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The effect of reward interdependence on cooperation and
information-sharing intentions

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Abstract

Incentives are central to reinforce behaviour. 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, while some field studies found an increase in information exchange and team productivity. In 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 poor quality of others' work, higher preference for joint layout, and less withdrawal as response to reluctant engagement of others. The findings suggest that high reward interdependence can indeed act as an incentive for cooperative behaviour and information sharing, also in an experimental setting.

Key words: Reward interdependence, cooperation, helping behaviour, information sharing, group work

The effect of reward interdependence on cooperation and information sharing intentions

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 sector (Davenport & Prusak, 1998). Both developments led to increasing demands on group work, as organizations realized that cooperative behaviour 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 what facilitates effective team work and information sharing (Eby & Dobbins, 1997; Jones & Jordan, 1998; Ng & Van Dyne, 2005). Incentives are central to reinforce behaviour (Honeywell-Johnson & Dickinson, 1999). In the context of group work, the distinction between individual and collective incentives is important, which is the reason 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 while 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.

Overview of research

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 characterised 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 behaviour among group members (Wageman & Baker, 1997). Fan and Gruenfeld (1998) argued that high reward interdependence creates a sense of common fate and hence, the motivation to cooperate should be increased.

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, & Skon, 1981; Cotton & Cook, 1982; DeMatteo, Eby, & Sundstrom, 1998; Honeywell-Johnson & Dickinson, 1999; Rynes, Gerhart & Parks, 2005). In one of the most recent reviews on team-based rewards, DeMatteo, Eby, and Sundstrom (1998) 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 indeed direct effects of reward interdependence on information exchange, productivity and perception of group effectiveness (Barnard & Rush, 1995; Campion, Medsker, & Higgs, 1993; Campion, Papper, & Medsker, 1996), while others found no effects (Magjuka & Baldwin, 1991; Wageman, 1995).

Field studies on reward interdependence

Some of the field studies included in the review 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 judgements 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 types 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 did not find an interaction between reward and task interdependence. A closer look at the data showed that only in teams with either hybrid tasks or hybrid rewards or with a combination of both, a negative effect on performance was found. Consequently, only main effects of reward and task interdependence on group performance were significant but not the interaction between them. Both, group and individual rewards, as well as

group and individual tasks in any combination resulted in a better performance than conditions with either hybrid rewards or hybrid tasks or both. Additionally, Wagemann (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, & 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 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 on effectiveness even if both types of interdependence were studied. However, it is of interest whether or not the positive effect of reward interdependence will disappear if the interaction between task and reward interdependence is taken into account, which has been a central focus in experimental research.

Experimental research on reward interdependence

Two recent experimental studies (Wageman & Baker, 1997; Allen, Sargent, & Bradley, 2003) examined the interaction of reward and task interdependence. Both studies conducted a group copy editing activity. Task interdependence was manipulated by the extent to which the group members could contribute some unique knowledge to the task completion of the other group members. Reward interdependence differed in the proportion of total monetary reward,

which depended on the performance of others. Wageman and Baker (1997) manipulated three different levels of task and reward interdependence, Allen et al. (2003) realized only two levels. Wageman and Baker (1997) found an interaction between task and reward interdependence on group performance. But contrary to their hypothesis, reward interdependence did not influence performance and cooperative behaviour in the group independently of task interdependence. These findings were also confirmed in the Study by Allen et al. (2003). Equally, Allen et al. (2003) found that helping behaviour or effort was not influenced by reward interdependence or its interaction with task interdependence. In addition, they found no interactive effect of task and reward interdependence on performance. In both experimental studies, high task interdependence had a positive effect on cooperation and helping behaviour, suggesting that task interdependence is indeed the dominant predictor of cooperation and helping behaviour in groups.

However, as Allen et al. (2003) pointed out themselves, group performance in the highly interdependent task condition differed significantly from performance in the low interdependent task condition. High interdependent tasks required considerable interaction among group members to perform well. Also, participants experienced the high interdependence tasks as 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 manipulation of task interdependence. In the high task interdependence condition, high rewards depended directly on cooperative behaviour 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 on the dependent variables. In contrast, in the low task interdependence condition, individual

group members had no possibility to influence the performance of the other group members because of the different types of knowledge participants were trained in. Thus, there was no motivation to cooperate and share knowledge to perform well and receive a higher reward, and thus 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 behaviour in an experimental design.

Aims of the presented research

In contrast to former studies, we wanted to investigate the influence of reward interdependence in a task context where 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 aim, we designed an experimental scenario with the task context of a small seminar group of university students. In the student work groups, group members can share different information and cooperate in different ways (e.g. exchange of relevant literature, excerpts of articles, work techniques as well as assistance with individual problems of group members). In the designed scenario, the group members are given the choice of three different ways to go about the task: Individually, collectively or in a combination of both. In the described scenario, cooperation vs. non-cooperation has different costs and benefits. On the one hand, performance of the individual group member can be promoted by cooperation and sharing of information. On the other hand, cooperation also needs additional resources such

as time and effort – resources that can then not be used for the individual mastery of the task. Consequently, rewards in our scenario 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 work 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 show more cooperative and helping behaviour than individuals in the low reward interdependence condition, such as giving assistance to other group members, and engaging in collective effort like group meetings etc.

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

Additionally, strong concerns about the work quality of other group members are also an indicator for high reward interdependence. It was thus hypothesized that:

H3: Individuals in the high reward interdependence condition show a higher concern about the work quality of other group members than individuals in the low reward interdependence condition.

We also expected that in the high reward interdependence condition, commitment to the group and perceived group identity should be increased. We therefore hypothesized that presentation as a group toward non-group members should more important than in the low reward interdependence condition.

H4: Individuals in the high reward interdependence condition have a stronger preference for a joint presentation of the whole group than individuals in the low reward interdependence condition, such as investing time in a joint layout for the presentation of the group work.

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 group performance.

H5: Individuals in the low reward interdependence condition show a greater readiness to withdraw from the group work than individuals in the high reward interdependence condition, if other group members are not equally committed to the task.

Study 1

Method

Participants

Forty-six undergraduate and graduate students of the University of Zurich participated in the first Study (39 women, 7 men, age: $M = 27.52$, $SD = 7.08$). Forty-two participants studied psychology as main subject. The other four studied journalism, political science, sociology and philosophy as main subject. On average they studied since 4.83 semesters ($SD = 3.40$, range from 2 to 16 semesters). Participants received credit points or took part in a lottery of a book token amounting to 75 Euro.

Research Design

The research design of Study 1 is a one-factorial between-group 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 had to write a term paper that was based on a literature research. Each student had to prepare one part of the paper and give a presentation about his/her part before the whole seminar 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 presentation was achieved. In addition, the mark for the term paper was part of the final grade for graduation.

The three scenario versions 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 whole presentation of the group before the seminar 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 in the mixed and high reward interdependence conditions respectively.

Measures

After participants read one of the three scenario versions, they had to answer a short questionnaire about their preference for a joint vs. individual literature research, their response to

poor quality of another group members' work, their willingness to share an article with another group member and their reaction to reluctant engagement of the other group members. These questions were rated on a six-point scale (from 1 = very unlikely to 6 = very likely). In addition, we asked them about their preference for a joint layout of the presentation. This question were rated on a four-point scale (from 1 = individual layout, 2 = tendence to individual layout, 3 = tendence to joint layout, 4 = joint layout), because a six-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 four-point scale (from 1 = strongly disagree to 4 = strongly agree). A sample item is "We can benefit from our knowledge and our experiences, 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. Inter-correlations between measures are represented in Table 1.

Insert Table 1 Here

Manipulation check measures

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 four-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 same three items (e.g. “My mark for the term paper (the presentation, respectively) 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 labelled as a Study about „Work strategies during university education”. The scenario was introduced by the experimenter and the participants were requested to take some time to put themselves into the described situation and then to proceed with answering the questions. The participants needed about twenty minutes to read the scenario carefully and answer questions and were debriefed afterwards.

Results

Manipulation check

To check the manipulation of reward interdependence, an analysis of variance (ANOVA) was conducted for both, the reward interdependence for the term paper and the reward interdependence for the presentation separately. 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 under the condition of high reward interdependence ($M_{high} = 3.50, SD_{high} = .57$) than for the conditions of low and mixed reward interdependence ($M_{mixed} = 2.53, SD_{mixed} = .69; M_{low} = 2.72, SD_{low} = .58$). Only in the high reward interdependence condition, the individual mark for the term paper depended on the performance of the other group members and their parts of the term paper.

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 for the presentation 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 condition of high reward interdependence as well as in the condition of mixed reward interdependence, the group received a collective mark for the presentation and thus participant's 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 simply 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 making 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 of equal to 1 as recommended by Erdfelder and his 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 independent variables and the preference for a joint 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 joint layout of the presentation and the reaction to reluctant engagement of the other group members as dependent variables (figure 1). The MANOVA showed an overall effect of reward interdependence on all dependent variables, Wilks' $\lambda = .58$, $F(10, 76) = 2.39$, $p = .02$, $\eta^2 = .24$.

Insert Figure 1 Here

Results of univariate tests showed confirmation of all hypotheses but one. Hypothesis 1 predicted that the willingness to show cooperative and helping behaviour 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 a joint 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 a joint 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 on an article 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 conditions of high and mixed reward interdependence reported a greater willingness to intervene in case of poor work of another group member than participants in the low reward interdependence condition. As assumed in hypothesis 4, preference for a joint 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 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 decreased under high and mixed reward interdependence, if other team members were reluctant to commit themselves, $F(2, 42) = 1.47, p = .24, \eta^2 = .07$.

Controls

Overall, we found a very favourable 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 on articles to other group members, regardless of reward interdependence (see above, hypothesis 2). However, taking into account attitude towards information sharing 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 uneven sex distribution of the sample in Study 1, 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 into account sex as 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 (Wageman & Baker, 1997, Allen et al., 2003), was possible to manipulate reward interdependence independently of task interdependence and reward interdependence was shown to have direct effects on important aspects of cooperation and information sharing when task interdependence was low to moderate.

As expected, participants showed greater concerns for the work of other group members, a stronger preference for joint literature research and for a joint presentation of the whole group towards non-group members, and a lower readiness to withdraw from the group work under the condition of high and mixed reward interdependence, and 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. Thus 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 to intensify 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 difference between the mixed and high reward interdependence conditions in Study 1.

Study 2

Method

Participants

Twenty-eight undergraduates and graduate students of the University of Zurich took part in the second study. All participants studied education science as main subject and participated in

the same methodology course (24 women, 4 men; age: $M = 26.71$, $SD = 6.63$). On average, they studied for 4.18 semesters ($SD = 3.84$, range from 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 scenario versions 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 had 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 joint literature research, willingness to share an article with another group, and reaction to reluctant engagement 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 six-point scale (from 1 = strongly disagree to 6 = strongly agree) and only the item about a joint layout was rated on a four-point scale because a six-point-scale made no sense (from 1 = individual layout, 2 = tendency to individual layout, 3 = tendency to joint layout, 4 = joint layout).

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

Manipulation check measures

As in Study 1, we checked for the participants' perception of reward and task interdependence. Task interdependence was assessed by the same four-item scale (following Champion, Medsker, and Higgs, 1993; $\alpha = .62$). Reward interdependence was measured by the same three items as in Study 1 (following Champion, Medsker, and Higgs, 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 four-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 class room. 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 twenty minutes with debriefing 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 ($M_{low} = 2.88, SD_{low} = .50$). We further checked for differences in the 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 making decisions about which effects are 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, again a multivariate analysis of variance (MANOVA) was performed with reward interdependence as independent variables and the preference for a joint literature research, the willingness to help with another group member regarding 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 joint layout of the presentation and the reaction to reluctant engagement of the other group members as dependent variables (figure 2). The MANOVA showed an overall significant effect of reward interdependence on all dependent variables, Wilks' $\lambda = .40$, $F(6, 19) = 4.82$, $p = .01$, $\eta^2 = .60$.

Insert Figure 2 Here

Results of univariate test showed confirmation of all hypotheses. As predicted in hypothesis 1, the willingness to help other group members with problems regarding 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 a joint 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 was 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 on an article to another group member than participants in the low reward interdependence condition, which could be confirmed, $F(1, 24) = 3.28$, $p = .08$, $\eta^2 = .12$. As expected in hypothesis 3, we also found a significant effect of reward interdependence on the readiness to respond to poor quality of other members' work, $F(1, 24) = 10.69$, $p < .01$, $\eta^2 = .31$. Equally, participants in the high reward interdependence condition had a stronger preference for a joint layout than participants in the low reward condition, $F(1, 24) = 4.91$, $p = .04$, $\eta^2 = .17$, as proposed in hypothesis 4. Reaction to reluctant engagement 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 into account attitude towards information sharing as 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 covariate, 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, it was possible to manipulate reward interdependence independently of task interdependence and 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 could be confirmed. As expected under high reward interdependence, students showed more helping behaviour, higher willingness to pass on an article to another group member, higher concerns about the commitment to the group task of other group members, stronger preferences for a joint representation of the whole group, and a lower readiness to withdraw from the group in response to reluctant engagement of other group members than under low reward interdependence. In

contrast to Study 1, the willingness to pass on an article to another group member was significantly higher under high reward interdependence, and hypothesis two could therefore be confirmed. However, contrary to our expectations and unlike Study 1, preference for joint 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 one, we found a stronger willingness to help another group member with problems regarding literature research under high reward interdependence.

General discussion

Incentives are central to reinforce behaviour. 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 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 this paper 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 students had 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 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 effects of reward interdependence on the willingness to do joint literature research, helping behaviour (passing on articles relevant to other student's parts of the term paper), joint 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 in the sample in Study 2 where 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 joint literature research, invest in a joint layout for presentation, and willingness to respond to poor quality of other group member's work, and withdrawal if other group members were reluctant to engage in 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 vs. benefits of group vs. individual work strategies in Study 2 by revising the scenario only slightly, and consequently all five hypotheses could be confirmed in Study 2, with the exception of a reverse effect of one indicator of hypothesis 1 (joint literature research).

Limitations

Several limitations should be considered when interpreting the results presented here. First of all, we only investigated behaviour intentions and not actual cooperative behaviour 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 behavioural data. Also, social desirability certainly has to be considered when subjects report behaviour 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 subjects 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.

Theoretical implications

On summary, we draw the conclusion that it is indeed possible to show positive effects of reward interdependence also 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, where team work and information sharing become increasingly important, e.g. in the context of knowledge management projects (Davenport & Prusak, 1998), incentives for cooperation and extra efforts in team work are highly relevant. As the two studies have shown, intentions 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, former experimental studies found no effect of reward interdependence, because task interdependence was high and therefore prevented reward interdependence to act 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 through 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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Table 1

Inter-correlations in Studies 1 (data in first row) and 2 (data in second row)

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

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

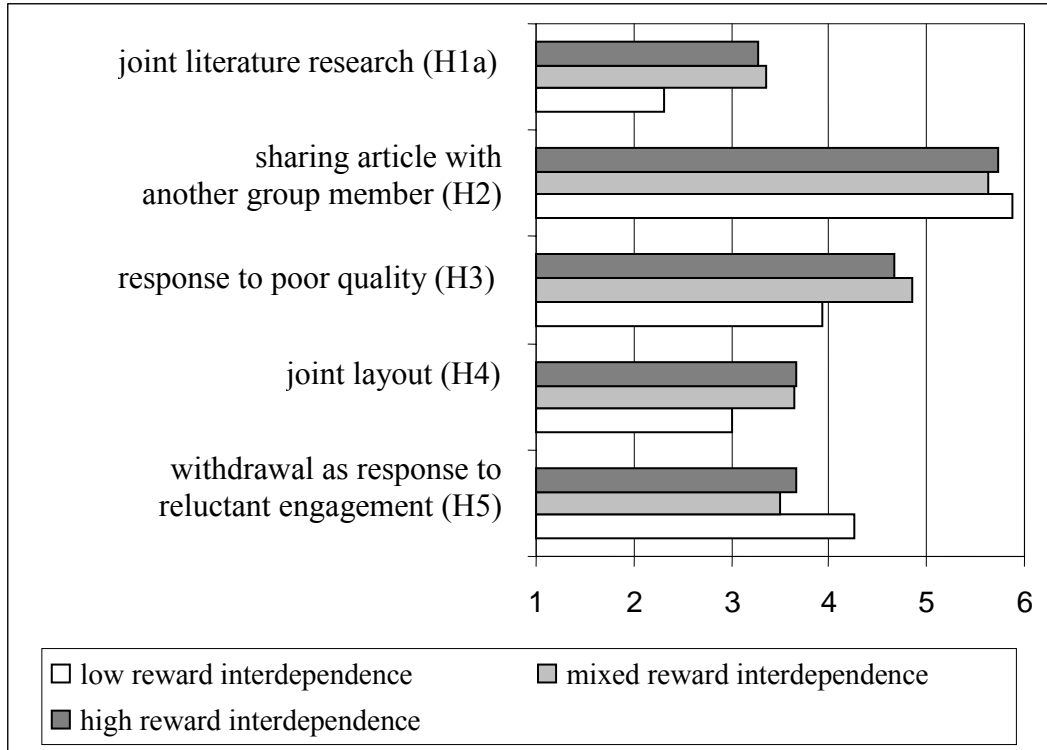


Figure 1. Mean rating differences in reward interdependence for Study 1

Notes.
 Joint layout: 4-point scale. All other scales: 6-point scale.

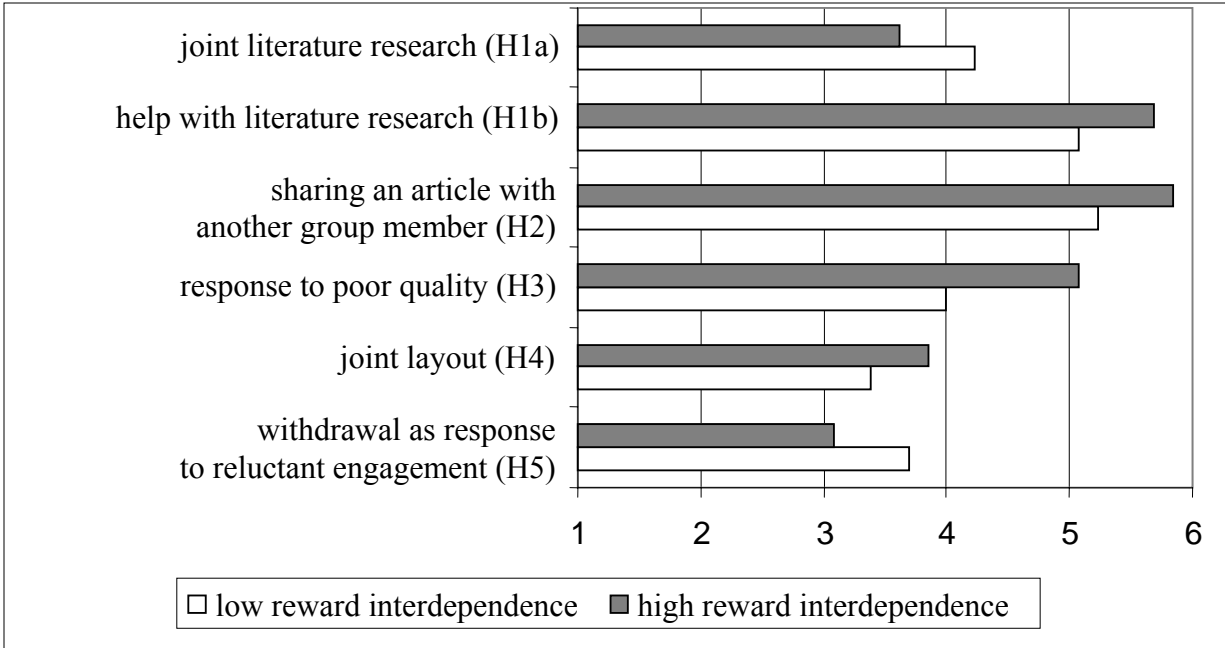


Figure 2. Mean rating differences in reward interdependence for Study 2

Notes.

Joint layout: 4-point scale. All other items: 6-point scale