

Individual and Group Contingencies in Cooperative Learning at the Collegiate Level

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Six sections of an undergraduate human development course ($N = 317$) taught across two semesters were exposed to one of three cooperative learning arrangements awarding bonus credit for individual and/or group improvement in exam performance: (1) individual improvement first required to earn group bonus credit, (2) group improvement first required to earn individual bonus credit, and (3) individual and group bonus credit earned separately. Based on exam scores in a previous unit of the course, students were categorized as high, average, and low performers. The high performers fared least well when individual improvement was primary in the cooperative contingency but had a much higher success rate under the other two contingencies. Low performers generally had the highest rate of success of all performance groups under all contingencies. Keywords: cooperative learning, group contingencies, individual contingencies, college students.

Cooperative learning has been widely used for enhancing academic performance and social outcomes (Slavin, 1989-90). Although much research has focused on cooperative learning at the elementary and high-school levels, cooperative learning may also be a viable strategy for promoting achievement among college students. Johnson, Johnson, and Smith's (1998) meta-analysis of cooperative, competitive, and individualistic learning approaches among college students and adults found that cooperative approaches promoted more individual achievement than competitive (effect size = 0.49) or individualistic approaches (effect size = 0.53).

A primary factor to consider when using cooperative learning procedures is the role of credit or reward contingencies. Specifically, do cooperative learning procedures affect student performance differently when differential weights are given to individual and group performance? Group performance contingencies commonly used in classroom settings can generally be classified as independent, interdependent, and dependent (Litow & Pumroy, 1975). Independent group-oriented contingencies are perhaps most commonly used in working with relative large groups. Criteria and consequences are the same for all students, but each individual student receives access to the consequence based on his or her own behavior. Grades are typically used as consequences in independent group-oriented contingencies. An interdependent group-oriented contingency allows every member of a group to receive the same consequence based on some aspect of the group's performance. Providing students with a reward based on a collective increase in a test score is an example of an interdependent contingency. In a dependent group-oriented contingency, access to a group consequence is based on the behavior of an individual student or sub-group of students within a group. For example, a dependent group-oriented contingency would consist of offering a reward to the entire class if two specific students arrived on time to class.

In order to be maximally effective, Slavin (1991) emphasized that cooperative learning procedures must incorporate both individual accountability and group rewards. Similarly, Johnson, Johnson, and Smith (2007) included positive interdependence and individual accountability in their basic elements of cooperation. Positive interdependence consists of group members working together to learn from one another and share in joint success. Individual accountability is crucial because it ensures that each student is held accountable for his or her individual performance.

Therefore, cooperative learning procedures often incorporate both interdependent and independent group-oriented contingencies. Applying an independent group-oriented contingency to students in a cooperative learning experience ensures that each student has access to rewards based on his or her own performance (individual accountability). Applying an interdependent group-oriented

contingency ensures that students have a stake in other students' performing well, which increases the likelihood of everyone's benefiting from group success.

Several different cooperative learning contingencies have been used in attempts to help undergraduate students improve their performance. In one such study, Williams, Carroll, and Hautau (2005) found that students at all performance levels (high, average, and low) can benefit from a variety of cooperative learning contingencies, although low- and average-performing students typically make greater gains than high-performing students under most cooperative contingencies. Additionally, they found that cooperative learning contingencies that combined group and individual requirements produced better group and individual improvement than contingencies that only required group improvement.

A related study by Carroll, Williams, and Hautau (2006) found that students who were required to improve individually in order to become eligible for group credit showed more improvement than students who could earn credit separately for individual and group improvement. Their results also indicated that having related, dependent components (i.e., having to earn individual credit to be eligible for group credit) produces better overall performance than when the individual and group contingencies are applied separately.

The finding in the Carroll et al. study (2006) most related to the current study was that a balanced credit ratio between the individual and group portions of a performance contingency can work better than a contingency favoring either individual or group credit. However, this was the case only when the individual and group portions were related (i.e., one had to meet the individual criterion to become eligible for group credit). Thus, irrespective of meeting the group criterion, one could not earn group credit without first meeting the individual criterion. Plus, one had to meet both the individual and group criteria to earn both individual and group credit.

When the individual and group portions were independent (i.e., one could earn individual credit, group credit, both, or neither), a contingency favoring group credit over individual credit produced a higher success rate than the balanced contingency. Although a balanced, related contingency—first requiring the individual criterion to be met—was the superior contingency in the Carroll et al. (2006) study, the researchers did not investigate the effects of a balanced contingency when the group criterion was primary (i.e., one first has to qualify for group credit before becoming eligible for individual credit).

In the current study, the researchers examined how undergraduate students fared under three balanced cooperative learning contingencies: one that required individual improvement in order to earn any bonus credit, one that required group improvement in order to earn any bonus credit, and one in which individual and group credit could be earned independently. In each case, the bonus credit attached to the individual and group aspects of the contingencies was balanced (i.e., the same amount of credit could be earned in the individual and the group portions of the contingencies). The major extension of this study over the Carroll et al. study (2006) was the inclusion of a balanced contingency that made group-improvement the primary criterion.

Method

Participants

A total of 317 students in six large sections ($n = 50-55$) of an undergraduate course in human development participated in the study. The study took place across two consecutive semesters. The course is a requirement for admission to the teacher education program at a large university in the Southeastern United States. Approximately 23% of students enrolled in the course were male, 77% were female, and a majority of the students (72%) were sophomores or juniors.

Course Structure

The course was divided into five content units: physical development, cognitive development, social development, psychological development, and values development. Course materials for each unit included a set of instructor notes, reading materials, and a short video. Several sections of the course were offered each semester, with course materials and procedures equivalent across all sections. Each of the primary instructors was a doctoral-level student trained by the same supervising professor. In essence, the sections were interchangeable and utilized identical course schedules, materials, and unit exams.

Students earned course credit through quizzes, attendance, daily homework assignments, a course paper, unit exams, and a final exam. Students completed a 50-item multiple-choice unit exam at the end of each content unit. Each exam consisted of questions over the instructor notes, reading materials, and a video related to the content of the unit. Students responded to exam questions on a scan form, which instructors scored immediately and returned to the students. Students were allowed to keep their exam booklets and scan forms long enough to see which items they missed and the correct answers to those items. Students' scores on three of those exams represented the phases of the study: Unit B (cognitive development) was the baseline or pre-cooperative learning unit, Unit C (social development) was the treatment or cooperative learning unit, and Unit D (psychological development) was the follow-up or post-cooperative learning unit.

Treatment Conditions

Students in each section were placed into cooperative groups based on their Unit B (baseline) exam scores. First, students' scores on the Unit B exam in each section were divided into quartiles, with the top quartile representing high scores, the bottom quartile representing low scores, and the middle two quartiles representing average scores. Students were then assigned to 4- to 6-member teams consisting of at least one high performer, at least one low performer, and at least two average performers. Where possible, researchers attempted to maximize within-group diversity in terms of race/ethnicity, gender, and perceived social skills.

Three different contingencies were randomly assigned and applied to three different sections of the course. This procedure was repeated over the course of two semesters (Fall 2006 and Spring 2007) so that each contingency was represented in two sections across the two semesters. Each contingency consisted of an individual requirement and a group requirement. In all contingencies, the individual criterion consisted of meeting one of the following requirements from the baseline to the treatment exam: maintaining an exam score of A, maintaining an exam score of B, or improving one's exam score by at least 1 point. In all contingencies, the group requirement consisted of improving the group's mean exam score by at least 1 point from the baseline to the treatment exam. However, the three contingencies differed in how these requirements could lead to bonus credit.

The individual-requirement contingency (Contingency 1) required students to first meet the individual criterion. Those who met the individual criterion earned 5 bonus points and were then eligible for an additional 5 points if their group also met the group criterion. The group-requirement contingency (Contingency 2) required students to first meet the group criterion. Students in groups who met the group criterion earned 5 bonus points and were then eligible for an additional 5 points if they also met the individual criterion. The split-requirement contingency (Contingency 3) allowed students to earn 5 bonus points for meeting an individual requirement and/or 5 points for meeting the group requirement, with these requirements not dependent upon each other.

Cooperative Learning Procedures

The cooperative learning activities were carried out during Unit C, a content unit that focused largely on social development. Instructors divided students into groups based on their Unit B exam scores. Each group had at least one high performer and one low performer. Each 4- to 6-member group

had a Unit B exam average score that approximated the overall class average for the Unit B exam. Before the first class period of Unit C, an explanation of cooperative learning procedures was posted at the course website. Students were able to access the names and email addresses of students in their group and were encouraged to contact one another before the start of the first class session in Unit C.

Students were not required or instructed to use a particular cooperative learning format, but past student reports suggest that students typically used some combination of STAD and Jigsaw II (Williams et al., 2005). Students sometimes divided responsibilities for answering and exchanging study questions over the reading materials in each unit and practice exam questions (consistent with the Jigsaw II format). However, all students in all groups were responsible for completing all assignments and readings (consistent with the STAD arrangement). Students were encouraged, but not required, to meet with their groups outside of class. During the cooperative learning unit, students sat near their group members in class and had a small amount time each day to interact with one another in class. Additionally, groups could use the course website to post questions and discuss issues in an online forum.

Dependent Measures

Students' exam scores on the Units B, C, and D exams served as a dependent measure and determined whether students met the requirements of the appropriate contingency. Unit B was the baseline exam, Unit C the treatment exam, and Unit D the follow-up exam. Each 50-item multiple-choice exam was taken individually. As an additional dependent measure, the researchers examined the percentage of high-, low-, and average-performing students who earned individual credit, group credit, and both types of credit under each contingency. Finally, the success rates of the combined performance levels were compared under each contingency.

Results

Because the pattern of exam scores and percentages of students at different performance levels earning bonus credit under the different cooperative contingencies was quite similar across the two semesters, the data for the different contingencies and performance levels were combined across semesters. This section first presents exam-score means for the different performance levels under the different contingencies and then the percentage of different performance levels earning individual, group, and combined credit under the different contingencies.

Exam Scores across Semesters

Table 1 shows that low performers across contingencies made the greatest improvement of any performance group in their exam scores from the baseline to the cooperative learning unit. Average performers made moderate improvements in their exam scores across contingencies, and high performers either stayed at approximately the same level or decreased slightly from the baseline to the cooperative learning unit across contingencies. In the unit following the cooperative learning unit, all performance groups under all contingencies decreased their mean exam scores compared to the cooperative learning unit, suggesting a treatment effect for all cooperative contingencies.

Table 1
Student Exam Means across Phases, Contingencies, and Performance Levels

	Phase		
	Pre-CL (Unit B)	CL (Unit C)	Post-CL (Unit D)
Contingency 1			
Individual requirement			
High	45.4	44.4	41.9

Average	39.8	42.1	39.4
Low	30.6	38.2	34.4
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Contingency 2			
Group requirement			
High	43.7	43.9	42.9
Average	38.3	41.4	40.6
Low	30.6	36.4	34.3
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Contingency 3			
Split requirement			
High	46.1	45.3	44.5
Average	39.4	41.8	37.8
Low	32.6	38.6	35.0
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The contingency that proved slightly more productive than the other contingencies for the low performers was the individual-requirement contingency. In this contingency, meeting the individual requirement was the only way students could earn any bonus credit. Thus, perhaps the low-performing students in this contingency realized that the best way to maximize the possibility of earning bonus credit was first to increase their individual exam scores. For average and high-performing students, the group-requirement contingency led to the greatest increases in exam scores. Average performers increased from an average exam score of 38.3 to 41.4 under the group contingency. Although this net increase is only 3.1 points, the increase represents an improvement of one letter grade—a C to a B. From the baseline to the treatment unit, high-performing students in the group-requirement contingency improved slightly from an average of 43.7 to 43.9 points.

Individual Criterion

Students could meet the individual criterion in one of three ways: improving their Unit B exam score by at least one point, maintaining a grade of A from Unit B to Unit C, or maintaining a grade of B from Unit B to Unit C. Table 2 shows that high-performing students were more likely to earn individual credit under both the split-requirement contingency (85.7%) and the group-requirement contingency (82.9%) than under the individual-requirement contingency (53.8%). Paradoxically, the pressure to meet the individual criterion would have seemed greater under the individual-requirement contingency than under either of the other contingencies, given that one could not earn group credit without first meeting the individual criterion under the individual contingency.

Table 2

Percentage of Students Meeting Requirements for Bonus Credit under Each Contingency

	Individual credit	Group credit	Individual and group credit
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Contingency 1			
Individual contingency			
High	53.8%	53.8%	53.8%
Average	82.7%	78.8%	78.8%
Low	100%	96.2%	96.2%
Total	79.8%	76.9%	76.9%
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Contingency 2
Group contingency

High	82.9%	94.3%	82.9%
Average	74.4%	95.3%	74.4%
Low	81.5%	92.6%	81.5%
Total	79.0%	94.3%	79.0%
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Contingency 3			
Split contingency			
High	85.7%	92.9%	82.1%
Average	84.6%	86.5%	75.0%
Low	88.9%	92.6%	85.2%
Total	85.9%	89.7%	79.4%

Another surprising finding was that approximately the same percentage of high performers met the individual criterion under the group-requirement contingency (82.9%) and the split-requirement contingency (85.7%), with both of these success rates much higher than that under the individual-requirement contingency (53.8%). Strangely, this pattern seems to suggest that high-performing students gave more attention to their individual scores under the contingencies that, either dependently or independently, allowed group improvement to be rewarded irrespective of one's individual performance.

Average-performing students were equally likely to meet the individual criterion under the split-requirement and individual-requirement contingencies (84.6% versus 82.7%). A somewhat lower percentage of average performers (74.4%) earned individual credit under the group-requirement contingency. Thus, average performers earned more individual credit under the contingencies that, either dependently or independently, permitted the earning of individual credit irrespective of group performance. This suggests that average performers focused more on their individual scores under these contingencies, an emphasis that perhaps increased the chances of earning credit based on the individual criterion.

For low performers, 100% of those in the individual-requirement contingency met the individual criterion, whereas 81.5% of those in the group-oriented contingency and 88.9% in the split-requirement contingencies earned individual credit. The most successful contingencies in terms of low performers' earning individual credit were the contingencies that awarded credit based on meeting the individual criterion (i.e., individual-requirement and split-requirement contingencies). This finding is not surprising considering that, in order to earn bonus credit under either of those contingencies, low performers had to individually improve their exam scores—not merely maintain an A or B, as the average- and high-performing students had to do.

Across all performance levels, the split-requirement contingency produced the highest success rate in earning individual credit (85.9% of students earning credit) compared to the individual-requirement and group-requirement contingencies (79.8% and 79.0%, respectively). Certainly, individual performance made a difference in maximizing credit under all contingencies, but students could differentially focus their efforts on the group or individual credit under the split contingency—apparently leading to more emphasis on individual credit.

Group Criterion

The group criterion could only be met by improving a group's mean exam score by at least one point from the Unit B to the Unit C exam. High- and average-performing students showed a similar pattern in terms of earning group credit. For high-performing students, the group-requirement and split-requirement contingencies were the best, with 94.3% and 92.9% of high performers earning group credit, respectively. With respect to group credit for high performers, these contingencies were far superior to the individual-requirement contingency, in which only 53.8% of high performers earned group credit.

Average performing-students were most likely to earn group credit under the group-requirement contingency—95.3% earned group credit under this contingency compared to 78.8% under the individual-requirement contingency and 86.5% under the split-requirement contingency.

A very high percentage of low performers earned group credit under all three contingencies—96.2% under the individual contingency, 92.6% under the group contingency, and 92.6% under the split contingency. Across performance levels, the group-requirement contingency contributed most to earning group credit—94.3% of students meeting the group criterion compared to 76.9% and 89.7% under the individual-requirement and split-requirement contingencies, respectively. This pattern is quite understandable, given that students had to meet the group criterion to earn any cooperative credit.

Individual Plus Group Criteria

High performers were equally likely to earn both individual and group credit under the group requirement and the split requirement (82.9% and 82.1% respectively). Again, the lowest percentage of high performer (53.8%) earned both individual and group credit under the individual contingency. Conversely, a higher percentage of low performers earned both individual and group credit under the individual contingency (96.2%) than under either the group (81.5%) or the split requirement contingency (85.2%). Average performers achieved similar success rates under all three contingencies: individual (78.8%), group (74.4%), and split (75.0%). Across performance groups, all of the contingencies proved about equal with respect to earning both individual and group credit—76.9% of students under the individual-requirement contingency, 79.0% under the group-requirement contingency, and 76.4% under the split-requirement contingency.

Discussion

The current study was a follow-up of the Carroll et al. (2006) study, which found a balanced, related contingency to be superior to related contingencies that favored either individual or group performance. However, a balanced contingency not included in the Carroll et al. study was one that required students to meet the group requirement before they could become eligible for earning individual credit. That contingency, as well as a contingency that made the individual criterion primary and a contingency that applied the individual and group criteria independently, were implemented in the current study.

Although the findings showed some differences by performance level under the three contingencies, overall percentage of success did not vary greatly across the three contingencies. The highest overall success rate was 94.3% for group credit under the group contingency and the lowest overall success rate of was 76.9% for group credit and individual plus group credit under the individual contingency. Six of nine overall percentages for earning some type of credit were in the mid to high 70% range.

One factor to consider when evaluating the results of the current study is that the most productive contingencies in terms of exam score improvement may not necessarily be the most productive for the percentage of students earning bonus credit. This is possible because many of the high and average performers could meet the individual criterion without actually improving their exam score. The individual criterion could be met by improving an exam score but also by maintaining an A or a B from the pre-cooperative learning exam to the cooperative learning exam. Thus, a student who went from a score of 48 (96%) to a score of 45 (90%) could earn individual credit even though that score decreased and consequently reduced the mean score of high performers and their group as a whole. Therefore, the percentages of students who earned individual, group, and both types of credit may better represent the results of the cooperative learning contingencies implemented in this study.

Much attention has been placed on the importance of both individual accountability and group contingencies in cooperative learning. Although the three contingencies in this study differentially emphasized these components, each of them did provide some type of individual accountability and group reward. Each student was held accountable for his or her exam score and could earn some bonus credit based on his or her individual score. Additional group credit was also a part of each contingency, although the conditions under which it could be earned varied across contingencies. In addition to the potential benefits of exam improvement in earning bonus credit, students presumably were motivated to do well on exams because of the importance of unit exam scores in the computation of their course grade.

Similar to group rewards, positive interdependence is also a key aspect of cooperative learning (Johnson, Johnson, & Smith, 2007). Positive interdependence generally exists when group members promote each other's achievement and believe that their goal can best be reached through mutual cooperation and effort. Although we did not specifically quantify the extent to which groups studied together, shared resources, or clarified content issues for one another, we did make positive interdependence part of the cooperative learning experience by incorporating the group reward contingency. Students were informed of the group requirement and were aware that group credit could only be earned if a group increased its mean by at least one point. Thus, students under all contingencies were aware that their bonus credit was linked in part to the achievement of all group members.

Because two of the contingencies used in the current study made different aspects of performance (i.e., individual requirement or group requirement) the primary condition for earning credit, one might assume that this dimension would be emphasized by students in that condition. In other words, the individual-requirement contingency might lead students to focus more on their own exam improvement, whereas the group-requirement contingency might encourage more emphasis on the exam performance of all members. Our results confirmed this hypothesis with respect to group credit—the group-requirement contingency indeed led to the highest percentage of students (across performance levels) earning group credit. In contrast, the individual-requirement contingency did not lead to the highest percentage of students earning individual credit. Rather, across performance levels, the split-requirement contingency contributed to the highest percentage of students earning individual credit.

Although the split-requirement contingency was most beneficial in terms of earning individual bonus credit, it was not superior to the other contingencies with respect to rate of success in earning group or individual plus group credit. Perhaps group members under the split contingency focused on the surest way to earn bonus credit—meeting the individual criterion—rather than trying to help other group members improve their performance. Nonetheless, the success rate for earning both individual and group credit was as high in the split contingency as in either of the other contingencies.

It should be noted that a majority of students at each performance level under each contingency earned both individual and group credit. However, the high performers under the individual priority contingency did not achieve a success rate comparable to that of other performance levels under this contingency or comparable to the success rate of high performers under the other two contingencies. Whether this disparity for high performers represents a replicable finding or reflects a sampling or procedural irregularity across the two semesters when the study was done cannot be determined from the current database. Certainly, this finding needs to be re-assessed for high performers using the contingency comparisons employed in the current study to determine if the disparity under the individual contingency was a sampling or procedural anomaly or a bona fide replicable finding.

The data for the current study suggest that students under the split contingency performed as well overall as students under the other contingencies. Also, the superior fairness of this contingency may make it the most palatable to students. Under the other contingencies, student credit can be undermined by either the individual or the group criterion. For example, under the individual contingency, students

who help their group improve may wind up with no credit if they fail to meet the individual criterion. Conversely, under the group criterion, students who individually improve may wind up with no credit if the group does not improve.

Because the individual and group dimensions are independent in the split contingency, students who have improved their performance are assured of credit for that improvement; students who have helped the group improve will definitely get credit for that group improvement; and students who have balanced their efforts so as to improve individually and help the group improve will get both individual and group credit. On the other hand, students are likely to be very discouraged when they work hard either individually or in a group but wind up with no credit to show for their efforts.

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