

## Original Communication

# The Effect of Reward Interdependence on Cooperation and Information-Sharing Intentions

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Incentives are central to the reinforcement of behavior. In the context of group work, it is important to distinguish between individual and collective incentives as rewards. High reward interdependence should constitute an incentive for cooperation among group members (e.g., collective vs. individual financial rewards), but experimental studies provide no support for this assumption, whereas some field studies found an increase in information exchange and team productivity. In the two experimental studies presented here ( $N_1 = 46$ ,  $N_2 = 28$ ), high reward interdependence resulted in a higher willingness to share information with and to help other group members, stronger responses to the poor quality of others' work, higher preference for a group layout, and less withdrawal as a response to the reluctant commitment of others. The findings suggest that high reward interdependence can indeed act as an incentive for cooperative behavior and information sharing in an experimental setting as well.

**Keywords:** reward interdependence, cooperation, helping behavior, information sharing, group work

In the work context, the importance of team work has been increasing continuously over the past years. At the same time, information and knowledge have become primary resources and central criteria for the successful functioning of organizations in both the private and public sectors (Davenport & Prusak, 1998). Both developments led to increasing demands on group work, as organizations realized that cooperative behavior and information sharing among organizational members need to be enhanced and supported to be successful (Lawler, 2000; Rynes, Gerhart, & Parks, 2005; Thompson, Levine, & Messick, 1999). Thus, there is a great interest in the factors that facilitate effective team work and information sharing (Eby & Dobbins, 1997; Jones & Jordan, 1998; Ng & Van Dyne, 2005). Incentives are central to the reinforcement of behavior (Honeywell-Johnson & Dickinson, 1999). In the context of group work, the distinction between individual and collective incentives is important, which is why reward interdependence has drawn the attention of researchers interested in group effectiveness. It is generally assumed that high reward interdependence constitutes an incentive for cooperation among group members. Interestingly, experimental studies on the effect of reward interdependence provide no support for this assumption, whereas in some field studies reward interdependence was associated with an increase in information

exchange, team productivity, and other related variables. It is therefore the aim of the studies presented here to further our understanding of the causal relation between reward interdependence and the motivation to cooperate and share information in an experimental setting.

Empirical research has identified different types of interdependence as being important for cooperation and information sharing. Wageman (2001) has differentiated between two types of structural interdependence, namely, task and outcome interdependence. Task interdependence refers to the necessity to work together to complete the task, whereas outcome interdependence is characterized by the degree to which outcomes of the work are dependent on the performance of all group members. One important type of outcome interdependence that can be used to characterize teams is reward interdependence. Reward interdependence is defined by Wageman (2001) as the extent to which the reward of an individual group member depends on the performance of other group members. It is assumed that high reward interdependence constitutes an incentive for cooperation and helping behavior among group members (Wageman & Baker, 1997). Fan and Gruenfeld (1998) argued that high reward interdependence creates a sense of common fate and, hence, should increase the motivation to cooperate.

Several researchers have investigated the effects of different types of rewards on cooperation and effectiveness of groups (for reviews see Miller & Hamblin, 1963; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Cotton & Cook, 1982; DeMatteo, Eby, & Sundstrom, 1998; Honeywell-Johnson & Dickinson, 1999; Rynes et al., 2005). In one of the most recent reviews on team-based rewards, DeMatteo et al. examined laboratory and field studies on reward interdependence that were conducted between 1985 and 1997. In summary, these studies provided mixed support for the effectiveness of team-based rewards. In the experimental research included in the review, no direct effect of reward interdependence on performance and cooperation was found, as the effect of reward interdependence was always moderated by task interdependence. However, the reviewed field studies provided mixed support for the effectiveness of reward interdependence. Some studies reported direct effects of reward interdependence on information exchange, productivity, and perception of group effectiveness (Barnard & Rush, 1995, cited in DeMatteo et al.; Campion, Medsker, & Higgs, 1993; Campion, Papper, & Medsker, 1996), whereas others found no effects (Magjuka & Baldwin, 1991; Wageman, 1995).

Some of the field studies included in the review mentioned above (DeMatteo et al., 1998) considered both reward and task interdependence and their effects on cooperation and effectiveness of work groups in organizations. For example, Campion et al. (1993) examined the effect of reward interdependence and found positive correlations with employee satisfaction, communication, and cooperation in teams. In a second study, Campion et al. (1996) also found positive correlations of reward interdependence with employee and manager judgments of team effectiveness, in addition to correlations with team communication and cooperation. Although task interdependence was also examined and had positive effects on team effectiveness, the authors did not consider a possible interaction with reward interdependence. Only Wageman (1995) considered the interaction between reward and task interdependence in a field study setting. In her study, she categorized existing teams at a large U.S. corporation according to task type depending on whether they were working on group, hybrid, or individual tasks. Reward interdependence was then manipulated in the field for all teams through group, individual, and hybrid rewards. However, Wageman (1995) did not find an interaction between reward and task interdependence. A closer look at the data showed that a negative effect on performance was found only in teams with either hybrid tasks or hybrid rewards or with a combination of both. Consequently, the main effects of reward and task interdependence on group performance were significant, but the interaction between them was not. Both group and individual rewards as well as group and individual tasks in any combination resulted in better performance than conditions with either hybrid rewards or hybrid tasks or both. Additionally, Wageman (1995) found main effects for task interdependence on cooperation and quality of the group process, but not for reward interdependence.

In a more recent study, Hertel, Konradt, and Orlikowski (2004) investigated the effect of different types of interdependence on the effectiveness of virtual teams. They found a significant correlation between team-based rewards and team effectiveness rated by both managers and team members, whereas task interdependence was only marginally correlated with team effectiveness. An effect of task interdependence could only be shown for new teams. Linear regression analysis revealed significant effects for team-based rewards and the quality of goal setting, whereas task interdependence was not predictive. A possible interaction between reward and task interdependence was not tested in this study. Most of the field studies did not consider the possible interaction between reward and task interdependence with respect to effectiveness, even if both types of interdependence were studied. However, whether or not the positive effect of reward interdependence disappears when the interaction between task and reward interdependence is taken into account is of interest and has been a central focus in experimental research.

Two recent experimental studies (Allen, Sargent, & Bradley, 2003; Wageman & Baker, 1997) examined the interaction of reward and task interdependence. Both studies used a group copy-editing activity. Task interdependence was manipulated by the extent to which group members could contribute unique knowledge to the task completion of the other group members. Reward interdependence differed in the proportion of the total monetary reward that depended on the performance of others. Wageman and Baker manipulated three different levels of task and reward interdependence, Allen et al. only two levels. Wageman and Baker found an interaction between task and reward interdependence with respect to group performance. But contrary to their hypothesis, reward interdependence did not influence performance and cooperative behavior in the group independently of task interdependence. These findings were also confirmed in the study by Allen et al. who found that helping behavior or effort was not influenced by reward interdependence or its interaction with task interdependence. In addition, they found no interaction between task and reward interdependence with respect to performance. In both experimental studies, high task interdependence had a positive effect on cooperation and helping behavior, suggesting that task interdependence is indeed the dominant predictor of cooperation and helping behavior in groups.

However, as Allen et al. (2003) pointed out themselves, group performance in the high task interdependence condition differed significantly from performance in the low task interdependence condition. High task interdependence tasks required considerable interaction among group members to be performed well. Also, participants experienced high task interdependence tasks as being more complex. Therefore, the low and high task interdependence conditions were not really comparable with respect to task difficulty. Additionally, we think that the findings in both studies and their limited support for the effects of reward interdependence might also be explained by the manipula-

tion of task interdependence. In the high task interdependence condition, high rewards depended directly on cooperative behavior and information sharing among group members in both studies because individuals could only perform well and receive the financial reward if they shared their unique knowledge. The manipulation therefore caused a ceiling effect in the dependent variables. In contrast, in the low task interdependence condition, individual group members were not able to influence the performance of the other group members because of the different types of knowledge participants had. Thus, there was no motivation to cooperate and share knowledge to perform well and receive a higher reward, so high reward interdependence could not act as an additional incentive for cooperation and sharing of knowledge among the group members. As a result of the manipulation of task and reward interdependence, both constructs were not completely independent of one another. Because of these restrictions in current research, it seemed desirable to examine the independent effect of reward interdependence on cooperation and sharing behavior in an experimental design.

In contrast to previous studies, this study aimed to investigate the influence of reward interdependence in a task context in which reward interdependence could actually function as an additional incentive for cooperation and information sharing. We therefore focused on a task with low to moderate task interdependence with the possibility of individual task completion without any cooperation at all. To this end, we designed an experimental scenario involving the task context of a small seminar group of university students. In student work groups, group members can share different pieces of information and cooperate in different ways (e.g., exchange of relevant literature and excerpts of articles, techniques for working more effectively, assistance with individual problems of group members). In the designed scenario, the group members are given a choice of three different ways to go about the task: individually, collectively, or a combination of both. In the described scenario, cooperation versus non-cooperation has different costs and benefits. On the one hand, the performance of an individual group member can be promoted by cooperation and information sharing. On the other hand, cooperation also requires additional resources such as time and effort – resources that are then not available for completion of one's own task. Consequently, in our scenario, rewards did not depend on task interdependence, and reward interdependence could actually function as an additional incentive for cooperation and information sharing. Because individual contributions to the group task were highly visible (see detailed description of scenario below), we did not expect social loafing to occur. It was therefore hypothesized that:

H1. Individuals in the high reward interdependence condition will show more cooperative and helping behavior than individuals in the low reward interdependence condition, such as (a) participating in collective efforts like group meetings, and (b) giving assistance to other group members, etc.

H2. Individuals in the high reward interdependence condition will show more information-sharing behavior than individuals in the low reward interdependence condition, such as exchanging excerpts of articles and passing on relevant literature to others, etc.

H3. Individuals in the high reward interdependence condition will show more concern about the quality of other group members' work than individuals in the low reward interdependence condition.

H4. As compared with those in the low reward interdependence condition, individuals in the high reward interdependence condition will show a higher commitment to the group and perceived group identity and, therefore, will have a stronger preference for a presentation involving the entire group (e.g., as demonstrated by investing time in a group layout for presenting the group's work), rather than only individuals.

H5. High reward interdependence should also be associated with greater concerns about group performance. If problems arise and other group members are not equally committed to the task, individuals in the high reward interdependence condition should not withdraw from the group because they have a strong individual interest in solving the problem and ensuring high group performance. We therefore hypothesized that, when other group members are not equally committed to the task, individuals in the low reward interdependence condition will show a greater readiness to withdraw from the group work than will individuals in the high reward interdependence condition.

## Study 1

### Method

#### Participants

Forty-six undergraduate and graduate students at the University of Zurich participated in the first study (39 women, 7 men, age:  $M = 27.52$ ,  $SD = 7.08$ ). Forty-two participants majored in psychology; the other four majored in journalism, political science, sociology, and philosophy. On average, they had been in college for 4.83 semesters ( $SD = 3.40$ , range: 2 to 16 semesters). Participants received credit points or took part in a lottery in which the prize was a book to the value of 75 €.

#### Research design

The research design of Study 1 is a one-factorial between-groups design with three factor levels (low, mixed, and high reward interdependence). To manipulate reward interdependence, three different versions of the student work group scenario were realized. All three versions of the scenario described the situation of a seminar work group consisting of three university students. The students were to write a

term paper based on literature research. Each student was to prepare one part of the paper and give a presentation about his/her part in front of the whole class. Within the university context, relevant rewards are high marks. The reward in our scenario therefore consisted of high marks and was reinforced by a conjunction with an interesting seminar in the following semester, which could only be attended if a high mark for both the term paper and the presentation was obtained. In addition, the mark for the term paper was part of the final grade for graduation.

The three versions of the scenario differed only in the reward interdependence realized by the grading. In the low reward interdependence condition, each student received an individual mark for his/her part of the term paper and his/her part of the presentation. In the mixed reward interdependence condition, each student received an individual mark for his/her part of the term paper and a collective mark for the group's presentation in front of the class – the average of both marks resulted in the final individual mark. In the high reward interdependence condition, the students received a collective mark for the entire group, which was also the individual mark for the term paper and the presentation. Participants were randomly assigned to one of the three experimental conditions, with 16 participants in the low reward interdependence condition and 15 each in the mixed and the high reward interdependence conditions.

## Measures

After participants read one of the three versions of the scenario, they were to answer a short questionnaire about their preferences with respect to a group versus individual literature research, their response to the poor quality of another group members' work, their willingness to share an article with another group member, and their reaction to the

reluctant commitment of other group members. These questions were rated on a 6-point scale (from 1 = *very unlikely* to 6 = *very likely*). In addition, we asked them about their preferences concerning a group layout of the presentation. This question was rated on a 4-point scale (from 1 = *individual layout*, 2 = *tendency toward individual layout*, 3 = *tendency toward group layout*, 4 = *group layout*) because a 6-point scale made no sense.

As a control variable, we also asked the participants about their general attitude towards cooperation and information sharing by including four items of the reciprocity scale of the *Knowledge Cooperation Inventory* (Moser, 2002), rated on a 4-point scale (from 1 = *strongly disagree* to 4 = *strongly agree*). A sample item is "We can benefit from each other's knowledge and experience if we share with each other" ( $\alpha = .79$ ). To account for possible effects of the uneven sex distribution in our sample, we additionally used sex as a covariate in our analyses. Intercorrelations between measures are shown in Table 1.

## Manipulation check measure

To check for the participants' perception of reward and task interdependence in the scenario, we included one four-item scale and two three-item scales following Campion et al. (1993), rated on a 4-point scale (from 1 = *strongly disagree* to 4 = *strongly agree*). The four-item scale assessed task interdependence (e.g., "I can write my part of the term paper and prepare the corresponding presentation without exchange and cooperation with the other group members."; reverse-scored;  $\alpha = .77$ ). The manipulation check of perceived reward interdependence distinguished between reward interdependence concerning the term paper and reward interdependence concerning the presentation. Both types of reward interdependence were assessed with the

Table 1  
Intercorrelations in Studies 1 (data in first row) and 2 (data in second row)

	1a	1b	2	3	4	5	6
Group literature research (1a)	–						
Help with literature research (1b)	–	–					
Sharing an article with another group member (2)	–.36 <sup>+</sup>	–	–				
Response to poor quality (3)	.01	.43*	–	–			
Group layout (4)	.05	.56**	.06	–	–		
Withdrawal as a response to reluctant commitment (5)	.02	.61**	.61**	–	–		
Attitude towards information sharing (6)	.14	–	.16	.18	–	–	
Reward interdependence (7)	–.11	.14	.02	–.09	–	–	
	.11	–	.05	–.24	–.21	–	
	.03	–.49**	–.31	–.47*	–.12	–	
	–.02	–	.08	–.10	.02	–.47**	–
	.45*	.20	.16	.19	–.04	–.41*	–
	.26 <sup>+</sup>	–	–.11	.28	.39**	–.19	–.01
	–.26	.40*	.33 <sup>+</sup>	.55**	.45*	–.39*	.03

Note. \*\*  $p < .01$ , \*  $p < .05$ , +  $p < .10$ .



same three items (e.g., “My mark for the term paper/the presentation depends primarily on the appraisal of the whole group”); in both cases one item had to be excluded because of its poor item-total correlation (remaining two item scales: term paper:  $r = .69$ ; presentation:  $r = .79$ ).

## Procedure

Participants were seated in separate cubicles. The study was labeled a study about “Work strategies during university education.” After the experimenter had introduced the scenario, the participants were to take some time to imagine themselves in the described situation and then to answer the questions. The participants needed about 20 min to read the scenario carefully and answer the questions. They were debriefed afterwards.

## Results

### Manipulation check

To check the manipulation of reward interdependence, separate analyses of variance (ANOVA) were conducted for the reward interdependence for the term paper and the reward interdependence for the presentation. For the term paper, the reward interdependence manipulation was successful,  $F(2, 43) = 10.52, p < .01, \eta^2 = .33$ . As expected, the perceived reward interdependence for the term paper was higher for the high reward interdependence condition ( $M_{high} = 3.50, SD_{high} = .57$ ) than for the low and mixed reward interdependence conditions ( $M_{mixed} = 2.53, SD_{mixed} = .69$ ;  $M_{low} = 2.72, SD_{low} = .58$ ). The individual mark for the term paper only depended on the performance of the other group members and their parts of the term paper in the high reward interdependence condition.

For the presentation, the manipulation of reward interdependence manipulation was also successful,  $F(2, 43) = 8.10, p < .01, \eta^2 = .27$ . As expected, the perceived reward interdependence was higher for mixed and high reward interdependence ( $M_{high} = 3.40, SD_{high} = .54$ ;  $M_{mixed} = 3.30, SD_{mixed} = .68$ ) than for low reward interdependence ( $M_{low} = 2.63, SD_{low} = .53$ ). In the high reward interdependence condition as well as in the mixed reward interdependence condition, the group received a collective mark for the presentation, and thus the participants' marks depended on each other's performance at the presentation.

As expected, the check for differences of perceived task interdependence between the three experimental conditions was not significant,  $F(2, 43) = 1.03, p = .37$ .

### Multivariate analysis of variance

Given the modest sample size and to estimate the practical significance of the results without disregarding results sim-

ply because we did not have enough power to detect meaningful differences, we examined adjusted critical  $F$  values and adjusted alpha levels using a procedure called *compromise power analysis* (Erdfelder, Faul, & Buchner, 1996). Compromise power analysis provides critical  $F$  values and alpha levels to help make decisions about which effects are meaningfully and statistically significant and interpretable, especially with moderate to small sample sizes. For the post hoc compromise power analysis we used an alpha-beta ratio equal to 1 as recommended by Erdfelder and colleagues. Compromise power analysis showed, for an assumed medium effect size of  $f = .25$ , a critical  $F$  value of  $F(2, 42) = 1.19$  with a critical alpha = .32 and a power = .68.

To test the effect of reward interdependence on cooperation and information sharing, a multivariate analysis of variance (MANOVA) was performed with reward interdependence as the independent variable and the preference for group literature research, the response to poor quality of another group members' work, the willingness to share an article with another group member, the preference for a group layout of the presentation, and the reaction to reluctant commitment of the other group members as dependent variables (Figure 1). The MANOVA showed an overall effect of reward interdependence on all dependent variables, Wilks'  $\Lambda = .58, F(10, 76) = 2.39, p = .02, \eta^2 = .24$ .

Results of univariate tests showed confirmation of all hypotheses but one. Hypothesis 1 predicted that the willingness to show cooperative and helping behavior is stronger under high reward interdependence than under low reward interdependence. The univariate analysis showed a significant effect of reward interdependence on the preference for group literature research,  $F(2, 42) = 2.37, p = .11, \eta^2 = .10$ . Participants in the high reward and mixed reward conditions showed a greater preference for group literature research than participants in the low reward condition. Hypothesis 2 could not be supported, reward interdependence was not related to the willingness to pass an article on to another group member,  $F(2, 42) = .73, p = .49$ . As predicted in Hypothesis 3, reward interdependence influenced participants' response to poor quality of other group members' work,  $F(2, 42) = 3.30, p = .05, \eta^2 = .14$ . Participants in the high and mixed reward interdependence conditions reported a greater willingness to intervene in case of another group member's poor work than participants in the low reward interdependence condition. As assumed in Hypothesis 4, preference for a group layout was significantly stronger for participants with high and mixed reward interdependence,  $F(2, 42) = 5.02, p = .01, \eta^2 = .19$ , than participants in the low reward interdependence condition. Hypothesis 5 predicted that there would be a greater readiness to withdraw from the group work under low reward interdependence than under high and mixed reward interdependence, if other group members had reservations about their commitment. As expected, withdrawal was lower under high and mixed reward interdependence if other team members were reluctant to commit themselves,  $F(2, 42) = 1.47, p = .24, \eta^2 = .07$ .

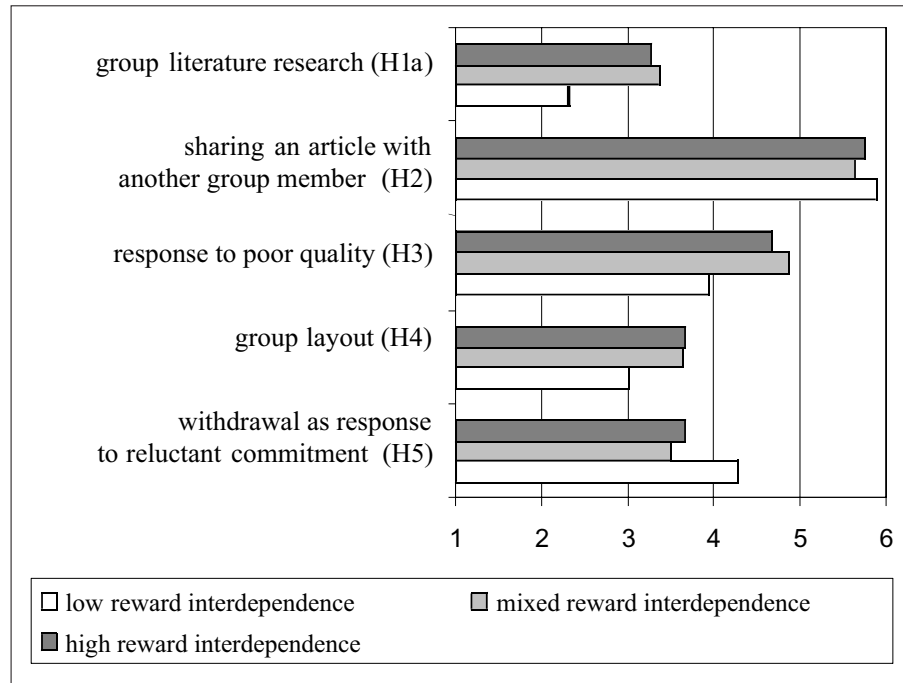


Figure 1. Mean rating differences in reward interdependence for Study 1. Notes. Group layout: 4-point scale. All other scales: 6-point scale.

## Controls

Overall, we found a very favorable attitude towards information sharing and strong intentions to cooperate with other group members ( $M = 3.60$ ,  $SD = .45$ ; 4-point scale), with attitude towards information sharing as a significant covariate, Wilks'  $\Lambda = .68$ ,  $F(5, 37) = 3.49$ ,  $p = .01$ ,  $\eta^2 = .32$ . This might also explain the readiness to pass articles on to other group members, regardless of reward interdependence (see above, Hypothesis 2). However, taking attitude towards information sharing into account as a covariate, the multivariate test still revealed a significant effect of the experimental conditions (Wilks'  $\Lambda = .57$ ,  $F(10, 74) = 2.40$ ,  $p = .02$ ,  $\eta^2 = .25$ ).

Because of the Study 1 sample's uneven sex distribution, sex was tested as a covariate, but was not significant, Wilks'  $\Lambda = .79$ ,  $F(5, 37) = 2.01$ ,  $p = .10$ ,  $\eta^2 = .21$ . Even when taking sex into account as a covariate, the multivariate test still revealed a significant effect of the experimental conditions, Wilks'  $\Lambda = .57$ ,  $F(10, 74) = 2.41$ ,  $p = .02$ ,  $\eta^2 = .25$ .

## Discussion

In contrast to previous experimental research (Allen et al., 2003; Wageman & Baker, 1997), we were able to manipulate reward interdependence independently of task interdependence, and reward interdependence was shown to have a direct effect on important aspects of cooperation and information sharing when task interdependence was low to moderate. As expected, participants showed greater con-

cern for other group members' work, a stronger preference for group literature research and for presenting themselves as a group in front of non-group members, and a lower readiness to withdraw from the group work under high and mixed reward interdependence conditions. Thus, all hypotheses except Hypothesis 2 were confirmed. The missing support for Hypothesis 2 can perhaps be explained by the extremely positive attitude towards cooperation in the student sample as indicated by the control variable measuring general attitude towards cooperation. Within the study context, cooperation is the rule and usually to the advantage of everybody. Also, there is seldom a reason for direct competition between students. Therefore, the advantages of cooperation generally outweigh the risks of being exploited by other students.

Because of the very positive perception of cooperation in the first study, we conducted a second study with the aim of intensifying the conflict between the individual interest to perform well and the collective goal to cooperate and help each other to promote group performance. Therefore, we revised the scenario description to further strengthen the dilemma between individual and collective costs and benefits. Furthermore, we decided to manipulate only low and high reward interdependence in Study 2 because of the little amount of difference between the mixed and high reward interdependence conditions in Study 1.

## Study 2

### Method

#### Participants

Twenty-eight undergraduates and graduate students at the University of Zurich took part in the second study. All participants majored in education science and participated in the same methodology course (24 women, 4 men; age:  $M = 26.71$ ,  $SD = 6.63$ ). On average, they had been in college for 4.18 semesters ( $SD = 3.84$ , range: 2 to 20).

#### Research design

The research design of Study 2 was a one-factorial between-groups design. In contrast to Study 1, we realized only two factor levels (low and high reward interdependence). Thus, we used only two different versions of the scenario. As in Study 1, the scenario described the situation of a seminar work group of three students. To further intensify the conflict between the individual goal to reach a high mark and be able to attend the seminar in the following semester and the collective goal to cooperate and share information with others, we included a further limited access to the seminar in the following semester. In addition, we adapted some of the items and included one additional item (see measures below).

As in Study 1, the two versions of the scenario differed only in the degree of reward interdependence realized through the grading. In the low reward interdependence condition, an individual mark was given for both the individual part of the term paper and the presentation. In the high reward interdependence condition, the collective mark was also the individual mark. Participants were randomly assigned to one of the two experimental conditions, with 14 participants in each condition.

#### Measures

After the scenario description, the participants were to answer the same questionnaire as in Study 1. To intensify dilemma perception, three items of the questionnaire used in Study 1 were adapted slightly (preference for group literature research, willingness to share an article with another group member, and reaction to the reluctant commitment of other group members). One new item was included in Study 2, concerning the willingness to help another group member with problems in literature research. All items were rated on a 6-point scale (from 1 = *strongly disagree* to 6 = *strongly agree*) and only the item about a group layout was rated on a 4-point scale because a 6-point scale made no sense (from 1 = *individual layout*, 2 = *tendency toward individual layout*, 3 = *tendency toward group layout*, 4 = *group layout*).

As in Study 1, we included four items to measure the general attitude towards cooperation and information sharing as a control variable (from the reciprocity scale of the Knowledge Cooperation Inventory, Moser, 2002;  $\alpha = .71$ ), with items rated on a 4-point scale (from 1 = *strongly disagree* to 4 = *strongly agree*). In addition, to account for possible effects of the uneven sex distribution in our second sample, we used sex as a covariate in our analyses. Intercorrelations between measures are shown in Table 1.

#### Manipulation check measures

As in Study 1, we checked the participants' perception of reward and task interdependence. Task interdependence was assessed by the same four-item scale (following Campion et al., 1993;  $\alpha = .62$ ). Reward interdependence was measured by the same three items as in Study 1 (following Campion et al., 1993;  $\alpha = .71$ ), but without a differentiation between the term paper and the presentation, because we excluded the mixed reward interdependence condition, and with a revised third item because of its poor item-total correlation in Study 1. Participants responded on a 4-point scale (from 1 = *strongly disagree* to 4 = *strongly agree*).

#### Procedure

The experiment was part of a course on empirical research methods at the Institute of Education Science. All participants took part in the study at the same time in the classroom. The title of the study was the same as in Study 1. At the beginning, participants were asked to read the scenario carefully and to answer the questionnaire afterwards. Average time for completion was about 20 min. Debriefing occurred afterwards.

## Results

#### Manipulation check

To check for the efficacy of the reward interdependence manipulation, we conducted an ANOVA on the perceived reward interdependence. The ANOVA revealed the expected significant effect,  $F(1, 26) = 5.3$ ,  $p = .03$ ,  $\eta^2 = .17$ . Participants in the high reward interdependence condition perceived greater reward interdependence ( $M_{high} = 3.33$ ,  $SD_{high} = .54$ ) than participants in the low reward interdependence condition ( $M_{low} = 2.88$ ,  $SD_{low} = .50$ ). In our check for differences in perceived task interdependence, the ANOVA revealed no significant difference between the two conditions as expected,  $F(1, 26) = .69$ ,  $p = .42$ .

### Multivariate analysis of variance

As in Study 1, we used compromise power analysis to provide critical  $F$  values and alpha levels to help make decisions about which effects were meaningfully and statistically significant and interpretable, especially with moderate to small sample sizes. Our post hoc compromise power analysis was computed setting the alpha-beta ratio equal to 1 and showed, for an assumed medium effect size of  $f = .25$ , a critical  $F$  value of  $F(1, 26) = 0.93$  with a critical alpha = .34 and a power = .66.

To test the effect of reward interdependence on cooperation and information sharing, a multivariate analysis of variance (MANOVA) was performed with reward interdependence as the independent variable and the preference for group literature research, the willingness to help another group member with literature research, the response to the poor quality of another group members' work, the willingness to share an article with another group member, the preference for a group layout of the presentation, and the reaction to the reluctant commitment of other group members as dependent variables (Figure 2). The MANOVA showed an overall significant effect of reward interdependence on all dependent variables, Wilks'  $\Lambda = .40$ ,  $F(6, 19) = 4.82$ ,  $p = .01$ ,  $\eta^2 = .60$ .

Results of a univariate test showed confirmation of all hypotheses. As predicted in Hypothesis 1, the willingness to help other group members with problems with literature research is significantly higher under high reward interdependence than under low reward interdependence,  $F(1, 24) = 6.10$ ,  $p = .02$ ,  $\eta^2 = .20$ . Preference for group literature research also showed a significant effect of reward interdependence when using the adjusted critical alpha level,  $F(1, 24) = 1.43$ ,  $p = .24$ ,  $\eta^2 = .06$ ; however, the differences in means were contrary to our expectations. Thus, Hypothesis 1 received only mixed support. Hypothesis 2 predicted

that participants in the high reward interdependence condition would show a higher willingness to pass an article on to another group member than participants in the low reward interdependence condition, which was confirmed,  $F(1, 24) = 3.28$ ,  $p = .08$ ,  $\eta^2 = .12$ . As expected by Hypothesis 3, we also found a significant effect of reward interdependence on the readiness to respond to the poor quality of another member's work,  $F(1, 24) = 10.69$ ,  $p < .01$ ,  $\eta^2 = .31$ . Similarly, participants in the high reward interdependence condition had a stronger preference for a group layout than participants in the low reward condition,  $F(1, 24) = 4.91$ ,  $p = .04$ ,  $\eta^2 = .17$ , as proposed by Hypothesis 4. Reaction to the reluctant commitment of other group members yielded the predicted significant effect of reward interdependence,  $F(1, 24) = 3.77$ ,  $p = .06$ ,  $\eta^2 = .14$ , with greater readiness to withdraw from the group for participants in the low reward interdependence condition, if other group members had reservations about committing themselves (Hypothesis 5).

### Controls

As in Study 1, participants had a very positive attitude towards information sharing and showed very strong intentions to cooperate with other group members ( $M = 3.61$ ,  $SD = .36$ ), with attitude towards information sharing again as a significant covariate, Wilks'  $\Lambda = .50$ ,  $F(6, 18) = 2.97$ ,  $p = .03$ ,  $\eta^2 = .50$ . However, even when taking attitude towards information sharing into account as a covariate, the multivariate test still revealed a significant effect of the experimental conditions, Wilks'  $\Lambda = .39$ ,  $F(6, 18) = 4.75$ ,  $p = .01$ ,  $\eta^2 = .61$ .

To account for a possible influence of the uneven sex distribution, sex was tested as a covariate. However, the multivariate test showed that sex was again not a significant co-

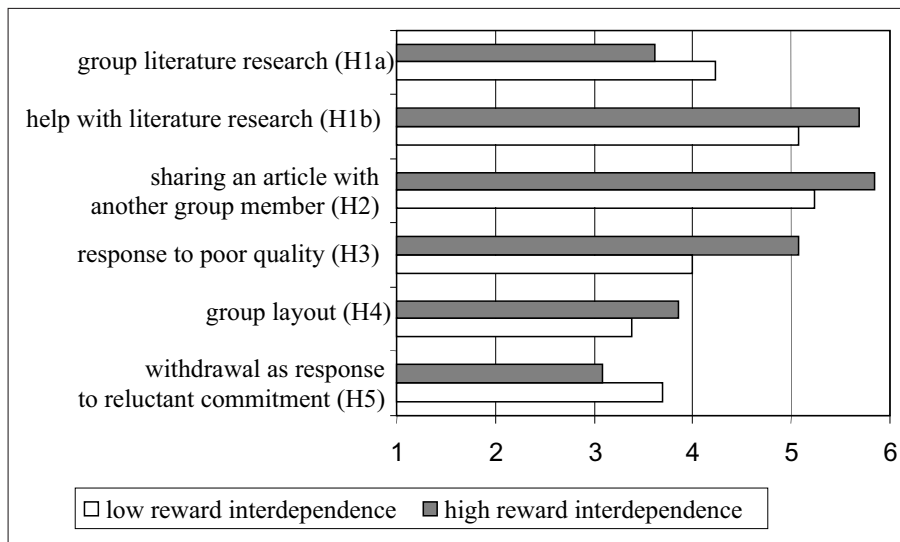


Figure 2. Mean rating differences in reward interdependence for Study 2. Notes. Group layout: 4-point scale. All other items: 6-point scale.



variate, Wilks'  $\Lambda = .83$ ,  $F(6, 18) = .63$ ,  $p = .71$ ,  $\eta^2 = .17$ , and the experimental conditions still had a significant effect, Wilks'  $\Lambda = .41$ ,  $F(6, 18) = 4.35$ ,  $p = .01$ ,  $\eta^2 = .59$ .

## Discussion

As in Study 1, we were able to manipulate reward interdependence independently of task interdependence. Central aspects of cooperation and information sharing were influenced by the manipulation of reward interdependence. In contrast to Study 1, the goal to strengthen the dilemma perception was clearly achieved in Study 2, and all hypotheses were confirmed. As expected under high reward interdependence, students showed more helping behavior, a higher willingness to pass an article on to another group member, higher concerns about other group members' commitment to the group task, stronger preferences for presenting themselves as a group in front of non-group members, and a lower readiness to withdraw from the group in response to the reluctant commitment of other group members than under low reward interdependence. In contrast to Study 1, the willingness to pass an article on to another group member was significantly higher under high reward interdependence; Hypothesis 2 was therefore confirmed. However, contrary to our expectations and unlike in Study 1, preference for group literature research was stronger under low reward interdependence than under high reward interdependence in Study 2. At the same time and in line with our Hypothesis 1, we found a stronger willingness to help another group member with problems with literature research under high reward interdependence.

## General Discussion

Incentives are central to the reinforcement of behavior. In the context of group work, it is important to distinguish between individual and collective incentives, a fact that has drawn the attention of researchers interested in group effectiveness. It is generally assumed that high reward interdependence constitutes an incentive for cooperation among group members, but to date, results of experimental studies have provided no support for this assumption. Interestingly though, in some field studies, reward interdependence was associated with an increase in information exchange, team productivity, and other related variables. It was therefore the aim of our studies to examine the effect of reward interdependence on cooperation and information exchange in an experimental setting and to manipulate reward interdependence independently of task interdependence.

Manipulation checks in both studies showed that it was indeed possible to manipulate reward interdependence independently of task interdependence. We developed a scenario of a seminar work group, manipulating reward interdependence by using different procedures for grading the term paper and presentation that students were to work on.

In the low reward interdependence condition, individual marks were given for each student for his or her part of the paper and the presentation; in the high reward interdependence condition, a collective mark was given to the entire seminar group as an individual mark for both presentation and term paper. In a mixed condition only used in Study 1, a combination of high and low reward interdependence was used (individual mark for paper, collective mark for presentation). In both studies, we expected the effects of reward interdependence on the willingness to do group literature research, helping behavior (passing on articles relevant to other students' parts of the term paper), group layout for presentation, concern about commitment to group task, and withdrawal if other group members were reluctant to commit themselves. In both studies, the participants showed an extremely positive attitude towards cooperation, even more so than in the sample in Study 2 in which most students knew each other personally. Although the general attitude towards cooperation was very positive, we found significant effects of reward interdependence on the willingness to do group literature research, to invest in a group layout for a presentation, and to respond to the poor quality of another group member's work, as well as withdrawal if other group members were reluctant to commit to the group task. While Study 1 provided support for all but one hypothesis (sharing articles with other group members), it was possible to increase the dilemma perception of costs versus benefits of group versus individual work strategies in Study 2 by slightly revising the scenario, and consequently all five hypotheses were able to be confirmed in Study 2, with the exception of a reverse effect of one indicator of Hypothesis 1 (group literature research).

Several limitations should be considered when interpreting the results presented here. First of all, we only investigated behavior intentions and not actual cooperative behavior with the scenarios developed for the two studies. While intention formation to cooperate is a prerequisite for actual cooperation, it is certainly necessary to conduct further experiments on reward interdependence with behavioral data. Also, social desirability certainly has to be considered when participants report behavior intentions. Secondly, the student participants represent a population with a predominantly positive attitude towards cooperation and information sharing where cooperation usually is an advantage for everybody and the mutual benefits of cooperation outweigh the possible costs of cooperation such as exploitation. It would certainly be helpful for the understanding of reward interdependence if different samples with working participants and scenarios closer to actual work situations could be used, where mixed-motive situations and social dilemmas are more prevalent than in the student context. On the other hand, it can also be argued that the student samples were actually a much harder test for the effects of reward interdependence because participants had such a positive attitude and potential costs for cooperation are comparatively low in the student context.

In summary, we conclude that it is indeed possible to also show the positive effects of reward interdependence in an experimental setting and provide further support for the effects of reward interdependence, so far only found in some field studies. In the current work situation, in which team work and information sharing are becoming increasingly important, for example, in the context of knowledge management projects (Davenport & Prusak, 1998), incentives for cooperation and extra effort in team work are highly relevant. As the two studies have shown, the intention to share information, to help others in case of problems, and the willingness to put extra effort into team work and care about the quality of work are significantly increased under high reward interdependence. However, we think it is important to emphasize that this effect of reward interdependence is only found if cooperation is an option but not necessary to complete the task. This is only the case if task interdependence is low or moderate and cooperation is voluntary as a consequence. Under this condition, reward interdependence can act as an effective incentive to promote team cooperation and information sharing. In our opinion, previous experimental studies found no effect of reward interdependence because task interdependence was high and therefore prevented reward interdependence from acting as an additional incentive. We consider the independent effects of reward interdependence to be important in further understanding the motivational basis of team cooperation and information sharing. We agree with Hertel et al. (2004) that task interdependence mainly acts as incentive in the first stages of team work when coordination processes are important and being implemented. In contrast, perceived reward interdependence stays important throughout all stages of team work. For further research on reward interdependence, we believe that mediating processes and effects on group performance should be considered, such as spontaneous goal setting, chosen group goal level, and commitment to team goals (Guthrie & Hollensbe, 2004), bringing together goal setting theory and current findings on group performance and information sharing.

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