linked intrinsic motivation to high-quality learning and adjustment (e.g., Benware & Deci, 1984; Ryan & Grolnick, 1986), the findings from this meta-analysis are of particular import for primary and secondary school educators.

Specifically, the results indicate that, rather than focusing on rewards for motivating students' learning, it is important to focus more on how to facilitate intrinsic motivation, for example, by beginning from the students' perspective to develop more interesting learning activities, to provide more choice, and to ensure that tasks are optimally challenging (e.g., Cordova & Lepper, 1996; Deci, Schwartz, et al., 1981; Harter, 1974; Reeve, Bolt, & Cai, 1999; Ryan & Grolnick, 1986; Zuckerman, Porac, Lathin, Smith, & Deci, 1978). In these ways, we will be more able to facilitate the type of motivation that has been found to promote creative task engagement (Amabile, 1982), cognitive flexibility (McGraw & McCullers, 1979), and conceptual understanding of learning activities (Benware & Deci, 1984; Grolnick & Ryan, 1987).

The results of the meta-analysis also provided strong support for CET. Specifically, the predictions made by CET, based on an analysis of whether reward types and reward contingencies are likely to be experienced as informational or controlling, were uniformly supported and were particularly strong for the behavioral measure. Thus, although Cameron and Pierce argued that CET should be abandoned and stated that there is no reason for teachers to resist using rewards in the classroom, it is clear that CET provides an excellent account of reward effects and that there is, in fact, good reason for teachers to think carefully about when and how to use rewards in the classroom.

Appendix

A list of each study used in our meta-analyses. A (D) indicates an unpublished dissertation. The second column indicates types of rewards and/or reward contingencies, followed by whether participants were children or undergraduates, followed by whether the dependent measure was free-choice behavior or self reported interest. (Codes appear in Notes to the Appendix.) Finally, we explain whether our treatment of the study and results differed from Cameron and Pierce's. If a study was coded the same, the same control groups were used in the comparisons, and the effect sizes we reported did not differ from the effect sizes Cameron and Pierce reported by more than 0.10 in either direction, we noted that the study was the same in the two meta-analyses. If there was a difference, we explained what it was.

Table 1a
Studies used in our meta-analyses compared with Cameron and Pierce (1994)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
Amabile et al., 1986, Exp. 1	*E*, 1, *F*, *S*	Same.[1]
Amabile et al., 1986, Exp. 3	*E*, 2, *S*	Same.
Anderson et al., 1976	*V*, *E*, 1, *F*	This had multiple no-reward control groups. We selected the one recommended as appropriate by the study's authors and comparable to ones used for other studies in this meta-analysis. C. & P.[2] used a control group that the authors said was inappropriate, in which the experimenter avoided eye contact with the young children and ignored their attempts to interact, even though there were just the two people in the room. The study's authors said that this condition was uncomfortable, even painful, for both the children and experimenter. Not surprisingly, that group showed free-choice intrinsic motivation that was considerably lower than any other group.
Anderson & Rodin, 1989	*V*, 2, *S*	Nearly the same.[3] Both meta-analyses treated the composite dependent variable as self-report.
Arkes, 1979	*C*, 2, *F*, *S*	Same.
Arnold, 1976	*E*, 2, *S*	Same.
Arnold, 1985	*E*, *C*, 2, *S*	Same.
Bartelme, 1983 (D)	*P*, 2, *S*	Excluded, type I.[4]
Blanck et al., 1984, Exp. 1	*V*, 2, *F*, *S*	Same for free-choice; nearly the same for self-report.
Blanck et al., 1984, Exp. 2	*V*, 2, *F*, *S*	Excluded, type II.[5]
Boggiano & Ruble, 1979	*E*, *P*, 1, *F*	Excluded, type II.
Boggiano et al., 1982	*E*, 1, *F*	Same.
Boggiano et al., 1985	*E*, *C*, *P*, 1, *F*	The study's authors crossed reward contingency with salience of reward. They referred to the two reward contingencies as task contingent and performance contingent, and C. & P. coded them that way, treating the task-contingent conditions as engagement contingent.[6] However, the salience manip-

Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		ulation in the task-contingent condition changed the contingency. In the low-salience group, rewards were given for simply working on the puzzles, which makes them engagement contingent, but in the high salience group, rewards were given for each puzzle "completed," which makes them completion contingent.
Brennan & Glover, 1980	*E*, 2, *F*	This was engagement contingent because participants got rewards if they "work with the Soma puzzle for at least 8 minutes," but C. & P. coded it task noncontingent. Further, C. & P. combine two control groups, including one that had not worked on the task for the same amount of time as the rewards group during the experimental period, but we used only the control group that had worked on the task for the same amount of time.
Brewer, 1980 (D)	*E*, *P*, 1, *F*, *S*	Excluded, type I.
Brockner & Vasta, 1981	*C*, 2, *F*, *S*	Same.
Butler, 1987	*V*, 1, *S*	Nearly the same.
Calder & Staw, 1975	*C*, *D*, 2, *S*	This study provided monetary rewards for completing a set of puzzles, thus making it completion contingent, but C. & P. coded it engagement contingent. Also, C. & P. collapsed across interesting and dull tasks.[7]
Chung, 1995	*E*, *P*, *D*, 1, *F*	Excluded, type III.[8]
Cohen, 1974 (D)	*V*, *P*, 2, *F*, *S*	Excluded, type I.
Crino & White, 1982	*V*, 2, *F*, *S*	Same.
Dafoe, 1985 (D)	*N*, *P*, 1, *F*, *S*	Excluded, type I.
Daniel & Esser, 1980	*P*, *D*, 2, *F*, *S*	In this study, participants were told "they could win up to $2 depending on how quickly they correctly assembled the puzzles." This conveyed that the rewards depended on doing well relative to a standard and not just on finishing the puzzles. Thus, we coded it performance contingent, but C. & P. coded it completion contingent. Also, C. & P. collapsed across interesting and dull tasks.
Danner & Lonky, 1981, Exp. 2	*V*, *E*, 1, *F*, *S*	Nearly the same.
Deci, 1971, Exp. 1	*C*, 2, *F*, *S*	Same.
Deci, 1971, Exp. 3	*V*, 2, *F*, *S*	Same.
Deci, 1972a	*N*, 2, *F*	Same.

continued

Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
Deci, 1972b	*V*, *C*, 2, *F*	Same.
Deci et al., 1975	*V*, 2, *F*	Excluded, type II.
DeLoach et al., 1983	*E*, 1, *F*	Same.
Dimitroff, 1984 (D)	*E*, 1, *F*, *S*	Excluded, type I.
Dollinger & Thelen, 1978	*V*, *P*, 1, *F*, *S*	This had three tangible rewards groups, a verbal rewards group, and a control group. C. & P. inappropriately collapsed across verbal and tangible rewards, and they did not use the free-choice data.
Earn, 1982	*N*, 2, *F*, *S*	Rewards were given "simply for participating in the study" which makes it task noncontingent, but C. & P. coded it engagement contingent.
Efron, 1976 (D)	*V*, *E*, *P*, 2, *S*	Excluded, type I.
Eisenstein, 1985	*U*, *C*, *D*, 1, *F*	Excluded, type II.
Enzle et al., 1991	*P*, 2, *F*	Excluded, type II.
Fabes, 1987, Exp. 1	*C*, *P*, 1, *F*	Same for the performance-contingent condition. For the other condition, participants were given rewards "when they finished" a block construction, making it completion contingent, but C. & P. coded it engagement contingent.
Fabes, 1987, Exp. 2	*C*, 1, *F*	This study used the same procedure as the completion-contingent condition in Fabes (1987, Exp. 1), making it completion contingent, but C. & P. coded it engagement completion.
Fabes et al., 1986	*E*, 1, *F*, *S*	Excluded, type II.
Fabes et al., 1988	*E*, 1, *F*, *S*	Same for free-choice, but C. & P. did not include the self-report. In this study, children selected a face ranging from frown to smile to reflect how much they enjoyed the task, a procedure that is common for obtaining self-report data from young children.
Fabes et al., 1989	*E*, 1 *F*	Excluded, type II.
Feehan & Enzle, 1991, Exp. 2	*C*, 2, *F*	Excluded, type II.
Goldstein, 1977 (D)	*V*, *C*, *P*, 1, *F*, *S*	Excluded, type I.
Goldstein, 1980 (D)	*C*, 2, *F*	Excluded, type I. This included competition conditions but we did not use those because competition has a complex effect on intrinsic motivation (Reeve & Deci, 1996).
Greene & Lepper, 1974	*U*, *E*, *P*, 1, *F*	Same for the two unexpected groups and the engagement-contingent group, but C. & P. exclude the performance-contingent group.
Griffith, 1984 (D)	*E*, *D*, 1, *F*	Excluded, type I. To be comparable to most other studies in this meta-analysis, we included only partici-

Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		pants who worked in the individual context.
Griffith et al., 1984	*C*, 1, *F*	Children were rewarded for finishing reading a passage up to the bookmark, which makes it completion contingent, but C. & P. coded it engagement contingent. (The McLoyd, 1979 study used the same instructions and C. & P. did code it completion contingent.)
Hamner & Foster, 1975	*E*, *C*, *D*, 2, *S*	Same coding for completion contingent. In engagement contingent, participants were paid "75 cents for the 20 minute task," but C. & P. coded it as task noncontingent. Also, C. & P. collapsed across interesting and dull tasks.
Harackiewicz, 1979	*V*, *E*, *P*, 1, *S*	Same for verbal rewards. Nearly the same for engagement contingent. C. & P. excluded the two performance-contingent rewards groups.
Harackiewicz & Manderlink, 1984	*P*, 1, *S*	Same.
Harackiewicz et al., 1984, Exp. 1	*P*, 2, *F*, *S*	Same.
Harackiewicz et al., 1984, Exp. 2	*U*, *P*, 2, *F*, *S*	Same coding, but C. & P. made an error in the self report effect size for performance contingent, showing it as enhancement when in fact it was undermining with a $d = -0.16$.
Harackiewicz et al., 1984, Exp. 3	*P*, 2, *F*, *S*	Same.
Harackiewicz et al., 1987	*P*, 1, *S*	Same.
Hitt et al., 1992	*E*, *D*, 2, *F*, *S*	Excluded, type III.
Hyman, 1985 (D)	*E*, *P*, 1, *F*	Excluded, type I.
Karniol & Ross, 1977	*E*, *P*, 1, *F*	Same except we coded the performance-contingent conditions for whether participants got the maximum rewards with implicit positive feedback or less than maximum rewards with implicit negative feedback.
Kast & Connor, 1988	*V*, *IC*, 1, *S*	Excluded, type II.
Koestner et al., 1987	*V*, 2, *F*, *S*	Same.
Kruglanski et al., 1971	*N*, 1, *S*	Rewards were given "because you have volunteered for this study . . ." so they were task noncontingent, but C. & P. coded them engagement contingent.
Kruglanski et al., 1972	*U*, 1, *S*	Same.
Kruglanski et al., 1975, Exp. 1	*C*, 1, *S*	Participants were rewarded either for the number of coin flips they guessed correctly or for the number of block constructions they completed correctly, making it completion contingent, but C. & P. coded it

continued

Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		performance contingent. It explored moderation by endogenous versus exogenous rewards.
Kruglanski et al., 1975, Exp. 2	*P*, 1, *S*	There were two reward groups and two control groups. In one pair, people worked on a stock market game and earned cash after each trial for good investments. The control group was the same as the experimental group except they were told they had to give back their earnings, so it was not a reasonable no-reward control group. In the other pair of conditions, money was not mentioned to the no-reward control group. We excluded the pair of conditions without a proper control group, but C. & P. collapsed across the two pairs of conditions.
Lee, 1982 (D)	*P*, 2, *F*, *S*	Excluded, type I.
Lepper et al., 1973	*U*, *E*, 1, *F*	Same coding. Same effect sizes for engagement contingent. C. & P. made an error in calculating the effect size for unexpected rewards.
Lepper et al., 1982, Exp. 3	*E*, 1, *F*	Excluded, type II.
Liberty, 1986, Exp. 1 (D)	*C*, 2, *F*, *S*	Excluded, type I.
Liberty, 1986, Exp. 2 (D)	*C*, 2, *F*, *S*	Excluded, type I.
Loveland & Olley, 1979	*E*, *D*, 1, *F*	Same coding, but C. & P. collapsed across interesting and dull tasks.
Luyten & Lens, 1981	*C*, *P*, 2, *F*, *S*	Same for performance contingent. In the other rewards condition participants were paid after each of three puzzles they solved, so it was completion contingent, but C. & P. coded it as engagement contingent.
McGraw & McCullers, 1979	*C*, 2, *S*	Same.
McLoyd, 1979	*C*, *D*, 1, *F*	Coded the same, but C. & P. collapsed across interesting and dull tasks.
Morgan, 1981, Exp. 1	*E*, 1, *F*, *S*	Same on free-choice; nearly the same on self-report.
Morgan, 1981, Exp. 2	*E*, 1, *F*, *S*	Same.
Morgan, 1983, Exp. 1	*E*, 1, *F*, *S*	Same on free-choice; nearly the same on self-report.
Morgan, 1983, Exp. 2	*E*, 1, *F*, *S*	Same.
Mynatt et al., 1978	*E*, *D*, 1, *F*	Coded the same, but C. & P. collapsed across interesting and dull tasks.
Newman & Layton, 1984	*E*, *D*, 1, *F*	Excluded, type II.
Ogilvie & Prior, 1982	*E*, 1, *F*	Same.
Okano, 1981, Exp. 1	*E*, 1, *F*, *S*	Excluded, type II.
Okano, 1981, Exp. 2	*N*, *E*, 1, *F*, *S*	Excluded, type II.
Orlick & Mosher, 1978	*V*, *U*, *P*, 1, *F*	Same coding for verbal and unexpected. In performance contingent, children got rewards "if you do a good job today and tomorrow on the balance

Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		board," but C. & P. coded it as completion contingent. There were discrepancies in the effect sizes.
Pallak et al., 1982	*V*, *U*, *P*, 1, *F*	Same for verbal and unexpected. C. & P. did not report how they coded the tangible expected rewards condition, which was performance contingent.
Patrick, 1985 (D)	*E*, *P*, 1, *F*, *S*	Excluded, type I.
Perry, et al., 1977	*E*, 1, *F*, *S*	Excluded, type II.
Picek, 1976 (D)	*E*, *P*, 2, *F*, *S*	Excluded, type I.
Pittman et al., 1977	*P*, 2, *F*, *S*	Same coding, but C. & P. used only self-report. We also used free-choice persistence, calculated as the number of trials.
Pittman et al., 1980	*V*, *IC*, 2, *F*	Same except that C. & P. did not do an analysis of informational versus controlling positive feedback.
Pittman et al., 1982, Exp. 1	*N*, *E*, 1, *F*	Same codings and nearly the same free-choice effects. C. & P. imputed a self-report value of 0.00, but participants were not asked how interesting or enjoyable they found the activity.
Pittman et al., 1982, Exp. 2	*E*, 1, *F*	Nearly the same.
Porac & Meindl, 1982	*C*, 2, *F*	C. & P. coded this engagement contingent, but participants received $1.50 for each puzzle solved. C. & P. reported a comparison for 40 experimental and 20 control participants, but there were only 50 participants in the study. We calculated the reward effect size based on a comparison of the rewarded groups with neutral and extrinsic mind sets versus the non-rewarded groups with neutral and extrinsic mind sets, because that comparison provided corresponding reward versus no-reward conditions.
Pretty & Seligman, 1984, Exp. 1	*V*, *U*, *E*, 2, *F*, *S*	Same for unexpected and engagement contingent. Nearly the same for verbal on free-choice.
Pretty & Seligman, 1984, Exp. 2	*U*, *E*, 2, *F*, *S*	Same.
Reiss & Sushinsky, 1975, Exp. 1	*E*, 1, *F*	Same.
Rosenfield et al., 1980	*P*, 2, *F*, *S*	This study had performance-contingent, completion-contingent, and task-noncontingent groups, and a control group with feedback comparable to that in performance contingent. There was no appropriate control group for completion contingent or task noncontingent. It also crossed tangible rewards with positive versus

continued

Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		negative feedback. C. & P. reported a verbal effect for positive versus negative feedback, and then they collapsed across feedback to examine tangible-reward effects. We did a moderator analysis of rewards signifying positive versus negative feedback. C. & P. listed a performance-contingent self report $d = 2.80$, but the correct d was 0.22. For free-choice, there was a modest discrepancy.
Ross, 1975, Exp. 1	*E*, 1, *F*, *S*	Same for free-choice; they did not include self-report.
Ross, 1975, Exp. 2	*E*, 1, *F*, *S*	Nearly the same for free-choice; they did not include self-report.
Ross et al., 1976	*N*, *E*, 1, *F*	Same for engagement contingent. In the other group, children were rewarded "for waiting," which is task noncontingent, but C. & P. coded it engagement contingent.
Ryan, 1982	*IC*, 2, *F*	We included this study only in the supplemental meta-analysis of Informational versus Controlling verbal rewards. C. & P. excluded it.
Ryan et al., 1983	*V*, *E*, *P*, *IC*, 2, *F*, *S*	Same on verbal and engagement contingent. There were two performance-contingent groups, one informational and one controlling. There were three no-reward control groups, one with informational positive feedback, one with controlling positive feedback, and one with no-feedback. We compared performance-contingent both to comparable-feedback controls and no-feedback controls in the moderator analyses. C. & P. did only the comparable-feedback comparisons. Also, C. & P. did not do an informational-controlling comparison.
Salancik, 1975	*P*, 2, *F*, *S*	Same coding. C. & P. collapsed across positive and negative feedback conditions, but we did a moderator analysis for positive versus negative.
Sansone, 1986	*V*, 2, *S*	Same.
Sansone, 1989	*V*, 2, *S*	Same.
Sansone et al., 1989	*V*, 2, *S*	Same.
Sarafino, 1984	*E*, 1, *F*, *S*	Same.
Shanab, 1981	*V*, 2, *F*, *S*	Same.
Shiffman-Kaufman, 1990 (D)	*E*, *P*, 1, *F*, *S*	Excluded, type I. For comparability with other studies, we used only data from the 10-day assessments.

Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
Smith, 1975 (D)	*V*, *U*, *P*, 2, *F*, *S*	Excluded, type I.
Smith, 1980 (D)	*E*, *D*, 1, *F*	Excluded, type I. In this study, there was also a condition called positive feedback, but the statements were not competence feedback.
Smith & Pittman, 1978	*P*, 2, *F*, *S*	Same for self-report. C. & P. imputed a score of 0.00 for free-choice performance, even though means and significance tests were reported.
Sorensen & Maehr, 1976	*C*, 1, *F*	Excluded, type II.
Staw et al., 1980	*C*, 2, *S*	Participants got a $1 reward for completing 15 puzzles, making it completion contingent, but C. & P. coded it engagement contingent.
Swann & Pittman, 1977, Exp. 1	*N*, *E*, 1, *F*	Same.
Swann & Pittman, 1977, Exp. 2	*E*, 1, *F*	There were two engagement-contingent groups, an engagement-contingent plus verbal-rewards group, and two no-reward control groups. There was not a control group for the engagement plus verbal group. We compared the two engagement to the two control groups, but C. & P. used all three reward groups.
Taub & Dollinger, 1975	*P*, 2, *S*	Same.
Thompson et al., 1993	*E*, 2, *F*	Excluded, type III.
Tripathi & Agarwal, 1985	*V*, *E*, 2, *F*, *S*	Nearly the same.
Tripathi & Agarwal, 1988	*E*, *P*, 2, *F*, *S*	Same for engagement contingent on free-choice. For performance contingent, there were two tasks, with free-choice data reported for only one. Both we and C. & P. used the data for the one task and assigned $d = 0.00$ for the other, but C. & P. averaged the effects whereas we combined them meta-analytically. In the self-report data, C. & P. combined the engagement and performance conditions, so it is unclear which analysis they were used in.
Vallerand, 1983	*V*, 1, *S*	Same.
Vallerand & Reid, 1984	*V*, 2, *S*	Same.
Vasta & Stirpe, 1979	*C*, 1, *F*	This study had pre-post data for a rewards group and a control group. C. & P. did pre-post analyses for the rewards group and ignored the control group. We compared the rewards group to the control group with pre-post analyses. We coded it completion contingent, but C. & P. did not code it.
Weinberg & Jackson, 1979	*P*, 2, *S*	Same.

continued

Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
Weiner, 1980	*C*, 2, *F*, *S*	Participants received $.25 for each anagram completed, which makes it completion contingent, but C. & P. coded it performance contingent.
Weiner & Mander, 1978	*E*, *P*, 2, *F*, *S*	Same.
Williams, 1980	*E*, 1, *F*, *S*	Same.
Wilson, 1978 (D)	*E*, *D*, 2, *F*, *S*	Excluded, type I.
Wimperis & Farr, 1979	*N*, *C*, 2, *S*	In one group, participants received $1.75 for being in the study, making it task noncontingent, but C. & P. coded it engagement contingent. In the other, participants "were paid for each model or subunit completed," making it completion contingent, but C. & P. coded it performance contingent.
Yuen, 1984 (D)	E, 2, *F*, *S*	Excluded, type I.
Zinser, 1982	*V*, 1, F	Same.

Note. (D) = Unpublished Dissertation; V = Verbal Rewards; U = Unexpected Tangible Rewards; N = Task-Noncontingent Rewards; E = Engagement-Contingent Rewards; C = Completion-Contingent Rewards; P = Performance-Contingent Rewards; D = Dull-Task condition included in study and used in supplemental meta-analysis; IC = Informational versus Controlling comparison was made in supplemental meta-analysis. The code of 1 means the participants were children and the code of 2 means they were undergraduates. Finally, F means that the free-choice dependent measure was used and S means that the self-report measure was used.

[1] Same means that Cameron and Pierce and we coded the study the same, used the same control groups, and found effects sizes that did not differ from each other by more that 0.10 in either direction.

[2] C. & P. refers to Cameron and Pierce.

[3] Nearly the same means the studies were coded the same and the same control groups were used, but that the effect sizes were different by more than 0.10, probably due to differences in estimation of standard deviations. If the discrepancy is large, we make note of that.

[4] "Excluded, type I" refers to dissertations, and Cameron and Pierce excluded all dissertations.

[5] "Excluded, type II" refers to studies that Cameron and Pierce excluded for no apparent reason.

[6] Cameron and Pierce (1994) did not use the term "engagement-contingent." When we say they coded a reward engagement-contingent, it means that they coded it as both "task-contingent" and what they referred to as "not contingent using a behavioral definition." Because the intersection of those two codes is equivalent to our engagement-contingent code, we say that they coded it as engagement-contingent to minimize confusion for the reader. Similarly, they did not use the term completion-contingent, but what they coded as both "task-contingent" and "contingent using a behavioral definition" is equivalent to what we call completion-contingent.

[7] These studies used both interesting and uninteresting tasks. We excluded the uninteresting tasks from the primary meta-analyses and included them in the supplemental meta-analysis concerned with initial task interest. Cameron and Pierce collapsed across the interesting and dull tasks even though it has been firmly established in the literature that initial task interest interacts with reward effects.

[8] "Excluded, type III" refers to studies that Cameron and Pierce excluded because they were published after Cameron and Pierce's cut-off date.

Notes

[1]The value *k* represents the number of effects considered in calculating a composite effect size. Because, for any given calculation, the data were aggregated across all relevant conditions within a study in order to ensure independence of effect sizes, *k* also represents

the number of studies that were included in the calculation of a composite effect size. The value *d* represents the composite effect size corrected for reliability (Hedges & Olkin, 1985). In regard to CIs, if both endpoints are on the same side of 0.00, it indicates that the mean for the reward groups is significantly different from the mean for the no-reward groups.

[2]Although one end of the CI appears to be 0.00, it was actually slightly negative and was rounded to 0.00. A significance test indicated that the composite effect size was significant.

References

Amabile, T. M. (1982). Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology, 43,* 997–1013.

Amabile, T. M., DeJong, W., & Lepper, M. R. (1976). Effects of externally imposed deadlines on subsequent intrinsic motivation. *Journal of Personality and Social Psychology, 34,* 92–98.

Benware, C., & Deci, E. L. (1984). Quality of learning with an active versus passive motivational set. *American Educational Research Journal, 21,* 755–765.

Boggiano, A. K., Barrett, M., Weiher, A. W., McClelland, G. H., & Lusk, C. M. (1987). Use of the maximal-operant principle to motivate children's intrinsic interest. *Journal of Personality and Social Psychology, 53,* 866–879.

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

Cameron, J., & Pierce, W. D. (1996). The debate about rewards and intrinsic motivation: Protests and accusations do not alter the results. *Review of Educational Research, 66,* 39–52.

Cordova, D. I., & Lepper, M. R. (1996). Intrinsic motivation and the process of learning: Beneficial effects of contextualization, personalization, and choice. *Journal of Educational Psychology, 88,* 715–730.

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

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

Deci, E. L. (1972a). Effects of contingent and non-contingent rewards and controls on intrinsic motivation. *Organizational Behavior and Human Performance, 8,* 217–229.

Deci, E. L. (1972b). Intrinsic motivation, extrinsic reinforcement, and inequity. *Journal of Personality and Social Psychology, 22,* 113–120.

Deci, E. L., Betley, G., Kahle, J., Abrams, L., & Porac, J. (1981). When trying to win: Competition and intrinsic motivation. *Personality and Social Psychology Bulletin, 7,* 79–83.

Deci, E. L., Connell, J. P., & Ryan, R. M. (1989). Self-determination in a work organization. *Journal of Applied Psychology, 74,* 580–590.

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

Deci, E. L., & Ryan, R. M. (1980). The empirical exploration of intrinsic motivational processes. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 13, pp. 39–80). New York: Academic Press.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Deci, E. L., & Ryan, R. M. (1991). A motivational approach to self: Integration in personality. In R. Dienstbier (Ed.), *Nebraska Symposium on Motivation: Vol. 38. Perspectives on motivation* (pp. 237–288). Lincoln: University of Nebraska Press.

Deci, E. L., Schwartz, A. J., Sheinman, L., & Ryan, R. M. (1981). An instrument to assess adults' orientations toward control versus autonomy with children: Reflections on intrinsic motivation and perceived competence. *Journal of Educational Psychology, 73,* 642–650.

Eisenberger, R., & Cameron, J. (1996). Detrimental effects of reward: Reality or myth? *American Psychologist, 51,* 1153–1166.

Grolnick, W. S., & Ryan, R. M. (1987). Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology, 52,* 890–898.

Harackiewicz, J. M., Manderlink, G., & Sansone, C. (1984). Rewarding pinball wizardry: The effects of evaluation on intrinsic interest. *Journal of Personality and Social Psychology, 47,* 287–300.

Harter, S. (1974). Pleasure derived by children from cognitive challenge and mastery. *Child Development, 45,* 661–669.

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. New York: Academic Press.

Johnson, B. T. (1993). *DSTAT 1.10: Software for the meta-analytic review of literatures* [Software and manual]. Hillsdale, NJ: Erlbaum.

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

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

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

McGraw, K. O., & McCullers, J. C. (1979). Evidence of a detrimental effect of extrinsic incentives on breaking a mental set. *Journal of Experimental Social Psychology, 15,* 285–294.

Mossholder, K. W. (1980). Effects of externally mediated goal setting on intrinsic motivation: A laboratory experiment. *Journal of Applied Psychology, 65,* 202–210.

Reeve, J., Bolt, E., & Cai, Y. (1999). Autonomy-supportive teachers: How they teach and motivate students. *Journal of Educational Psychology, 91,* 537–548.

Rosenfield, D., Folger, R., & Adelman, H. (1980). When rewards reflect competence: A qualification of the overjustification effect. *Journal of Personality and Social Psychology, 39,* 368–376.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43,* 450–461.

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

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

Ryan, R. M., & Grolnick, W. S. (1986). Origins and pawns in the classroom: Self-report and projective assessments of individual differences in children's perceptions. *Journal of Personality and Social Psychology, 50,* 550–558.

Ryan, R. M., & La Guardia, J. G. (1999). Achievement motivation within a pressured society: Intrinsic and extrinsic motivations to learn and the politics of school reform. In T. C. Urdan (Ed.), *Advances in motivation and achievement: The role of context* (Vol. 11, pp. 45–85). Greenwich, CT: JAI Press.

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

Ryan, R. M., & Stiller, J. (1991). The social contexts of internalization: Parent and teacher influences on autonomy, motivation and learning. In M. L. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement* (Vol. 7, pp. 115–150). Greenwich, CT: JAI Press.

Smith, W. E. (1975). *The effect of anticipated vs. unanticipated social reward on subsequent intrinsic motivation.* Unpublished doctoral dissertation, Cornell University, Ithaca, NY.

Zuckerman, M., Porac, J., Lathin, D., Smith, R., & Deci, E. L. (1978). On the importance of self-determination for intrinsically motivated behavior. *Personality and Social Psychology Bulletin, 4,* 443–446.

Authors

EDWARD L. DECI is Professor of Psychology, Department of Clinical and Social Sciences in Psychology, University of Rochester, Rochester, NY 14627; deci@psych.rochester.edu. His research examines the effects of social contexts on motivation and self-determination as they relate to effective functioning in various real-world domains.

RICHARD KOESTNER is Associate Professor of Psychology, McGill University, 1205 Dr. Penfield Avenue, Montreal, Quebec H3A 1B1, Canada; koestner@hebb.psych.mcgill.ca. He is a clinical psychologist whose research focuses on factors affecting the development and maintenance of motivation and self-regulation in personality.

RICHARD M. RYAN is Professor of Psychology, Department of Clinical and Social Sciences in Psychology, University of Rochester, Rochester, NY 14627; ryan@psych.rochester.edu. A clinical psychologist, he specializes in motivation, self-determination, and well-being, and their application to numerous areas including the impact of educational reform.