Research on Cooperative Learning and Achievement: What We Know, What We Need to Know

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Research on cooperative learning is one of the greatest success stories in the history of educational research. While there was some research on this topic from the early days of this century, the amount and quality of that research greatly accelerated in the early 1970's, and continues unabated today, a quarter-century later. Hundreds of studies have compared cooperative learning to various control methods on a broad range of measures, but by far the most frequent objective of this research is to determine the effects of cooperative learning on student achievement. Studies of the achievement effects of cooperative learning have taken place in every major subject, at all grade levels, in all types of schools in many countries. Both field studies and laboratory studies have produced a great deal of knowledge about the effects of many types of cooperative interventions and about the mechanisms responsible for these effects. Further, cooperative learning is not only a subject of research and theory; it is used at some level by millions of teachers. A recent national survey (Puma, Jones, Rock, & Fernandez, 1993) found that 79% of elementary teachers and 62% of middle school teachers reported making some sustained use of cooperative learning.

Given the substantial body of research on cooperative learning and the many cooperative learning programs in widespread use, it might be assumed that there is little further research to be done. Yet this is not the case. There are many very important questions in research on this topic, and a great deal of development and evaluation remains to be done. In its fullest conception cooperative learning provides a radically different approach to instruction, whose possibilities have been tapped only on a limited basis.

While there is a growing consensus among researchers about the positive effects of cooperative learning on student achievement as well as a rapidly growing number of educators using cooperative learning at all levels of schooling and in many subject areas, there is still a great deal of confusion and disagreement about why cooperative learning methods affect achievement and, even more importantly, under what conditions cooperative learning has these effects. Researchers investigating cooperative learning effects on achievement have often operated in isolation from one another, almost on parallel tracks, and some describe theoretical mechanisms held to explain achievement effects of cooperative learning that are totally different from the mechanisms assumed by others. In particular, there are researchers who emphasize the changes in incentive structure brought about by certain forms of cooperative learning, while others hold that changes in task structure are all that is required to enhance learning. The problem is that applications of cooperative learning typically change many aspects of both incentive and task structures, so disentangling which is responsible for which outcomes can be difficult.

In earlier writings, (Slavin, 1989, 1992, 1995) I identified four major theoretical perspectives (and two minor ones) designed to explain the achievement effects of cooperative learning. This paper updates and extends the discussion of these perspectives, further explores conditions under which each may operate, and suggests research and development needed to move the field of cooperative learning forward.

Four Major Theoretical Perspectives on Cooperative Learning and Achievement

Motivational Perspectives

Motivational perspectives on cooperative learning focus primarily on the reward or goal structures under which students operate (see Slavin, 1977, 1983a, 1995). From a motivationalist perspective (e.g., Johnson & Johnson, 1992; Slavin, 1983a, b, 1995), cooperative incentive structures create a situation in which the only way group members can attain their own personal goals is if the group is successful. Therefore, to meet their personal goals, group members must both help their groupmates to do whatever helps the group to succeed, and, perhaps even more importantly, to encourage their groupmates to exert maximum efforts. In other words, rewarding groups based on group performance (or the sum of individual performances) creates an interpersonal reward structure in which group members will give or withhold social reinforcers (e.g., praise, encouragement) in response to groupmates' task-related efforts (see Slavin, 1983a). One intervention that uses cooperative goal structures is the group contingency (see Slavin, 1987), in which group rewards are given based on group members' behaviors. The theory underlying group contingencies does not require that group members be able to actually help one another or work together. The fact that their outcomes are dependent on one anothers' behavior is enough to motivate students to engage in behaviors which help the group to be rewarded, because the group incentive induces students to encourage goal-directed behaviors among their groupmates (Slavin, 1983a, b; 1995). A substantial literature in the behavior modification tradition has found that group contingencies can be very effective at improving students' appropriate behaviors and achievement (Hayes, 1976; Litow & Pumroy, 1975).

The motivationalist critique of traditional classroom organization holds that the competitive grading and informal reward system of the classroom creates peer norms opposing academic efforts (see Coleman, 1961). Since one student's success decreases the chances that others will succeed, students are likely to express norms that high achievement is for "nerds" or teachers' pets. Such work restriction norms are familiar in industry, where the "rate buster" is scorned by his or her fellow workers (Vroom, 1969). However, by having students work together toward a common goal, they may be motivated to express norms favoring academic achievement, to reinforce one another for academic efforts.

Not surprisingly, motivational theorists build group rewards into their cooperative learning methods. In methods developed by my colleagues and myself at Johns Hopkins University (Slavin, 1994, 1995), students can earn certificates or other recognition if their average team scores on quizzes or other individual assignments exceed a pre-established criterion (see also Kagan, 1992). Methods developed by David and Roger Johnson (1994) and their colleagues at the University of Minnesota often give students grades based on group performance, which is defined in several different ways. The theoretical rationale for these group rewards is that if students value the success of the group, they will encourage and help one another to achieve, much in contrast to the situation in the traditional, competitive classroom.

Empirical Support for the Motivational Perspective. Evidence from practical applications of cooperative learning in elementary and secondary schools supports the motivationalist 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).

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. Of sixty-four studies of cooperative learning methods that provided group rewards based on the sum of group members' individual learning, fifty (78%) found significantly positive effects on achievement, and none found negative effects (Slavin, 1995). The median effect size for the studies from which effect sizes could be computed was +.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 +.07. Comparisons of alternative treatments 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; Huber, Bogatzki, & Winter, 1982). The importance of group goals and individual accountability is discussed further later in this chapter.

Social Cohesion Perspectives

One theoretical perspective somewhat related to the motivational viewpoint holds that the effects of cooperative learning on achievement are strongly mediated by the cohesiveness of the group, in essence that students will help one another learn because they care about one another and want one another to succeed. This perspective is similar to the motivational perspective in that it emphasizes primarily motivational rather than cognitive explanations for the instructional effectiveness of cooperative learning. However, motivational theorists hold that students help their groupmates learn at least in part because it is in their own interests to do so. Social cohesion theorists, in contrast, emphasize the idea that students help their groupmates learn because they care about the group. A hallmark of the social cohesion perspective is an emphasis on teambuilding activities in preparation for cooperative learning, and processing or group self-evaluation during and after group activities. Social cohesion theorists tend to downplay or reject the group incentives and individual accountability held by motivationalist researchers to be essential. For example, Cohen (1986, pp. 69-70) states "if the task is challenging and interesting, and if students are sufficiently prepared for skills in group process, students will experience the process of groupwork itself as highly rewarding...never grade or evaluate students on their individual contributions to the group product." Cohen's (1994a) work, as well as that of Shlomo and Yael Sharan (1992) and Elliot Aronson (Aronson, Blaney, Stephan, Sikes, & Snapp, 1978) and their colleagues, may be described as social cohesiveness theories. Cohen, Aronson, and the Sharan's all use forms of cooperative learning in which students take on individual roles within the group, which Slavin (1983a) calls "task specialization" methods. In Aronson's Jigsaw method, students study material on one of four or five topics distributed among the group members. They meet in "expert groups" to share information on their topics with members of other teams who had the same topic, and then take turns presenting their topics to the team. In the Sharan's Group Investigation method, groups take on topics within a unit studied by the class as a whole, and then further subdivide the topic into tasks within the group. The students investigate the topic together and ultimately present their findings to the class as a whole. Cohen's adaptation of DeAvila and Duncan's (1980) Finding Out/Descubrimiento program has students take different roles in discovery-oriented science activities.

One main purpose of the task specialization used in Jigsaw, Group Investigation, and Finding Out/Descubrimiento is to create interdependence among group members. In the Johnsons' methods, a somewhat similar form of interdependence is created by having students take on roles as "checker," "recorder," "observer," and so on. The idea is that if students value their groupmates (as a result of teambuilding and other cohesiveness-building activities) and are dependent on one another, they are likely to encourage and help one another to succeed. The Johnsons' (1989, 1994) work straddles the social cohesion and motivationalist perspectives described in this paper; while their models do use group goals and group incentives, their theoretical writings emphasize development of group cohesion through teambuilding, group self-evaluation, and other means more characteristic of social cohesion theorists.

Empirical support for the social cohesion perspective

The achievement outcomes of cooperative learning methods that emphasize task specialization are unclear. Research on the original form of Jigsaw has not generally found positive effects of this method on student achievement (Slavin, 1995). One problem with this method is that students have limited exposure to material other than that which they studied themselves, so learning gains on their own topics may be offset by losses on their groupmates' topics. In contrast, there is evidence that when it is well implemented, Group Investigation can significantly increase student achievement (Sharan & Shachar, 1988). In studies of at least four weeks' duration, the Johnson's (1994) methods have not been found to increase achievement more than individualistic methods unless they incorporate group rewards (in this case, group grades) based on the average of group members' individual quiz scores (see Slavin, 1995). Studies of forms of Jigsaw that have added group rewards to the original model have found positive achievement outcomes (Mattingly & Van Sickle, 1991).

Research on practical classroom applications of methods based on social cohesion theories provide inconsistent support for the proposition that building cohesiveness among students through teambuilding alone (i.e., without group incentives) will enhance student achievement. There is some evidence that group processing activities such as reflection at the end of each class period on the group's activities can enhance the achievement effects of cooperative learning (Yager, Johnson, Johnson, and Snider, 1986). On the other hand an Israeli study found that teambuilding activities had no effect on the achievement outcomes of Jigsaw (Rich, Amir, and Slavin, 1986).

In general, methods which emphasize teambuilding and group process but do not provide specific group rewards based on the learning of all group members are no more effective than traditional instruction in increasing achievement (Slavin, 1995), although there is evidence that these methods can be effective if group rewards are added to them. One major exception is Group Investigation (Sharan & Hertz-Lazarowitz, 1980; Sharan & Shachar, 1988; Sharan & Sharan, 1992). However, in this method groups are evaluated based on their group products, which are composed of unique contributions made by each group member. Thus, this method may be using a form of the group goals and individual accountability held by motivationalist theories to be essential to the instructional effectiveness of cooperative learning.

Cognitive Perspectives

The major alternative to the motivationalist and social cohesiveness perspectives on cooperative learning, both of which focus primarily on group norms and interpersonal influence, is the cognitive perspective, which holds that interactions among students will in themselves increase student achievement for reasons which have to do with mental processing of information rather than with motivations. Cooperative methods developed by cognitive theorists involve neither the group goals that are the cornerstone of the motivationalist methods nor the emphasis on building group cohesiveness characteristic of the social cohesion methods. However, there are several quite different cognitive perspectives, as well as some which are similar in theoretical perspective but have developed on largely parallel tracks. These are described in the following sections.

Developmental Perspectives

One widely researched set of cognitive theories is the developmental perspective (e.g., Damon, 1984; Murray, 1982). The fundamental assumption of the developmental perspective on cooperative learning is that interaction among children around appropriate tasks increases their mastery of critical concepts. Vygotsky (1978, p.86) defines the zone of proximal development as "... the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (emphasis added). In his view, collaborative activity among children promotes growth because children of similar ages are likely to be operating within one another's proximal zones of development, modeling in the collaborative group behaviors more advanced than those they could perform as individuals. Vygotsky (1978) described the influence of collaborative activity on learning as follows:

> "Functions are first formed in the collective in the form of relations among children and then become mental functions for the individual ... Research shows that reflection is spawned from argument."

Similarly, Piaget (1926) held that social-arbitrary knowledge -- language, values, rules, morality, and symbol systems -- can only be learned in interactions with others. Peer interaction is also important in logical-mathematical thought in disequilibrating the child's egocentric conceptualizations and in provision of feedback to the child about the validity of logical constructions.

There is a great deal of empirical support for the idea that peer interaction can help non-conservers become conservers. Many studies have shown that when conservers and nonconservers of about the same age work collaboratively on tasks requiring conservation, the nonconservers generally develop and maintain conservation concepts (see Bell, Grossen, and Perret-Clermont, 1985; Murray, 1982; Perret-Clermont, 1980). In fact, a few studies (e.g. Ames and Murray, 1982; Mugny and Doise, 1978) have found that pairs of disagreeing nonconservers who had to come to consensus on conservation problems both gained in conservation. The importance of peers' operating in one anothers' proximal zones of development was demonstrated by Kuhn (1972), who found that a small difference in cognitive level between a child and a social model was more conducive to cognitive growth than a larger difference.

On the basis of these and other findings, many Piagetians (e.g., Damon, 1984; Murray, 1982; Wadsworth, 1984) have called for an increased use of cooperative activities in schools. They argue that interaction among students on learning tasks will lead in itself to improved student achievement. Students will learn from one another because in their discussions of the content, cognitive conflicts will arise, inadequate reasoning will be exposed, disequilibration will occur, and higher-quality understandings will emerge.

From the developmental perspective, the effects of cooperative learning on student achievement would be largely or entirely due to the use of cooperative tasks. In this view, the opportunity for students to discuss, to argue, to present and hear one anothers' viewpoints is the critical element of cooperative learning with respect to student achievement. For example, Damon (1984, p.335) integrates Piagetian, Vygotskian, and Sullivanian perspectives on peer collaboration to propose a "conceptual foundation for a peer-based plan of education.":

1. Through mutual feedback and debate, peers motivate one another to abandon misconceptions and search for better solutions.

2. The experience of peer communication can help a child master social processes, such as participation and argumentation, and cognitive processes, such as verification and criticism.

3. Collaboration between peers can provide a forum for discovery learning and can encourage creative thing.

4. Peer interaction can introduce children to the process of generating ideas.

However, Damon (1984, p.337) explicitly rejects the use of "extrinsic incentives as part of the group learning situation," arguing that "there is no compelling reason to believe that such inducements are an important ingredient in peer learning."

One category of practical cooperative methods closely related to the developmental perspective is group discovery methods in mathematics, such as Marilyn Burns' (1981) Groups of Four method. In these techniques, students work in small groups to solve complex problems with relatively little teacher guidance. They are expected to discover mathematical principles by working with unit blocks, manipulatives, diagrams, and other concrete aids.

The theory underlying the presumed contribution of the group format is that in the exploration of opposing perceptions and ideas, higher-order understandings will emerge; also, students operating within one anothers' proximal zones of development will model higher-quality solutions for one another. However, studies of group discovery methods such as Groups of Four (Burns, 1981) find few

achievement benefits for them in comparison to traditional expository teaching (Davidson, 1985; L. Johnson, 1985; L. Johnson & Waxman, 1985).

Despite considerable support from theoretical and laboratory research, there is little evidence from classroom experiments done over meaningful time periods that "pure" cooperative methods, which depend solely on interaction to produce higher achievement, will do so. However, it is likely that the cognitive processes described by developmental theorists are important as mediating variables to explain the effects of group goals and group tasks on student achievement (Slavin, 1987, 1995). This possibility is explored later in this paper.

Cognitive Elaboration Perspectives

A cognitive perspective on cooperative learning quite different from the developmental viewpoint is one which might be called the cognitive elaboration perspective. Research in cognitive psychology has long held that if information is to be retained in memory and related to information already in memory, the learner must engage in some sort of cognitive restructuring, or elaboration, of the material (Wittrock, 1986). One of the most effective means of elaboration is explaining the material to someone else. Research on peer tutoring has long found achievement benefits for the tutor as well as the tutee (Devin-Sheehan, Feldman, & Allen, 1976). Donald Dansereau and his colleagues at Texas Christian University have found in an impressive series of brief studies that college students working on structured "cooperative scripts" can learn technical material or procedures far better than can students working alone (Dansereau, 1988; O'Donnell, in press; Newbern, Dansereau, Patterson, & Wallace, 1994). In this method, students take roles as recaller and listener. They read a section of text, and then the recaller summarizes the information while the listener corrects any errors, fills in any omitted material, and helps think of ways both students can remember the main ideas. On the next section, the students switch roles. Dansereau and his colleagues found in a series of studies that while both the recaller and the listener learned more than did students working alone, the recaller learned more (O'Donnell & Dansereau, 1992). This mirrors both the peer tutoring findings and the findings of Noreen Webb (1989, 1992), who discovered that the students who gained the most from cooperative activities were those who provided elaborated explanations to others. In this research as well as in Dansereau's, students who received elaborated explanations learned more than those who worked alone, but not as much as those who served as explainers.

One practical use of the cognitive elaboration potential of cooperative learning is in writing process models (Graves, 1983), in which students work in peer response groups or form partnerships to help one another draft, revise, and edit compositions. Such models have been found to be effective in improving creative writing (Hillocks, 1984), and a writing process model emphasizing use of peer response groups is part of the Cooperative Integrated Reading and Composition Writing/Language Arts program (Stevens, Madden, Slavin, & Farnish, 1987), a program which has also been used to increase student writing achievement. Part of the theory behind the use of peer response groups is that if students learn to evaluate others' writing, they will become better writers themselves, a variant of the cognitive elaboration explanation. However, it is unclear at present how much of the effectiveness of writing process models can be ascribed to the use of cooperative peer response groups as opposed to other elements (such as the revision process itself).

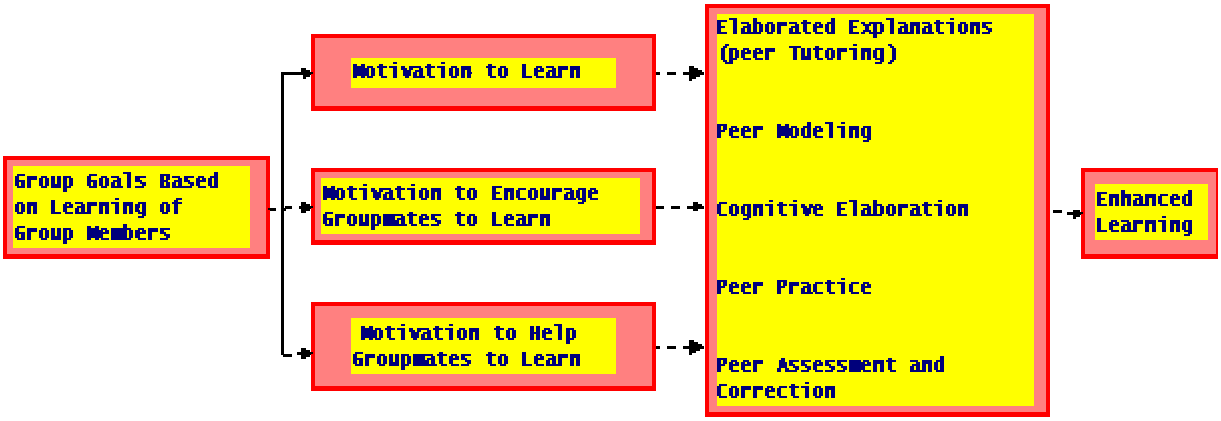
One interesting development in recent years which relates to the cognitive elaboration perspective on cooperative learning is Reciprocal Teaching (Palincsar & Brown, 1984), a method for teaching reading comprehension skills. In this technique, students are taught to formulate questions for one another around narrative or expository texts. In doing so, they must process the material themselves and learn how to focus in on the essential elements of the reading passages. Studies of Reciprocal Teaching have generally supported its effects on student achievement (Palincsar, 1987; Rosenshine & Meister, 1994).

Reconciling the Four Perspectives

The four theoretical perspectives discussed above all have well-established rationales, and most have supporting evidence. All apply in some circumstances, but none are probably both necessary and sufficient in all circumstances. Research in each tradition tends to establish setting conditions favorable to that perspective. For example, most research on cooperative learning models from the motivational and social cohesiveness perspectives takes place in real classrooms over extended

periods, as both extrinsic motivation and social cohesion may be assumed to take time to show their effects. In contrast, studies undertaken from the developmental and cognitive elaboration perspectives tends to be very short, making issues of motivation moot. These latter paradigms also tend to use pairs, rather than groups of four; pairs involve a much simpler social process than groups of four, which may need time to develop ways of working well together. Developmental research almost exclusively uses young children trying to master conservation tasks, which bear little resemblance to the "social-arbitrary" learning that characterizes most school subjects; cognitive elaboration research mostly involves college students.

However, 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 would argue that motivation drives cognitive process, which in turn produces learning. For example, it is unlikely that over the long haul students would engage in the kind of elaborated explanations found by Webb (1989) to be essential to profiting from cooperative activity. Similarly, motivational theorists would hold that an intermediate effect of extrinsic incentives must be to build cohesiveness, caring, and pro-social norms among group members, which could in turn affect cognitive processes. One model of the relationship among the four alternative perspectives is diagrammed below (from Slavin, 1995).



The process depicted above shows how group goals might operate to enhance the learning outcomes of cooperative learning. Provision of group goals based on the individual learning of all group members might affect cognitive processes directly, by motivating students to engage in peer modeling, cognitive elaboration, and/or practice with one another. Group goals may also lead to group cohesiveness, increasing caring and concern among group members, making them feel responsible for one another's achievement, thereby motivating students to engage in cognitive processes which enhance learning. Finally, group goals may motivate students to take responsibility for one another independently of the teacher, thereby solving important classroom organization problems and providing increased opportunities for cognitively appropriate learning activities.

From the perspective of the model diagrammed in Figure 1, researchers from outside of the motivational perspective are attempting to short-circuit the process to intervene directly on mechanisms identified as mediating variables in the full model. For example, social cohesion theorists intervene directly on group cohesiveness by engaging in elaborate teambuilding and group processing training. The Sharan and Shachar (1988) Group Investigation study suggests that this can be successfully done, but it takes a great deal of time and effort. In this study, teachers were trained over the course of a full year, and then teachers and students used cooperative learning for three months before the study began. Earlier research on Group Investigation failed to provide a comparable level of preparation of teachers and students, and the achievement results of these studies were less consistently positive (Sharan, Kussell, Hertz-Lazarowitz, Bejerano, Raviv, & Sharan et al., 1984).

Cognitive theorists would hold that the cognitive processes that are essential to any theory relating cooperative learning to achievement can be created directly, without the motivational or affective changes discussed by the motivationalist and social cohesion theorists. This may turn out to be accurate, but at present demonstrations of learning effects from direct manipulation of peer cognitive

interactions have mostly been limited to very brief durations and to tasks which lend themselves directly to the cognitive processes involved. For example, the Piagetian conservation tasks studied by developmentalists have few practical analogs in the school curriculum. However, the research on Reciprocal Teaching in reading comprehension (Palincsar & Brown, 1984) shows promise as a means of intervening directly in peer cognitive processes. Long-term applications of Dansereau's (1988) cooperative scripts for comprehension of technical material and procedural instructions also seem likely to be successful.

What Factors Contribute to Achievement Effects of Cooperative Learning?[1]

Research on cooperative learning has moved beyond the question of whether cooperative learning is effective in accelerating student achievement to focus on the conditions under which it is optimally effective. The foregoing discussion describes alternative overarching theories to explain cooperative learning effects, and an integration of these theories. Beyond this, it is important to understand in more detail the factors that contribute to or detract from the effectiveness of cooperative learning.

There are two primary ways to learn about factors that contribute to the effectiveness of cooperative learning. One is to compare the outcomes of studies of alternative methods. For example, if programs that incorporated group rewards produced stronger or more consistent positive effects (in comparison to control groups) than programs that did not, then this would provide one kind of evidence that group rewards enhance the outcomes of cooperative learning. The problem with such comparisons is that the studies being compared usually differ in measures, durations, subjects, and many other factors that could explain differing outcomes. Better evidence is provided by studies that compared alternative forms of cooperative learning. In such studies, most factors, other than the ones being studied can be held constant. The following sections discuss both types of studies to further explore factors that contribute to the effectiveness of cooperative learning for increasing achievement.

Group Goals and Individual Accountability

As noted earlier, reviewers of the cooperative learning literature have long concluded that cooperative learning has its greatest effects on student learning when groups are recognized or rewarded based on individual learning of their members (Slavin, 1983a, 1983b, 1989, 1992, 1995; Ellis & Fouts, 1993; Newmann & Thompson, 1987; Manning & Lucking, 1991; Davidson, 1985; Mergendoller & Packer, 1989). For example, methods of this type may give groups certificates based on the average of individual quiz scores of group members, where group members could not help each other on the quizzes. Alternatively, group members might be chosen at random to represent the group, and the whole group might be rewarded based on the selected member's performance. In contrast, methods lacking group goals give students only individual grades or other individual feedback, and there is no group consequence for doing well as a group. Methods lacking individual accountability might reward groups for doing well, but the basis for this reward would be a single project, worksheet, quiz, or other product that could theoretically have been done by only one group member.

The importance of group goals and individual accountability is in providing students with an incentive to help each other and to encourage each other to put forth maximum effort (Slavin, 1995). If students value doing well as a group, and the group can succeed only by ensuring that all group members have learned the material, then group members will be motivated to teach each other. Studies of behaviors within groups that relate most to achievement gains consistently show that students who give each other explanations (and less consistently, those who receive such explanations) are the students who learn the most in cooperative learning. Giving or receiving answers without explanation generally reduces achievement (Webb, 1989, 1992). At least in theory, group goals and individual accountability should motivate students to engage in the behaviors that increase achievement and avoid those that reduce it. If a group member wants her group to be successful, she must teach her groupmates (and learn the material herself). If she simply tells her groupmates the answers, they will fail the quiz that they must take individually. If she ignores a groupmate who is not understanding the material, the groupmate will fail and the group will fail as well. In groups lacking individual accountability, one or two students may do the group's work, while others engage in "social loafing" (Latane, Williams, & Harkins, 1979). For example, in a group asked to complete a single project or solve a single problem, some students may be discouraged from participating. A group trying to complete a common problem may not want to stop and explain what is going on to a groupmate who doesn't understand, or may feel it is useless or counterproductive to try to involve certain groupmates.

The evidence from research on cooperative learning strongly supports the importance of group goals that can be achieved only by ensuring the learning of all group members. The most recent comprehensive review of this topic by Slavin (1995) provides one kind of evidence to support this conclusion. Studies of methods that incorporated group goals and individual accountability produced a much higher median effect size than did studies of other methods. As noted earlier, the median effect size across fifty-two studies was +.32, compared to a median of only +.07 across twenty-five studies that did not incorporate group goals and individual accountability. Seventy-eight percent of studies of methods using group goals and individual accountability found significantly positive effects, and there were no significantly negative effects. In methods lacking these, elements only 37% of studies found significantly positive effects, and 14% found significantly negative effects.

A comparison among Learning Together studies (Johnson & Johnson, 1989) also supports the same conclusions. Across eight studies of Learning Together methods in which students were rewarded based on a single worksheet or product, the median effect size was near zero (+.04). However, among four studies that evaluated forms of the program in which students were graded based on the average performance of all group members on individual assessments, three found significantly positive effects.

Finally, comparisons within the same studies consistently support the importance of group goals and individual accountability. For example, Fantuzzo, King, & Heller (1992) conducted a component analysis of Reciprocal Peer Tutoring (RPT). They compared four conditions in which students worked in dyads to learn math. In one, students were rewarded with opportunities to engage in special activities of their choice if the sum of the dyad's scores on daily quizzes exceeded a criterion. In another, students were taught a structured method of tutoring each other, correcting efforts, and alternating tutor-tutee roles. A third condition involved a combination of rewards and structure, and a fourth was a control condition in which students worked in pairs but were given neither rewards nor structure. The results showed that the reward + structure condition had by far the largest effects on math achievement (ES=+1.42), and that reward alone had much larger effects than structure alone. The reward + structure condition exceeded structure-only by an effect size of +1.88, and the reward-only group exceeded control by an effect size of +.21 (the structure-only group performed less well than the control group).

Other studies also found greater achievement for cooperative methods using group goals and individual accountability than for those that do not. Huber, Bogatzki, & Winter (1982) compared a form of STAD to traditional group work lacking group goals and individual accountability. The STAD group scored significantly better on a math test (ES=+.23). In a study of TAI, Cavanaugh (1984) found that students who received group recognition based on the number of units accurately completed by all group members both learned more (ES=+.24) and completed more units (ES=+.25) than did students who received individual recognition only. O'Donnell (in press) compared dyads working with and without incentives. Students who received explicit incentives based on their learning learned significantly more than those who did not in three experimental studies. Okebukola (1985), studying science in Nigeria, found substantially greater achievement in STAD and TGT, methods using group goals and individual accountability, than in forms of Jigsaw and Johnsons' methods that did not. In another study, Okebukola found much higher achievement in classes that used a method combining cooperation and group competition (one form of group reward) than in a "pure" cooperative method that did not use group rewards of any kind (ES=+1.28).

A few reviewers (e.g., Damon, 1984; Kohn, 1986) have recommended against the use of group rewards, fearing that they may undermine long-term motivation. There is no evidence that they do so, and they certainly do not undermine long-term achievement. Among multi-year studies, methods that incorporate group rewards based on individual learning performance have consistently shown continued or enhanced achievement gains over time (Stevens & Slavin, 1995a, b; Hertz-Lazarowitz, Ivory, & Calderơn, 1993; Greenwood, Delquadri, & Hall, 1989). In contrast, multi-year studies of methods lacking group rewards found few achievement effects in the short or long-term (Solomon, Watson, Schaps, Battistich, & Solomon, 1990; Talmage, Pascarella, & Ford, 1984).

Cohen (1994b) raises the possibility that while group rewards and individual accountability may be necessary for lower-level skills, they may not be for higher-level ones. As evidence of this she cites a study by Sharan et al. (1984) that compared STAD and Group Investigation. In this study STAD and GI students performed equally well (and better than controls) on a test of English as a foreign

language, and STAD students did significantly better than GI on "lower level" (knowledge) items (ES=+.38). On "high level" items, GI students performed non-significantly higher than STAD students, with a difference of less than half of a point on a 15 point test. Otherwise there is no evidence that group rewards are less important for higher order skills, although the possibility is intriguing.

Structuring Group Interactions

While it is clear that all other things being equal, group rewards and individual accountability greatly enhance the achievement outcomes of cooperative learning, there is some evidence that carefully structuring the interactions among students in cooperative groups can also be effective, even in the absence of group rewards. For example, Meloth & 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). In the other group, students earned team scores if their members improved each week on quizzes. A comparison of the two groups on a reading comprehension test found greater gains for the strategy group (also see Meloth & Deering, 1994) Berg (1993) and Newbern et al. (1994) found positive effects of scripted dyadic methods that did not use group rewards, and Van Oudenhoven, Wiersma, & Van Yperen (1987) found positive effects of structured pair learning whether feedback was given to the pairs or only to individuals.

Research on Reciprocal Teaching (Palincsar & Brown, 1984) also shows how direct strategy instruction can enhance the effects of a technique related to cooperative learning. In this method, the teacher works with small groups of students and models such cognitive strategies as question generation and summarization. The teacher then gradually turns over responsibility to the students to carry on these activities with each other. Studies of Reciprocal Teaching have generally found positive effects of this method of reading comprehension (Palincsar & Brown, 1984; Palincsar, Brown, & Martin, 1987; Rosenshine & Meister, 1994). The effects of group rewards based on the individual learning of all group members are clearly indirect; they only motivate students to engage in certain behaviors, such as providing each other with elaborated explanation. The research by Meloth and Deering (1992), Berg (1993), and others

suggests that students can be directly taught to engage in cognitive and interpersonal behaviors that lead to higher achievement, without the need for group rewards.

However, there is also a growing body of evidence to suggest that a combination of group rewards and strategy training produces much better outcomes than either alone. First, the Fantuzzo et al. (1992) study, cited earlier, directly 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 the RPT and CWPT 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 the Berg (1993) study that provided groups with structure but not rewards. As noted earlier, studies of scripted dyads also find that adding incentives adds to the effects of these strategies (O'Donnell, in press). The consistent positive findings for CIRC, which uses both group rewards and strategy instruction, also argue for this combination.

Which Students Gain Most from Cooperative Learning?

Several studies have focused on the question of which students gain the most from cooperative learning. One particularly important question relates to whether cooperative learning is beneficial to students at all levels of prior achievement. It would be possible to argue (see, for example, Allan, 1991; Robinson, 1990) that high achievers could be held back by having to explain material to their low-achieving groupmates. However, it would be equally possible to argue that because students who give elaborated explanations typically learn more than those who receive them (Webb, 1992), high achievers should be the students who benefit most from cooperative learning because they give the most frequent elaborated explanations.

The evidence from experimental studies that met the inclusion criteria for this review support neither position. A few studies found better outcomes for high achievers than for low and a few found that low achievers gained the most (see Slavin, 1995). Most, however, found equal benefits for high, average, and low achievers in comparison to their counterparts in control groups. One two-year study of

schools using cooperative learning most of their instructional day found that high, average, and low achievers all achieved better than controls at similar achievement levels. However, a separate analysis of the very highest achievers, those in the top 10% and top 5% of their classes at pretest, found particularly large positive effects of cooperative learning on these students (Slavin, 1991; Stevens & Slavin, 1995b).

A few studies have looked for possible differences in the effects of cooperative learning on students of different ethnicities. Several have found particularly large effects for black students. However, other studies have found equal effects of cooperative learning for students of different backgrounds (Slavin, 1995).

Other studies have examined a variety of factors that might interact with achievement gain in cooperative learning. Okebukola (1986) and Wheeler & Ryan (1973) found that students who preferred cooperative learning learned more in cooperative methods than those who preferred competition. Chambers & Abrami (1991) found that students on successful teams learned more than those on less successful teams.

Finally, a small number of studies have compared variations in cooperative procedures. Moody & Gifford (1990) found that while there was no difference in achievement gains of homogeneous and heterogeneous groups performed better than mixed groups. Foyle, Lyman, Tompkins, Perne, & Foyle (1993) found that cooperative learning classes assigned daily homework achieved more than those not assigned homework. Kaminski (1991) and Rich et al. (1986) found that explicit teaching of collaborative skills had no effect on student achievement. Jones (1990) compared cooperative learning using group competition to an otherwise identical method that compared groups to a set standard (as in STAD). There were no achievement differences, but a few attitude differences favored the group competition.

Are Group Goals and Individual Accountability Always Necessary?

The previous discussion has summarized evidence that generally supports the motivationalist view that group goals and individual accountability are necessary for cooperative learning to result in achievement gains, at least in applications of several weeks or months (my 1995 review considered only studies of at least four weeks' duration). Yet there are a few cases in which achievement gains (in comparison to control groups) have been found for cooperative learning treatments that lack one or both of these elements. Are there conditions under which they may not be necessary?

Before exploring this question, it is important to further consider the theoretical rationale for the importance of group goals and individual accountability. Both are principally designed to motivate students to teach each other, to be concerned about the learning of their groupmates. The assumption behind them is that while groupmates may readily interact with each other and help each other, without appropriate structuring this interaction and help may take the form of sharing answers or doing each other's work rather than making certain that groupmates can independently solve problems or know the material. In cooperative learning techniques in which groups are rewarded based on the individual learning of each group member, the group members want the group to succeed, and the only way they can make this happen is to teach and assess one another to make certain that every group member can independently show mastery of whatever the group is studying.

The theoretical and empirical support for the centrality of group goals and individual accountability is strong for a broad range of school tasks. Yet there may be some kinds of tasks that do not require these elements.

Controversial Tasks Without Single Answers. One category of tasks that may not require group goals and individual accountability is tasks in which it is likely that students will benefit by hearing others thinking aloud. This is the classic Vygotskian paradigm; students in collaborating groups make overt their private speech, giving peers operating at a slightly lower cognitive level on a given task a stepping stone to understanding and incorporating higher-quality solutions in their own private speech (see Bershon, 1992). Tasks of this kind would be ones at a very high level of cognitive complexity but without a well-defined path to a solution or a single correct answer, especially tasks on which there are likely to be differences of opinion. For such tasks, the process of participating in arguments or even of listening to others argue and justify their opinions or solutions may be enough to enhance

learning, even if no teaching, explanation, or assessment goes on within the group. Perhaps the best classroom evidence on this type of task is from Johnson and Johnson's (1979) studies of structured controversy, in which students argue both sides of a controversial issue using a structured method of argumentation. Other examples of such tasks might include group projects without a single right answer (e.g., planning a city), and solving complex problems, such as nonroutine problems in mathematics or finding the main idea of paragraphs. In each of these cases it may be that hearing others' thinking processes is beneficial even if co-teaching does not take place.

It is still important to note that use of group goals and individual accountability is unlikely to interfere with modeling of higher-level thinking, and is likely to add teaching and elaborated explanation (Webb, 1992). For example, Stevens, Slavin, & Farnish (1991) evaluated a method of teaching students to find the main ideas of paragraphs in which four-member groups first came to consensus on a set of paragraphs and then worked to make certain that every group member could find the main idea. Groups received certificates based on the performance of their members on individual quizzes. The consensus procedure evoked arguments and explanations, modeling higher quality thinking, but the teaching procedure made sure that students could each apply their new understandings. The program's effects on tests of main idea and inference skills were substantial.

Voluntary Study Groups. A second category of cooperative tasks that may not require group goals and individual accountability is situations in which students are strongly motivated to perform well on an external assessment and can clearly see the benefit of working together. The classic instance of this is voluntary study groups common in postsecondary education, especially in medical and law schools. Medical and law students must master an enormous common body of information, and it is obvious to many students that participating in a study group will be beneficial. While there is little extrinsic reason for students to be concerned about the success of other study group members, there is typically a norm within study groups that each member must do a good job of presenting to the group. Because study group membership is typically voluntary, study group members who do not participate effectively may be concerned that next term they may not be invited back.

There is little research on voluntary study groups in postsecondary institutions, and it is unclear how well this idea would apply at the elementary or secondary levels. In the U.S., it would seem that only college-bound senior high school students are likely to care enough about their grades to actively participate in study groups like those seen at the postsecondary level, yet it may be that similar structures could be set up by teachers and that norms of reciprocal responsibility to the group could be developed. Another problem, however, is that voluntary study groups can and do reject (or fail to select) members who are felt to have little to contribute to the group. This could not be allowed to happen in study groups sponsored by the school..

Structured Dyadic Tasks. A third category of cooperative tasks that may not require group goals and individual accountability is tasks that are so structured that learning is likely to result if students engage in them, regardless of their motivation to help their partners learn. Examples of this were discussed earlier. One is the series of studies by Dansereau (1988) and his colleagues in which pairs of college students proceeded through a structured sequence of activities to help each other learn complex technical information or procedures (see O'Donnell & Dansereau, 1992). Another was two Dutch studies of spelling which also involved dyads and in which the study behavior (quizzing each other in turn) was structured and obviously beneficial (Van Oudenhoven, Wiersma, & Van Yperen, 1987; Van Oudenhoven, Van Berkum, & Koopmans, 1987). In contrast to cooperative methods using group goals and individual accountability to indirectly motivate students to teach each other, these methods allow the teacher to directly motivate students to engage in structured turn taking behaviors known to increase learning. The successful use of structured dyadic tasks in elementary schools seems largely limited to lower level, rote skills such as memorizing multiplication tables, spelling lists, or place names.

As in the case of controversial tasks without single correct answers, there is evidence that adding group rewards to structured dyadic tasks enhances the effects of these strategies. Fantuzzo, Polite, & Grayson (1990) evaluated a dyadic study strategy called Reciprocal Peer Tutoring. A simple pair study format did not increase student arithmetic achievement, but when successful dyads were awarded stickers and classroom privileges, their achievement markedly increased. A similar comparison of dyadic tutoring with and without group rewards at the college level also found that group rewards greatly enhanced the achievement effects of a structured dyadic study model

(Fantuzzo, Riggio, Connelly, & Dimeff, 1989), and a series of studies have shown positive effects of the Reciprocal Peer Tutoring model in many subjects and at many grade levels (e.g., Fantuzzo, Polite, & Grayson, 1990). A similar program combining structured reciprocal tutoring with group rewards called Classwide Peer Tutoring has also been successful in increasing student achievement in a variety of subjects and grade levels (Greenwood, Delquardi, & Hall, 1989; Maheady, Harper, & Mallette, 1991).

Needs for Additional Research

The four theoretical models explaining the achievement effects of cooperative learning described in this paper are all useful in expanding our understanding of the conditions under which various forms of cooperative learning may affect student achievement. Figure 1, which links these theoretical perspectives in a causal model, provides a framework for predicting different causal paths by which cooperative learning might affect achievement.

In particular, the model shows the importance of group goals and individual accountability, but also suggests ways that achievement might be affected more directly by introducing peer activities that may not require extrinsic motivation. This paper explores three types of tasks or situations in which group goals and individual accountability may not be necessary: controversial tasks lacking single right answers, voluntary study groups, and structured dyadic tasks. There is no research on voluntary study groups (such as medical or law school study groups), but research does find instances in which the other two types of cooperative tasks are effective without group goals and individual accountability. However, there is also evidence that adding group goals and individual accountability to these tasks further enhances their instructional effectiveness.

Clearly, there is a need for further research on conditions under which group goals and individual accountability may not be necessary. As a practical matter, it is probably the case that most teachers using cooperative learning do not provide group rewards based on the individual learning of all group members, and feel that it is unnecessary and cumbersome to do so. Widespread reluctance to use extrinsic incentives, based in part on a misreading of research on the "undermining" effects of rewards on long-term motivation (Cameron & Pierce, 1994) has contributed to many educators' reluctance to use group rewards. For both theoretical and practical reasons it would be important to know how to make "reward-free" cooperative learning methods effective.

A related need for research concerns effective uses of project-based learning. Most research on cooperative learning has involved the use of these methods to help children master fairly well-defined skills or information. They key exceptions to this are work of the Sharans (Sharan & Sharan, 1992) and of Elizabeth Cohen (1994b). Cooperative learning practice has increasingly shifted toward project-based or active learning (Stern, in press), in which students work together to produce reports, projects, experiments, and so on. It is possible to make inferences to optimal conditions for project-based learning from research on more cut-and-dried content (see Slavin, in press), and the work of Cohen and the Sharans does imply that well-implemented, project-based learning can be more effective than traditional instruction (the Sharan & Shachar [1988] study is by far the best evidence of this). However, there is a great deal of work yet to be done to identify effective, replicable methods, to understand the conditions necessary for success in project-based learning, and to develop a more powerful theory and rationale to support project-based learning.

There is a need for both development and research at the intersection of cooperative learning and curriculum. Our own work has for many years focused on development and evaluation of cooperative learning methods that are tied to particular subjects and grade levels, such as Cooperative Integrated Reading and Composition (Stevens et al., 1987) and our newest programs, WorldLab (social studies and science) and MathWings (Slavin, Madden, Dolan, & Wasik, 1994). Elizabeth Cohen's (1994a) Complex Instruction program and Eric Schaps' (Soloman et al., 1990) Child Development Project have also developed specific, broadly applicable curriculum materials to be used in a cooperative learning format. These contrast with most cooperative learning models which typically provide some general guidance for how to adapt cooperative learning to different subjects and grade levels but rarely provide actual student materials. How is cooperative learning affected by the existence of specific materials? Does use of these materials improve the learning outcomes of cooperative learning? Does it make cooperative learning more likely to be implemented well in the first place and maintained over time? Or does the use of prepared materials lead to less thoughtful use of

cooperative learning or less ability to adapt in situations lacking materials? These questions are more important for practice than for theory but they are very important for practice. Not incidentally, there is a need for development of high-quality well-developed, well-researched cooperative curricula in many subjects and grade levels, especially at the secondary level.

Related to the need for research on curriculum-based methods is a need for research on effective strategies for professional development and follow up to support cooperative learning. Nearly all cooperative learning training programs make extensive use of simulations, and this seems so obviously effective that perhaps it is not worth studying (although perhaps it is at least worth documenting). There has been some research on the effectiveness of peer coaching to support implementations of cooperative learning (e.g., Joyce, Hersh, & McKibbin, 1983). Yet there is much more work to be done to identify strategies for professional development likely to lead to high-quality, thoughtful, and sustained implementation. A few factors worth studying might include contrasts between schoolwide and teacher-by-teacher implementations, expert versus peer coaches, inservice focusing on generic principles versus specific strategies, and use of teacher learning communities (Calderσn, 1994), groups of teachers who meet on a regular basis to support each other's innovative efforts.

Perhaps the only determined opposition to cooperative learning within the community of professional educators has come from advocates for gifted students. There is some research on the effects of cooperative learning on gifted students both within heterogeneous classes (Stevens & Slavin, 1995b) and within separate programs for the gifted (Gallagher, 1995), and so far there is little evidence to support fears that gifted students are shortchanged by cooperative learning. However, much more research is needed in this area to understand, for example, whether different cooperative methods have different effects for gifted students and how the effects of cooperative learning might be different in homogeneous and heterogeneous settings. On this last question, there is a broader need to study cooperative learning in the context of attempts to replace homogeneous with heterogeneous grouping, especially in middle and high schools, and to use cooperative learning instead of homogeneous reading groups in elementary schools.

This paper has focused on the achievement outcomes of cooperative learning, but there are of course many other outcomes that are in need further research. Among there are studies of cooperative learning effects on intergroup relations, self-esteem acceptable of mainstreamed classmates, pro-social norms, and so on (see Slavin, 1995; Hawley & Jackson, 1995).

In general, there is a need for more research on all outcomes in senior high schools and in post-secondary institutions, and a need for development and evaluations of cooperative methods for young children, especially those in prekindergarten, kindergarten, and first grade.

In summary, although cooperative learning has been studied in an extraordinary number of field experiments of high methodological quality, there is still much more to be done. Cooperative learning has the potential to become a primary format used by the teachers to achieve both traditional and innovative goals. Research must continue to provide the practical, theoretical, and intellectual underpinnings to enable educators to achieve this potential.

References

Allen, S.D. (1991). Ability grouping research reviews: What do they say about grouping and the gifted? *Educational Leadership*, 48(6), 60-65.

Ames, G.J., and Murray, F.B. (1982). When two wrongs make a right: Promoting cognitive change by social conflict. *Developmental Psychology*, 18, 894-897.

Aronson, E., Blaney, N., Stephan, C., Sikes, J., and Snapp, M. (1978). *The Jigsaw classroom.* Beverly Hills, CA: Sage.

Bell, N., Grossen, M., & Perret-Clermont, A-N. (1985). Socio-cognitive conflict and intellectual growth. In M. Berkowitz (ed.), *Peer conflict and psychological growth.* San Francisco: Jossey-Bass.

Berg, K.F., (1993, April). *Structured cooperative learning and achievement in a high school mathematics class.* Paper presented at the annual meeting of the American Educational Research Association, Atlanta.

Bershon, B.L. (1992). Cooperative problem solving: A link to inner speech. In R. Hertz-Lazarowitz & N. Miller (Eds.) *Interaction in cooperative groups* (pp. 36-48). New York: Cambridge University Press.

Burns, M. (1981, September). Groups of four: Solving the management problem. *Learning*, 46-51.

Calderσn, M. (1994). Mentoring and coaching minority teachers. In J. DeVillar & J. Cummins (Eds.), *Successful cultural diversity: Classroom practices for the 21st century.* Albany, NY: SUNY Press.

Cameron, J., & Pierce, W.D. (1994). Reinforcement, reward, and intrinsic motivation: A meta-analysis. *Review of Educational Research*, 64, 363-423.

Cavanagh, B.R. (1984). Effects of interdependent group contingencies on the achievement of elementary school children. *Dissertation Abstracts*, 46, 1558.

Chambers, B., & Abrami, P.C. (1991). The relationship between Student Team Learning outcomes and achievement, causal attributions, and affect. *Journal of Educational Psychology*, 83, 140-146.

Cohen, E. (1986). *Designing groupwork: Strategies for the heterogeneous classroom.* New York: Teachers College Press.

Cohen, E.G., (1994a). *Designing groupwork: Strategies for the heterogeneous classroom* (2nd Ed.). New York: Teachers College Press.

Cohen, E.G. (1994b). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research*, 64(1), 1-35.

Coleman, J. (1961). *The Adolescent Society.* New York: Free Press.

Damon, W. (1984). Peer education: The untapped potential. *Journal of Applied Developmental Psychology*, 5, 331-343.

Dansereau, D.F. (1988). Cooperative learning strategies. In C.E. Weinstein, E.T. Goetz, & P.A. Alexander (Eds.), *Learning and study strategies: Issues in assessment, instruction, and evaluation* (pp. 103-120). Orlando, FL: Academic Press.

Davidson, N. (1985). Small-group learning and teaching in mathematics: A selective review of the research. In R.E. Slavin, S. Sharan, S. Kagan, R. Hertz-Lazarowitz, C. Webb, & R. Schmuck (Eds.). *Learning to cooperating to learn* (pp. 211-230). New York: Plenum.

De Avila, E., & Duncan, S. (1980). *Finding Out/Descubrimiento.* Corte Madera, CA: Linguametrics Group.

Devin-Sheehan, L., Feldman, R., and Allen, V. (1976). Research on children tutoring children: A critical review. *Review of Educational Research*, 46(3), 355-385.

Ellis, A.K., & Fouts, J.T. (1993). *Research on educational innovations. Princeton Junction*, NJ: Eye on Education.

Fantuzzo, J.W., King, J.A., & Heller, L.R. (1992). Effects of reciprocal peer tutoring on mathematics and school adjustment: A component analysis. Journal of Educational Psychology, 84, 33-339.

Fantuzzo, J.W., Polite, K., & Grayson, N. (1990). An evaluation of reciprocal peer tutoring across elementary school settings. Journal of School Psychology, 28, 309-323.

Fantuzzo, J.W., Riggio, R.E., Connelly, S., & Dimeff, L.A. (1989). Effects of reciprocal peer tutoring on academic achievement and psychological adjustment: A component analysis. Journal of Educational Psychology, 81, 173-177.

Foyle, H.C., Lyman, L.R., Tompkins, L., Perne, S., & Foyle, D. (1993). Homework and cooperative learning: A classroom field experiment. Illinois School Research and Development, 29(3), 25-27.

Gallagher, J.J. (1995). Educational of gifted students: A civil rights issue? Phi Delta Kappan, 76(5), 408-410.

Graves, D. (1983). Writing: Teachers and children at work. Exeter, NH: Heinemann

Greenwood, C.R., Delquadri, J.C., & Hall, R.V. (1989). Longitudinal effects of classwide peer tutoring. Journal of Educational Psychology, 81, 371-383.

Hawley, W.D., & Jackson, A.W. (Eds.) (1995). Toward a common destiny: Improving race and ethnic relations in America. San Francisco: Jossey-Bass.

Hayes, L. (1976). The use of group contingencies for behavioral control: A review. Psychological Bulletin, 83, 628-648.

Hertz-Lazarowitz, R. Ivory, G., & Calderσn, M. (1993). The Bilingual Cooperative Integrated Reading and Composition (BCIRC) project in the Ysleta Independent School District: Standardized test outcomes. Baltimore, MD: Johns Hopkins University, Center for Research on Effective Schooling for Disadvantaged Students.

Hillocks, G. (1984). What works in teaching composition: A meta-analysis of experimental treatment studies. American Journal of Education, 93, 133-170.

Huber, G.L., Bogatzki, W., and Winter, M. (1982). Kooperation als Ziel schulischen Lehrens und Lehrens. Tubingen, West Germany: Arbeitsbereich Padagogische Psychologie der Universitat Tubingen.

Johnson, D.W., & Johnson, R.T. (1979). Conflict in the classroom: Controversy and learning. Review of Educational Research, 49, 51-70.

Johnson, D.W., & Johnson, R.T. (1989). Cooperation and competition: Theory and research. Edina, MN: Interaction Book Co.

Johnson, D.W., & Johnson, R.T. (1992). Positive interdependence: Key to effective cooperation. In R. Hertz-Lazarowitz & N. Miller (Eds.), Interaction in cooperative groups: The theoretical anatomy of group learning (pp. 174-199). New York: Cambridge University Press.

Johnson, D.W., & Johnson, R.T. (1994). Learning together and alone: Cooperative, competitive, and individualistic learning (4th Ed.). Boston: Allyn & Bacon.

Johnson, D.W., Maruyama, G., Johnson, R., Nelson, D., & Skon, L. (1981). Effects of cooperative, competitive, and individualistic goal structures on achievement: A meta-analysis. Psychological Bulletin, 89, 47-62.

Johnson, L.C. (1985). The effects of the groups of four cooperative learning model on student problem-solving achievement in mathematics. Unpublished doctoral dissertation, University of Houston.

Johnson, L.C. & Waxman, H.C. (1985, March). Evaluating the effects of the "groups of four" program. Paper presented at the annual convention of the American Educational Research Association, Chicago.

Jones, D.S.P. (1990). The effects of contingency based and competitive reward systems on achievement and attitudes in cooperative learning situations. Unpublished doctoral dissertation, Temple University.

Joyce, B.R., Hersh, R.H., & McKibbin, M. (1983). The structure of school improvement. New York: Longman.

Kagan, S. (1992). Cooperative Learning (8th Ed.). San Juan Capistrano, CA: Kagan Cooperative Learning.

Kaminski, L.B. (1991). The effect of formal group skill instruction and role development on achievement of high school students taught with cooperative learning. Unpublished doctoral dissertation, Michigan State University.

Kohn, A., (1986). No contest: The case against competition. Boston: Houghton-Mifflin.

Kuhn, D. (1972). Mechanism of change in the development of cognitive structures. Child Development, 43, 833-844.

Latane, B., Williams, K., & Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. Journal of Personality and Social Psychology, 37, 822-832.

Litow, L., & Pumroy, D. (1975). A brief review of classroom group-oriented contingencies. Journal of Applied Behavior Analysis, 8, 341-347.

Maheady, L., Harper, G.F., & Mallette, B. (1991). Peer-mediated instruction: Review of potential applications for special education. Reading, Writing, and Learning Disabilities, 7, 75-102.

Mandl, H., & Renkl, A. (1993). A plea for "more local" theories of cooperative learning. Learning and Instruction, 3, 12-18.

Manning, M.L., & Lucking, R. (1991). The what, why, and how of cooperative learning. The Social Studies, May/June, 120-124.

Mattingly, R.M., & Van Sickle, R.L. (1991). Cooperative learning and achievement in social studies: Jigsaw II. Social Education, 55(6), 392-395.

Meloth, M.S., & Deering, P.D. (1992). The effects of two cooperative conditions on peer group discussions, reading comprehension, and metacognition. Contemporary Educational Psychology, 17, 175-193.

Meloth, M.S., & Deering, P.D. (1994). Task talk and task awareness under different cooperative learning conditions. American Educational Research Journal, 31(1), 138-166.

Mergendoller, J., & Packer, M.J. (1989). Cooperative learning in the classroom: A knowledge brief on effective teaching. San Francisco: Far West Laboratory.

Moody, J.D., & Gifford, V.D. (1990, November). The effect of grouping by formal reasoning ability levels, group size, and gender on achievement in laboratory chemistry. Paper presented at the annual meeting of the Mid-South Educational Research Association, New Orleans.

Mugny, B., & Doise, W. (1978). Socio-cognitive conflict and structuration of individual and collective performances. European Journal of Social Psychology, 8, 181-192.

Murray, F.B. (1982). Teaching through social conflict. Contemporary Educational Psychology, 7, 257-271.

Newbern, D., Dansereau, D.F., Patterson, M.E., & Wallace, D.S. (1994, April). Toward a science of cooperation. Paper presented at the annual meeting of the American Educational Research Association, New Orleans.

Newmann, F.M., & Thompson, J. (1987). Effects of cooperative learning on achievement in secondary schools: A summary of research. Madison, WI: University of Wisconsin, National Center on Effective Secondary Schools.

O'Donnell, A.M. (in press). The effects of explicit incentives on scripted and unscripted cooperation. Journal of Educational Psychology.

O'Donnell, A.M. & Dansereau, D.F. (1992). Scripted cooperation in student dyads: A method for analyzing and enhancing academic learning and performance. In R. Hertz-Lazarowitz & N. Miller (Eds.), Interaction in cooperative groups: The theoretical anatomy of group learning (pp. 120-144). New York: Cambridge University Press.

Okebukola, P.A. (1985). The relative effectiveness of cooperative and competitive interaction techniques in strengthening students' performance in science classes. Science Education, 69, 501-509.

Okebulola, P.A. (1986). The influence of preferred learning styles on cooperative learning in science. Science Education, 70, 509-517.

Palincsar, A.S. (1987, April). Reciprocal teaching: Field evaluations in remedial and content area reading. Paper presented at the annual convention of the American Educational Research Association, Washington, DC.

Palincsar, A.S. & Brown, A.L. (1984). Reciprocal teaching of comprehension monitoring activities. Cognition and Instruction, 2, 117-175.

Palincsar, A.S., Brown, A.L., & Martin, S.M. (1987). Peer interaction in reading comprehension instruction. Educational Psychologist, 22, 231-253.

Perret-Clermont, A-N. (1980). Social interaction and cognitive development in children. London: Academic Press.

Piaget, J. (1926). The language and thought of the child. New York: Harcourt Brace.

Puma, M.J., Jones, C.C., Rock, D., & Fernandez, R. (1993). Prospects: The congressionally mandated study of educational growth and opportunity. Interim Report. Bethesda, MD: Abt Associates.

Rich, Y., Amir, Y., & Slavin, R.E. (1986). Instructional strategies for improving children's cross-ethnic relations. Ramat Gan, Israel: Bar Ilan University, Institute for the Advancement of Social Integration in the Schools.

Robinson, G.E. (1990). Synthesis of research on class size. Educational Leadership, 47(7), 80-90.

Rosenshine, B., & Meister, C. (1992). The use of scaffolds for teaching higher level cognitive strategies. Educational Leadership, 49(7), 26-33.

Rosenshine, B., & Meister, C. (1994). Reciprocal teaching: A review of research . Review of Educational Research, 64, 4788-530.

Sharan, S., & Hertz-Lazarowitz, R. (1980). A group-investigation method of cooperative learning in the classroom. In S. Sharan, P. Hare, C. Webb, & R. Hertz-Lazarowitz (Eds.), Cooperation in education. Provo, UT: Brigham Young University Press.

Sharan, S., Kussell, P., Hertz-Lazarowitz, R., Bejarano, Y., Raviv, S., & Sharan, Y. (1984). Cooperative learning in the classroom: Research in desegregated schools. Hillsdale, NJ: Erlbaum.

Sharan, S., & Shachar, C. (1988). Language and learning in the cooperative classroom. New York: Springer-Verlag.

Sharan, Y., & Sharan, S. (1992). Expanding cooperative learning through group investigation. New York: Teachers College Press.

Slavin, R.E. (1977). Classroom reward structure: An analytic and practical review. Review of Educational Research, 47, 633-650.

Slavin, R.E. (1983a). Cooperative learning. New York: Longman.

Slavin, R.E. (1983b). When does cooperative learning increase student achievement? Psychological Bulletin, 94, 429-445.

Slavin, R.E. (1985). Team-Assisted Individualization: Combining cooperative learning and individualized instruction in mathematics. In R.E. Slavin, S. Sharan, S. Kagan, R. Hertz-Lazarowitz, C. Webb, & R. Schmuck (Eds.), Learning to cooperative, cooperating to learn (pp. 177-209). New York: Plenum.

Slavin, R.E. (1987). Cooperative learning: Where behavioral and humanistic approaches to classroom motivation meet. Elementary School Journal, 88, 9-37.

Slavin, R.E. (1989). Cooperative learning and achievement: Six theoretical perspectives. In C. Ames and M.L. Maehr (Eds.), Advances in motivation and achievement. Greenwich, CT: JAI Press.

Slavin, R.E. (1991). Are cooperative learning and untracking harmful to the gifted? Educational Leadership, 48(6), 68-71.

Slavin, R.E. (1992). When and why does cooperative learning increase achievement? Theoretical and empirical perspectives. In R. Hertz-Lazarowitz & N. Miller (Eds.), Interaction in cooperative groups: The theoretical anatomy of group learning (pp. 145-173). New York: Cambridge University Press.

Slavin, R.E. (1995). Cooperative learning: Theory, research, and practice (2nd Ed.). Boston: Allyn & Bacon.

Slavin, R.E. (1994). Using Student Team Learning (2nd Ed.). Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.

Slavin, R.E. (in press). Cooperative learning: Theory, research, and implications for active learning. In D. Stern (Ed.), Active Learning. Paris: Organization for Economic Co-operation and Development.

Slavin, R.E., Madden, N.A., Dolan, L.J., & Wasik, B.A. (1994). Roots & Wings: Inspiring academic excellence. Educational Leadership, 52(3), 10-13.

Solomon, D., Watson, M., Schaps, E., Battistich, V., & Solomon, J. (1990). Cooperative learning as part of a comprehensive classroom program designed to promote prosocial development. In S. Sharan (Ed.) Cooperative Learning: Theory and Research. New York: Praeger.

Stern, D. (Ed.) (in press). Active learning. Paris: Organization for Economic Co-Operation and Development.

Stevens, R.J., & Slavin, R.E. (1995a). Effects of a cooperative learning approach in reading and writing on academically handicapped and nonhandicapped students. The Elementary School Journal, 95(3), 241-262.

Stevens, R.J., & Slavin, R.E. (1995b). The cooperative elementary school: Effects on students' achievement, attitudes, and social relations. American Educational Research Journal, 32, 321-351.

Stevens, R.J., Madden, N.A., Slavin, R.E., & Farnish, A.M. (1987). Cooperative Integrated Reading and Composition: Two field experiments. Reading Research Quarterly, 22, 433-454.

Stevens, R.J., Slavin, R.E., & Farnish, A.M. (1991). The effects of cooperative learning and direct instruction in reading comprehension strategies on main idea identification. Journal of Educational Psychology, 83, 8-16.

Talmage, H., Pascarella, E.T., & Ford, S. (1984). The influence of cooperative learning strategies on teacher practices, student perceptions of the learning environment, and academic achievement. American Educational Research Journal, 21, 163-179.

Van Oudenhoven, J.P., Van Berkum, G., & Swen-Koopmans, T. (1987). Effect of cooperation and shared feedback on spelling achievement. Journal of Educational Psychology, 79, 92-94.

Van Oudenhoven, J.P., Wiersma, B., & Van Yperen, N. (1987). Effects of cooperation and feedback by fellow pupils on spelling achievement. European Journal of Psychology of Education, 2, 83-91.

Vroom, V.H. (1969). Industrial social psychology. In G. Lindzey and E. Aronson (Eds.), The handbook of social psychology: Second edition (Vol. 5). Reading, Mass: Addison-Wesley.

Vygotsky, L.S. (1978). Mind in Society (Edited by M. Cole, V. John-Steiner, S. Scribner, & E. Souberman). Cambridge, MA: Harvard University Press.

Wadsworth, B.J. (1984). Piaget's theory of cognitive and affective development (3rd Ed.), New York: Longman.

Webb, N.M. (1989). Peer interaction and learning in small groups. International Journal of Educational Research, 13, 21-39.

Webb, N.M. (1992). Testing a theoretical model of student interaction and learning in small groups. In R. Hertz-Lazarowitz & N. Miller (Eds.), Interaction in cooperative groups: The theoretical anatomy of group learning (pp. 102-119). New York: Cambridge University Press.

Wheeler, R. & Ryan, F.L. (1973) Effects of cooperative and competitive classroom environments on the attitudes and achievement of elementary school students engaged in social studies inquiry activities. Journal of Educational Psychology, 65, 402-407.

Wittrock, M.C. (1986). Students' thought processes. In M.C. Wittrock (Ed.), Handbook of Research on Teaching (3rd Ed.) New York: Macmillan.

Yager, S., Johnson, R.T., Johnson, D.W., & Snider, B. (1986). The impact of group processing on achievement in cooperative learning. Journal of Social Psychology, 126, 389-397.