Classroom Applications of Cooperative Learning

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Cooperative learning refers to instructional methods teachers use to organize students into small groups, in which students work together to help one another learn academic content. Cooperative learning methods are extensively researched, and under certain well-specified conditions they are known to substantially improve student achievement in most subjects and grade levels. Yet, the structured forms of cooperative learning that have proven to be effective are not used as often as more informal forms. Further, there remains considerable debate about the theoretical basis for achievement outcomes of cooperative learning. This chapter reviews and describes widely used, practical forms of cooperative learning, and presents evidence on their effects on academic achievement.

Cooperative learning methods vary widely in their details. Group sizes may be from two to several. Group members may have individual roles or tasks, or they may all have the same task. Groups may be evaluated or rewarded based on group performance or the average of individual performances, or they may simply be asked to work together.

In one form or another, cooperative learning has been used and studied in every major subject, with students from preschool to college, and in all types of schools. Cooperative learning is used at some level by hundreds of thousands of teachers. One national U.S. survey in the 1990s found that 79% of elementary teachers and 62% of middle school teachers reported regular use of cooperative learning (Puma, Jones, Rock, & Fernandez, 1993). Antil, Jenkins, Wayne, and Vadasy (1998) found that 93% of a sample of U.S. teachers reported using cooperative learning, with 81% reporting daily use.

There have been hundreds of studies of cooperative learning focusing on a wide variety of outcomes, including academic achievement in many subjects, second language learning, attendance, behavior, intergroup relations, social cohesion, acceptance of classmates with handicaps, attitudes toward subjects, and more (see Johnson & Johnson, 1998; Rohrbeck et al., 2003; Slavin, 1995; Webb, 2008).

Theoretical Perspectives on Cooperative Learning

Although there is a fair consensus among researchers about the positive effects of cooperative learning on student achievement, discussed in this chapter, there remains a controversy about why and how cooperative learning methods affect achievement and, most importantly, under what conditions cooperative learning has these effects. Different groups of researchers investigating cooperative learning effects on achievement begin with different assumptions and conclude by explaining the achievement effects of cooperative learning in quite different theoretical terms. In earlier work, Slavin (1995) identified motivationalist, social cohesion, cognitive-developmental and cognitive-elaboration as the four major theoretical perspectives on the achievement effects of cooperative learning.

The motivationalist perspective presumes that task motivation is the single most impactful part of the learning process, asserting that the other processes such as planning and helping are driven by individuals' motivated self interest. Motivationalist-oriented scholars focus more on the reward or goal structure under which students operate (Slavin, 1995, 2010). Methods derived from this perspective emphasize the use of group goals and individual accountability, meaning that group success depends on the individual learning of all group members (see below). By contrast, the social cohesion perspective (also called social interdependence theory) suggests that the effects of cooperative learning are largely dependent on the cohesiveness of the group. This perspective holds that students help each other learn because they care about the group and its members and come to derive self-identity benefits from group membership (Johnson & Johnson, 1998).

The two cognitive perspectives on cooperative learning focus on the interactions among groups of students, holding that, in themselves, these interactions lead to better learning and thus better achievement (see O'Donnell, Volume 1).

The alternative perspectives on cooperative learning may be seen as complementary, not contradictory. For example, motivational theorists would not argue that the cognitive theories are unnecessary. Instead, they assert that motivation drives cognitive process, which in turn produces learning (Slavin, 1995). They would argue that it is unlikely over the long haul that students would engage in the kind of explanations to each other found by Webb (2008) and others to be essential to profiting from cooperative activity unless the learning of their teammates is important to them. Similarly, social cohesion theorists might hold that the utility of extrinsic incentives must lie in their contribution to group cohesiveness, caring, and pro-social norms among group members, which could in turn affect cognitive processes.

A simple path model of cooperative learning processes, adapted from Slavin (1995), is diagrammed below. It depicts the main functional relationships among the major theoretical approaches to cooperative learning.

Figure 1. Integration of Theoretical Perspectives on Cooperative Learning Effects on Learning

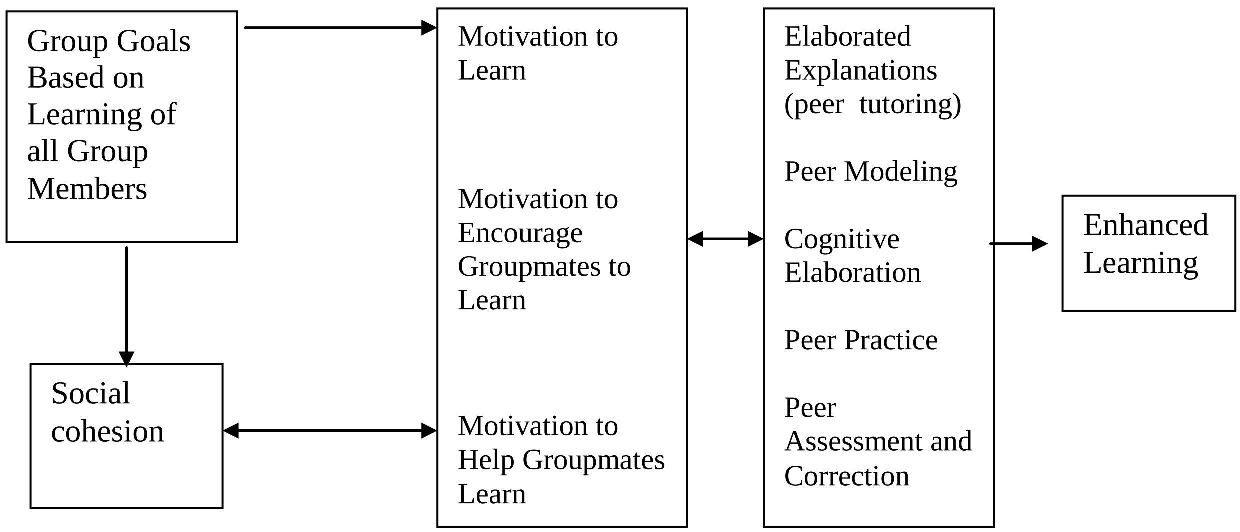

Figure 1 begins with a focus on group goals or incentives based on the individual learning of all group members. That is, the model assumes that motivation to learn and to encourage and help others to learn activates cooperative behaviors that will result in learning. This would include both task motivation and motivation to interact in the group. In this model, motivation to succeed leads to learning directly, and also drives the behaviors and attitudes that lead to group cohesion, which in turn facilitates the types of group interactions that yield enhanced learning and academic achievement. The relationships are conceived to be reciprocal, such that as task motivation leads to the development of group cohesion, which may reinforce and enhance task motivation. By the same token, the cognitive processes may become intrinsically rewarding and lead to increased task motivation and group cohesion.

Group Goals and Individual Accountability

Considerable evidence from practical applications of cooperative learning in elementary and secondary schools supports the position that group rewards are essential to the effectiveness of cooperative learning, with one critical qualification. Use of group goals or group rewards enhances the achievement outcomes of cooperative learning ,if and only if, the group rewards are based on the individual learning of all group members (Slavin, 1995). Most often, this means that team scores are computed based on average scores on quizzes, which all teammates take individually without teammate help. For example, in Student Teams-Achievement Divisions, or STAD (Slavin, 1994), students work in mixed-ability teams to master material initially presented by the teacher. Following this, students take individual quizzes on the material, and the teams may earn certificates based on the degree to which team members have improved over their own past records. The only way the team can succeed is to ensure that all team members have learned, so the team members' activities focus on explaining concepts to one another, helping one another practice, and encouraging one another to achieve. In contrast, if group rewards are given based on a single group product (for example, the team completes one worksheet or solves one problem), there is little incentive for group members to explain concepts to one another, and one or two group members may do all the work (see Slavin, 1995, 2010).

A review of 99 studies of cooperative learning in elementary and secondary schools that involved durations of at least four weeks compared achievement gains in cooperative learning and control groups (Slavin, 1995). Of 64 studies of cooperative learning methods that provided group rewards based on the sum of group members' individual learning, 50 studies (78%) found significantly positive effects on achievement, and none found negative effects (Slavin, 1995). The median effect size for these 64 studies was $d = +.32$ (thirty-two percent of a standard deviation separated cooperative learning and control treatments).

In contrast, studies of methods that used group goals based on a single group product or provided no group rewards found few positive effects, with a median effect size of only $d = +.07$. Comparisons of forms of cooperative learning with and without group rewards within the same studies found similar patterns; group goals based on the sum of individual learning performances were necessary to the instructional effectiveness of the cooperative learning models (e.g., Fantuzzo, Polite, & Grayson, 1990; Fantuzzo, Riggio, Connelly, & Dimeff, 1989).

Why are group goals and individual accountability so important? To understand this, consider the alternatives. In some forms of cooperative learning, students work together to complete a single worksheet or to solve one problem. In such methods, there is little reason for more able students to take the time to explain what is going on to their less able groupmates or to ask their opinions. When the group task is to *do* something, rather than to *learn* something, the participation of less able students may be seen as interference rather than help. It may be easier in this circumstance for students to give each other answers than to explain concepts or skills to one another. More aggressive students may dominate the group, and others may avoid participating, letting others do the work (and the learning).

When the group's task is to ensure that every group member *learns* something, it is in the interests of every group member to spend time explaining concepts to his or her groupmates, and to ask groupmates for explanations and help in understanding the topic of study. Studies of student behavior within cooperative groups have found that the students who gain most from cooperative work are those who give and receive elaborated explanations (Webb, 1985, 2008). In contrast, giving and receiving answers without explanations were *negatively* related to achievement gain. Group goals and individual accountability motivate students to give elaborated explanations and to take one another's learning seriously, instead of simply giving answers.

Structuring Group Interactions

There is some evidence that teaching learning strategies to students working in cooperative groups can be effective, even in the absence of group rewards. For example, Meloth and Deering (1992) compared students working in two cooperative conditions. In one, students were taught specific reading comprehension strategies and given *think sheets* to remind them to use these strategies (e.g., prediction, summarization, character mapping; see MacArthur, Volume 3). In the other group, students were not taught these strategies. A comparison of the two groups on a reading comprehension test found greater gains for the strategy group.

However, there is also evidence to suggest that a combination of group rewards and strategy training produces much better outcomes than either alone. The Fantuzzo et al. (1992) study, cited earlier, made a comparison between rewards alone, strategy alone, and a combination, and found the combination to be by far the most effective. Further, the outcomes of dyadic learning methods, which use group rewards as well as strategy instruction, produced some of the largest positive effects of any cooperative methods, much larger than those found in studies that provided groups with strategy teaching but not rewards. As noted earlier, studies of scripted dyads also find that adding incentives adds to the effects of these strategies (O'Donnell, 1996).

Research on Pragmatic Approaches to Cooperative Learning

Research and development over the years have led to the creation and evaluation of several practical approaches to cooperative learning. The most widely used and extensively researched of these programs are described in the following sections. These sections include tables showing all cooperative learning studies that met the standards of the Best Evidence Encyclopedia (BEE; www.bestevidence.org) in reading and math. Inclusion in the BEE reviews requires a well-matched control group, a duration of at least 12 weeks, and measures not inherent to the treatment (see Slavin, 2008). In each table; studies are listed in order by evaluation design: Randomized, randomized quasi-experiment, matched, matched post-hoc. A randomized quasi-experiment is a study in which schools or classes are assigned at random to treatments, but there are too few units to allow for analysis at the level of random assignment (Slavin, 2008). Within categories, studies are listed in order of sample size. Mean effect sizes are computed weighting by sample size. Full reports of the BEE reviews are published for elementary reading by Slavin, Lake, Chambers, Cheung, and Davis (2009), for secondary reading by Slavin, Cheung, Groff, and Lake (2008), for elementary math by Slavin and Lake (2008), and for secondary math by Slavin, Lake, and Groff (2009).

Cooperative learning methods fall into two main categories. One set, *Structured Team Learning*, involves rewards to teams based on the learning progress of their members, and individual accountability, which means that team success depends on individual learning, not group products. A second set, *Informal Group Learning Methods*, includes methods more focused on social dynamics, projects, and discussion than on mastery of well-specified content.

Structured Team Learning Methods

Student Team Learning. Student Team Learning (STL) techniques were developed and researched at Johns Hopkins University (see Slavin, 1994, 1995). More than half of all experimental studies of practical cooperative learning methods involve STL methods.

All cooperative learning methods share the idea that students work together to learn and are responsible for one another's learning as well as their own. STL methods also emphasize the use of team goals and team success, which can only be achieved if all members of the team learn the objectives being taught. That is, in Student Team Learning the students' tasks are not to *do* something as a team but to *learn* something as a team.

Three concepts are central to all Student Team Learning methods: *team rewards, individual accountability,* and *equal opportunities for success*. Using STL techniques, teams earn certificates or other team rewards if they achieve above a designated criterion. *Individual accountability* means that the team's success depends on the individual learning of all team members. This focuses the activity of the team members on explaining concepts to one another and making sure that everyone on the team is ready for a quiz or other assessment that they will take without teammate help. *Equal opportunities for success* means that students contribute to their teams by improving over their past performances. This ensures that high, average, and low achievers are equally challenged to do their best and that the contributions of all team members are valued.

Four principal Student Learning methods have been extensively developed and researched. Two are general cooperative learning methods adaptable to most subjects and grade levels: Student Team-Achievement Divisions (STAD) and Teams-Games-Tournament (TGT). The remaining two are comprehensive curriculums designed for use in particular subjects at particular grade levels: Team Assisted Individualization (TAI) for mathematics in years 3-6 and Cooperative Integrated Reading and Composition (CIRC) for reading and writing instruction in grades 3 to 5. Middle school adaptations of CIRC are called Student Team Reading and The Reading Edge.

Student Teams-Achievement Divisions (STAD). In STAD (Slavin, 1994), students are assigned to four-member learning teams mixed in performance level, sex and ethnicity. The teacher presents a lesson, and the students work within their teams to make sure that all team members have mastered the lesson. Finally, all students take individual quizzes on the material, at which time they may *not* help one another.

Students' quiz scores are compared to their own past averages, and points are awarded based on the degree to which students meet or exceed their own earlier performances. These points are then summed to form team scores, and teams that meet certain criteria earn certificates or other rewards. The whole cycle of activities, from teacher presentation to team practice to quiz, usually takes three to five class periods.

STAD has been used in a wide variety of subjects, including mathematics, language arts, and social studies. It has been used from grade 2 through college. STAD is most appropriate for teaching well-defined objectives, such as mathematical computations and applications, language usage and mechanics, geography and map skills, and science facts and concepts. In STAD, students work in 4-member heterogeneous teams to help each other master academic content.

Numerous studies of STAD have found positive effects of the program on traditional learning outcomes in math, language arts, science, and other subjects (Barbato, 2000; Mevarech, 1985; Reid, 1992; Slavin, 1995; Slavin & Karweit, 1984). For example, Slavin and Karweit (1984) carried out a large, year-long randomized evaluation of STAD in Math 9 classes in Philadelphia. These were classes for students not felt to be ready for Algebra I, and were therefore the lowest-achieving students. Overall, 76% of students were African American, 19% were White, and 6% were Hispanic. Forty-four classes in 26 junior and senior high schools were randomly assigned within schools to one of four conditions: STAD, STAD plus *Mastery Learning*, *Mastery Learning*, or control. All classes, including the control group, used the same books, materials, and schedule of instruction, but the control group did not use teams or mastery learning. In the *Mastery Learning* conditions, students took formative tests each week, students who did not achieve at least an 80% score received corrective instruction, and then students took summative tests.

Shortened versions of the standardized Comprehensive Test of Basic Skills (CTBS) in mathematics served as pretest and posttest. The four groups were very similar at pretest. There was a significant effect of a teams factor (*d* = +0.21). The effect size comparing STAD + *Mastery Learning* to control was *d* = +0.24, and that for STAD without *Mastery Learning* was *d* = +0.18. There was no significant *mastery learning* main effect or teams by mastery interaction. Effects were similar for students with high, average, and low pretest scores.

Table 1 summarizes all studies of STAD that met the BEE inclusion criteria in elementary and secondary math. Across 11 comparisons, nine of which used random assignment to conditions, the sample size- weighted effect size was +0.14. These studies involved a total of more than 4000 students in grades 3-12.

Not all studies of STAD have found positive outcomes, however. In particular, two large evaluations by Tracey, Madden, and Slavin (in press) and Glassman (1989) found no effects of STAD on math achievement. In both cases, however, high-quality implementations were not achieved. The remaining 9 studies did find positive effects, averaging +0.43.

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Teams-Games-Tournament (TGT). Teams-Games-Tournament (Slavin, 1994) uses the same teacher presentations and teamwork as in STAD, but replaces the quizzes with weekly tournaments. In these, students compete with members of other teams to contribute points to their team score. Students compete at three-person tournament tables against others with a similar past record in mathematics. Table assignments rotate to keep the competition fair. The winner at each tournament table brings the same number of points to his or her team, regardless of which table it is; this means that low achievers (competing with other low achievers) and high achievers (competing with other high achievers) have equal opportunity for success. As in STAD, high performing teams earn certificates or other forms of team rewards. TGT is appropriate for the same types of objectives as STAD. Several studies of TGT have found positive effects on achievement in math, science, and language arts (Slavin, 1995).

Team Assisted Individualization (TAI). Team Assisted Individualization (TAI: Slavin et al. 1986) shares with STAD and TGT the use of four-member mixed ability learning teams and certificates for high-performing teams. However, where STAD and TGT use a single pace of instruction for the class, TAI combines cooperative learning with individualised instruction. Also, where STAD and TGT apply to most subjects at grade levels, TAI is specifically designed to teach mathematics to students in grades 3-6 (or older students not ready for a full algebra course).

In TAI, students enter an individualized sequence according to a math placement test and then proceed at their own learning rates. In general, team members work on different units. Teammates check each others' work against answer sheets and help one another with any problems. Final unit tests are taken without teammate help and are scored by student monitors. Each week, teachers total the number of units completed by all team members and give certificates or other team rewards to teams that exceed a criterion score based on the number of final tests passed, with extra points for perfect papers and completed homework.

Because students take responsibility for checking each other's work and managing the flow of materials, the teacher can spend most of the class time presenting lessons to small groups of students drawn from the various teams who are working at the same point in the mathematics sequence. For example, the teacher might call up a decimals group, present a lesson, and then send the students back to their teams to work on problems. Then the teacher might call the fractions group, and so on. Several large evaluations of TAI have shown positive effects on math achievement in the upper-elementary grades (e.g., Slavin & Karweit, 1985; Stevens & Slavin, 1995).

Table 2 summarizes all studies of TAI in elementary math. Across 5 comparisons (2 randomized) involving almost 3000 students, the sample-size weighted effect size was +0.19.

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Cooperative Integrated Reading and Composition (CIRC). A comprehensive program for teaching reading and writing in the upper elementary grades is called Cooperative Integrated Reading and Composition (CIRC) (Stevens et al. 1987). In CIRC, teachers use reading texts and reading groups, much as in traditional reading programs. However, all students are assigned to teams composed of two pairs from two different reading groups. While the teacher is working with one reading group, the paired students in the other groups are working on a series of cognitively engaging activities, including reading to one another, making predictions about how narrative stories will come out, summarising stories to one another, writing responses to stores, and practicing spelling, decoding, and vocabulary. Students work as a total team to master main idea and other comprehension skills. During language arts periods, students engage in writing drafts, revising and editing one another's work, and preparing for publications of team books.

In most CIRC activities, students follow a sequence of teacher instruction, team practice, team pre-assessments and quizzes. That is, students do not take the quiz until their teammates have determined that they are ready. Certificates are given to teams based on the average performance of all team members on all reading and writing activities.

Research on CIRC and similar approaches has found positive effects in upper-elementary and middle school reading (Stevens & Durkin, 1992; Stevens, Madden, Slavin, & Farnish, 1987; Stevens & Slavin, 1995a, 1995b). CIRC has been adapted as the upper-elementary and middle school component of the Success for All Comprehensive reform model and is currently disseminated under the name *Reading Wings* by the Success for All Foundation (see Slavin & Madden, 2009).

Table 3 summarizes all studies of CIRC and its related programs in elementary and secondary reading. Across 13 studies (one of which was randomized) involving more than 14,000 students in grades 1-8, the weighted mean effect size was +0.27.

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Peer-Assisted Learning Strategies (PALS). Peer Assisted Learning Strategies (PALS) is a dyadic learning approach in which pairs of children take turns as teacher and learner (see Fuchs, Fuchs, Compton, & McMasters, Volume 3). The children are taught simple strategies for helping each other, and are rewarded based on the learning of both members of the pair. Research on PALS in elementary and middle school math and reading has found positive effects of this approach on student achievement outcomes, (e.g., Calhoon, 2005; Calhoon et al., 2006;

Fuchs, Fuchs, & Karns, 2001; Fuchs, Fuchs, Kazden, & Allen, 1999; Mathes & Babyak, 2001). Positive effects of a similar program called Classwide Peer Tutoring (Greenwood, Delquardi, & Hall, 1989) have also been found, and another similar approach has been found to be effective in two Belgian studies (Van Keer & Verhenge, 2005, 2008).

Table 4 summarizes all studies of PALS and related methods in elementary and secondary reading and math. Across 11 reading studies, five of which used random assignment, the weighted effect size was +0.30. There were a total of about 1700 students across the studies. Three randomized studies of PALS in math, involving more than 600 students, found a weighted mean effect size of +0.09.

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IMPROVE. *IMPROVE* (Mevarech, 1985) is an Israeli mathematics program that uses cooperative learning strategies similar to those used in *STAD* but also emphasizes teaching of metacognitive skills and regular assessments of mastery of key concepts and re-teaching of skills missed by many students. Studies of *IMPROVE* have found positive effects on the mathematics achievement of elementary and middle school students in Israel (Mevarech & Kramarski, 1997; Kramarski, Mevarech, & Lieberman, 2001).

For example, Mevarech and Kramarski (1997, Study 1) evaluated *IMPROVE* in four Israeli junior high schools over one semester. Three seventh grade classes used *IMPROVE* and five served as matched controls, using the same books and objectives. The experimental classes were selected from among those taught by teachers with experience teaching *IMPROVE*, and matched control classes were selected as well. Students were pre- and posttested on tests certified by the Israeli superintendent of mathematics as fair to all groups. Pretest scores were similar across groups. On analyses of covariance with classes nested within treatments, treatment effects significantly favored the *IMPROVE* classes on scales assessing introduction to algebra (*d* = +0.54) as well as mathematical reasoning (*d* = +0.68), for an average effect size of *d* = +0.61. Effects were similar for low, average, and high achievers.

Table 5 summarizes all studies of IMPROVE in secondary math. Across 3 studies (one randomized) involving almost 700 Israeli middle schoolers, the weighted mean effect size was +0.52.

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Informal Group Learning Methods

Jigsaw. Jigsaw was originally designed by Elliot Aronson and his colleagues (1978). In Aronson's Jigsaw method, students are assigned to six-member teams to work on academic material that has been broken down into sections. For example, a biography might be divided into early life, first accomplishments, major setbacks, later life, and impact on history. Each team member reads his or her section. Next, members of different teams who have studied the same sections meet in expert groups to discuss their sections. Then the students return to their teams and take turns teaching their teammates about their sections. Since the only way students can learn sections other than their own is to listen carefully to their teammates, they are motivated to support and show interest in one another's work.

Slavin (1994) developed a modification of Jigsaw at Johns Hopkins University and then incorporated it in the Student Team Learning programme. In this method, called Jigsaw II, students work in four-or five-member team as in TGT and STAD. Instead of each student being assigned a particular section of text, all students read a common narrative, such as a book chapter, a short story, or a biography. However, each student receives a topic (such as "climate" in a unit on France) on which to become an "expert." Students with the same topics meet in expert groups to discuss them, after which they return to their teams to teach what they have learned to their teammates. Then students take individual quizzes, which result in team scores based on the improvement score system of STAD. Teams that meet preset standards earn certificates. Jigsaw is primarily used in social studies and other subjects where learning from text is important (Mattingly & Van Sickle, 1991).

Learning together. David Johnson and Roger Johnson at the University of Minnesota developed the Learning Together models of cooperative learning (Johnson & Johnson, 1998). The methods they have researched involve students working on assignment sheets in four- or five-member heterogeneous groups. The groups hand in a single sheet and receive praise and rewards based on the group product. Their methods emphasize team-building activities before students begin working together and regular discussions within groups about how well they are working together. Numerous relatively brief experiments have shown positive effects of these approaches (see Johnson & Johnson, 1998).

Group Investigation. Group Investigation, developed by Shlomo Sharan and Yael Sharan (1992) at the University of Tel-Aviv, is a general classroom organization plan in which students work in small groups using cooperative inquiry, group discussion, and cooperative planning and projects. In this method, students form their own two- to six-member groups. After choosing subtopics from a unit being studied by the entire class, the groups further break their subtopics into individual tasks and carry out the activities necessary to prepare group reports. Each group then makes a presentation or display to communicate its findings to the entire class. A study in Israel by Sharan & Shachar (1988) found positive effects of Group Investigation on achievement in language and literature.

Present and Future Issues

Cooperative learning occupies a strange place in educational research and practice. On one hand, it is universally known and almost universally admired. Most researchers and educators have positive attitudes toward cooperative learning and believe it to be effective for many outcomes (see Antil et al., 1998). Yet the forms of cooperative learning that have been found to be effective, especially for academic achievement outcomes, remain at the edge of practice, perhaps in a state of permanent innovation. That is, cooperative learning has never disappeared but has never become common practice.

There are several developments that could cause cooperative learning to be more widely and effectively used. One is the movement toward evidence-based reform in education, in which government policies increasingly favor the use of programs and practices proven to be effective in rigorous evaluations (see Slavin, 2002). As shown in this paper, there is substantial evidence from large-scale, well-designed, often randomized evaluations that repeatedly shows positive achievement effects of cooperative learning. Further, many additional programs that have strong evidence of effectiveness also use cooperative learning, even if they use several other elements as well. Policies favoring use of proven programs will inevitably increase use of cooperative learning. For example, schools might receive either direct funding to implement proven programs or competitive preference points on competitive grant applications for applicants committing to do high-quality implementations of proven models.

A second possible factor in increasing use of cooperative learning could be advances in technology. To date, technology in schools has generally worked against cooperative learning by isolating students on individualized computers. However, the rise in the use of interactive whiteboards and other technological aids for whole-class and small-group lessons creates possibilities to enhance the use of cooperative learning. Teachers are increasingly using (or adapting) prepared lessons on their whiteboards, and these could build in support to teachers in using cooperative methods. For example, students could view a series of brief videos modelling cooperative learning skills, and then try them out in their groups right away.

Another avenue by which cooperative learning may enter mainstream practice is through embedding effective cooperative methods in specific curricular approaches. Examples of this include the Success for All reading program (Slavin, Madden, Chambers, & Haxby, 2009) and writing process models (Harris & Graham, 1996), both of which emphasize daily use of cooperative learning integrated with content instruction. Development and successful evaluation of additional methods of this kind would add both to understanding of effective applications of cooperative principles and to facilitating broader and more consistent use of cooperative learning.

More research is needed on how and why cooperative learning works, and how it may be made to work better. Studies comparing conditions under which dyads may be more or less effective than groups of four might be interesting, and much more needs to be known about specific means of helping students learn and use effective groupwork strategies and metacognitive learning strategies. Further explorations are needed to understand how and under what conditions group goals and individual accountability affect learning outcomes of cooperative learning. There is a need to develop approaches integrating cooperative learning activities with various types of technology, both classroom technologies such as interactive whiteboards, mentioned earlier, and traditional computers.

Although there is already a great deal of research on cooperative learning, there is still much room for theoretical and practical advances. Cooperative learning is so different from ordinary teaching that it opens a vast set of questions and possibilities that are far from being exhausted.

Conclusion

Research on cooperative learning over a 30-year period has found that under a set of well-defined circumstances, students working in structured small groups can learn significantly better than can students working in traditional classrooms. Positive learning outcomes depend on the use of programs in which students have group goals and are individually accountable for learning the content the group is engaged with. Outcomes are generally enhanced if students are taught specific ways of working in groups dealing with both metacognitive and social strategies for making best use of the group learning setting. Providing sufficient training and follow-up to ensure high-quality implementation is also essential.

Anyone who has visited classes using cooperative learning well can see why these methods would be effective. Working in structured groups, students are usually highly motivated, excited, and engaged. Students who might otherwise be too shy or uncertain to participate in whole-class lessons usually engage actively in small groups, where participation is safe, supportive, and difficult to avoid. Surveys invariably find that students of all levels of prior achievement greatly prefer to work in groups as long as they are structured so that the learning of all group members is the group goal (so that one group member cannot do all the work).

Although important research continues to appear, the basic principles of cooperative learning have been established for many years, and there are many pragmatic training programs available. Yet cooperative learning remains as it has been for 30 years, an innovative approach not unfamiliar to teachers but not used as a standard part of instruction. Most school principals can lead a visitor to a teacher enthusiastically using cooperative learning programs that are demonstrably working for the students, yet the visitor will note on the way to see that teacher the many fellow-teachers in the same school who are teaching students in rows, or using informal forms of group work without group goals or individual accountability, which research has never supported. Studies of actual use of cooperative learning (e.g., Antil, Jenkins, Waine, & Vadasy, 1998) find that most use of cooperative learning is informal, and does not incorporate the elements that research has repeatedly found to be essential.

Reviews of research looking at a broad range of instructional interventions, including applications of technology, curricular innovations, after school and summer school programs, and many others, find achievement effects much less than those of cooperative learning (Slavin & Lake, 2008; Slavin et al., 2008; Slavin et al., 2009 a, b). In fact, a review of research on programs for struggling readers found that participation in cooperative learning had effects on the reading performance of students in the lowest quarter of their classes similar to the effects of one-to-one tutoring by certified teachers (Slavin, Lake, Cheung, Davis, & Madden, 2009). Yet while government programs often support less well-evaluated and more expensive alternatives, cooperative learning has remained a grass-roots innovation used by teachers who happen to encounter it, existing at the edge of education policy.

There remains a need for development and evaluation of cooperative learning programs that solve key problems of teaching and learning in all subjects and grade levels, and for continued research to identify the conditions under which cooperative learning is most likely to be effective. The greatest need at this point, however, is to develop and evaluate forms of cooperative learning that can be readily and successfully adopted by schools on a large scale, and to study the impediments to successful adoption of cooperative strategies. After 30 years of research and application, cooperative learning still has much more to contribute to students' learning.

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Table 1

Student Teams-Achievment Divisions (STAD)

Study	Design	Duration	N	Grade	Sample Characteristics	Posttest	Subgroup Effect Sizes	Overall Effect Size
Elementary Math								
STAD								
Tracey, Madden, & Slavin (in press)	Random Assignment	1 year	34 schools 2235 students	4-5	Low-SES schools in England	Optional SATs		-0.07
Mevarech (1985)	Random assignment	15 weeks	67 students	5	Israeli school, middle-class students	Objective-Based Test		+0.19
						Computation	+0.36	
						Comprehension	+0.01	
Glassman (1989)	Randomized quasi-experiment	6 months	2 schools 24 classes 441 students	3-5	Schools in diverse, suburban district in Long Island, New York	ITBS		+0.01
Mevarech (1991)	Randomized quasi-experiment	12 weeks	54 students	3	Low SES school in Israel	Teacher-Designed Test		+0.78
						Low Achievers	+0.86	
						High Achievers	+0.69	
Suyanto (1998)	Matched	4 months	10 schools 30 classes 664 students	3-5	Schools across rural Indonesia	Indonesian Elementary School Test of Learning		+0.40
Student Team Mastery Learning								
Mevarech (1985)	Random assignment	15 weeks	67 students	5	Israeli school, middle-class students	Objective-Based Test		+0.29
						Computation	+0.36	
						Comprehension	+0.21	
Mevarech (1991)	Randomized quasi experiment	12 weeks	54 students	3	Low SES school in Israel	Teacher-Designed Test		+0.80
						Low achievers	+0.80	
						High Achievers	+0.80	

Secondary Math								
STAD								
Slavin & Karweit (1984)	Randomized	1 year	588 students in 44 classes at 26 schools	Junior & senior high	Low-achieving students in Philadelphia	Shortened CTBS		+0.21
						STAD + Mastery	+0.24	
						STAD, no Mastery	+0.18	
Nichols (1996)	Randomized	18 weeks	80 students in 3 classes at 1 school	10th (some 11th, 12th)	Suburban high school in midwestern US	ITBS		+0.20
Barbato (2000)	Randomized quasi-experiment	1 year	208 students in 8 sections	10th	Suburban high school in Westchester County, NY	NY State Integrated Mathematics Tests		+1.09
Reid (1992)	Matched	1 year	50 students (25T, 25C) at 1 school	7th	Chicago students of low SES, all minority	ITBS		+0.38

Table 2

Team-Assisted Individualization (TAI)

Study	Design	Duration	N	Grade	Sample Characteristics	Posttest	Subgroup Effect Sizes	Overall Effect Size
Elementary Math								
Slavin & Karweit (1985)	Random assignment	16 weeks	17 classes 382 students	3-5	Hagerstown, Maryland	CTBS		+0.28
						TAI vs MMP		
						Computations	+0.39	
						Concepts/ Applications	+0.01	
						TAI vs Control		
						Computations	+0.67	
						Concepts/ Applications	+0.06	
Slavin & Karweit (1985)	Random assignment	18 weeks	10 classes 212 students	4-6	Inner-city, Wilmington, Delaware	CTBS		+0.38
						Computations	+0.76	
						Concepts and Applications	0.00	
Slavin, Madden, & Leavey (1984a)	Matched	24 weeks	59 classes 1,367 students	3-5	Schools located in middle class suburb of Baltimore, Maryland	CTBS		+0.14
						Computations	+0.18	
						Concepts and Applications	+0.10	
						Students with special needs		
						Computations	+.19	
						Concepts and Applications	+0.23	
Stevens & Slavin (1995)	Matched	2 years	45 classes 873 students	2-6	Schools located in diverse Baltimore suburb	CAT		+0.20
						Computations	+0.29	
						Applications	+0.10	
						Students with special needs		
						Computations	+0.59	
						Applications	+0.35	
						Gifted Students		
						Computations	+0.59	
						Applications	+0.19	

Karper & Melnick (1993)	Matched	1 year	165 students	4,5	School in affluent suburb of Harrisburg, Pennsylvania	District Standardized Test		-0.11
						Computation	-0.11	
						Concepts	-0.22	

Table 3

Cooperative Integrated Reading and Composition (CIRC)/The Reading Edge

Study	Design	Duration	N	Grade	Sample Characteristics	Posttest	Subgroup Effect Sizes	Overall Effect Size
Elementary Reading								
CIRC								
Stevens and Slavin (1995a)	Matched	2 years	7 schools (3E, 4C) 63 classes (31E, 32C) 1299 students (635E,	2-6	Mostly White students in working-class suburb of Baltimore. 9%FL, 95%W.	CAT		+0.23
						Vocabulary	+0.20	
						Comprehension	+0.26	
Stevens & Slavin (1995b)	Matched	2 years	5 schools (2E, 3C) 45 classes (21E, 24C)	2-6	Suburban district in Maryland 10% FL, 93%W.	CAT		+0.25
						Comprehension	+0.28	
						Vocabulary	+0.21	
Jenkins et al. (1994)	Matched	1 year	2 schools 860 students (332 E, 528 C)	1-6	Mount Vernon, Washington 36% FL	MAT		+0.18
						Comprehension	+0.09	
						Vocabulary	+0.31	
						Total	+0.18	
Stevens, Madden, Slavin, & Farnish (1987; Study 1)	Matched	12 weeks	10 schools (6E, 4C) 21 classes (11E, 10C)	3-4	Middle-class suburb of Baltimore. 4% FL. 84% W, 16% AA.	CAT		+0.18
						Comprehension	+0.19	
						Vocabulary	+0.17	
Stevens, Madden, Slavin, & Farnish (1987; Study 2)	Matched	6 months	9 schools (4E, 5C) 22 classes (9E, 13C) 450 students	3-4	Middle-class suburb of Baltimore. 18% FL. 78% W, 22% AA.	CAT		+0.45
						Comprehension	+0.35	
						Vocabulary	+0.11	
						Total	+0.23	
						Durrell	+0.54	
Bramlett (1994)	Matched	1 year	8 schools (9 C, 9 E) 18 classes 392 students (198E,	3	Rural southern Ohio	CAT		+0.08
						Comprehension	+0.10	
						Total Reading	+0.07	
						Word Analysis	+0.10	
						Vocabulary	+0.03	

Rapp (1991)	Matched	1 year	2 schools (1 E, 1 C) 88 students	3	Working-class schools in Lewistown, ID	ITBS		+0.14
						Comprehension	+0.09	
						Vocabulary	+0.18	
Calderon, Hertz-Lazarowitz, & Slavin (1998)	Matched	2 years	7 schools (3E, 4C) Year 1: 84 students (51E, 33C)	2 and 3	Spanish-dominant students transitioning to English in high-poverty schools	STAAS 2nd graders	+0.30	+0.87
						NAPT 3rd graders		
						1 year	+0.62	
						2 years	+0.87	
Skeans (1991)	Matched post hoc	19 months	630 students (348 E, 282 C)	3 and 5	Suburban district near Houston	MAT: 3rd grade		-0.03
						Vocabulary	+0.20	
						Comprehension	+0.08	
						MAT: 5th grade		
						Vocabulary	-0.15	
						Comprehension	-0.24	
Secondary Reading								
CIRC/Student Team Reading								
Stevens & Durkin (1992), Study 1	Matched	1 year	3986 students	6-8th	Five middle schools in Baltimore	CAT		+0.40
						Reading Vocabulary	+0.46	
						Reading Comprehension	+0.34	
Stevens & Durkin (1992), Study 2	Matched	1 year	1233 students (455T, 768C)	6th	Twenty classes in six middle schools in an urban district in Maryland	All students		
						CAT Vocabulary	-0.02	+0.06
						CAT Comp	+0.13	
						Special Ed		
						CAT Vocabulary	+0.28	+0.04
						CAT Comp	+0.60	
The Reading Edge								
Chamberlain, Daniels, Madden, & Slavin (2007a,b)	Randomized	1 year	788 students in 2 cohorts (405T, 383C)	6th	Two majority White, high poverty rural middle schools in West Virginia and Florida	GMRT (Gates)		+0.15
						Total	+0.15	
						Comprehension	+0.12	
						Vocabulary	+0.15	
Slavin, Daniels, & Madden (2005)	Matched	3 years	3470 students (1748T, 1722C in 14 schools (7T, 7C)	6th - 8th	High-poverty schools throughout the US	State assessments		+0.33

Table 4

Peer-Assisted Learning Strategies (PALS) and Other Same Age Tutoring Programs

Study	Design	Duration	N	Grade	Sample Characteristics	Posttest	Subgroup Effect Sizes	Overall Effect Size
Elementary Reading								
PALS								
Mathes & Babyak (2001)	Randomized Quasi-Experiment	14 weeks	20 classes (10E, 10C) 110 students (61E, 49C)	1	Schools in Florida 63%W, 36%AA	Woodcock		+0.61
						Word Identification	+0.51	
						Word Attack	+0.92	
						Passage Comprehension	+0.41	
Calhoon et al. (2006)	Randomized Quasi-Experiment	20 weeks	3 schools 6 classrooms 78 students (41E, 37 C)	1	Students taught in English in a majority-Hispanic school in NM; 75% FL, 32%W, 68%H	DIBELS		+0.29
						Nonsense Word Fluency	+0.58	
						Oral Reading Fluency	+0.00	
Fuchs, Fuchs, Kazdan, & Allen (1999)	Randomized quasi-experiment	21 weeks	45 students 15 students each in PALS, PALS-HG (PALS + tutoring strategies), or control...	2-3	Students in a southeastern city. 24% FL, 62% W, 38% AA.	SDRT Reading Comprehension		+0.36
						PALS	+0.72	
						PALS HG	0.00	
Mathes, Torgesen, & Allor (2001)	Matched	16 weeks	24 classes (12E, 12C) 140 students (84E, 56C)	1	Schools in the southeast; 65%W, 32%AA	Woodcock		+0.50
						Word Identification	+0.39	
						Word Attack	+0.59	
						Passage Comprehension	+0.56	
						TERA-2	+0.48	
Mathes et al. (1998)	Matched	16 weeks	20 classes (10E, 10C) 96 students (48E, 48C)	1	Schools in southeastern city	Woodcock		+0.37
						Word Identification	+0.21	
						Word Attack	+0.54	
						Passage Comprehension	+0.37	

PALS + Strategy Instruction								
Van Keer & Verhaeghe (2005)	Matched	1 year	Second graders: 11 classes (5E, 6C) 215 students (91E, 124C) Fifth graders: 10 classes (4E, 6C) 208 students (101E, 107C)	2, 5	Middle class schools in Flanders, Belgium	Dutch Reading Comprehension Test		+0.29
						2nd graders	+0.17	
						5th graders	+0.40	
Van Keer & Verhaeghe (2008)	Matched	1 year	Second graders: 12 classes (6E, 6C) 234 students (110E, 124C) Fifth graders: 15 classes (9E, 6C) 293 students (186E, 107C)	2, 5	Middle class schools in Flanders, Belgium	Dutch Reading Comprehension Test		+0.24
						2nd graders	+0.26	
						5th graders	+0.21	
Secondary Reading								
PALS								
Calhoon (2005)	Randomized quasi-experiment	31 weeks	38 students taught by 4 teachers in 2 schools	6-8	Special education classes at two middle schools in the southwest	Woodcock		+0.46
						Letter-Word Identification	+0.84	
						Passage Comprehension	+0.66	
						Word Attack	+0.46	
						Reading Fluency	-0.13	
Fuchs, Fuchs, & Kazdan (1999)	Matched	16 weeks	102 students (52T, 50C) in 18 classes (9T, 9C)	HS	Special education and remedial classes in ten high schools	CRAB		+0.19
						Comprehension	+0.33	
						Correct words read	+0.04	
Hankinson & Myers (2000)	Matched	12 weeks	83 students (51T, 32C)	8^{th}	Suburban middle school near Pittsburgh	GMRT (Gates)		-0.04
						Vocabulary.	0.1	
						Comprehension.	0.44	
						PSSA		
						Reading Comp.	-0.34	

Elementary Math									
PALS									
Fuchs, Fuchs, Yazdian, & Powell (2002)	Randomized quasi-experiment	16 weeks	20 classes 323 students	1	Schools in southeastern city	SAT			+0.10
							High Achieving	+0.09	
							Avg. Achieving	+0.10	
							Low Achieving	+0.14	
Fuchs, Fuchs, & Karns (2001)	Randomized quasi-experiment	15 weeks	20 teachers 228 students	K	Schools in southeastern city	SESAT			+0.24
							High Achieving	-0.41	
							Avg. Achieving	+0.52	
							Low Achieving	+0.51	
							Disability	+0.65	
						SAT			
							High Achieving	+0.85	
							Avg Achieving	-0.20	
							Low Achieving	+0.47	
							Disability	+0.20	
Secondary Math									
PALS and Curriculum-Based Management									
Calhoon & Fuchs (2003)	Randomized quasi-experiment	15 weeks	92 students (45T, 47C) in 10 classes at 3 schools	9th - 12th	Students with disabilities in a southeastern urban district	**TCAP**			-0.30

Table 5

IMPROVE

Study	Design	Duration	N	Grade	Sample Characteristics	Posttest	Subgroup Effect Sizes	Overall Effect Size
Secondary Math								
Kramarski, Mevarech, & Lieberman (2001)	Randomized quasi-experiment	1 year	182 students in 6 classes at 3 schools	7th	Israeli junior high schools	Comprehensive content exam		+0.79
Mevarech & Kramarski (1994, 1997), Study #1	Matched	1 semester	247 students (99T, 148C) in 8 classes at 4 schools	7th	Israeli junior high schools	Certified Israeli math test		+0.61
						Intro to Alg	+0.54	
						Math reasoning	+0.68	
Mevarech & Kramarski (1994, 1997), Study #2	Matched	1 year	265 students (164T, 101C) in 9 classes at 4 schools	7th	Israeli junior high schools	Algebra test	Similar effects for different ability groups and subtests	+0.25