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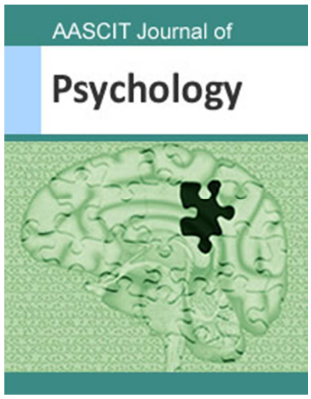


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# Effect of Task and Goal Interdependence on Achievement, Cooperation, and Support Among Elementary School Students

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## Abstract
The effects of three interdependence conditions (task and goal interdependence, task interdependence and goal independence, and individual efforts (i.e., no interdependence) were compared on achievement, attitudes toward cooperation, peer academic support, and peer personal support. One hundred and forty-eight Italian elementary school students participated in a one-year cooperative learning program. At the end of the program students were randomly assigned to experimental conditions and participated to two 90-minute instructional units. Participants completed an achievement assessment and the Classroom Life Measure after the second instructional unit. Students assigned to the task and goal interdependence condition showed higher achievement, more cooperativeness, and more perceived peer academic and social support than did students in other two conditions. Similarly, students in the task interdependence with goal independence condition showed more positive attitudes toward cooperation and perceptions of more peer personal support than did students in the individual condition.

## 1. Introduction

Positive interdependence is widely recognized as the defining characteristic of cooperation, just as negative interdependence is the defining characteristic of competition, and no interdependence is the defining characteristic of individualistic efforts (Deutsch, 1949a, 1962; Johnson & Johnson, 1989, 2009). There are a number of ways positive interdependence can be established among group members (Deutsch, 1962; Johnson & Johnson, 1989, 1992a; Johnson, Johnson & Holubec, 2008). Two of the categories of interdependence are outcome (goal and reward) and means (role, resource, task) interdependence. That is, cooperation may be established by working toward a mutual goal or for a joint reward, or cooperative may be established by the actions required on the part of group members to achieve their goals (i.e., means by which the goal is to be reached) such as assigning group members roles, combining the diverse resources of group members, or engaging in a division of labor. While Lewin (1935) and Deutsch (1949) posited that cooperation consisted of positive goal interdependence, there are other researchers who posited that means interdependence is also characteristic of cooperation (e.g., Johnson & Johnson, 1992a, 1992b; Thomas, 1957). Outcome interdependence has been researched extensively (Deutsch, 1962; Johnson & Johnson,

1989, 2009; Skinner, 1968), but there is a relative lack of research on means interdependence. Especially unexamined is the impact of task interdependence (i.e., a division of labor) on achievement and other variables of interest. The primary purpose of this study, therefore, is to examine the relative impact of task interdependence, with and without goal interdependence, on achievement, attitudes toward cooperation, peer academic support, and peer personal support.

In order to examine the impact of goal and task interdependence on the proposed dependent variables, it is first necessary to define the two types of interdependence. *Positive goal interdependence* may be defined as participants perceiving that they cannot succeed in reaching their goal if and only if the other individuals with whom they are cooperatively linked also reach their goals (Deutsch, 1949). They therefore promote each other's efforts to achieve the goals. In contrast, negative goal interdependence exists when individuals perceive that they can obtain their goals if and only if the other individuals with whom they are competitively linked fail to obtain their goals (Deutsch, 1949). They therefore obstruct each other's efforts to achieve the goals. No goal interdependence exists when individuals perceive that they can reach their goal regardless of whether other individuals in the situation attain or do not attain their goals.

*Task interdependence* exists when a task is broken down into subtasks so that the each group member has to complete a subtask if the group is going to achieve its goal (Johnson & Johnson, 1992a). Task interdependence may involve a pooled task in which subtasks are performed separately and in any order, or it involve a sequential task in which subtasks must be completed in a specified sequence. Task interdependence motivates individuals to complete a unique part of the group's work so the group can achieve its goals (Thomas, 1957; Johnson & Johnson, 1992a). A group member completes his or her subtask out of recognition that (a) other group members cannot benefit from their work unless the group member does his or her part (and vice versa) and (b) the group will achieve its goals only if all members adequately complete their subtasks.

In examining the impact of task interdependence with and without positive goal interdependence, this study investigated four issues. The issues focus on the relative impact of positive goal and task interdependence, goal independence and task interdependence, and individualistic efforts (i.e., goal and task independence) on (a) achievement, (b) attitudes toward cooperation, (c) perceptions of peer academic support, and (d) perceptions of peer personal support. In addition, almost all the research on task interdependence and these dependent variables has been conducted with adults in North America. (Johnson & Johnson, 1989, 2009) The unique nature of the sample and setting of the study will be descripted.

The first issue investigated in this study concerns the relative impact of positive goal and task interdependence, goal independence and task interdependence, and individualistic efforts (i.e., goal and task independence) on achievement. There is considerable research demonstrating that positive goal interdependence results in higher achievement and productivity than do negative or no goal interdependence (e.g., Johnson, & Johnson, 1974, 1978, 1989, 2009; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981). There have been few studies examining the impact of task interdependence on achievement. Allen, Sargent, and Bradley (2003) found that task interdependence decreased achievement, perhaps due to the increased task complexity introduced by task interdependence. Wageman and Baker (1997) found that task interdependence in and of itself did not have a positive impact on performance. It was only when it was combined with reward interdependence that achievement was increased. These findings are somewhat surprising, as other research indicates that task interdependence has a positive effect on knowledge sharing, group efficacy, trust, integration of others' ideas, and helping behavior (Alavi & McCormick, 2008; Erez & Katz, 2002; Katz-Navon, 2005; Staples, & Webster, 2008; Webb, Troper & Fall, 1995), all of which should promote achievement. Thus, there is contradictory evidence concerning task interdependence and achievement, with the direct evidence indicating the increased task complexity created by task interdependence will tend to decrease achievement while other studies indicate a position relationship between task interdependence and factors such as group efficacy that should increase achievement. It is necessary, therefore, to conduct further studies on the impact of task interdependence on achievement to resolve this inconsistency. Based on these studies, it may be hypothesized that the combination of goal and task interdependence will result in higher achievement than will task interdependence with goal independence or individualistic efforts. The combination of task interdependence and goal independence may produce lower achievement than will individualistic efforts, due to the increased complexity of task interdependence procedures.

The second issue concerns the relative impact of positive goal and task interdependence, goal independence and task interdependence, and individualistic efforts (i.e., goal and task independence) on attitudes toward cooperation. While there is considerable evidence that more positive attitudes toward cooperation are found in cooperative than in competitive or individualistic situations (Johnson & Johnson, 1989), there is no research comparing the impact of task interdependence (with and without goal independence) and individualistic efforts on attitudes toward cooperation. This may be the first study to make such a comparison. Since task interdependence is inherently cooperative, it may be hypothesized that the most positive attitudes toward cooperation will be found in the positive goal interdependence, task interdependence condition. In addition, more positive attitudes toward cooperation may be found in the task interdependence, goal independence condition than in the individualistic condition.

The third issue concerns the relative impact of positive goal and task interdependence, goal independence and task interdependence, and individualistic efforts (i.e., goal and task independence) on perceived peer academic support. Social support plays an important role in promoting physical and psychological health as well as achievement and productivity (Johnson, 2013; Johnson & Johnson, 1989). Social support can be specific (i.e., aimed at certain activities the person is engaging in) or global (i.e., aimed at the person as a whole). Peer academic support is aimed at supporting and encouraging the specific actions needed to achieve and be productive. There is evidence that positive goal interdependence results in higher perceived peer academic support than do competitive or individualistic efforts (e.g., Gaith, 2002; 2003; Gaith, Shaaban & Harkous, 2007; Johnson & Johnson, 1983; 1989; 2005; Johnson, Johnson, Buckman, & Richards, 1985; Johnson, Johnson & Anderson, 1983). There is an absence of research assessing the impact to task interdependence on perceived peer academic support. This may be the first study to do so. Because task interdependence even with goal independence is inherently cooperative and is specifically imbedded in the academic task, it may be predicted that it will result in greater perceived peer academic support than will individualistic efforts. The highest level of perceived peer academic support, however, is expected to be in the task and positive goal independence condition.

The fourth issue concerns the relative impact of positive goal and task interdependence, goal independence and task interdependence, and individualistic efforts (i.e., goal and task independence) on perceived peer personal support. Again, there is considerable evidence that cooperative efforts promote higher levels of peer personal support than do competitive or individualistic efforts (e.g., Gaith, 2002; 2003; Gaith, Shaaban & Harkous, 2007; Johnson & Johnson, 1983; 1989; 2005; Johnson, Johnson, Buckman, & Richards, 1985; Johnson, Johnson & Anderson, 1983). There has been little or no research, however, on the impact of task interdependence (with or without goal interdependence) on peer personal support. This may be the first study to do so. Because of the inherently cooperative nature of task interdependence, it is hypothesized that it (with and without goal interdependence) will promote higher levels of peer personal support than will individualistic efforts. The highest level of peer personal support is expected to be situations containing both task interdependence and goal interdependence.

The fifth issue is whether task interdependence will be effective when used with elementary school students. Research on the effect of task interdependence has focused mainly on college students or adults in working groups and organizations (e.g., Aube & Rousseau, 2005; Aube, Rousseau, Mama, & Morin, 2009; Bachrach, Powell, Collins, & Richey, 2006; De Dreu, 2007; Hirst, 1988; Katz-Navon, & Erez, 2005; Langfred, 2005; 2007; Rico & Cohen, 2005; Somech, Desivilya, & Lidogoster, 2009) and school disciplinary teams (e.g., Somech, 2008). There have been only a few published studies about the effect of positive task interdependence on elementary school students (e.g., Bertucci, Conte, Johnson & Johnson, 2010), especially elementary students outside of North America. In this study, therefore, elementary students in Italy will be the individuals participating in the study.

# 2. Method

## 2.1. Participants

One hundred and forty-eight 3rd and 4th grade Italian elementary school students participated in this study (72 males and 76 females). Students were randomly assigned to three conditions: 60 students (26 males and 34 females) were assigned to the positive task plus goal interdependence condition; 42 students (24 males and 18 females) were assigned to the positive task interdependence with goal-independence condition; and 46 students (22 males and 24 females) were assigned to the individualistic/no interdependence condition.

## 2.2. Learning Unit

The learning unit for the experimental sessions covered content focused on recycling and garbage disposal. Participating teachers had not covered these topics previously during their classes, and the content was mostly unfamiliar to students. The researchers and teachers developed separate but similar learning materials for third and fourth grade students. The learning materials for each grade consisted of two parts (one for each instructional day). Each day's content consisted of four paragraphs made up of six lines of text each. A paper-based achievement test, covering the content of the two-day lesson, was also developed for each grade level. A pilot study was conducted with fifteen 3rd and 4th grade students to verify that learning materials and assessment questions were age-understood.

## 2.3. Procedure and Experimental Design

Prior to the data collection for this study, all students participated in weekly cooperative learning activities for the duration of one year. Participants experienced different cooperative learning activities, working in pairs and changing partners every session. Immediately before the experimental session, students were randomly assigned to the three experimental conditions: (task plus positive goal interdependence, task interdependence with goal independence, and no interdependence/individual efforts). Participants in both cooperative learning conditions were also randomly placed in pairs. The 90-minute instructional sessions took place during two consecutive days beginning at 9:00 a.m. each day. A researcher observed each condition to ensure that teachers and students were following the research protocols. After a short introduction, students received the content sheets and were asked to learn the material (in pairs or individually) in order to complete an individual test at the end of the second session. There was no time limit and students were free to read the material as many times as they

wanted before the assessment.

### 2.4. Independent Variable

The independent variable was positive interdependence versus no interdependence. Two types of positive interdependence were studied: goal interdependence and task interdependence. Three conditions were included: (a) task interdependence plus positive goal interdependence, (b) task interdependence and goal independence, and (c) individualistic efforts (no goal or task interdependence). *Positive goal interdependence* was operationalized by telling students that (a) the goal of their group was to ensure that all members learned the assigned material, (b) group members were expected to work together and help each other learn the material, and (c) the goal of the group was to collect at least 12 points total on the test (with a minimum of 6 points earned by each partner). *Positive task interdependence* was operationalized by asking group members to perform the following steps while alternating roles for each paragraph in the lesson content: (a) read one paragraph out loud to partner; (b) paraphrase and summarize the material just read; (c) generate a question covering the principal aspects of the paragraph; and (d) answer the question. For example, in order to learn the first paragraph Student 1 performs step a, Student 2 performs step b, Student 1 performs step c, and Student 2 performs step d. To learn the second paragraph Student 2 performs step a, Student 1 performs step b, Student 2 performs step c, and Student 1 performs step d and so forth through the entire lesson. Students could receive up to 6 points for performing their two assigned steps competently. No interdependence (e.g., individualistic efforts) was operationalized by telling students to work independently without interacting with each other. Students had to perform by themselves the four steps to learn the material. They could earn up to 12 points for doing so. The researcher and teachers randomly observed each experimental condition to ensure that the students were following the proper procedures.

### 2.5. Dependent Variables

The first dependent variable was achievement. A paper-based achievement test, covering the content of the two-day lesson, was developed for each grade level. The assessment included 8 multiple choice questions with one correct and two incorrect answer options per question. One question was developed from the content covered in each paragraph. The assessment measure was administered individually at the end of the second instructional session. Students were instructed to complete the test alone without interacting with each other.

After the assessment, students completed three subscales of the Classroom Life Measure (Johnson, & Johnson, 1983, 1997; Johnson, Johnson, & Anderson, 1983): attitudes toward cooperation, peer academic and personal social support scales. Two bilingual social scientists translated the Classroom Life Measure questions from English into Italian individually and then compared translations (Chiari, 2003). An item was not finalized until both bilingual researchers reached agreement on the translated version (Brislin, 1970). A third bilingual social scientist then translated all items back into English to ensure that they matched the original questions. All items were written to fit a five-point Likert-type scale (from strongly disagree to strongly agree). Students were instructed to rate their attitudes toward cooperation and perception of academic and personal support referring to their experience during the two previous instructional days only.

The second dependent variable was attitudes toward cooperation. The cooperation scale consisted of seven items that measured liking for and positive attitudes toward working cooperatively with other students. The Cronbach's Alpha for this scale was 0.81.

The third dependent variable was perceived peer academic support. The peer academic support scale consisted of four items that measured participants' perception that classmates cared about how much they learned and desired to help their partner learn. The Cronbach's Alpha for this scale was 0.67. The peer personal support scale consisted of five items that measured students' perceptions that classmates care about and like them. The Cronbach's Alpha for this scale was 0.78.

### 2.6. Statistical Analyses

An analysis of variance (ANOVA) was conducted to determine the effect of interdependence conditions on academic achievement. Planned comparisons were conducted as follow-up tests.

A multivariate analysis of variance (MANOVA) was conducted to determine the effect of interdependence on attitudes toward cooperation and perceptions of academic and personal support. Univariate analysis of variance (ANOVAs) and planned comparisons were conducted as follow-up tests. Effect sizes were also calculated for each variable comparison of interest.

## 3. Results

The first variable investigated was academic achievement. The F omnibus test for type of interdependence was significant ($F(2, 145) = 16.73$, $p < .001$, $n^2 = .19$). Specifically, students assigned to task plus goal interdependence outperformed students assigned to task interdependence and students assigned to individual learning conditions ($F(1, 145) = 30.41$, $p < .001$, $n^2 = .17$). No significant differences were found between students assigned to task interdependence and individual learning ($F(1, 145) = 2.51$, $p = 0.12$, $n^2 = .017$), although the direction of the difference favors task interdependence. Descriptive statistics (i.e., means and standard deviations) are shown in Table 1.

***Table 1.*** *Means and standard deviations on achievement and different CLM scales.*

| | Task and goal interdependence | | Task interdependence And Goal Independence | | Individual learning | | |
|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | F |
| Achievement | 5.92 | 1.51 | 4.83 | 1.46 | 4.35 | 1.30 | 16.73* |
| Cooperation | 31.22 | 3.17 | 28.45 | 5.26 | 19.89 | 4.16 | 100.28* |
| Peer Academic Support | 17.18 | 2.43 | 13.90 | 3.83 | 13.41 | 1.98 | 27.78* |
| Peer Personal Support | 19.53 | 3.83 | 17.36 | 4.76 | 12.56 | 2.10 | 17.55* |

Note. Task and goal interdependence: n = 60; task interdependence: n = 42; individual learning: n = 46.
* $p < .01$

The multivariate F omnibus was significant (Wilk's Lambda = 0.345, $F(6, 286) = 33.48$, $p < .000$, $n^2 = .48$). Results show that univariate F omnibus for attitudes toward cooperation was significant ($F(2,145) = 100.28$, $p < .001$, $n^2 = .58$). Students assigned to both cooperative learning conditions showed better attitudes toward cooperation than students assigned to the individual learning condition ($F(1,145) = 178.91$, $p < .001$, $n^2 = .55$). Students assigned to task plus goal interdependence showed more positive attitudes toward cooperation than students assigned to the task interdependence condition ($F(1,145) = 10.88$, $p < .001$, $n^2 = .07$).

The univariate F omnibus for perception of peer academic support was significant ($F(2,145) = 27.78$, $p < .001$, $n^2 = .28$). Participants in both cooperative learning conditions showed a higher perception of peer academic support than students assigned to the individual learning condition ($F(1,145) = 17.55$, $p < .001$, $n^2 = .11$). Students in the task plus goal condition showed a higher perception of peer academic support than students assigned to the task-only interdependence condition ($F(1,145) = 32.69$, $p < .001$, $n^2 = .18$).

The univariate F omnibus for perception of peer personal support was also significant ($F(2,145) = 46.76$, $p < .001$, $n^2 = .39$). Students in both cooperative learning conditions showed a higher perception of peer personal support than students assigned to individual learning ($F(1,145) = 78.92$, $p < .001$, $n^2 = .35$). Students assigned to the task and goal interdependence condition showed a higher perception of peer personal support than students assigned to task interdependence ($F(1,145) = 8.50$, S .004, $n^2 = .06$). The means and standard deviations are shown in Table 1.

## 4. Discussion

Social interdependence theory defines cooperative, competitive, and individualistic efforts in terms of the interdependence among individuals' goals (e.g., Deutsch, 1949, 1962; Johnson, & Johnson, 1989, 2005, 2009). There are, however, other ways to structure interdependence among individuals than mutual goals (Johnson & Johnson, 1992a, 1992b). While considerable research has been conducted on some of the other ways to structure positive interdependence, such as reward, resource, role, and outside enemy, comparative little research has been conducted on task interdependence. The purpose of this study was to investigate the impact of task interdependence on achievement, attitudes toward cooperation, and perceptions of peer academic and personal support.

The combination of positive goal and task interdependence resulted in significantly higher achievement than did the other two conditions. These results corroborate the previous research indicating that individuals bound together by positive goal interdependence typically achieve higher than did persons working individualistically (Johnson & Johnson, 1989, 2009). In this study, however, individuals bound together by task interdependence (and goal independence) did not achieve significantly higher (or lower) than did persons working individualistically, although marginally higher achievement may be found in the task interdependence condition ($p = 0.12$). It may be, however, that task interdependence in and of itself does not create enough commitment to groupmates' achievement for participants to promote each other's success. The complexity of task interdependence may reduce members' achievement, but not enough to fall below the level of achievement in the individualistic condition. Overall, it may be concluded that task interdependence in and of itself does not increase achievement over individualistic efforts, and that the combination of positive goal and task interdependence may not produce a level of achievement beyond that induced by positive goal interdependence alone.

It is interesting that while task interdependence may not increase achievement, both task interdependence conditions created more positive attitudes toward cooperation than did participating in the individualistic condition. In terms of attitudes toward cooperation, positive goal and task interdependence seem to be additive, with the combination of both types of interdependence resulting in the most positive attitudes toward cooperation. Even with goal independence, task interdependence created positive attitudes towards cooperation. Thus, the means interdependence was evident to participants, and affected their attitudes, even while they worked to achieve independent goals.

In terms of social support, however, task interdependence had mixed effects. Task interdependence (with goal independence) seemed to have no significant effect on the specific social support by peers for academic achievement. While the combination of positive goal and task interdependence created a significantly higher level of

perceived peer academic support, task interdependence (with goal independence) did not. Even though the participants were engaged in a division of labor, they did not perceive a significant level of academic support from each other. The obvious conclusion is that it takes positive goal interdependence to induce perceptions of peer academic support.

On a more global level, however, task interdependence did induce a significant level of perceived peer personal support. On the personal (global) level, the two types of interdependence seem to have an additive effect. The highest level of perceived peer personal support was found in the positive goal and task interdependence condition. Since positive goal interdependence typically promotes higher perceived peer personal support than do individualistic efforts (Johnson & Johnson, 1989), this finding is not surprising. The second highest level of perceived peer personal support was found in the task interdependence with goal independence condition. That is somewhat surprising. It means that participating in a division of labor, even when working on an individual goal and not actively facilitating each other's achievement, participants still perceived a personal connection and level of support among each other.

Finally, the results of this study are valuable because they extend the research on positive interdependence beyond North America populations to an Italy population and from adults participants to third and fourth grade elementary school participants. This increases the generalizability of the overall results on positive interdependence and achievement, attitudes toward cooperation, and perceptions of peer academic and personal support.

The theoretical significance of this study is the added knowledge about the impact of task interdependence on the dependent variables. The findings also both clarify the nature of task interdependence and the way it affects group productivity, the attitudes of group members, and the degree to which social support (both specific and global) is built among group members. Theoretically, the various forms of positive interdependence should be differentiated and the unique contribution of each identified. This study provides further evidence as to the effectiveness and limitations of task interdependence. It also provides further differentiation of task interdependence from positive goal interdependence.

The practical significance of the study is the increased understanding of how to use task interdependence in applied situations. For educators and others to structure cooperative situations effectively, it is necessary to understand the impact of including the various types of outcome and means interdependence. The results of this study provide important guidance as to how to use task interdependence effectively. A division of labor will probably not increase achievement or perceptions of peer academic support. But it may still be worth doing, as it may increase positive attitudes toward cooperation and perceived peer personal support.

In summary, two of the categories of interdependence are outcome (goal and reward) and means (role, resource, task) interdependence. Both types are highly prevalent in cooperative situations. Outcome interdependence has been research extensively (Johnson & Johnson, 1989, 2009). There is a relative lack of research on the impact of means interdependence. Especially unexamined is the impact of task interdependence. Johnson and Johnson (1989, 1992a, 1992b, 2009) posited that without positive goal interdependence, positive means interdependence would have little or no effect on achievement, as such a comparison would involve positive means and goal interdependence with positive means interdependence and goal independence. Thus, the lack of positive goal interdependence would result in an individualistic goal and, therefore, achievement could be expected to be approximately the same as that found in individualistic situations or, given the added complexity of task interdependence, achievement could be lower than that found in individualistic situations.

What was actually found was that while the combination of positive goal and task interdependence produced higher achievement, more positive attitudes toward cooperation, and greater perceived peer academic and personal support than did an individualistic goal structure, task interdependence in and of itself did not significantly affect achievement or perceived peer academic support. Thus, task interdependence does not seem to increase achievement and does not seem to have an additive effect with positive goal interdependence. The same is true for perceived peer academic support. Engaging in a division of labor, however, did create more positive attitudes toward cooperation and greater perceived peer personal support than did an individualistic goal structure. It may have had an additive effect with positive goal interdependence on these two variables. Overall, task interdependence did not affect achievement. Participating in a division of labor, however, did seem to affect liking for cooperation and overall global social support among participants.

The findings of this study are limited by the nature of the sample (Italian elementary students). The results are also limited by the procedures used to implement the cooperative and individualistic conditions, the nature of the instruments used to measure academic achievement, participants' attitudes toward cooperation, and participants perceptions of academic and personal social support. This study needs to be replicated with different populations using a variety of outcome measures. Finally, it should be noted that the findings of any one study must be considered tentative, awaiting further research and replications. Thus, future research may provide further insight into the optimal conditions for maximizing the outcomes of different types of positive interdependence and expand the research environment to a variety of other settings.

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