



Pressure to cooperate: Is positive reward interdependence really needed in cooperative learning?

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Background. Despite extensive research on cooperative learning, the debate regarding whether or not its effectiveness depends on positive reward interdependence has not yet found clear evidence.

Aims. We tested the hypothesis that positive reward interdependence, as compared to reward independence, enhances cooperative learning only if learners work on a 'routine task'; if the learners work on a 'true group task', positive reward interdependence induces the same level of learning as reward independence.

Sample. The study involved 62 psychology students during regular workshops.

Method. Students worked on two psychology texts in cooperative dyads for three sessions. The type of task was manipulated through resource interdependence: students worked on either identical (routine task) or complementary (true group task) information. Students expected to be assessed with a Multiple Choice Test (MCT) on the two texts. The MCT assessment type was introduced according to two reward interdependence conditions, either individual (reward independence) or common (positive reward interdependence). A follow-up individual test took place 4 weeks after the third session of dyadic work to examine individual learning.

Results. The predicted interaction between the two types of interdependence was significant, indicating that students learned more with positive reward interdependence than with reward independence when they worked on identical information (routine task), whereas students who worked on complementary information (group task) learned the same with or without reward interdependence.

Conclusions. This experiment sheds light on the conditions under which positive reward interdependence enhances cooperative learning, and suggests that creating a real group task allows to avoid the need for positive reward interdependence.

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In over 30 years, research on cooperative learning has been one of social and educational psychology's domains that has contributed the most to the understanding of learning, from early experiments of the effects of cooperation on learning (Aronson, Blaney, Stephan, Sikes, & Snapp, 1978; Johnson & Johnson, 1974) to more recent theoretical integrations (e.g., Johnson & Johnson, 2009). Little doubt is left today on the effects of cooperative learning: an impressive number of meta-analyses, old and new, show that cooperative learning has beneficial effects on self-esteem, student interactions, and learning (see the numerous studies and meta-analyses, e.g., Johnson & Johnson, 2002; Johnson, Johnson, & Smith, 2007; Roseth, Johnson, & Johnson, 2008; Serrano & Pons, 2007). Despite the consensus on the robustness of the effect, however, the question of the conditions under which cooperative learning is effective is still open. In particular, scholars disagree on the necessity of positive reward interdependence (rewarding students as a group) for the above positive effects to appear: 'The use of reward within cooperative learning is controversial [. . .], and there are relatively few clear data on this effect' (O'Donnell, 1996, p. 75). The present research brings for the first time experimental evidence that whether positive reward interdependence enhances cooperative learning depends on the way resources are distributed in the task: positive reward interdependence, as compared to reward independence, enhances cooperative learning only if learners work on a 'routine task' (a task that could be achieved individually when members possess all information); if the learners work on a 'true group task' (involving the necessity of information exchange to complete the task), positive reward interdependence induces the same level of learning as reward independence and thus is not needed.

Positive interdependence in cooperative learning

Cooperative learning is a generic term that encompasses various pedagogical practices, as illustrated by the handbook of cooperative methods (Sharan, 1999), but with some common social psychological mechanisms. All cooperative learning methods require students to work as a team in order to reach a common goal. Cooperative and constructive student interactions are encouraged in order to reach this common goal. A strong individual responsibility regarding individual and partner's learning is promoted, as well as a strong positive interdependence among members of the team (Davidson, 1994). However, as mentioned by O'Donnell (1996, p. 74), 'Researchers agree that positive interdependence among members is necessary [but] few agree on the most appropriate way to create such interdependence'. The core of the theoretical tussle is whether positive goal interdependence (working cooperatively) is sufficient or if positive reward interdependence (being rewarded together) is also needed.

Positive goal and reward interdependence

Research on the reasons why students work together has focused on the goals and the rewards (Johnson & Johnson, 1989). Positive goal interdependence refers to a situation in which students can reach their goal only if the other team members reach their own, which is typical of the classic definition of cooperation (Deutsch, 1962; Johnson & Johnson, 1989). Rewards refer to the consequences of goal achievement. Positive reward interdependence is at work when 'each group member receives the same reward when the group achieves its goals' (Johnson & Johnson, 1994, p. 33).

Some researchers, as Johnson and Johnson (1989), suggest that positive goal interdependence leads, in and of itself, to constructive student interactions; positive student interactions, in turn, improve learning. In sum, in their view, positive goal interdependence is sufficient to induce actual cooperation, and its positive effects. On the contrary, Slavin (1995) proposes that positive reward interdependence (students are rewarded as a group) is the factor that largely explains the relation between cooperation and gain in learning. Students would work cooperatively only when they gain joint reward for that. This point has been fiercely debated with opposite positions represented by Slavin (1991a,b), supporting the need for positive reward interdependence, and Kohn (1991a,b), opposing it. Other authors have joined the debate more recently (van Vijfeijken, Kleingeld, van Tuijl, Algera, & Thierry, 2002, 2006; Wageman, 1995), but to date, these positions remain intractable.

A few articles have addressed this issue from an experimental point of view (Mesch, Johnson, & Johnson, 1988; Slavin, 1984, 1996), but until now no convincing experimental results have been found. For example, some studies indicated that positive goal interdependence in itself increased achievement over individual work, but the combination of positive goal and reward interdependence was better (Mesch *et al.*, 1988). Others indicated that positive effects of reward interdependence either appeared in the short term (only when the reward system was clearly in place), or was entirely absent (Chapman & Cope, 2004). Other studies (Johnson, Johnson, & Stanne, 1989; Ortiz, Johnson, & Johnson, 1996) suggested that positive goal interdependence was sufficient to enhance learning, but in these studies positive reward interdependence co-varied with positive goal interdependence (the group received a bonus point contingent upon individual performance). Other studies indicated no significant additional effect of positive reward interdependence (Huber & Eppler, 1990, Study 1; Watson & Marshall, 1995). Others indicated that neither positive goal interdependence, nor the addition of positive reward interdependence increased achievement (Lew, Mesch, Johnson, & Johnson, 1986). Moreover, some authors have warned against the potentially negative effect of rewards (O'Donnell, 1996). In sum, it is still not clear whether positive goal interdependence is sufficient or if positive reward interdependence is also needed to enhance learning outcomes in cooperative learning.

Interestingly, Cohen (1994) proposed that the efficacy of the different types of positive interdependence depends on the student interactions that are stimulated. Indeed, Terwel, Gillies, van den Eeden, and Hoek (2001), as well as Webb (2009), demonstrated the mediating role of student interactions. Thus, it is important to differentiate routine tasks (that could be achieved individually) and true group task (involving the necessity to interact in order to exchange information and resources, before students can complete their tasks, Cohen & Cohen, 1991). According to Cohen (1994), Slavin's proposition on the necessity of positive reward interdependence would be valid for routine tasks, for which it is important to motivate students to interact. Nevertheless, if positive student interactions are already stimulated, because students with a true group task need to exchange information, positive reward interdependence would not be necessary for learning gains to appear. However, to date, this theoretical contention has never been experimentally tested.

In sum, the above research converges to suggest the theoretical hypothesis that, in addition to positive goal interdependence, positive reward interdependence is also needed to enhance learning only when students need external incentive to interact (routine task), and that positive goal interdependence is sufficient when students really need to interact in order to master the task (true group task). In order to operationalize

the difference between true group tasks and routine tasks, we have drawn upon the literature on resource interdependence.

Positive resource interdependence

During cooperative work, resources – e.g., texts to study – can be distributed in a complementary way to the learners (positive resource interdependence), so that learners need to share their information in order to master the whole task. One can also distribute the same resources to the learners (resource independence), which renders learners independent from one another.

Several studies have investigated the impact of resource interdependence (Johnson *et al.*, 1989; Lambiotte *et al.*, 1987, 1988; Ortiz *et al.*, 1996). Lambiotte and colleagues proposed students to work on texts in scripted dyads. In all conditions, positive goal interdependence was induced, and students' learning was individually evaluated after group work. They found that positive resource interdependence led to better learning than resource independence. Nevertheless, these studies did not document what made positive resource interdependence efficient.

With a procedure very similar to Lambiotte and colleagues', more recent research has shown that positive resource interdependence and resource independence contribute to design two different dynamics as far as student interactions are concerned (see Buchs, Butera, Mugny, & Darnon, 2004, for a review). Research showed that when students worked on identical information (resource independence), their discussions were more often confrontational and the climate was more individualistic and even competitive (Buchs, Butera, & Mugny, 2004, Studies 1 and 2). In this context, partners' competence became threatening and detrimental for students' learning (Buchs & Butera, 2009; Buchs, Pulfrey, Gabarrot, & Butera, 2010). Competitive relational activities (i.e., reported activities directed to social comparison of competence) have been shown to be responsible for the negative effects on learning of working on identical information (Buchs, Butera, & Mugny, 2004, Study 1).

On the contrary, working on complementary information (positive resource interdependence) created a reciprocal informational dependence since students accessed only one part of the needed information (Buchs & Butera, 2001). In line with Cohen and Cohen (1991), reciprocal interdependence prompted students' involvement in information transmission (explaining, questioning) and favoured social processes of cooperation (Buchs, Butera, & Mugny, 2004, Study 1). The partner was perceived as an informational support and partner's competence was welcomed and beneficial for learning (Buchs & Butera, 2009).

Thus, these studies indicated that working on identical information can be viewed as a routine task in which constructive interactions need to be strengthened, whereas working on complementary information can be viewed as a true group task (the task cannot be accomplished unless the partner participates) that stimulates constructive interactions in itself.

When is reward interdependence needed?

In the present experiment, students worked in cooperative dyads on academic texts, and we measured to what extent they learned these texts. Thus, positive goal interdependence was induced in all conditions. Yet, is reward interdependence also needed to enhance learning? Under what conditions? To answer these questions, the experiment

manipulated reward interdependence by inducing either positive reward interdependence (group reward) or reward independence (individual reward), as well as resource interdependence, under the form of either positive resource interdependence (students worked with complementary texts) or resource independence (identical texts). Based on the above analysis, we hypothesize that in resource independence (identical information), the task is in fact a routine task, an individual task to carry out in dyads, and positive reward interdependence will be needed to prompt students to interact and to make cooperative learning beneficial. In contrast, when students work under positive resource interdependence (complementary information), the task is in fact a true group task that involves students in positive interactions, and renders reward interdependence unnecessary to foster cooperative learning. In sum, we expect an interaction effect, whereby positive reward interdependence leads to better learning than reward independence when students work on identical information, but not when students work on complementary information.

Method

Participants

This study took place during the normal programme of second-year social psychology workshops in a large French university. Students were required to work with a same-sex partner they did not know before the workshop. We included in the experimental sample only the 62 students who were present and worked in the three experimental sessions as well as in the fourth non-experimental session when the delayed individual learning test was administered: 30 students in reward independence conditions (the same groups as in Buchs, Butera, & Mugny, 2004, Study 2) – 12 on identical information and 18 on complementary information – and 32 in positive reward interdependence conditions – 20 on identical information and 12 on complementary information. Among the dyads, only one was a masculine one. Results did not change significantly when this dyad (working on identical information with positive reward interdependence) was removed, so this dyad was kept in the analysis.

Materials

Students worked on six social psychology texts (each text presented one mechanism intervening in manipulation, extracted from Cialdini, 1987's book) related to the topic of the course, but never previously used in the course (Rule of Reciprocity, Commitment and Consistency, Social proof, Liking, Authority, and Scarcity). Moreover, we checked that the specific content of these texts had not been addressed in any other course in the students' curriculum. The content of the texts was therefore unfamiliar to the students, and represented a challenge in that they included a series of new psychological principles, along with experimental demonstrations and field applications. The six texts were formatted in such a way that they could be read independently in less than 20 minutes without taking notes (from $M = 7.25$ to 8.14 minutes, $F(5,40) = 0.28$, ns). These texts had been pre-tested by Buchs, Butera, and Mugny (2004); students perceived them as an 'optimal challenge' (Harter, 1978), as they perceive them as accessible ($M = 5.56$ on a scale from 1 = *difficult* to 7 = *easy*) but challenging ($M = 4.81$ on a scale from 1 = *nomastery* to 7 = *totalmastery*).

Procedure

The present experiment used the procedure and materials validated by Buchs, Butera, and Mugny (2004). Students worked in cooperative dyads for three 2-hour sessions, which represented half of the total duration of the usual workshops in this university. Such duration might seem short, but Johnson and Johnson's (1989) meta-analysis showed no effect of the duration of study on the effects of cooperative learning. Participants were required to read the texts and share their ideas. Positive goal interdependence was introduced in all experimental conditions by stressing that students had to care both for their own learning but also for their partner's learning. The goal was to reach mastery for both student, and they received a feedback regarding their level of mastery. In line with scripted cooperation (O'Donnell, 1999), two roles were introduced in order to facilitate partner's participation, summarizer and listener; students alternated in these roles during the task (see below). Then resource interdependence was introduced: students worked on two psychological texts at each session, either identical or complementary (see the 'Independent variables' section). They had 20 minutes to read one text followed by 10 minutes discussion according to their roles. After they worked on the two texts, students were asked to answer 10 questions (Multiple Choice Test, MCT) on each text studied in the session. The MCT format for experimental sessions was introduced according to reward interdependence conditions, either individual or common (see the 'Independent variables' section). A follow-up test took place 4 weeks after the third session of dyadic work; this individual MCT allowed examining individual learning. All MCT were presented to the students as formative assessments that would help them to prepare for the final exam. The content of the texts studied during the experiment was part of the general area to be reviewed for the final social psychology exam, but students were informed that the results obtained during the training would not be included in their final evaluation mark.

Independent variables

Resource interdependence

In the *resource independence condition*, students worked on identical information. For each session, the two students in the dyads read silently the two texts and then, discussed the texts according to the assigned roles. More precisely, each had 20 minutes to read the first text, and after, one of the students played the summarizer role while the other played the listener role during the 10-minutes discussion. After that, they both read the second text during 20 minutes and the roles were reversed for the discussion. In the *positive resource interdependence*, students worked on complementary information. For each session, each student read only one text and accessed the other text thanks to her/his partner. One of the students started to read the first text during 20 minutes, and played the summarizer role during discussion. After that, the other student read the second text and played the summarizer role. In order to sustain a good level of attention from the listener, this latter was asked to read a newspaper article (students were informed that the purpose was to maintain their attention during the reading period and that the newspaper would not be discussed).

Reward interdependence

Reward interdependence was manipulated through the format of the MCT at the end of each experimental session. In both conditions, students were asked to discuss the

whole information, insure that both partners understand the two texts, and clarify all points. It should be noted that students were working on materials highly relevant for their final, certificative exam, and that the feedback they received was a very important opportunity to assess their level of mastery. In the reward independence condition, students were informed that they would individually answer an MCT on the two texts at the end of each session. They received a feedback regarding their respective level of mastery. In the positive reward interdependence, students were informed that they would answer together a common MCT on the two texts at the end of each session. They received a feedback concerning their common level of mastery. It was specified that they had to clarify all points during the discussion, and that they would have no time to discuss deeply again while answering the common MCT, they would just have to reach a common answer. This procedure provided an incentive for students to make sure that both partners reached an agreement on the understanding of the study materials with a view of being rewarded based on their common learning. It is worth noting that the results of the three tests that took place during the three experimental sessions will not be reported. Indeed these measures are not comparable across conditions, since they used two different methods of assessment – two individual MCTs in the reward independence condition, and a common MCT in the positive reward interdependence condition – and they only served the purpose of manipulating reward interdependence.

Dependent variables

Individual learning was assessed through a delayed MCT. This learning test took place 4 weeks after the last session of dyadic work. Students were not forewarned about this test, which was used to obtain the measure of delayed individual learning. Four questions for each text were introduced in this MCT. The tests included both questions about the text content (regarding the theory and the related experiments; e.g., ‘The text on authority reports that submission to authority necessitates . . .’) and comprehension questions (questions requesting generalization to new situations; e.g., ‘Paul witnesses a road accident. When he approaches the scene to offer assistance, a man arrives stating that he is a physician and initiates a clearly wrong manipulation. What is Paul going to do . . .’). One point was allocated for a correct answer, 0 for no answer and -0.25 for mistakes (to discourage students from answering at random). These criteria were those used in the official evaluation made in the regular courses, and were explained again to students before the MCT. Thus, individual learning score was the mean of the six texts and ranged from -1 to $+4$.

Results

In this experiment, analyses at the dyad level would be the most appropriate. However, following Kenny, Mannetti, Pierro, Livi, and Kashy (2002), with the present number of dyads and participants, analyses at the individual level are still valid if intra-class correlations are low. Intra-class correlation regarding learning outcome was $\rho_1 = .25$, indicating that the effect of non-independence on p value is low. Thus, in the Results section, individual students are used as the unit of analysis.

A 2 (Resource interdependence: Identical information, Complementary information) \times 2 (Reward interdependence: Positive reward interdependence, Reward independence) between-participant ANOVA on the measure of delayed individual

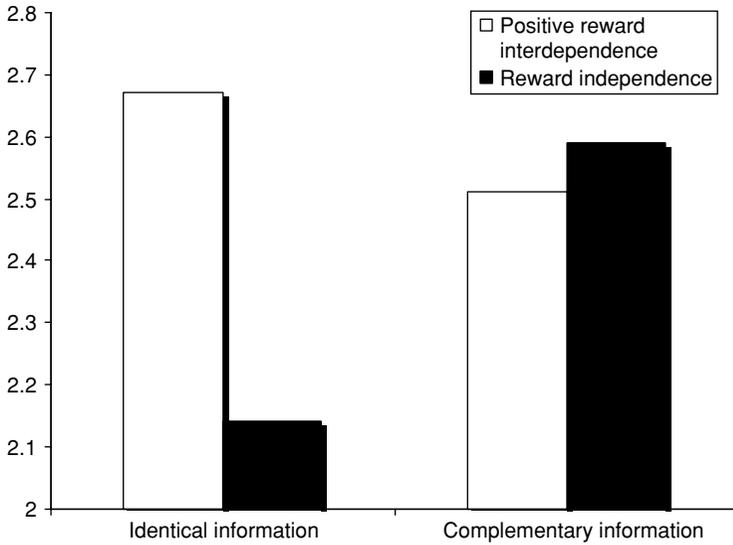


Figure 1. Individual learning (-1 to $+4$) depending on resource interdependence and reward interdependence.

learning revealed that none of the main effects was significant, but the predicted interaction was significant, $F(1,58) = 5.02, p < .03, \eta_p^2 = .08$; see Figure 1. As expected, the simple effect of reward interdependence was significant when students worked on identical information, $F(1,58) = 7.73, p < .01, \eta_p^2 = .12$, as students learned more when positive reward interdependence was introduced ($M = 2.67, SD = 0.53$) than when reward was independent ($M = 2.14, SD = 0.54$), whereas the simple effect was non-significant when students worked on complementary information, $F(1,58) = 0.17, p > .68, \eta_p^2 = .01$ ($M = 2.51, SD = 0.39$ and $M = 2.59, SD = 0.56$, respectively).

Discussion

This study originated from the observation that, notwithstanding more than 30 years of research and the availability of meta-analytical data, there is still a debate regarding whether positive reward interdependence is needed to promote learning in cooperative learning. Some researchers propose that positive goal interdependence is sufficient (e.g., Johnson & Johnson, 1989), others suggest that positive reward interdependence is also needed (e.g., Slavin, 1995). To date, no empirical evidence has favoured one position over the other. We undertook comparing these two positions by drawing on the theoretical suggestion made by Cohen (1994) that the efficacy of positive reward interdependence may depend on the type of task at hand (routine task vs. group task). We hypothesized that positive reward interdependence would be needed to enhance learning, as compared to reward independence, in tasks that can be achieved individually (routine tasks), tasks for which it is important to motivate students to interact. Nevertheless, if positive student interactions are already stimulated by the need to share information (true group tasks), positive reward interdependence would not be necessary. In our experiment, we tested this prediction by manipulating resource

interdependence. Previous studies (e.g., Buchs, Butera, & Mugny, 2004) underlined that working on identical information (resource independence) can be viewed as a routine task, whereas working on complementary information (positive resource interdependence) can be considered as a true group task that cannot be accomplished unless the full participation of all members.

Results indicated that, indeed, when students worked on identical information, the introduction of positive reward interdependence enhanced learning, as compared to reward independence. On the contrary, positive reward interdependence did not influence learning when students worked on complementary information. Working on complementary information is a true group task (the task cannot be accomplished unless the partner participates), and the addition of positive reward interdependence is useless.

The first contribution of the present article is theoretical. These results offer for the first time empirical evidence that allow a clear-cut conclusion on the necessity of positive reward interdependence to foster cooperative learning. Thus, it can be proposed that when informational interdependence reinforces student's involvement in cooperative learning (working on complementary information), the addition of a positive reward interdependence is not needed. Nevertheless, this addition could favour learning in tasks in which students' involvement is less important (working on identical information). In sum, although Johnson and Johnson's (1989) view that positive goal interdependence is sufficient to induce the positive effects of cooperative learning has been considered at odds with Slavin's (1995) view that positive reward interdependence is also needed, the present results suggest that these two views are in fact valid under different conditions.

These results have also some important practical implications and can contribute to give some alternative directions to the use of positive reward interdependence. Indeed, some educators may rightly be afraid that positive reward interdependence undermines long-term motivation (see Chapman & Cope, 2004; Damon, 1984). Rewards could elicit an instrumental cooperation in which students' interest is focused more on group productivity than on individual leaning. This type of interdependence can orient students' achievement goal (Dweck & Leggett, 1988) and favour some maladaptive behaviours. For example, positive reward interdependence could stimulate performance goal more than mastery or learning goal and elicit more concerns for good answers than deep understanding. The study we have conducted underlines that an alternative to reward interdependence is to think about how to stimulate student interactions, which implies, among other things, to propose true group tasks. Reflections on means interdependence can be an interesting direction for educators as suggested by Abrami and Chambers (1996).

References

- Abrami, P. C., & Chambers, B. (1996). Research on cooperative learning and achievement: Comments on Slavin. *Contemporary Educational Psychology*, *21*(1), 70-79. doi:10.1006/ceps.1996.0005
- Aronson, E., Blaney, N., Stephan, C., Sikes, J., & Snapp, M. (1978). *The jigsaw classroom*. Beverly Hills, CA: Sage Publications.
- Buchs, C., & Butera, F. (2001). Complementarity of information and quality of relationship in cooperative learning. *Social Psychology of Education*, *4*, 335-357. doi:10.1023/A:1011392906032
- Buchs, C., & Butera, F. (2009). Is a partner's competence threatening during dyadic cooperative work? It depends on resource interdependence. *European Journal of Psychology of Education*, *24*(2), 145-154. doi:10.1007/BF03173007

- Buchs, C., Butera, F., & Mugny, G. (2004). Resource interdependence, student interactions and performance in cooperative learning. *Educational Psychology, 24*(3), 291-314. doi:10.1080/0144341042000211661
- Buchs, C., Butera, F., Mugny, G., & Darnon, C. (2004). Conflict elaboration and cognitive outcomes. *Theory Into Practice, 43*(1), 23-30. doi:10.1207/s15430421tip4301_4
- Buchs, C., Pulfrey, C., Gabarrot, F., & Butera, F. (2010). Competitive conflict regulation and informational dependence in peer learning. *European Journal of Social Psychology, 40*(3), 418-435. doi:10.1002/ejsp.631
- Chapman, E. S., & Cope, M. T. (2004). Group reward contingencies and cooperative learning: Immediate and delayed effects on academic performance, self-esteem, and sociometrics ratings. *Social Psychology of Education, 7*, 73-87. doi:10.1023/B:SPOE.0000010669.95227.f3
- Cialdini, R. B. (1987). *Influence et manipulation [Influence and manipulation]*. Paris: A. Michel.
- Cohen, B. P., & Cohen, E. G. (1991). From groupwork among children to R&D teams: Interdependence, interaction and productivity. In E. Lawler, B. Markovsky, C. Ridgeway, & H. Walker (Eds.), *Advances in group processes* (Vol. 8, pp. 205-226). Greenwich, CT: Jai Press.
- Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research, 64*(1), 1-35.
- Damon, W. (1984). Peer education: The untapped potential. *Journal of Applied Developmental Psychology, 5*, 331-343. doi:10.1016/0193-3973(84)90006-6
- Davidson, N. (1994). Cooperative and collaborative learning: An integrative perspective. In J. S. Thousand, R. A. Villa, & A. I. Nevin (Eds.), *Creativity and collaborative learning: A practical guide to empowering students and teachers* (pp. 13-30). Baltimore, MD: Paul H. Brookes Publishing.
- Deutsch, M. (1962). Cooperation and trust: Some theoretical notes. In M. R. Jones (Ed.), *Nebraska Symposium on Motivation* (pp. 275-319). Lincoln, NE: University of Nebraska Press.
- Dweck, C. S., & Leggett, E. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*, 256-273. doi:10.1037/0033-295X.95.2.256
- Harter, S. (1978). Pleasure derived from challenge and the effects of receiving grades on children's difficulty level choices. *Child Development, 49*, 788-799. doi:10.2307/1128249
- Huber, G. L., & Eppler, R. (1990). Team learning in German classrooms: Processes and outcomes. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp. 151-172). New York: Praeger.
- Johnson, D. W., & Johnson, R. T. (1974). Instructional goal structure: Cooperative, competitive, or individualistic. *Review of Educational Research, 44*, 213-240.
- Johnson, D. W., & Johnson, R. T. (1989). *Cooperation and competition, theory and research*. Minneapolis, MN: Interaction Book Company.
- Johnson, D. W., & Johnson, R. T. (2002). Social interdependence theory and university instruction: Theory into practice. *Swiss Journal of Psychology, 61*(3), 119-129. doi:10.1024//1421-0185.61.3.119
- Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher, 38*(365), 365-379. doi:10.3102/0013189X09339057
- Johnson, D. W., Johnson, R. T., & Smith, K. (2007). The state of cooperative learning in postsecondary and professional settings. *Educational Psychology Review, 19*, 15-29. doi:10.1007/s10648-006-9038-8
- Johnson, D. W., Johnson, R. T., & Stanne, M. B. (1989). Impact of goal and resource interdependence on problem-solving success. *Journal of Social Psychology, 129*(5), 621-629.
- Johnson, R. T., & Johnson, D. W. (1994). An overview of cooperative learning. In J. S. Thousand, R. A. Villa, & A. I. Nevin (Eds.), *Creativity and collaborative learning: A practical guide to empowering students and teachers* (pp. 31-44). Baltimore, MD: Paul H. Brookes.

- Kenny, D. A., Mannetti, L., Pierro, A., Livi, S., & Kashy, D. A. (2002). The statistical analysis of data from small groups. *Journal of Personality and Social Psychology*, *83*, 126–137. doi:10.1037/0022-3514.83.1.126
- Kohn, A. (1991a). Don't spoil the promise of cooperative learning. *Educational Leadership*, *48*(5), 93–94.
- Kohn, A. (1991b). Group grade grubbing versus cooperative learning. *Educational Leadership*, *48*(5), 83–87.
- Lambiotte, J. G., Dansereau, D. F., O'Donnell, A. M., Young, M. D., Skaggs, L., & Hall, R. (1988). Effects of cooperative script manipulations on initial learning and transfer. *Cognition and Instruction*, *5*(2), 103–121. doi:10.1207/s1532690xci0502.1
- Lambiotte, J. G., Dansereau, D. F., O'Donnell, A. M., Young, M. D., Skaggs, L. P., Hall, R. H., . . . Rocklin, T. R. (1987). Manipulating cooperative scripts for teaching and learning. *Journal of Educational Psychology*, *79*(4), 424–430. doi:10.1037/0022-0663.79.4.424
- Lew, M., Mesch, D., Johnson, D. W., & Johnson, R. T. (1986). Positive interdependence, academic and collaborative-skills group contingencies, and isolated students. *American Educational Research Journal*, *23*, 476–488.
- Mesch, D., Johnson, D. W., & Johnson, R. T. (1988). Impact of positive interdependence and academic group contingencies on achievement. *Journal of Social Psychology*, *128*(3), 345–352.
- O'Donnell, A. M. (1996). Effects of explicit incentives on scripted and unscripted cooperation. *Journal of Educational Psychology*, *88*(1), 74–86. doi:10.1037/0022-0663.88.1.74
- O'Donnell, A. M. (1999). Structuring dyadic interaction through scripted cooperation. In A. M. O'Donnell & A. King (Eds.), *Cognitive perspectives on peer learning. The Rutgers Invitational Symposium on Education Series* (pp. 179–196). Mahwah, NJ: Erlbaum.
- Ortiz, A. E., Johnson, D. W., & Johnson, R. T. (1996). The effect of positive goal and resource interdependence on individual performance. *Journal of Social Psychology*, *136*(2), 243–249.
- Roseth, C. J., Johnson, D. W., & Johnson, R. T. (2008). Promoting early adolescents' achievement and peer relationships: The effects of cooperative, competitive, and individualistic goal structures. *Psychological Bulletin*, *134*(2), 223–246. doi:10.1037/0033-2909.134.2.223
- Serrano, J. M., & Pons, R. M. (2007). Cooperative learning: We can also do it without task structure. *Intercultural Education*, *18*(3), 215–230. doi:10.1080/14675980701463562
- Sharan, S. (Ed.), (1999). *Handbook of cooperative learning methods*. Westport, CT: Greenwood Publishing Group.
- Slavin, R. E. (1984). Students motivating students to excel: Cooperative incentives, cooperative tasks, and students achievement. *Elementary School Journal*, *85*(1), 53–63. doi:10.1086/461391
- Slavin, R. E. (1991a). Group rewards make groupwork work. *Educational Leadership*, *48*(5), 89–91.
- Slavin, R. E. (1991b). Synthesis of research on cooperative learning. *Educational Leadership*, *48*(5), 71–82.
- Slavin, R. E. (1995). When and why does cooperative learning increase achievement? Theoretical and empirical perspectives. In R. Hertz-Lazarowitz & N. Miller (Eds.), *Interaction in cooperative groups: The theoretical anatomy of group learning* (pp. 145–173). New York: Cambridge University Press.
- Slavin, R. E. (1996). Developmental and motivational perspectives on cooperative learning: A reconciliation. *Contemporary Educational Psychology*, *21*, 43–69. doi:10.1006/ceps.1996.0004
- Terwel, J., Gillies, R. M., van den Eeden, P., & Hoek, D. (2001). Co-operative learning processes of students: A longitudinal multilevel perspective. *British Journal of Educational Psychology*, *71*(4), 619–645. doi:10.1348/000709901158703
- van Vijfeijken, H., Kleingeld, A., van Tuijl, H., Algera, J. A., & Thierry, H. (2002). Task complexity and task, goal, and reward interdependence in group performance management: A prescriptive model. *European Journal of Work and Organizational Psychology*, *11*(3), 363–383. doi:10.1080/13594320244000193

- van Vijfeijken, H., Kleingeld, A., van Tuijl, H., Algera, J. A., & Thierry, H. (2006). Interdependence and fit in team performance management. *Personnel Review*, 35(1), 98-117. doi:10.1108/00483480610636812
- Wageman, R. (1995). Interdependence and group effectiveness. *Administrative Science Quarterly*, 40(1), 145-180. doi:10.2307/2393703
- Watson, S. B., & Marshall, J. E. (1995). Effects of cooperative incentives and heterogeneous arrangement on achievement and interaction of cooperative learning groups in a college life science course. *Journal of Research in Science Teaching*, 32(3), 291-299. doi:10.1002/tea.3660320308
- Webb, N. M. (2009). The teacher's role in promoting collaborative dialogue in the classroom. *British Journal of Educational Psychology*, 79(1), 1-28. doi:10.1348/000709908X380772

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