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Evidence for the negative impact of reward on self-regulated learning

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The undermining effect refers to the detrimental impact rewards can have on intrinsic motivation to engage in a behaviour. The current study tested the hypothesis that participants' self-regulated learning behaviours are susceptible to the undermining effect. Participants were assigned to learn a set of Swahili–English word pairs. Half of the participants were offered a reward for performance, and half were not offered a reward. After the initial study phase, participants were permitted to continue studying the words during a free period. The results were consistent with an undermining effect: Participants who were not offered a reward spent more time studying the words during the free period. The results suggest that rewards may negatively impact self-regulated learning behaviours and provide support for the encouragement of intrinsic motivation.

Keywords: Motivation; Undermining effect; Self-regulated learning.

Motivation is generally regarded as the underlying reason for completing a behaviour, but conceptualizations of motivation vary widely, with different theories focusing on reward, personal differences, or internal states. Often, reward outcomes are assumed to explain human behaviour, and approaches such as the incentive theory emphasize the importance of external rewards for motivating behaviour (Schmidt, Lebreton, Cléry-Melin, Daunizeu, & Pessigilone, 2012). For example, Schmidt et al. (2012) examined effort for mental and physical tasks and found that monetary incentives correlated positively with subjects’ increased exertion and preparation for both types of tasks. These results support common anecdotal accounts that individuals work harder if they are paid more or if they are being graded. Offering individuals incentives for higher performance could have obvious advantages for improvement in several contexts, including the classroom. However, many tasks are pursued only for personal fulfilment, due to intrinsic motivation, in the absence of external incentives. Emphasizing external rewards and performance outcomes may inhibit individuals’ motivation to complete a behaviour for personal satisfaction, a phenomenon known as motivational undermining (Deci, 1971).

Motivation and rewards

Common frameworks for motivation (e.g., Deci, 1971) distinguish between intrinsic motivation (i.e., inherent, self-gratifying interest) and extrinsic motivation (i.e., rewards). As intrinsic motivation
for an activity increases one is more likely to independently devote time to that task. However, intrinsic motivation is susceptible to environmental influences (Deci, 1971; Deci, Koestner, & Ryan, 1999). For example, when a task is completed in exchange for external rewards, dependence on external motivation increases, and intrinsic motivation decreases. This finding has been termed the undermining effect, in that extrinsic reward serves to undermine the strength of intrinsic motivation.

The undermining effect is commonly demonstrated through a free-choice paradigm (Deci et al., 1999) in which subjects can choose whether to engage in an experimental task or spend their time in other ways. Participants in a reward condition are compared with a no-reward condition that acts as a control. In an initial phase, the reward group is provided with an incentive to participate in a task; in the second phase (free-choice period) the reward is removed, and the frequency and duration of task engagement is observed and compared with the no-reward group. The amount of time spent engaging in the experimental task during the free-choice period is commonly used as a measure of intrinsic motivation. For example, Lepper, Greene, and Nisbett (1973) provided children in a preschool classroom with a drawing station and observed how long children spontaneously chose to use the materials. The children who chose to draw were later selected to participate in the same task one-on-one with an experimenter. The experimenter offered half of the students the possibility of earning a “Good Player Award”, while the others believed they were simply volunteering to help the researcher. When given the opportunity to resume normal play, children who had engaged in drawing to earn an award spent less time drawing relative to students volunteering their time. Several decades of research have subsequently demonstrated that, across a variety of tasks, removing rewards significantly reduces the time spent on a task relative to groups that did not receive any external incentive (see Deci et al., 1999, for a review). In addition, several lines of research indicate that the more rewards rely on performance completion or final outcomes, the more severely they risk decreasing, or undermining, internal motivation (Deci, Koestner, & Ryan, 2001).

Importantly, the type of reward offered may moderate the degree of undermining observed based on the degree to which performance predicts the distribution of reward (Deci et al., 1999). For instance, in task-noncontingent scenarios, individuals are rewarded for simply being present during a task, and neither accurately completing the task nor finishing the task is required for payment. Such non-contingent scenarios lead to the lowest degree of undermining because pressure to participate in the task is limited, and no feedback is provided about performance (Cameron & Pierce, 1994). In contrast, performance-contingent rewards risk the greatest impact on internal motivation but also have the most beneficial effect on effortful behaviour overall. Participants are only provided with a reward if performance is at, or above, a set criterion (e.g., students receiving points for correct answers). If this feedback is negative and critical (e.g., receiving a low grade on a test reflects ability rather than effort), then it increases the likelihood of undermining intrinsic reward. For example, when performance-contingent rewards are implemented in a classroom setting, students may shift their focus to performing well and away from fully comprehending the material (Elliott & Dweck, 1988). If performance feedback is informative and positive, then it increases the chances of participants experiencing positive effects of increased motivation, such as increased self-efficacy. Deci et al. (1999) posited that increasing environmental control negatively affects internal motivation, and argued that internal motivation encourages improvement and leads to self-sufficiency. In a learning context, decreased intrinsic motivation to explore or improve may result in less overall practice and experience and, consequently, less learning.

**Rewards and learning**

Several lines of evidence indicate that external rewards may affect the level of effort but, counter to popular belief, have little impact on learning. For example, Nilsson (1987) examined the
influence of monetary incentives on memory for a list of words. Participants were informed either just prior to study, or just prior to a test, that individuals who remembered the most words would receive the equivalent of $10 (i.e., 100 Swedish K). The two monetary reward groups did not differ in performance relative to a control condition without a monetary reward. Similarly, Kang and Pashler (2014) offered participants a monetary incentive as they studied a list of words. They observed that even relatively large amounts of money did not improve performance relative to low or no monetary incentives (see also Craik & Tulving, 1975, Experiment 10; Ngaosuvan & Mäntylä, 2005, for similar findings). Instead, Kang and Pashler’s results suggest that learning was most sensitive to the strategy employed and the amount of exposure to study material rather than the reward offered.

A few studies have reported a small benefit of reward on memory performance. Murayama and Kuhbandner (2011) had participants in a reward and control group answer difficult trivia questions and rate their interest for each question. Participants completed an immediate test and an additional surprise test a week later. A small advantage was evident for the reward group relative to the control group; however, this benefit was limited to less interesting items that were tested at a delay.

In summary, studies examining the impact of reward motivation on memory indicate that it has minimally positive benefits, if any, on memory performance. This contradicts the intuition that increased effort and motivation should enhance learning. Why would a reward have little influence on learning? One candidate explanation is that learning is more likely to reflect the efficacy of the processes engaged at encoding rather than the amount of effort or time devoted to learning (Craik & Lockhart, 1972), and that increased effort alone will not be helpful in the absence of an effective strategy (Kang & Pashler, 2014). For example, Nilsson’s (1987) participants self-reported engaging in much greater effort when offered a reward than those in the control condition, but they did not ultimately perform better. Thus, incentives appear to increase participants’ self-reported effort on task even when those efforts are not fruitful.

However, we are not aware of any prior studies that have examined changes in independent learning behaviours elicted by the presence of reward or that allowed participants to change their study strategies in response to rewards. This is important, as most learning is self-regulated and guided by the learner. Indeed, as Kornell and Bjork (2007) emphasized, “Self-regulated study involves, in the main, decisions students make while they study on their own, away from a teacher’s guiding hand.” (p. 219). Accordingly, the motivation for the current study was to examine the impact of a reward on self-regulated learning behaviours in a manner that goes beyond prospective or retrospective self-reports. The current design allowed us to explore whether participants experienced decreased task motivation in the presence of a performance-contingent reward.

**The current study**

The goal of the current study was to examine the degree to which a manipulation of motivation influences learning behaviours in an undermining paradigm. Participants learned Swahili–English word pairs and were divided into externally rewarded and non-rewarded groups. Before viewing the words, the reward group was informed of an incentive contingent on performance. Specifically, if they scored high enough on a test, they would be entered into a drawing for a gift card. Following the test, and after performance incentives were removed, a free-choice paradigm was used to measure how often subjects in both groups engaged in re-studying during a break. If the presence of external rewards affects overall motivation to study, participants in the reward group should engage in longer study times than participants in the non-reward group. Conversely, if removing an external reward undermines motivation, the reward group should exhibit shorter study times than the non-reward group, demonstrating an undermining effect on learning behaviours. Given that reward often has little influence on memory (e.g., Nilsson, 1987), we also anticipated...
that the reward group and non-reward group would not differ on performance on the cued recall test.

EXPERIMENTAL STUDY

Method

Subjects
Participants were 118 undergraduate students recruited from the Psychology Department’s research pool at Colorado State University, who received class credit in exchange for participation. Participants were randomly assigned to the reward group (n = 58) or the non-reward group (n = 60).

Materials
Participants in each group studied 26 Swahili–English word pairs selected from a corpus developed by Nelson and Dunlosky (1994). The corpus includes normative ratings for each pair for learning difficulty, likelihood of remembering, and how closely the Swahili words matched their English counterpart. Word pairs were selected to be of a range of difficulty levels (.25 to .60). All procedures were conducted using MatLab (MathWorks Inc., 2010).

Procedure
During the first phase of the experiment, all participants studied a list of 26 word pairs presented in a random order for 3 s each. Participants were instructed to learn as many words as possible in anticipation of a memory test. Participants in the reward group were additionally informed that if they answered at least 4 items correctly, they would be entered into a draw at the end of the semester for a $10 Amazon gift card.

Following the study phase, participants completed a brief distractor task for 90 s, recalling as many cities or states in the United States as possible. Participants were then given a cued recall test for half (13) of the studied words. Specifically, they were provided with a sheet of paper that contained 13 Swahili words and were instructed to recall the English translation for each. Once finished, participants were informed of their score, and the reward group was told whether or not they had qualified for the draw.

After the test, the experimenter left the room for 5 min under the guise of preparing another computer programme for the second half of their task. Participants were informed that, until the experimenter returned, they had the option to read available magazines, wait for the experimenter to return, or to continue studying the words. Unknown to the participants, the amount of time they spent studying the words was recorded by the computer programme. Once the experimenter returned, participants were moved to another room to complete a second, irrelevant task.

Results

If an undermining effect was present, participants in the reward group should spend less time studying the words during the free-choice period than participants in the non-reward group (see Figure 1). A one-way ANOVA confirmed that mean study times for the non-reward (M = 182 s, SD = 74) group reliably exceeded those for the reward group (M = 140 s, SD = 74), F(1,116) = 7.8, MSE = 6764.5, p = .008, η² = .06. Thus, individuals in the reward group demonstrated an undermining effect.

We also examined the proportion difficulty level of words and reward condition. Those data showed that recall did not differ between participants offered a reward (M = .22, SD = .14) compared with those in the non-reward condition (M = .21,
SD = .14), $F < 1$. A 2 (Reward: reward, non-reward) × 3 (Item Difficulty: low, medium, high) ANOVA indicated that easier words were significantly more likely to be recalled than medium and difficult words, $F(2, 348) = 92$, $MSE = .85$, $p < .001$, $\eta^2 = .35$. However, difficulty did not interact with reward group, $F(1, 348) = 1.48$, $MSE = .85$, $p = .23$, $\eta^2 = .008$. Thus, the incentive offered did not influence retention but did influence subsequent study time.

**Discussion**

Previous work suggests that providing an external reward often fails to enhance memory (e.g., Nilsson, 1987). Our results were consistent with this finding, as a performance-contingent reward had no impact on retention relative to an unrewarded control group. More importantly, prior research does not address whether reward motivation impacts other behaviours, such as the choice to engage in additional learning. Research on the undermining effect has broadly shown that rewards decrease intrinsic motivation to perform a task (Deci et al., 1999). Our results are consistent with accounts of undermining as rewards offered in exchange for test performance decreased motivation to continue to study that material. Specifically, participants offered a reward for better performance chose to study less during their free time than participants not offered a reward.

These results suggest that an important consideration for using motivation to enhance learning is not only its effects on immediate performance but also its effects on continued engagement. Although previous research has demonstrated that rewards offer few benefits for short-term memory performance that does not mean that rewards have no long-term consequences. Our results suggest a more enduring consequence of using performance-contingent rewards, namely that individuals may be less likely to engage in additional learning when given the freedom to do so.

For educators this should be disconcerting. A great deal of research in psychology and education is concerned with improving student learning outcomes. Much of this research has focused on how students typically regulate their own study habits (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Kornell & Bjork, 2007; Son & Metcalfe, 2000). The emphasis on self-regulation is especially important because there is often a disconnect between students’ beliefs regarding effective study strategies and the likelihood that they use optimal study strategies to facilitate learning. For instance, students frequently self-report highlighting text and “cramming” for exams because these strategies allow them to easily interact with the material while quickly increasing feelings of mastery (e.g., Hartwig & Dunlosky, 2012; Kornell & Bjork, 2007; Morehead, Rhodes, & DeLozier, 2015), despite these being relatively ineffective strategies relative to more elaborate and effortful techniques (see Dunlosky et al., 2013, for a review). However, in typical educational settings, most studying occurs outside the supervision of instructors and is thus self-regulated; instructing students as to the most effective study techniques will offer little benefit if they are unwilling to apply them. Therefore, it is imperative that students are sufficiently engaged and motivated to learn independently.

**REFERENCES**


