The Journal of Experimental Education

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/vjxe20

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Published online: 11 May 2012.


To link to this article: http://dx.doi.org/10.1080/00220973.2011.602372

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MOTIVATION AND SOCIAL PROCESSES

Effects of Cooperative Versus Individual Study on Learning and Motivation After Reward-Removal

David A. Sears and Hui-Hua Pai
Purdue University

Rewards are frequently used in classrooms and recommended as a key component of well-researched methods of cooperative learning (e.g., Slavin, 1995). While many studies of cooperative learning find beneficial effects of rewards, many studies of individuals find negative effects (e.g., Deci, Koestner, & Ryan, 1999; Lepper, 1988). This may be because the effects of reward-removal are not typically assessed in studies of cooperative learning whereas they typically are in studies of individuals. Alternatively, rewards and their removal might function differently for groups than individuals. The present study tested the hypothesis that groups would show less detrimental effects of reward-removal than individuals. Results showed a significant interaction where dyads increased their performance after reward-removal, while individuals showed a decrease on difficult transfer questions.

Keywords cooperative learning, motivation, reward, reward-removal, transfer

Rewards are an integral scaffold of well-researched methods of cooperative learning (Slavin, 1995). Group rewards given based on individual performances are known to increase individuals’ learning and are thought to do so by motivating them to share knowledge (Johnson & Johnson, 2009; Slavin, 1996). In the absence of external scaffolds, such as group rewards, cooperative learning shows little educational benefit (Slavin, 1996). In cases where it shows benefits to learning despite lacking external scaffolds, it is often on tasks that involve going beyond taught procedures and rote memorization (Barron, 2000b; Cohen, 1994; Phelps & Damon, 1989; Sears, 2006). When people work alone, by contrast, rewards can undermine intrinsic motivation and result in less learning and lower level cognitive strategies that persist even after reward-removal (Deci, Koestner, & Ryan, 1999, 2001; Lepper, 1988; McGraw, 1978). This raises two questions: (a) Do rewards and their removal function differently for groups versus individuals...
and (b) Do their effects vary as a function of the type of understanding being assessed (e.g., rote memorization versus conceptual understanding)?

Much of what we know about the effects of rewards and reward-removal on learning and motivation comes from studies of individuals. Much of the work on cooperative learning has not examined what happens to group or individual performance after reward-removal (see O’Donnell, 1996, for a notable exception). A concern that educators often raise about using rewards to support effective cooperative learning is whether such supports will translate to the real world (Antil, Jenkins, Wayne, & Vadas, 1998; Deci et al., 2001; Kohn, 1991; Skinner, Williams, & Neddenriep, 2004). Conducting research at the intersection of motivation and cooperative learning presents an opportunity to address these concerns while also refining our theories in both domains: (a) by isolating the effects of social interaction on motivation and (b) by deepening our understanding of when and why cooperative learning offers outcomes distinct from individual study.

The present study addresses the question of whether rewards and their removal might function differently for groups than individuals. Building on self-determination theory (Deci & Ryan, 1985, 2002), we suggest that the social nature of cooperation may add an orthogonal dimension to learning situations that can lead to distinct outcomes for groups compared with individuals. Specifically, we address the hypothesis that reward-removal may prove less deleterious to group learning and motivation than to individual learning and motivation because productive interaction patterns may persist even in the face of a decline in individual task-related interest. We next examine literature from cooperative learning and motivation research before moving to a more detailed overview of the experiment.

COOPERATIVE LEARNING

Studying together does not guarantee increased learning. When people work together some of their attention must be devoted to the task and some to the social interaction. Efforts at coordinating activities may or may not pay off (Barron, 2003). For example, social loafing is a well-known phenomenon whereby group members work less diligently in a group than if they had worked alone because they expect others to take up the slack (Latané, Williams, & Harkins, 1979). Working together can also interfere with generating one’s own cognitive connections to a topic because some time is spent listening to a partner’s ideas. For example, high status students or those who more strongly demand the attention of their peers may dominate the discussion in groups and reduce the chance their partners will share knowledge effectively (Barron, 2000a; Cohen, 1994). A number of studies have found no benefit of studying together on rote memorization tasks (e.g., Phelps & Damon, 1989; Wright & Klump, 2004).

Despite these potential problems, cooperative learning is one of the most widely used instructional strategies in education in part because of the perception that two heads are better than one and in part because much research has shown ways in which it can be implemented effectively (Antil et al., 1998; Johnson & Johnson, 2009; O’Donnell, 2006; Slavin, 1996). For example, scripts, prompts, and roles have been used to promote the type of cognitive activities thought to underlie successful learning, such as question-asking, knowledge-checking, and explaining (Coleman, 1998; King, 1999; O’Donnell, 1999; Webb, 1982, 2009). Training in social skills and academic skills has also been used to prepare students for the dual demands (i.e., social and academic)
of cooperative learning (e.g., Gillies, 2002; Gillies & Ashman, 1998). Other approaches have focused on the task itself as a means of shaping the interaction and ensuring that each student has a way to contribute, such as by requiring task specialization in jigsaw methods (Blaney, Stephan, Rosenfield, Aronson, & Sikes, 1977; Cohen, 1994; Sears, 2006; Steiner, 1972).

Underlying many of these approaches is a common theme: interdependence. Interdependence means that the success of the individual and the group are dependent on one another. When individuals’ successes contribute to the group’s success, positive interdependence is established (Johnson & Johnson, 1999, 2009; Slavin, 1980). One of the most extensively studied and successful scaffolds of cooperative learning promotes positive interdependence by providing group rewards based upon individual test scores (Slavin, 1996). As an example, if the combined average of each group member’s test score is higher than their previous average, then the group members may each receive a certificate of achievement (Slavin, 1995). The idea is that with the right balance of motivation toward the task and the group, students will balance their degree of social interaction and task interaction to learn the material themselves while helping their peers learn it too. They do this, at least in part, because the desired reward depends on their improvement and the improvement of their partners. It is important to note that this approach has strong empirical support. In a review of 99 studies, Slavin (1995) found that when individual accountability and group rewards were used, cooperative learning produced an effect size of .32. When either factor was absent, cooperative learning had little effect (effect size of .07 in each case).

Simply stated, rewards have been a key factor in the success of cooperative learning for learning and for social relations. For example, students in cooperative learning groups that were supported with group rewards on the basis of individual achievement reported more cross-group friendships than did those in control classrooms, including across race (Slavin & Cooper, 1999) and across academic achievement level (Stevens & Slavin, 1995). Some of the noted effects even persisted after a year, suggesting that benefits of productive collaboration can generalize beyond the task itself and may have particularly long-lasting effect on social relations.

While cooperative learning without the support of group rewards often yields little educational benefit, it is important to consider the cases where it does. Many of the cases that have shown benefits of cooperative learning without the use of group rewards have involved assessments of deep understanding. For example, Sears (2006) found that college students who worked in pairs on a statistics lesson that included a discovery-learning component outperformed individuals on measures of transfer while showing similar levels of performance on basic calculations. Phelps and Damon (1989) found little benefit of cooperative learning for simple rote memorization tasks and potential benefit on complex tasks. These studies and others (e.g., Barron, 2000b; Cohen, 1994) provide initial evidence that in the absence or rewards cooperative learning may not benefit low-level learning compared with individual study but can still promote deep understanding and transfer. For these reasons, measures of different levels of understanding were included in the present study.

**EXTRINSIC REWARDS AND INTRINSIC MOTIVATION**

Using rewards to support learning has raised concerns with researchers and practitioners (Antil et al., 1998; Deci & Ryan, 2002; Kohn, 1991). This is due, at least in part, to work conducted in the field of motivation. Rewards constitute a form of extrinsic motivation, an inducement that
comes from a source other than the interaction between the task itself and the person engaging in it (Deci & Ryan, 1985; Lepper, 1988; Ryan & Deci, 2000). While extrinsic motivators may be temporarily effective, they can undermine future motivation and performance (Deci et al., 1999; Lepper & Greene, 1978). How can we reconcile this finding with the generally positive findings from the field of cooperative learning regarding effects of rewards? One possibility is that effects of rewards differ for individuals versus groups. Another is simply methodological. Studies in the field of motivation tend to include measures of task engagement while rewards are available and after they are no longer available (Ryan & Deci, 2000), whereas the cooperative learning research tends to focus on the former only. It is important to note that motivation research has shown that once the reward is no longer available, interest and performance often decline (Deci et al., 1999; Lepper & Greene, 1978). If rewards function similarly for individuals working alone versus in groups, then we would expect to see a similar level of decline in group motivation and performance after reward-removal.

Central to why rewards are believed to undermine individuals’ motivation and performance is intrinsic motivation. Intrinsic motivation refers to motivation to engage in an activity for its own sake (Deci & Ryan, 1985, 2002; Lepper, 1988; Schunk, Pintrich, & Meece, 2008). It is positively related to achievement, perceptions of competence, and learning (Gottfried, 1990). In terms of education, it is considered important because it helps individuals enjoy what they are doing, spend more time practicing, and thereby improve (Deci & Ryan, 1985). Furthermore, level of intrinsic motivation predicts future achievement even when past performance is accounted for (Meece, Wigfield, & Eccles, 1990). It is also positively associated with optimal learning strategies and deeper conceptual understanding (Grolnick & Ryan, 1987; Lepper, 1988; McGraw, 1978; Nolen, 1988).

The effect of rewards on intrinsic motivation depends on multiple factors. Lepper and Greene (1978) found that extrinsic reward given for working at an interesting task was detrimental to intrinsic motivation. When the reward is salient, the activity becomes a means to an end and subsequent intrinsic motivation and performance can be diminished (Lepper, 1988; Ross, 1975; Ryan & Deci, 2000). However, rewards do not always undermine intrinsic motivation. In a review of 96 studies, Cameron and Pierce (1994) concluded that rewards did not undermine intrinsic motivation unless tangible rewards were given simply for doing a task without regard to level of performance. One explanation for these findings is derived from cognitive evaluation theory. According to Ryan and Deci (2000), rewards have two aspects: one controlling and one informational. When people believe that they act in order to earn reward, the reward is viewed as a control of their behavior and people attribute the reason for their action to something outside of themselves. In contrast, when reward is linked to performance or progress, people place the causality of behavior inside themselves. These performance-contingent rewards offer student autonomy, rather than being controlling. Thus, reward can be used effectively without undermining (and potentially even increasing) intrinsic motivation, at least when a task is not already interesting (Cameron and Pierce, 1996; Ryan & Deci, 2000).

MERGING COOPERATIVE LEARNING AND MOTIVATION RESEARCH

An important question about rewards is whether their effects generalize from individualistic contexts to cooperative contexts. From a theoretical perspective, it may be a mistake to expect
cooperative learning to function similarly to individual learning in terms of effects of rewards and their removal because cooperation adds an additional dimension to the process—a social dimension. Self-determination theory posits that autonomy, competence, and relatedness are fundamental elements of motivation (Ryan & Deci, 2000). Relatedness, the need to feel a sense of belonging or connectedness with others, is particularly relevant to cooperative learning (while autonomy and competence are relevant to both groups and individuals). In a recent study, Hänze and Berger (2007) found that students in cooperative learning groups reported significantly higher autonomy, competence, and relatedness than peers in traditional classrooms.

If the relatedness dimension of motivation functions independently or interactively with the other two dimensions, this could explain potential differences in individuals’ motivation when working alone versus cooperatively. For example, in a cooperative learning context, even if a task by itself is optimally challenging, how much to interact and whether to raise questions about one’s own knowledge or one’s partner’s knowledge may be unclear. Given this situation, cooperative groups may find the task daunting or unpleasant whereas individuals may find the task interesting or enjoyable. The reverse is also possible, such that the opportunity to work with a peer may prove motivating for an otherwise dull task. Recent work at the intersection of cooperative learning and motivation reflects the importance of the relatedness dimension to students’ perceptions of group work. Hijzen, Boekaerts, and Vedder (2006) found that high school students’ ratings of peer social and emotional supports and sense of belonging were significantly correlated with ratings of the quality of their cooperative learning experiences.

How do rewards, often recommended for successful cooperation, interact with this relatedness dimension? They appear to support it, at least while the rewards are in place. We know from research on cooperative learning that group rewards when combined with individual accountability tend to produce significant gains in learning and friendships (Slavin, 1996; Slavin & Cooper, 1999; Stevens & Slavin, 1995). One possible reason for these effects stems from social interaction often being an ill-defined process. For a novel task, how much to cooperate and in what fashion is often unclear. When certain interactions could threaten someone’s sense of autonomy or competence, less productive alternatives may be sought. By explicitly rewarding knowledge-sharing, questions about how and how much to cooperate may be answered. For example, when group rewards are at stake, it may seem less embarrassing or impinging to express misunderstanding or to challenge a peer’s perspective because ultimately such actions are in the interest of the group. Being able to help one’s team succeed should also promote a greater sense of control (autonomy) and relatedness and thus increase intrinsic motivation and performance. Likewise, processes that undermine productive cooperation, such as social loafing (Latané et al., 1979), should be averted. This suggests that (group) rewards may promote productive patterns of social interaction—in addition to any effects they might have on individuals working alone (positive or negative). Thus, by adding a social dimension, cooperative learning could theoretically yield distinct results for learning and motivation compared with individual learning. For individuals, rewards may affect level of effort and cognitive strategies on a task but for groups it could do that and affect social interactions.

The empirical evidence for the effects of rewards on groups versus individuals is scant. While many studies of individuals have examined the effects of rewards and their removal on learning and motivation, few studies of cooperative learning have examined the effects of reward-removal. A notable exception is O’Donnell’s (1996) study of group performance under conditions of reward-removal.
and scripted interactions. O’Donnell (1996) examined the effect of group rewards plus individual accountability on scripted versus unscripted cooperative learning. She found that rewards showed a significant benefit for motivation and learning. Most relevant here is that her third study included two phases—a first in which rewards were available, and a second that occurred one week later in which rewards were not explicitly offered. In the second phase, O’Donnell found a significant main effect of reward on a free-recall task. Participants who had been offered a reward in the first phase significantly outperformed the never-rewarded participants in the second phase. At least two possible explanations for these results exist. First, reward may have promoted greater knowledge sharing and group cohesiveness in the first phase and carried over to the second phase. Second, participants may have thought a reward was still available and thus continued to work together more effectively than those who were never offered reward. The first explanation, that reward promotes productive group interactions that persist after reward-removal, forms the central hypothesis for the present study.

STUDY OVERVIEW

The present study examines the effects of reward and reward-removal in cooperative versus individualistic contexts on motivation and three levels of learning: (a) factual recall, (b) comprehension, and (c) transfer. Factual recall provides a measure of low-level learning while comprehension and transfer represent deeper understanding because they involve interpreting and applying what one has learned (Bloom, 1956). Benefits of cooperation for learning may be greatest for deep understanding (Phelps & Damon, 1989; Sears, 2006). Whereas some studies of rewards have found that they yield similar benefits to individuals regardless of question type (Lysakowski & Walberg, 1981), other research has shown that extrinsic incentives, such as rewards, may undermine deep understanding while promoting rote learning (Grolnick & Ryan, 1987; McGraw, 1978; Nolen, 1988).

The study took place in a lab setting with undergraduates who had little or no training in reading music, an activity that might be considered intrinsically interesting. Participants worked alone or in pairs to learn how to read music in a first phase and how to read rhythm in a second phase. They took a posttest (individually) at the end of each phase that consisted of factual recall questions, comprehension questions, and difficult transfer questions. Half of the participants were told of a reward that was contingent upon their (group) performance in Phase 1. At the start of Phase 2, participants in the reward conditions were told that no additional reward was available for that phase. The overarching research question and key hypotheses follow:

Research Question: Do rewards and their removal affect participants’ learning and motivation differently depending on whether they study alone versus in groups?

Hypothesis 1: Groups and individuals will both benefit from rewards, at least on measures of low-level learning.

Hypothesis 2: In the absence of rewards, groups will outperform individuals on measures of deep understanding.
Hypothesis 3: Compared to individuals, groups will show less negative effects of reward-removal on learning and motivation. Measures of deep understanding are expected to be most sensitive to these differences.

METHOD

Participants

Forty undergraduates (25 men, 15 women) at a large public university, responded to flyers advertising modest compensation for participation in a study of music learning that required volunteers between 18 and 25 years of age with little or no background in reading music. They were assigned to one of four conditions \( (n = 10 \text{ per condition}) \) split by two factors: reward (yes or no) and grouping (individual vs. dyad). Assignment to the reward/no-reward conditions was random. Assignment to dyadic or individual conditions was based on participant availability, with the stipulation that members within each dyad were not friends and were the same gender. Seven men and 3 women participated in the individual-reward condition; 6 men and 4 women participated in the three remaining conditions.

Design

The experiment followed a \( 2 \times 2 \times 2 \) design. Grouping (individual vs. dyad) and reward (reward vs. no reward) were between-subjects independent variables. Phase (Phase 1 and Phase 2) was a within-subjects independent variable. The dependent variables consisted of performance on the posttests and ratings of motivation.

Materials

Learning activities

The learning activities for each phase of the experiment consisted of music lessons presented in PowerPoint. The PowerPoint presentation for the first phase consisted of 14 slides about melody (e.g., note names, scales, clefs). The presentation for the second phase consisted of 16 slides about rhythm (e.g., note duration, time signature). Most slides in the presentations included facts to be learned, and the remainder included links to music activities or examples on the internet (such as ear-training exercises or songs that exemplified a concept).

Learning measures

The posttest at the end of each phase consisted of a music reading test and a rhythm test, respectively. Both tests involved six musical phrases; each phrase contained 9 to 25 musical notes or rests to identify. From these six musical phrases, three types of questions were asked: (a) factual recall, (b) comprehension, and (c) transfer. The musical phrases used in the first phase were different from those used in the second phase.
Recall

The recall questions asked participants to write in the names of the notes in a musical phrase (or their durations, for the rhythm posttest). A total of 48 notes from the first four musical phrases comprised the recall questions for the first posttest. A total of 68 notes and rests from four other musical phrases comprised the recall questions for the second posttest. Each note or rest for the recall questions were scored as correct or incorrect. Percentage correct was calculated for each of the four phrases, and these scores were averaged to obtain an overall percentage correct score on the recall questions at each phase. This approach was taken so that phrases with more notes would not be weighted more heavily in the recall score than phrases with fewer notes.

Comprehension

The two comprehension questions required participants to name the tune for two of the first four musical phrases. These questions required participants to imagine hearing the notes they saw in order to recognize the song. In other words, they went beyond simply naming notes and assessed whether participants could experience the notes as music. The comprehension questions were scored as either correct or incorrect and then averaged.

Transfer

The fifth and sixth musical phrases on each posttest comprised the transfer items and were designed in preparation for future learning (PFL) fashion (Bransford & Schwartz, 1999). The first of these two phrases involved listening to a recording while also seeing a written version of what was played. The written version had some notes missing. The participants’ task was to listen to the music and try to fill-in the missing notes. This is a difficult musical activity known as dictation. By having only a few notes missing from the musical phrase, this first PFL item served as a resource or practice problem—to introduce participants to dictation. The second PFL item consisted of a blank musical staff on which participants were to dictate the sixth musical phrase. This was the target transfer item, so called because it was meant to assess what participants were prepared to do after learning about dictation from the resource item. The target transfer question consisted of 16 notes on the first posttest and 18 notes or rests on the second posttest. The scoring of these items is described in the results section. Figure 1 shows sample materials from the study. As can be seen from these materials, many of the practices in learning to read music are similar to learning in other domains where names and symbols must be associated and remembered.

Motivation measures

The motivation measures utilized 7-point Likert scale items.

Intrinsic motivation

We assessed intrinsic motivation using paper-and-pencil surveys given at the end of each posttest. The surveys consisted of five questions modified from the Intrinsic Motivation Inventory (Deci & Ryan, 2009; Ryan, 1982). The questions contained statements such as “How much did
you enjoy the activity?” that participants rated on a 7-point Likert scale ranging from 1 (strongly disliked it) to 7 (strongly liked it).

**Preference for cooperation**

Following the intrinsic motivation survey was a question that asked participants to rate, on a 7-point Likert scale ranging from 1 (strongly prefer alone) to 7 (strongly prefer together), how much they would prefer to work alone versus with a partner on the given music activity.

**Effort**

We assessed effort during each learning phase with questions reported on a 7-point Likert scale ranging from 1 (very little) to 7 (very much). The first question asked how much effort the participant gave during the melody phase. The second asked the same question about the rhythm phase. These two questions were located at the end of the intrinsic motivation survey that was given after the final posttest. This was done to avoid potential test sensitization confounds (such as seeing a question about effort in Phase 1 and thus trying harder during Phase 2).

**Video recording**

A video camera recorded participants’ interactions for future qualitative analyses (only for participants who consented to being recorded). In addition, the amount of time participants spent...
studying at each phase was recorded to serve as a covariate in the analyses of learning and motivation.

Procedures

In the first phase, participants were given up to 30 min to study the lesson on melody (alone or in dyads) and then 15 min to take the posttest (individually). At the start of this phase, participants in the reward conditions were informed that they could earn US$5 if they (their group) scored (averaged) 75% correct or higher on the posttest. In this way, interdependence and individual accountability was established for the dyad-reward condition. Participants in the nonreward conditions were not told about the 5 dollar reward. After studying the material, participants took the music reading posttest and intrinsic motivation survey individually.

In the second phase, the same procedure was implemented but with a different lesson and posttest (rhythm). Participants stayed in the same condition to which they were originally assigned: individual-reward, individual-no-reward, dyad-reward, and dyad-no-reward. The key difference between the two phases was the removal of reward. Participants in the reward conditions were informed at the start of the second phase that no reward was available for their performance on the second posttest. At the completion of the second phase, all participants were compensated for their time.

RESULTS

Reliability and Validity of the Posttests

The posttests were scored on a percentage correct basis so that items could be easily averaged by item type. On the recall items, each of the four musical phrases had multiple notes that required naming. If participants correctly named 8 notes out of 10 for a given musical phrase, they would receive 80% correct on that phrase. Their score on the recall items would be the average percent correct across all four musical phrases. The two comprehension items were simply scored as correct or incorrect. The practice transfer problem was designed to introduce the topic of dictation rather than to assess it, so it was not part of the posttest score.

Scoring the target transfer items involved matching an expert version of the dictation to the participants’ attempts and giving credit for correct matches. For the target transfer problem involving melody, participants were scored for showing matching musical intervals. For the target transfer problem involving rhythm, participants were scored for showing matching note and rest durations. Unlike the other problems, which could simply be scored as correct or incorrect, these problems involved making judgments in the matching process (e.g., to avoid “off-by-one” mistakes if a participant left one note out of their dictation). Thus, inter-rater reliability was checked for these items. Each author independently scored the target transfer problems. The total scores were highly correlated: \( r = .97 \) and .84 for the melody and rhythm target transfer problems, respectively.

Participants struggled with the comprehension (song identification) items and this may have been simply because they had not been exposed to those songs previously. This possibility, along with a floor effect (\( M = 10.6\% \) correct), prompted their elimination from further analysis.
With the comprehension items removed, the posttests were found to be internally consistent, $\alpha = .80$ for Posttest 1 and .79 for Posttest 2. The five intrinsic motivation questions and the effort question were averaged to comprise the motivation measure for each phase of the study. The motivation measure was internally consistent, $\alpha = .87$ and .86 for the first and second phases, respectively. A multivariate analysis of variance (MANOVA) compared responses to the preference for cooperation questions and revealed no significant differences between conditions. This suggests that the nature of the learning activities were not biased toward one condition over another.

**Phase 1**

A multivariate analysis of variance tested the hypothesis that rewards would increase motivation and learning. Grouping (individual vs. dyad) and reward (reward vs. no reward) served as independent variables. Scores on recall, transfer, and motivation served as dependent variables. Study time served as a covariate. As expected, reward caused significant differences between conditions, Wilks’ $\lambda = .75$, $F(3, 33) = 3.70$, $p = .02$, $\eta^2_p = .25$. These differences were the result of the reward conditions scoring significantly higher on two of the three dependent measures than the no-reward conditions. On recall, the reward conditions scored significantly higher than the no-reward conditions, $F(1, 35) = 4.43$, $p = .04$, $\eta^2 = .10$. On transfer, no significant differences of reward were found, $F(1, 35) = .03$, $p = .86$, $\eta^2 = .00$. On motivation, the reward conditions scored significantly higher than the no-reward conditions, $F(1, 35) = 7.04$, $p = .01$, $\eta^2 = .17$. No significant differences on the overall set of measures were found for grouping or the interaction term (Grouping × Reward). Table 1 shows means and standard deviations of each condition on each measure.

**Phase 2**

A multivariate analysis of variance tested the hypothesis that in the absence of rewards, dyads would show greater transfer than individuals would. Similar to the Phase 1 analysis, grouping (individual vs. dyad) and reward (reward vs. no reward) served as independent variables. Scores on recall, transfer, and motivation served as the dependent variables. Study time served as a covariate. As expected, results indicated a significant difference between Grouping conditions, Wilks’ $\lambda = .75$, $F(3, 33) = 3.60$, $p = .02$, $\eta^2_p = .25$. These differences were the result of the dyad conditions scoring significantly higher on transfer than the individual conditions, $F(1, 35) = 8.33$, $p = .01$.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Transfer</th>
<th></th>
<th>Recall</th>
<th></th>
<th>Motivation (1–7)</th>
</tr>
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<tr>
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<td>No reward</td>
<td>Reward</td>
<td>No reward</td>
<td>Reward</td>
<td>No reward</td>
</tr>
<tr>
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<td>59%</td>
<td>$M$ 62%</td>
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<tr>
<td></td>
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<td>$SD$ 32%</td>
<td>22%</td>
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</tr>
<tr>
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<td>$M$ 35%</td>
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<td>1.1</td>
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</table>
p = .01, \eta^2 = .18. No significant differences between dyads and individuals were found on the recall or motivation measures. No significant differences on the overall set of measures were found for reward or the interaction term (Grouping × Reward). Table 2 shows means and standard deviations of each condition on each measure. Because Phase 1 results indicated no differences between dyads versus individuals whereas Phase 2 (after reward-removal) revealed significantly greater performance for dyads than individuals on the transfer items, it appears that dyads and individuals reacted differently to reward-removal. To test this directly, a repeated-measures analysis of variance compared transfer performance of the dyads versus individuals in the reward condition from Phase 1 to Phase 2. The analysis revealed a significant Phase × Grouping interaction, Wilks’ λ = .74, F(1, 18) = 6.48, p = .02, \eta^2 = .24. As expected, the individual condition showed more negative effect of reward-removal than the dyad condition. The individual condition showed a drop in scores from Phase 1 (M ± SD: 59% ± 37%) to Phase 2 (26% ± 26%). The dyad condition did not simply mitigate the decrease in scores; it showed an increase in scores from Phase 1 (36% ± 36%) to Phase 2 (42% ± 23%).

1 To test whether this interaction could be explained by changes in study time for the two reward conditions, changes in study time from Phase 1 to Phase 2 was entered as a covariate in the repeated-measures analysis. The Phase × Grouping interaction seen previously was no longer significant, Wilks’ λ = .84, F(1, 17) = 3.26, p = .09, \eta^2 = .12. The reward-dyads (15.4 ± 2.3 min) spent significantly longer studying than the reward-individuals (10.8 ± 3.9 min) in Phase 2, t(13)^2 = 2.42, p = .03, d = 1.32. Such was not the case in Phase 1, t(13) = 2.09, p = .06, d = 1.15. Thus, although the reward-individuals and reward-dyads reported similar levels of motivation for the task in Phase 2, their behaviors suggested a different story. After being informed of reward-removal, individuals spent significantly less time studying than dyads and showed a drop in performance on the difficult transfer items while the dyads showed an increase.

**DISCUSSION**

This study examined why research in the fields of cooperative learning and motivation report conflicting results for the effects of rewards. Rewards for cooperative groups, when paired with individual accountability, promote learning and motivation (e.g., Slavin, 1996; Slavin & Cooper, 1999). However, studies of cooperative learning typically do not evaluate performance

<table>
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<tr>
<th>Condition</th>
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<th></th>
<th>Recall</th>
<th></th>
<th>Motivation (1–7)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No reward</td>
<td>Reward</td>
<td>No reward</td>
<td>Reward</td>
<td>No reward</td>
<td>Reward</td>
</tr>
<tr>
<td>Individual (n = 10)</td>
<td>M</td>
<td>28%</td>
<td>26%</td>
<td>68%</td>
<td>75%</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>26%</td>
<td>26%</td>
<td>31%</td>
<td>31%</td>
<td>0.9</td>
</tr>
<tr>
<td>Dyad (n = 10)</td>
<td>M</td>
<td>46%</td>
<td>42%</td>
<td>61%</td>
<td>60%</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>20%</td>
<td>23%</td>
<td>33%</td>
<td>34%</td>
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</tr>
</tbody>
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after rewards are removed. By contrast, in the field of motivation, many studies reveal negative consequences of rewards for performance and motivation, especially after their removal (Deci et al., 1999; Lepper & Greene, 1978). A primary goal of the current work was to disambiguate whether this paradoxical effect of rewards was simply the result of the noted methodological differences or whether social interaction yields distinct consequences of rewards for learning and motivation. To address this issue, undergraduates studied, in one of four conditions, a novel and potentially inherently interesting topic: learning to read music. Participants were randomly assigned to a reward or nonreward condition. Half of the participants worked alone while the other half worked in pairs. In the first phase, reward-condition participants were told of a reward that was contingent upon their performance. For dyads, the reward was explained to be contingent on their combined individual performances. In this way, positive interdependence, which is recommended for effective cooperative learning (Johnson & Johnson, 2009; Slavin, 1996), was established. In the second phase, the reward-condition participants were told that no reward was available for that phase.

The key finding of the present study was that the effects of reward on self-perceptions of motivation were similar for groups and individuals whereas the effects on behaviors were different—cooperative groups mitigated negative effects of reward-removal on transfer. These results suggest that the different findings from the fields of cooperative learning and motivation are not simply attributable to methodological differences. Social interaction seems to affect how rewards impact learners. We subsequently discuss the results at each phase of the experiment and consider how social interaction could yield such distinctive outcomes.

In the first phase, reward was associated with significantly higher performance on factual recall items and higher ratings of motivation. Study time did not account for these differences. These results suggest that the reward did not just affect the magnitude of studying; it likely altered how participants studied or what material they focused on.

In the second phase, after participants in the reward conditions were told that the reward contingency was no longer in place, dyads significantly outperformed individuals on the target transfer items. Taken alone, this result adds to the growing evidence that one of the key contributions of (nonrewarded) cooperation to learning is its ability to promote transfer (Barron, 2000b; Cohen, 1994; Phelps & Damon, 1989; Sears, 2006). Given that this result was obtained after removal of the reward contingency, it may be tempting at first to think that reward-removal caused dyads and individuals to return to baseline levels of performance because they performed similarly to their nonreward peers. This return-to-baseline interpretation would match the pattern of participants’ own ratings of motivation, where the reward conditions reported significantly higher levels of motivation in the first phase, but returned to approximately the same levels as the nonreward conditions in the second phase.

However, a closer look comparing results across Phase 1 and Phase 2 shows that reward-removal produced different results for individuals and dyads. The transfer scores for the individual condition decreased when the reward was removed, while those for the dyad condition increased, a significant interaction effect. This finding is in line with our hypothesis that social bonds or positive patterns of group interaction may help mitigate negative effects of reward-removal on learning for dyads. Additional support for this hypothesis comes from participants’ study times after the reward contingency was withdrawn. Dyads in the reward condition spent significantly more time studying than individuals in the reward condition during Phase 2 (after reward-removal) but not during Phase 1.
Taken together, these results present a complex picture of the effects of rewards on individuals’ versus dyads’ learning and motivation. Dyads and individuals both perceived the effects of rewards similarly, as shown by their ratings of motivation. In terms of learning, however, studying cooperatively seems to have mitigated the negative effects of reward-removal on transfer. Differences between dyads and individuals in degree of persistence after reward-removal (i.e., study time) appears to explain this result. Dyads in the reward condition studied significantly more than their individual counterparts after the reward contingency was removed.

Because cooperative interaction appears to affect how rewards affect learners, additional questions for the fields of motivation and cooperative learning arise. Relatively few studies of cooperative learning have examined effects of reward-removal on motivation and learning. It is important to see if the findings here replicate on other tasks and with different sized cooperative groups (Moreland, 2010; Williams, 2010). If so, then some of the concerns regarding negative effects of rewards for cooperative learning could be rejected, and teachers could have greater confidence in the use of rewards for productive group-learning outcomes. Such work would need to include assessments of different levels of understanding because without the assessment of transfer in the present study, the different effects of rewards on individuals versus groups would not have been found.

In the field of motivation, relatively few studies explicitly compare the effects of rewards on individuals versus groups, yet such studies may provide important opportunities to weigh components of motivation in relation to each other. For example, because ratings of motivation were similar for individuals and dyads who were offered reward, self-perceptions of the effects of rewards may be determined in large part by components of motivation that apply equally to individuals and dyads. Learning behaviors, by contrast, appear to be dominated by components of motivation that differ for individuals versus dyads. Future work can examine whether motivational components such as competence, autonomy, and relatedness can explain these similarities and differences for individuals versus groups. One might expect that a sense of competence and autonomy would apply equally in cooperative versus individualistic contexts and direct our self-perceptions of motivation. Relatedness, a dimension one would expect to be affected by cooperative interaction (Hänze & Berger, 2007), may be a key motivator of behavior but less of an influence on self-perceptions, as suggested by the results of this study. If so, this dimension may be central to explaining cases where individual behaviors and motives are incongruent. Deci and Ryan (2002) noted this as a key area needing further theoretical explanation, saying, “people may identify with certain values that are quite inconsistent with other aspects of their sense of self, leading them to compartmentalize these identifications” (p. 437). The results here suggest that relatedness may be a key explanatory factor, and methodologically, the cooperative versus individual contexts may be a fruitful framework for examining such phenomena.

AUTHOR NOTES

David A. Sears is an assistant professor of educational psychology. Much of his research examines the intersection of cooperative learning and the transfer of learning. Hui-Hua Pai is a doctoral student in educational psychology. Her research interests include the effect of social and motivational factors on learning and transfer.
ACKNOWLEDGMENTS

This work was supported by Purdue Research Foundation (PRF) grants (#8000023719 and #8000029878). Any opinions, findings, and conclusions or recommendations expressed in this work are those of the authors and do not necessarily reflect the views of the Purdue Research Foundation or Purdue University. The authors are grateful to Helen Patrick and the reviewers of this work for their helpful feedback.

NOTES

1. A pretest was not included in this study because of threats of test sensitization. This interaction and the general change in pattern of results from Phase 1 to Phase 2 mitigates concerns about selection threats that could occur from random assignment of 40 participants to four conditions.

2. The degrees of freedom are lower in this analysis than the others because study times were recorded while half of the participants worked together in dyads.

REFERENCES


Williams, K. D. (2010). Dyads can be groups (and often are). *Small Group Research, 41*, 268–274.