THE INTERNATIONAL HANDBOOK OF COLLABORATIVE LEARNING

EDITED BY
CINDY E. HMEOLO-SILVER,
CLARK A. CHINN,
CAROL K. K. CHAN, AND
ANGELA O’DONNELL
Collaborative learning has become an increasingly important part of education, but the research supporting it is distributed across a wide variety of fields including social, cognitive, developmental, and educational psychology, instructional design, the learning sciences, educational technology, socio-cultural studies, and computer-supported collaborative learning. The goal of this book is to integrate theory and research across these diverse fields of study and, thereby, to further our understanding of collaborative learning and its instructional applications. The book is structured into the following four sections: 1) Theoretical Foundations 2) Research Methodologies 3) Instructional Approaches and Issues, and 4) Technology. Key features include the following:

**Comprehensive and Global** — This is the first book to provide a comprehensive review of the widely scattered research on collaborative learning, including the contributions of many international authors.

**Cross-Disciplinary** — The field of collaborative learning is highly interdisciplinary, drawing scholars from psychology, computer science, mathematics education, science education, and educational technology. Within psychology, the book brings together perspectives from cognitive, social, and developmental psychology as well as from the cross-disciplinary field of the learning sciences.

**Chapter Structure** — To ensure consistency across the book, authors have organized their chapters around integrative themes and issues. Each chapter author summarizes the accumulated literature related to their chapter topic and identifies the strengths and weaknesses of the supporting evidence.

**Strong Methodology** — Each chapter within the extensive methodology section describes a specific methodology, its underlying assumptions, and provides examples of its application.

This book is appropriate for researchers and graduate level instructors in educational psychology, learning sciences, cognitive psychology, social psychology, computer science, educational technology, teacher education, and the academic libraries serving them. It is also appropriate as a graduate level textbook in collaborative learning, computer-supported collaborative learning, cognition and instruction, educational technology, and learning sciences.

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Educational Psychology Handbook Series

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Whether in school or out of school; whether in face to face or virtual environments; and, whether in performance of a teacher-orchestrated or a self-selected task, positive interdependence in the form of cooperative learning remains foundational to the educational experience. That is a premise that has been widely accepted by educators and educational researchers for decades, as well as by those involved in human learning and performance within a wide array of disciplines—from business to medicine or from computer programming to mathematical problem solving. That collaborative learning is basic to human growth and development is likewise a belief shared by the editors of and contributors to the *Handbook of Collaborative Learning*. Although their theoretical orientations may vary to some extent, while the particular language or attributes they use to conceptualize cooperative learning may differ to a certain degree, and while the specific contexts for the research they report may contrast, all those involved in this important project are consistent in their valuing of cooperative learning as a positive mechanism for human growth and development.

Despite the long-espoused benefits of peer-to-peer cooperation within academic contexts, there is still much to know about the nature and forms of effective cooperative learning both from the perspective of the researcher and the teacher, as the editors of this Handbook have made most evident. For those engaged in research on cooperative learning, for instance, it is essential to become up-to-date on the more recent studies of cooperative learning undertaken not solely in the United States or in realm of curriculum but also in other countries and within other domains and disciplines of inquiry not as often investigated. Thus, we find contributions by scholars from across the globe populating this comprehensive volume; scholars who help bring the notion of cooperation into the international arena and into the 21st century. This is especially true with regard to the area of technology and collaborative learning (CL) or computer-supported collaborative learning (CSCL) environments. The focus on computer-involved or computer-supported cooperation in this work already distinguishes it from prior volumes devoted to cooperative or collaborative learning.
Another distinguishing feature of the *Handbook* is its thoughtful detailing of research methodologies that can be applied to the study of cooperative learning and to the analysis of its potential contributions to academic development. The consideration of the established and emergent research methodologies allows for a particularly broad and deep investigation of cooperative learning and its documented effects. However, the examination of new or effective methodologies is not restricted to research designs or data analyses. Rather, the contributors to this work also overview various pedagogical techniques or instructional interventions that promote or entail positive interdependence among students. Indeed, it is rare to find such a balance between research and practice within the pages of a scholarly volume and it is precisely due to this research–practice synergy that the *Handbook of Cooperative Learning* is an indispensable addition to the library of any educator who employs cooperative learning in his or her own teaching or who focuses on cooperative learning in his or her program of research.

As the editor for the Taylor and Francis series on the *Psychological Foundations of Teaching and Learning*, I am honored to have such a timely and comprehensive book within the series. Further, as the editors for this *Handbook*, Cindy Hmelo-Silver, Clark Chinn, Carol Chan, and Angela O’Donnell have once again demonstrated their expertise on the subject of cooperative learning. They have also succeeded in bringing together an equally impressive group of recognized scholars who cast a piercing, multidisciplinary light on positive interdependence, which allows others to see cooperative learning with new eyes.

Cooperative learning has likely been part of the human educational experience throughout history, from the gathering of mentors and mentees in forums or agoras of ancient cities to the online learning communities of contemporary societies. Despite its long and rich history, a number of questions related to cooperative learning remain. For instance, when and how does positive interdependence arise from human interactions around shared problems or tasks, what methods or techniques can be used to promote academic cooperation, and what modes of inquiry can be appropriately applied to unearth the learning and development that result from such student-to-student interactions? These are precisely the questions that the *Handbook of Collaborative Learning* can help to answer. Thus, those who apply cooperation techniques in their teaching or pursue the study of cooperative learning are well advised to listen to the lessons captured within the pages of this comprehensive, contemporary, and contributory volume.

Patricia A. Alexander

*Series Editor*

*Psychological Foundations of Teaching and Learning*
INTRODUCTION: WHAT IS COLLABORATIVE LEARNING?

An Overview

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Collaborative learning has become an increasingly important part of education, but the research on collaborative learning is distributed across a variety of literatures including social, cognitive, developmental, educational psychology, instructional design, the learning sciences, educational technology, sociocultural research, social psychology, sociology, and computer-supported collaborative learning. Although these fields overlap, researchers and practitioners do not necessarily read outside their own disciplines. As the study of collaborative learning continues to expand, there is a need for an interdisciplinary research agenda with sharing of theoretical and methodological perspectives. The goal of this volume is to integrate theory and research findings across these communities of scholars to forward our understanding of collaborative learning.

The motivations to create this book include an effort to integrate the scattered nature of the work on collaborative learning which is distributed across many disciplines and represented in a large number of journals. Much of the original work on cooperative learning was done in North America (e.g., Johnson & Johnson, 1989; Slavin, 1996) or in Israel (Sharan & Sharan, 1992). However, there is a burgeoning literature from a variety of countries that explores issues related to collaborative learning; another goal of this handbook is to reflect the increasingly international flavor of the research. Thus, it greatly expands the consideration of models of collaborative learning, evaluations of their effectiveness, methodologies for evaluating success, and ideas for moving forward with a productive research agenda.

The overarching purpose of this handbook is to document the current state of research on collaborative learning. To accomplish this, the book (a) describes the theoretical foundations of collaborative learning, (b) discusses methodologies for studying collaborative learning, (c) provides examples of instructional approaches and issues, and (d) addresses issues with respect to technology and collaborative learning, focusing
especially on computer-supported collaborative learning. These four topics form the four sections of the book. The contents of the book reflect the diversity of interests in collaborative learning. Researchers from 9 countries on four continents are represented in the book and this diversity of contribution marks a new interdisciplinary approach to the study of collaborative learning.

What is collaborative learning? How is it distinguished from cooperation? Damon and Phelps (1989) distinguished between three forms of peer learning: peer tutoring, cooperative learning, and collaborative learning. The main characteristics distinguishing these three approaches were the dimensions of equality and mutuality of influence. Peer tutoring typically involves an unequal relationship between a tutor and a tutee, the former being more knowledgeable than the latter about the content that is the subject of the tutorial interaction. There is little in the way of mutuality of influence. The tutee is less likely to influence the tutor than vice versa. The power of the participants in this kind of tutorial interaction is not equal. According to Damon and Phelps, cooperative learning can be high in equality but low on mutuality whereas collaborative learning may be high on both. The Damon and Phelps article was written from the perspective of developmental psychology and does not capture the range of techniques and variables that distinguish between forms of cooperative and collaborative learning. A developmental psychological perspective is only one of many lenses by which collaborative or cooperative learning can be viewed. For the purposes of this volume, we will use the terms *cooperative learning* and *collaborative learning* interchangeably with an emphasis on mutual influence and equality of participation.

We begin with theoretical overviews as these theoretical perspectives shape the kinds of research methodologies used and instructional approaches adopted. The section on methodology will provide a comprehensive review of methodological approaches and tools that can be used by researchers. The section on instructional approaches and issues discusses a broad range of methods, reflecting different theoretical perspectives with a strong research base. It also addresses critical issues such as motivation and assessment. Research from the very rapidly growing field of computer-supported collaborative learning is addressed in the final section.

**PERSPECTIVES ON PEER LEARNING**

There are a variety of ways to conceptualize collaborative learning and these varied perspectives have implications for key decisions one makes in forming groups for the purposes of academic performance, problem solving, or other task performance. The first section of the book addresses some of the differences in perspective among approaches to collaborative learning. Among the decisions to be made by teachers include deciding on the size of the group, whether it should be heterogeneous or homogeneous in composition with respect to variables such as ability, race, and ethnicity, whether the tasks should be structured or minimally structured or whether rewards should be used. Slavin (1996) distinguished between a number of perspectives on collaborative peer learning. The perspectives he discusses include a social motivational perspective, a social cohesion perspective, two developmental perspectives influenced by Piaget and Vygotsky respectively, and cognitive elaboration perspectives (O’Donnell & O’Kelly, 1994).

Most people have worked in groups, helped another student with schoolwork, received help with schoolwork, or had some experience with tutoring. All these experiences
involve peers working together to improve some aspect of academic performance. Another benefit of peer learning is greater interaction and respect among diverse students. For example, when peers are engaged in peer assisted learning strategies this can result in improved social outcomes for students with learning disabilities (Fuchs, Fuchs, Mathes, & Martinez, 2002). Peer learning is often recommended as a teaching strategy, and both students and teachers can respond well to its use. Many state and national curriculum standards include recommendations about the use of groups and other peer learning situations to enhance critical thinking, conceptual understanding, and other higher order skills. Students often enjoy interacting with one another. Teachers frequently find that the presence of other students can serve as a key instructional resource. Acceptance by peers is linked to many positive outcomes in school, such as satisfaction with school, improved academic performance, and positive beliefs about academic competence. The use of collaborative and cooperative learning in classrooms has the potential to provide the social and emotional support students need from their peers (Hymel, Bowker, & Woody, 1993; Wentzel, 1994; Wentzel & Asher, 1995; Wentzel, Battle, & Looney, 2001).

Many of the original theories of cooperative learning were strongly influenced by social-psychological principles (Deutsch, 1949). The general principle underlying these theories is that of interdependence (Johnson & Johnson, 1991). Interdependence is one example of a goal structure that guides interaction in a group. Interdependence is a condition in which group members’ goal accomplishments are linked together. Thus, if one is to succeed in accomplishing one’s goals, others in one’s group must also accomplish their goals. For one person to succeed in accomplishing his or her goals, other members of the group must be successful too: this is a condition of positive interdependence. Two social psychological approaches arose from this perspective on collaborative learning. According to social-motivational theory, positive interdependence is created among members of a group by orchestrating the availability of rewards or recognition to encourage cooperation and collaboration. Thus, students work together to jointly gain rewards. Deutsch’s theory (1949) suggests that cooperation and competition are two sides of the same coin, a view that was later supported by Johnson and Johnson (1991). In a competitive context, when one individual accomplishes his or her goals, other participants cannot do so. This is called negative interdependence. For example, when one individual wins a track race, it means that others cannot succeed in accomplishing their goals. In a cooperative context, in contrast, no one can accomplish his or her goals unless everyone does. The success of the group is dependent on everyone in the group succeeding. A relay team is an example of a cooperatively interdependent group. No one on the team succeeds unless everyone does. If one individual drops the baton, all team members fail.

Two different approaches have been taken to creating the kind of interdependence that is necessary for a cooperative group: the social-motivational perspective and the social cohesion perspective. A social-motivational approach to creating interdependence relies on the use of rewards or recognition for group productivity. Techniques derived from this perspective include teams-games-tournaments (TGT; De Vries & Edwards, 1973); team-accelerated instruction (TAI; Slavin, 1984); cooperative integrated reading and composition (CIRC; Madden, Slavin, & Stevens, 1986); and student teams achievement division (STAD; Slavin, 1986). The assumptions on which these techniques are based are that students will be motivated to work together and help one another because
the group as a whole will be rewarded or will receive recognition. Thus, if one person is not working to help the group, the whole group suffers. Interdependence is created by the use of rewards or the promise of recognition. STAD is one of the most thoroughly researched cooperative learning techniques (Slavin, 1996).

Rewards or recognition are given to teams with high levels of achievement. Again, teachers must decide how many teams to reward or recognize and how to do so. Although there is cooperation among members of a group, the groups compete with other groups in the class. Within the group, however, there is the opportunity for mutuality of influence and equality of interaction. The use of individual accountability mechanisms is an effort to ensure equal participation. Each student is responsible for his or her performance and points are awarded to a team based on improvement in performance. A weakness of STAD is that it focuses on lower level cognitive objectives. Because students use prepared answer sheets to respond to their peers’ efforts to answer questions, the cognitive levels of the tasks may remain quite low, focusing on factual recall and basic comprehension rather than on higher level abilities. Most of the specific collaborative learning contexts described in this volume aim for higher order outcomes on the part of students.

A second social psychological approach depends on creating interdependence through social cohesion. From this perspective, students are motivated to help one another succeed because they care about one another. Students are motivated to help one another because they wish to see one another succeed. David and Roger Johnson, directors of the Center for Cooperative Learning at the University of Minnesota, have conducted research on cooperative learning techniques since the 1970s. They developed the technique known as Learning Together (Johnson & Johnson, 1991).

Effective cooperative learning has five basic elements (Johnson & Johnson, 1991): positive interdependence; face-to-face promotive interaction in which students promote one another’s cognitive and affective skills within a group context; individual accountability in which each individual is held accountable for the work of the group thus encouraging personal responsibility; interpersonal and small-group skills; and group processing. In Learning Together, a great deal of attention is given to the role of social skills. However, students may need quite a bit of help in developing and displaying the appropriate social skills. Students come to classes with histories of experience with one another and depending on their previous experience, they may not exhibit the kinds of social skills needed for the more open-ended tasks involved in Learning Together. In using Learning Together, a teacher selects a lesson and identifies objectives both for the content and for social skills. The teacher must make a number of important decisions about the size of each group, and which students make up a group. He or she must ensure that adequate materials are available and that students are assigned particular roles within the group. The use of assigned roles helps students navigate the ambiguity of the more open-ended tasks involved in a technique such as Learning Together. The teacher explains the task to the students and establishes positive interdependence among group members. One function of assigning roles within the group is to maintain that interdependence as students work together. The teacher must also establish criteria for evaluating the success of the group and develop a strategy for ensuring that each individual in the group is accountable for his or her performance. As the students work together on the task, the teacher needs to monitor their interactions and note any evidence of expected behaviors (e.g., providing encouragement to others). He or she will comment on effective uses of
particular social skills. An important element of this particular approach is the group debriefing that occurs when the task is completed. Students analyze what things they did well and identify areas in need of improvement.

The tasks on which children work using Learning Together can be complex, requiring students to coordinate their efforts in pursuit of a single goal, to monitor progress toward that goal, and to redirect their efforts if necessary. These are advanced cognitive skills, and if students do not also have good social skills and know how to disagree and question the direction of the group, many kinds of interpersonal issues can arise.

Social psychological perspectives on peer learning do not directly address cognitive processes. A basic assumption of such techniques is that if students are motivated, good things will result and appropriate and effective cognitive processes will be deployed. It is true that motivation is an important element of effective learning. However, “will without skill” is unlikely to lead to successful outcomes. As Rogat, Linnebrink-Garcia, and DiDonato (chapter 14 this volume) note, collaborative learning environments can pose significant challenges to motivation and engagement. Under such circumstances, it is unlikely that effective cognitive processing will occur.

Social psychological perspectives on peer collaboration as described here are not well represented in this particular volume. Descriptions of these approaches and the research associated with documenting the effective use of collaborative learning techniques influenced by these perspectives are widely available (e.g., Slavin, 1996). This volume sought to go beyond the outcomes from these structured techniques to consider how higher order learning outcomes can be accomplished by the use of collaborative learning strategies.

COGNITIVE-ELABORATION PERSPECTIVES

Cognitive-elaboration approaches to peer learning are based on an information-processing approach. From this perspective, peer interaction is used to amplify, or cognitively elaborate, the performance of basic information-processing activities such as encoding, activation of schemas, rehearsal, metacognition, and retrieval. Encoding involves actively processing incoming information. Students with prior knowledge of a topic are more likely to encode new information effectively because they can link it to information that they already understand. Teachers can help students encode information more effectively by reminding them of what they already know that connects to the new content or helping them activate existing schemas or organized sets of knowledge about the topic. Schemas are the basic cognitive structures for organizing information. By practicing or rehearsing the information, students process it more deeply, making it easier to retrieve the information later. Performing these activities in the presence of peers will result in deeper processing and more active engagement (O’Donnell, Dansereau, Hythecker, et al., 1987). The presence of a peer can help students stay on task, and feedback provided by a peer can help students decide when they need to check their understanding of the content they are trying to explain (O’Donnell & Dansereau, 1992).

Noreen Webb’s work also stems from a cognitive-elaboration perspective (1989, 1991, 1992). Much of her work focuses on student learning of mathematics. Webb has explored the effects of various types of groupings on achievement (i.e., heterogeneous, homogeneous, female-dominated, male-dominated). Webb’s groups are more open-ended than the dyads that use scripted cooperation. The students decide how to participate,
although training in how to do so is usually provided. Students are taught how to seek help and get explanations of the content. Webb and her colleagues found that students who participate actively in a group learn more than students who are passive; those who provide explanations achieve more than those who do not; and higher quality explanations are associated with higher levels of achievement (Webb, 1989, 1991, 1992). High-level explanations are expressions of deeper processing and elaboration of content, and may aid in restructuring existing knowledge.

Webb (chapter 1 this volume) describes the key cognitive processes that are the focus of an information processing approach to collaborative learning. Both the theory and empirical evidence provide strong support for the activity of collaborative learning in engaging learners in constructive processing here. In this perspective, the focus is on the individual knowledge gains as a result of participating in collaboration. Webb notes that the information processing perspective is compatible and even synergistic with other perspectives.

**COGNITIVE-DEVELOPMENTAL PERSPECTIVES**

Both Piagetian and Vygotskian theories provide a foundation for understanding collaborative learning that focuses on development. They differ, however, in the emphasis on individual cognitive processes or social processes. The three theoretical perspectives described earlier (social motivational, social cohesion, and cognitive elaboration) all depend in part on Piagetian or Vygotskian theories. Both Piaget and Vygotsky stressed a constructivist approach to teaching and learning that involves both individual and social processes. A constructivist perspective suggests that individuals create meaning using their prior understandings to make sense of new experience and construct new understandings. The developmental perspective takes into consideration how children's knowledge develops as a result of social interaction (Golbeck & El-Moslimany, chapter 2 this volume). Moreover, Golbeck and El-Moslimany consider how children’s ways of collaboration change over time.

**Piagetian Theory**

Piaget developed a constructivist theory of cognitive development in which a child forms new conceptual structures as a result of interactions with his or her environment. Cognitive growth occurs through the process of adaptation. Conceptual development proceeds through the processes of assimilation (a process in which an outside event is brought into one's way of thinking) and accommodation (a process in which low-level schemas are transformed into higher level schemas). Modifications to existing cognitive structures occur when a structure is changed in some way as a result of experiencing new objects or events. The individual seeks equilibrium or balance in the cognitive system, and when this balance is disrupted, he or she seeks to restore equilibrium. The disequilibrium experienced fuels the effort to restore balance. Peers may provide opportunities for others to experience cognitive disequilibrium or cognitive conflict. For example, students may disagree about the solution of a problem or even about the representation of a problem. Through discussions and other activities such as experiments or other hands-on activities, they may restore cognitive equilibrium by arriving at new understandings as they work together.
Conceptual change teaching seeks to challenge students’ existing concepts so as to create cognitive disequilibrium. Providing students with evidence that contradicts students’ initial beliefs will require them to modify cognitive structures on the basis of new information. Through this process of adaptation, students build new cognitive structures.

A general approach to instruction that emerges from this notion is that the teacher first elicits students’ expectations about a phenomenon, and then gives them opportunities to test their predictions, uncover contradictory evidence, and contrast their expectations with their experiences (Neale, Smith, & Johnson, 1990). Teachers need to create conditions in which students are responsive to the data they gather. For example, in preparing for a unit of instruction on light and shadow, students might be asked to predict where their shadows will fall as they turn their bodies in the sunlight. Some students may respond with the expectation that their shadows will appear in front of their bodies. The teacher can challenge this expectation by providing experiences that contradict it. In this case, if the children are positioned sideways to the sun, their shadows will appear at their sides. The teacher needs to remind them that their predictions about what would happen were different from what actually happened. He or she must then ask them to think about why their predictions were not accurate. At the same time, the teacher should be aware that even though the contradictory information is available, students will not necessarily experience it as creating cognitive conflict. In fact, the new experience or information may simply be assimilated into a prior concept with little change in existing cognitive structures.

The intent of this strategy is first to make students aware of their beliefs, then to create cognitive conflict by presenting contradictory experiences. A key element here is the development of awareness of beliefs. Without such awareness, the disconnect between one’s expectations and what occurs may not be noticed. The goal is to have the students take in (assimilate) the new information, then restructure (accommodate) their existing cognitive structures as a result. However, this general approach to instruction may not always work. Accommodation is only one of many possible outcomes that may result when contradictions are presented (De Lisi & Golbeck, 1999). Students may ignore the contradiction between what they expected and what occurred, or they may believe that the actual event is what they anticipated. Chinn and Brewer (1993) showed that students rarely respond effectively to data that contradict their beliefs. In the example of the children’s shadows discussed above, it is best to have other children trace the shadows so that there is an observable record of the event and different interpretations of the events can be discussed.

Through a combination of predictions, observations, and efforts to reconcile differences, children may experience conceptual change. From a Piagetian perspective, cognitive structures develop as a result of this process of cognitive conflict and subsequent restoration of cognitive equilibrium. It is important to keep in mind that, although a teacher may believe that students have experienced cognitive conflict because she has arranged what appear to be contradictory experiences, it does not necessarily follow that they have experienced such conflict. Chinn and Brewer (1993) and De Lisi and Golbeck (1999) describe a variety of responses that children might have to information that conflicts with their existing knowledge. Processes such as cognitive disequilibrium and restoring balance to the cognitive system could also occur in social-motivational, social-cohesion, and cognitive-elaboration approaches to peer learning.
Piaget’s work has important implications for cooperative and collaborative learning, mainly because of his ideas about peer influence (De Lisi & Golbeck, 1999). According to Piaget, children are more likely to develop cognitively in contexts in which peers have equal power and all have opportunities to influence one another. In tutoring contexts, participants do not have equal power. When adults work with children, there is an inevitable power structure that is likely to result in children complying with the adult. The risk is that children will simply accept what the more powerful, authoritative adult says without experiencing cognitive conflicts or examining existing beliefs. Even when peers work together without an adult present in the group, power relations may not be equal. Certain children may have more status and power as a function of perceived ability, popularity, and other characteristics, such as gender or race. Children with high status typically have more influence over the interactions that occur in the group. They tend to say more, offer explanations, and provide answers to questions asked by children with lower status. Other children may simply go along with the ideas of these high-status children.

Vygotskian Theory

A second approach to understanding collaboration is associated with Vygotskian theory. Vygotsky’s perspective on development includes both cultural–societal and individual components. According to Vygotsky (1978), there is a dialectical relationship between the child and the cultural environment: “In the process of development, the child not only masters the items of cultural experience but the habits and forms of cultural behavior, the cultural methods of reasoning” (Vygotsky, 1929, p. 415). Although the social environment provides models of performance and skill, children must still master the skills for themselves. Moshman (1982) refers to this mutual influence between the individual and the environment as dialectical constructivism; in this view, knowledge lies in the continual interaction between the individual and the environment. He contrasts this type of constructivism with that of endogenous constructivism which is more Piagetian in nature and exogenous constructivism which is more akin to information processing.

The characteristics of a student’s environment are very important. According to Hogan and Tudge (1999), “The presence or absence of certain types of institutions (e.g., schools), technologies, and semiotic tools (e.g., pens or computers) as well as variations in the values, beliefs, and practices of different cultural groups are interdependent with differences in ways in which children’s development proceeds” (p. 41). An example of an effort to provide an environment that is conducive to positive development is the Head Start program. It was founded to improve the quality of the environments available to young children so that their cognitive development could be enhanced. The characteristics of the learner are also important, because traits such as motivation, work ethic, and curiosity affect the degree to which learners work to master the skills they need to participate in their community.

A second key idea concerns what Vygotsky termed the zone of proximal development. According to Vygotsky, the zone of proximal development is a level of competence on a task in which the student cannot yet master the task on his or her own but can perform the task with appropriate guidance and support from a more capable partner. Assistance comes from a more competent child or adult who can recognize the learner’s current level of functioning and the kind of performance that might be possible, and provide appropriate support. Cognitive development occurs as the child internalizes
the processes that take place in the course of interacting with a more competent adult or peer. The child’s cognitive structures are reorganized, and in later interactions the child may show evidence of having developed new cognitive structures by explaining his or her thinking or actions.

From a Vygotskian perspective, pairing an adult with a child is most likely to promote cognitive growth. The adult may be expected to have some skill in recognizing the child’s current level of functioning and adjusting instruction to support the child’s efforts. Webb (1991) noted that the kind of help a learner receives must match his or her needs. One might reasonably expect adults to provide more effectively the level of help needed by a learner in comparison to a peer. The zone of proximal development is jointly established by the participants (Hogan & Tudge, 1999) and is best accomplished when one partner is aware of the other’s current level of functioning and is able to prompt, hint, or otherwise scaffold or support the other partner’s developing competence. Students may have difficulties in providing appropriate levels of help for one another. Webb and Farivar (1994) found that middle school students could be taught how to solicit help. If adults are not available, more competent peers can support the learning of a less competent student. However, peers need assistance in providing the appropriate level of help. Person and Graesser (1999) have shown, for example, that naive tutors are not very good at identifying the tutee’s current level of functioning and scaffolding the tutee’s efforts so that his or her performance improves. Webb and Farivar (1994) have clearly shown that it is difficult to train young students to identify or act within another learner’s zone of proximal development. However, King and her colleagues (King, Staffieri, & Adelgais, 1998) show that with appropriate instructional support, peers can respond effectively to one another’s efforts.

Hakkarainen, Paavola, Kangas, and Seitamaa-Hakkarainen (chapter 3 this volume) present the sociocultural perspective on collaborative learning. This perspective is informed by Vygotsky’s views of how the individual interacts with the social world. In contrast with the information processing and Piagetian cognitive development perspectives, sociocultural theorists focus on the importance of participation in social practices of knowledge creation. They extend this to the trialogical approach that emphasizes social practices with shared objects. Stahl (chapter 4 this volume) looks to the underlying theoretical basis for computer-supported collaborative learning (CSCL) and argues that it is in the small group that is where the action is in CSCL, and therefore is the appropriate unit of study. Different theoretical perspectives lead to the range of research methods that are described in section II of this volume and have different implications for instructional designs, described in sections III and IV.

Collaborative learning environments are complex and are studied with a range of sophisticated research methods. These methods are both quantitative (Cress & Hesse, chapter 5 this volume; Janssen, Cress, Erkens, & Kirschner, chapter 6 this volume) and qualitative (Sawyer, chapter 7 this volume; Koschmann, chapter 8 this volume). One of the difficulties of the fragmented nature of the study of collaborative processes has been the lack of shared methodologies. Thus, we see different disciplines applying the methodologies of their discipline to the study of collaboration without due reference to the innovations in analysis that may be made in other areas of study. This section of the volume is critically important in laying out a variety of methodologies from which many disciplines can benefit. For example, researchers in education may not be knowledgeable about social network analysis which allows a researcher to track the influence of various
individuals in a group. This section of the volume opens up many opportunities for cross-fertilization of methodologies across disciplines in the service of understanding the nature of effective collaborative learning. Many approaches to analysis may involve combinations of methods (Jeong, chapter 9 this volume; Howley, Mayfield, & Rosé, chapter 10 this volume; Barron, Pea, & Engle, chapter 11 this volume; Puntambekar, chapter 12 this volume). Cress and Hesse (chapter 5) note that a hallmark of quantitative analysis is being able to make and test predictions about both learning processes and learning outcomes of individuals, interaction processes among group members, and learning outcomes of groups as well as the interrelationship among these factors. Many datasets used in collaborative learning have data that are hierarchically nested and violate the assumptions of standard inferential statistics; Janssen et al. discuss the multilevel analysis methods for addressing this issue in chapter 6.

Many collaborative learning studies use strictly qualitative techniques for data analysis. As Sawyer (chapter 7 this volume) notes, qualitative methods have many advantages for studying the naturally occurring activities in small groups, in particular the emergent characteristics of groups. Koschmann (chapter 8 this volume) describes a specific qualitative method, conversation analysis, to describe talk-in-interaction. Puntambekar (chapter 12 this volume) considers how a mix of methodologies can be used to answer complementary research questions. The remaining chapters in this section talk about specific approaches to analyzing collaboration that are somewhat agnostic to the qualitative–quantitative distinction. Jeong’s chapter on verbal analysis speaks to techniques derived from a cognitive science approach to analyzing knowledge representation and cognitive processes that have been extended to include social processes (chapter 9 this volume). The approach outlined emphasizes being able to classify utterances into codes that can then be quantified. Jeong rightly notes that the verbal data analysis approach is a tool in a toolbox of methodologies that can be used to analyze collaborative learning. Similarly, Barron et al. (chapter 11 this volume) suggests that video analysis can be an integral part of a range of research designs. Theoretical commitments drive the ways that video and verbal data analysis methods are employed. Barron et al. (chapter 11) provide recommendations for research practices that support video analysis. Howley et al. (chapter 10 this volume) bring the constructs from linguistic analysis to the study of collaborative learning. These constructs include the ability to study how reasoning processes are displayed through language as it can be used to examine multiple levels of social processes that are part and parcel of learning conversations. These approaches vary as to their levels of theoretical commitments and what counts as evidence of learning. One theme that runs throughout this section is the focus on the appropriate unit of analysis and what it should be. More information processing-oriented theories tend to be more concerned with the individual unit of analysis whereas other approaches focus on the group as the appropriate unit of study. Different methods are more or less suited for particular units of analysis but as several of the chapters have noted, there are often reasons to look across these different units.

Many aspects of collaborative learning are reflected in the range of issues that are important for the design of CL environments. As Rogat, Linnenbrink-Garcia, and DiDonato (chapter 14 this volume) observe, an assumption of CL environments is that they will promote motivation and engagement, but these environments can also provide challenges to student motivation as they must deal with the increased complexity of dealing with collaboration. They argue that we need methodologies that will allow us
to study the effects of shared motivational contexts. These methodologies should allow understanding of change over time. Bielaczyc, Kapur, and Collins (chapter 13 this volume) present a model of creating communities of learners that tries to reconceptualize educational practice and requires a real change in the roles of teachers and students, a theme that cuts through many collaborative learning innovations (e.g., Hmelo-Silver & DeSimone, chapter 21 this volume; Chan, chapter 25 this volume). Communities of learner models seek to foster both development of critical thinking skills as well as deep disciplinary understanding through engagement in consequential tasks. Bielaczyc et al. note the challenges needed to change the classroom culture to support such a model. One change is that the students need to assume responsibility for their learning. This is consistent with Miller, Sun, Wu, and Anderson’s (chapter 15 this volume) observations of how learners can take on group leadership (see also Gressick & Derry, 2010; Hmelo-Silver, Katic, Nagarajan, & Chernobilsky, et al., 2007). They argue that leadership is characterized as reciprocal social processes in which one individual can help guide collaborative groups. Consistent with the approach of community of learners and knowledge building, groups that have a focus on collective improvement are productive in the long term, but Miller et al. also note that it is important for students to lead in ways that don’t dominate (much like the soft leaders approach described in Hmelo-Silver et al., 2007). Another important challenge for collaborative learning is assessment. Like leadership, assessment is another opportunity for students to exert agency through peer and self-assessment in collaborative learning (van Aalst, chapter 16 this volume). Ashman and Gillies (chapter 17 this volume) address the elephant in many classrooms: can collaborative learning be used with diverse learners? In their review of the research, collaborative learning appears promising for students with learning difficulties but the results for students with social and emotional disorders are a little more mixed. In the latter population, groups must be carefully structured and students may need opportunities to learn social skills (including the regular education students). They note that teachers must be prepared to implement collaborative learning well for diverse populations of learners.

Many designs reflect the importance of a range of disciplinary roots. These principles are instantiated in many of the specific designs described in section III. Chinn and Clark (chapter 18 this volume) discuss the role of collaborative argumentation in the classroom. One reason for the importance of collaborative argumentation is its connection to specific disciplinary practices that require claims to be substantiated by evidentiary norms of particular disciplines. As a form of collaborative discourse, argumentation supports learning critical thinking and deep content understanding. However, collaborative argumentation in the classroom requires scaffolding to be productive as Chinn and Clark demonstrate. Moreover, Cornelius, Herrenkohl, and Wolfstone-Hay (chapter 19 this volume) argue for the importance of considering disciplinary norms in considering how to scaffold student learning and organize instruction, in particular, in considering appropriate kinds of discourse. Cornelius et al. suggest that one way of accomplishing this is through the consideration of disciplinary “rights and responsibilities” in choosing the discipline-specific tools that can foster productive collaboration. For example, they report a study in which they assigned different intellectual roles to students in science and history that reflected the norms of inquiry in those disciplines. Nonetheless, despite these disciplinary differences, having common participant structures may help provide routines that transcend disciplinary boundaries.
Several chapters provide examples of participant structures that support collaborative learning. Group Investigation (GI; Sharan, Sharan, & Tan, chapter 20 this volume) builds on the ideas of Dewey and Piaget in recognizing the importance of social factors in inquiry. Sharan et al. make clear the important role of teachers in structuring cooperative groups and promoting productive group norms. GI is organized around driving research questions that emphasize shared agency in planning, conducting, and evaluating their investigations. Another instructional model for collaborative learning is problem-based learning (PBL; Hmelo-Silver & DeSimone, chapter 21 this volume). Like GI, PBL is focused on facilitated collaborative inquiry. Rather than a driving question, PBL is focused on ill-structured problems and has a particular emphasis on promoting skills for self-regulated learning. Hmelo-Silver and DeSimone provide examples of how PBL might be adapted for different contexts and the kinds of scaffolds that can be used, some of which include a role for technology.

Technology plays an increased role in CL, reflected in the growing field of computer-supported collaborative learning (CSCL). Designing technology for CSCL is particularly challenging as Dennen and Hoadley note (chapter 22 this volume). Designers must consider not only the technology but also the different forms of group interaction with and around the technology, including the larger activities within which the technology is situated and the technology itself. They also note that theory only provides limited guidance in dealing with the complexity of CSCL environments. Fischer, Kollar, Stegmann, Wecker, Zottman, and Weinberger (chapter 23 this volume) note the importance of structuring interaction at both macro and micro levels. They argue that using scripts in CSCL empowers learners. They also argue that sometimes scripts should problematize what is being learned to encourage learners to engage in deeper cognitive processing. One issue to be considered is how scripts can be made adaptable for different learners and learning situations (and this seems to be an area where technology has a natural role).

CSCL designs build on what we know about collaborative learning but they also require that new possibilities be envisioned, and nowhere is this more salient than in the design of mobile CSCL technologies. Looi, Wong, and Song (chapter 24 this volume) note that mobile CSCL allows learning to be ubiquitous and to take advantage of the places where learners are—thus extending learning over time and space. The physical characteristics of different mobile devices provide affordances (and constraints) for collaboration in situ. Because these devices are ubiquitous, they can provide opportunities for extended engagement in CSCL, but Looi et al. also note the importance of the tasks developed to take advantage of this CSCL technology. Many of the learning tasks designed for mobile CSCL build on ideas of distributed cognition. Another important affordance of mobile technology is the capacity to bridge formal and informal learning. Looi et al. are cautious as they note the paucity of high quality research in the area of mobile CSCL.

An increasingly influential theoretical and pedagogical approach to CSCL is Knowledge Building (Chan, chapter 25 this volume). This approach draws from the practices of scientists and researchers who have a goal of collectively improving a community’s knowledge. This approach stresses agency for the participants in choosing their research goals and addresses the “soft skills” of collaboration and creative work with knowledge (Fischer & Sugimoto, 2006; Scardamalia & Bereiter, 2006). Central to this design, as Chan notes, has been the CSCL tool, Knowledge Forum (Scardamalia & Bereiter, 2006).
where participants can maintain a database of community knowledge and discourse. An important feature of Knowledge Forum is the Analytic Tool Kit, a suite of assessment tools, which can support formative assessment for teachers as well as provide data for researchers studying knowledge building. This chapter lays out the principles for knowledge building that can support productive CSCL. This is perhaps one of the most widely studied CSCL approaches, which is being used on an international scale. The unit of analysis for knowledge building is really a collective unit but there is also evidence of benefits for individual learners (Chan, chapter 25 this volume). Nonetheless, it can be a challenging model to implement, in particular in building social norms needed to sustain the kind of knowledge work that this model calls for (Hakkarainen, 2009). Developing these “knowledge practices” is an important area for future research.

Working with knowledge or collaboratively at any level places additional demands for metacognitive skill. Winne, Hadwin, and Perry (chapter 26 this volume) move from considering solo metacognition to considering shared and other regulation that come into play in CSCL environments as metacognition becomes socially shared. Moreover, the nature of CSCL can allow students’ metacognitive knowledge and skills to become visible, which can provide opportunities for formative feedback. As Winne et al. note, much of the metacognitive support comes from teachers and peers. They pose the challenge for CSCL research to develop “software systems to support metacognition and collaboration in ways that parallel or extend what effective teachers and competent peers do.” Making use of the trace data that are available in CSCL systems is a start to being able to support metacognition in such systems.

An important part of collaborative learning happens outside of school as Kafai and Fields (chapter 27 this volume) demonstrate in their discussion of virtual youth communities. A key aspect of such communities is that the participants have opportunities to choose what activities they participate in and the extent of their participation. Such informal spaces are an important middle ground between home and school and offer opportunities for different kinds of interactions with peers or mentors than might be found in a more formal setting. They present examples of two such communities: Whyville and Scratch. They demonstrate how peer helping is an important practice in these communities and ways in which these informal settings become sites for knowledge building. These take the form of “cheat” sites where youth can share hints about the virtual worlds, wikis, and other community forums. For example, Kafai and Fields have found that collaboration plays an important part in the development of these cheat sites. Collaboration and participation in these sites can be quite variable, as they illustrated in their example of the Scratch programming community. One mode of collaboration is remixing of different programs and modifying code (though participants had various views as to whether that was cheating or building on others’ work. The dynamic nature of these virtual communities makes them hard to study. It is hard to know what the appropriate unit of analysis is, and with the community in flux, it may be that collective knowledge is the only possible unit in these massive communities. Moreover, we need to better understand collaboration that happens across multiple spaces, both the physical and the virtual and how knowledge diffuses within and between spaces. Such communities are quite different from the formal settings where most of the other chapters focus. Kafai and Fields suggest the need for connective ethnography to study these virtual spaces and the communities that interact in them, making use of a range of data sources to understand collaboration in these settings.
Finally, central to collaboration, particularly that enabled by technology, is the role of culture. Zhang (chapter 28 this volume) brings the role of culture in technology-mediated collaboration to the forefront. Zhang notes the importance of considering the nature of cultural norms, whether it is culture writ large, as in an international collaboration, or we would add, writ small, as in trying to bring more student-centered norms into educational systems which may have been more teacher-centered. As Zhang notes, collaboration and learning are inherently cultural activities, and we need to understand these preexisting cultural practices and norms in designing collaborative learning environments. Several studies demonstrate that cross-cultural collaborations can help teachers and learners reflect on their assumptions about learning. These can also provide opportunities for the development of intercultural competence—important in an increasingly globalized world (Friedman, 2007).

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Theoretical Approaches
The potential of small-group collaboration to promote student learning is recognized by educators, researchers, and policy-makers alike. Confirmatory research evidence began appearing decades ago (e.g., meta-analyses by Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Slavin, 1983a,b). Since then much research has focused on clarifying the mechanisms by which working with peers produces positive learning outcomes. This chapter addresses the question from an information-processing perspective; that is, how students can learn by actively processing information while collaborating with others. In particular, this chapter focuses on the relationship between the dialogue among students and processes tied to cognitive change. The first part of this chapter describes the overt communication processes and internal cognitive processes that may be associated with positive learning outcomes. The second section describes debilitating processes that might prevent learning. The final section describes approaches that have been used to promote beneficial processes and inhibit detrimental processes.

MECHANISMS THAT MAY PROMOTE LEARNING

A number of overt communication processes during collaboration may trigger internal cognitive processes that are associated with learning. During group collaboration, students may present their ideas, and thereby convey information to others (e.g., when solving a problem, completing a task, or summarizing material); they may explain to their group mates to help the latter understand the material or learn how to complete the task; or they may justify their ideas in response to challenges, questions, disagreements, or perceived conflicts or discrepancies. Both the speakers and the listeners involved in these overt communication processes can learn by engaging in a number of internal cognitive processes. First, students may activate and strengthen their understanding of material they have already learned. Second, they may fill in gaps in their understanding, thus repairing mental models that may be correct globally but are fragmented or
incomplete with gaps of missing knowledge (Chi, 2000). Third, they may correct misconceptions in what Chi (2000) terms flawed mental models, which may include local mistakes or global inaccuracies. In all of these internal processes, learners actively construct their own learning by generating new relationships among pieces of information they already know, by linking new information to information they have previously learned, and by changing their thinking in light of new information they encounter (cf. Wittrock, 1990).

Both preparing to present ideas and presenting the ideas may promote learning on the speaker’s part. In the process of formulating an explanation or idea to be presented, students must transform what they know into communication that is relevant, coherent, complete, and accurate so that others can understand it. During this preparation, students may rehearse information they already know; identify the salient features of the problem or task; prioritize, reorganize, and clarify information to make it more coherent; see new relationships and build new connections between pieces of information or concepts; generate multiple ways of representing information and make explicit the links among different representations; monitor their own understanding and develop a metacognitive awareness of their own misconceptions or gaps in understanding—and seek new information to correct those misconceptions or fill in gaps in their understanding; and strengthen connections between new information and previously learned information, all of which may help these students to develop new perspectives and deeper understanding (Bargh & Schul, 1980). Presenting ideas may elicit many of the same processes, especially when the presentation exposes contradictions or incompleteness of ideas that are recognized by the explainer or are pointed out by others.

To communicate most effectively, those presenting material or explaining to others must take into account the level of understanding and extent of knowledge of their listeners. Having to tailor explanations to listeners’ comprehension may push speakers to construct more elaborate conceptualizations than they would otherwise do (Chi, 2000). First, anticipating the listener’s level of comprehension may promote such activity on the part of the explainer (Benware & Deci, 1984). Second, responding to evidence of listeners’ comprehension (e.g., as conveyed through listeners’ questions) may force explainers to generate revised or novel explanations (Roscoe & Chi, 2007).

Listeners may engage in processes analogous to those carried out by presenters. When comparing their own knowledge with what is being presented, listeners may recognize and fill in gaps in their own knowledge, recognize and correct misconceptions, see contradictions that cause them to seek new information (e.g., by asking questions), and generate new connections between their own ideas, or between their own and others’ ideas. They may generate self-explanations that help them internalize principles, construct specific inference rules for solving the problem, and repair imperfect mental models (Chi, 2000; Chi & Bassock, 1989; Chi, Bassock, Lewis, Reimann, & Glaser, 1989). To promote learning, then, listening must be active. The benefits will accrue when learners apply the information received to try to solve the problem or carry out the task themselves (Vedder, 1985).

Presenting and listening to information shared during the context of peer collaboration may be especially effective compared to other contexts such as explaining to or listening to adults (e.g., teachers), because peers share a similar language and can translate difficult vocabulary and expressions into language that fellow students can understand (Noddings, 1985). Moreover, learning material at the same time as other students
may help them tune into each other’s misconceptions, so they may give more relevant explanations than adults can (Vedder, 1985). And learners can control the pace of group discussion to better understand information and explanations offered.

The information-processing perspective on learning in collaborative groups is not independent of other theoretical perspectives discussed in this volume. First, for example, in sociocognitive conflict theory based on a Piagetian perspective (Piaget, 1932), conflict arises when there is a perceived contradiction between the learner’s existing understanding and what the learner experiences in the course of interacting with others. Learners may respond to this perceived contradiction and disturbance to their mental equilibrium by taking into account their own perspectives while considering others’ incompatible viewpoints, reexamining and questioning their own ideas and beliefs, seeking additional information to reconcile the conflicting viewpoints, and trying out new ideas (De Lisi & Golbeck, 1999; Forman & Cazden, 1985). They may carry out these processes as a result of hearing contradictory information or opinions, or through confronting others’ ideas and justifying their own positions.

Second, in sociocultural theory based on a Vygotskian perspective (Vygotsky, 1978), through a process sometimes called scaffolding or guided participation, a more skilled person enables a less competent person to carry out a task that the latter could not perform without assistance. By actively listening to the more competent person, explaining what he has heard, and applying the new information to the task at hand, the less-proficient student can practice, develop, and internalize skills so that they become part of his individual repertoire.

Third, in a perspective that may be termed coconstruction of knowledge, students contribute different pieces of information or build upon others’ explanations to jointly create a complete idea or solution (Hatano, 1993). By acknowledging, clarifying, correcting, adding to, building upon, and connecting each other’s ideas and suggestions, students may collaboratively build and internalize knowledge and problem-solving strategies that no group member has at the start (Hogan, Nastasi, & Pressley, 2000).

Empirical Evidence

Indirect evidence about the mechanisms in collaborative settings that may promote learning comes from correlational research linking explanations and learning outcomes. The strong relationship between explaining and achievement in collaborative groups has been well documented (Webb & Palincsar, 1996; more recently by Howe et al., 2007; Veenman, Denessen, van den Akker, & van der Rijt, 2005). Moreover, giving complex explanations (e.g., reasons elaborated with further evidence) has been shown to be more strongly related with learning outcomes than giving less complex explanations (e.g., simple reasons; Chinn, O’Donnell, & Jinks, 2000). Tutoring studies also corroborate the importance for tutor learning of giving elaborated explanations, such as conceptual explanations (e.g., discussing how an answer does or does not make sense; Fuchs et al., 1997), and explanations that integrate concepts and draw upon prior knowledge to generate new inferences (e.g., generating novel examples and analogies; Roscoe & Chi, 2008).

In contrast to the positive relationship between giving explanations and learning outcomes, research on the relationship between receiving explanations and achievement is inconsistent (Webb & Palincsar, 1996). In support of Vedder’s (1985) hypothesis that in order for receiving explanations to be effective, students must have and use the
opportunity for practice by attempting to apply the explanation received to the problem at hand, engaging in constructive activity after receiving an explanation (e.g., reworking the problem, paraphrasing the solution strategy) has been found to be positively related to achievement, whereas receiving or hearing an explanation without carrying out constructive activity is not (Webb & Mastergeorge, 2003; Webb, Troper, & Fall, 1995).

More direct evidence about mechanisms that promote learning comes from analyzing collaborative dialogues for indications that students are engaging in the cognitive processes described above. For example, Roscoe and Chi’s (2008) coding of explaining episodes in which students explained to other students about the basic structure, location, and function of the human eye revealed instances of students drawing upon their prior knowledge and making additional new connections with prior knowledge, generating novel examples and analogies, generating new inferences that went beyond the text material they were studying, rethinking their ideas, and repairing perceived errors and misconceptions. Explainers’ metacognitive statements were especially useful for signaling when students were making new connections and building their understanding (e.g., “This is something that I didn’t really get before”; Roscoe & Chi, 2007, p. 336). Other analyses of group discussions show how the group’s challenge of an explainer’s incomplete or incorrect ideas may cause the explainer to reexamine her prior knowledge, to formulate and test predictions based on her incorrect mental model, and to use information provided by her peers in response to her predictions to revise her ideas (e.g., a student revising her overly general concept of camouflage as an animal defense mechanism to a more accurate understanding that an animal will change its color to match only those in its natural background; Brown, Campione, Webber, & McGilly, 1992, pp. 177–178).

**DEBILITATING PROCESSES**

Despite the potential benefits of collaborative work, researchers have documented a number of debilitating processes that inhibit positive outcomes. Students may fail to share elaborated explanations, may not seek help when they need it, may disengage from interaction or suppress other students’ participation, may engage in too much conflict or avoid it altogether, may not coordinate their communication, and may engage in negative social-emotional behavior that impedes group functioning.

*Failure to Provide Elaborated Explanations*

The tendency of students to present ideas with little elaboration is well documented (e.g., Galton, Hargreaves, Comber, Wall, & Pell, 1999; Meloth & Deering, 1999). For example, when tutoring their peers, students tend to restate, paraphrase, or summarize text information with little elaboration (a “knowledge-telling bias”; Roscoe & Chi, 2008), unless they are trained to give elaborations (e.g., King, Staffieri, & Adelgais, 1998). Untrained tutors may provide elaborated explanations (e.g., creating analogies, drawing inferences, making new connections) only when their tutees ask deep questions about content not provided explicitly in the text (Roscoe & Chi, 2008). In some cases, the lack of elaboration may be due to students modeling their communications on teacher discourse that consists of giving unlabeled calculations, procedures, and answers to mathematics problems instead of labeled explanations or explanations of mathematical concepts (Webb, Nemer, & Ing, 2006).
Failure to Seek and Obtain Effective Help

Some listeners may be students who are having difficulty with the material and need help. They may not be able to correct their misconceptions or fill in gaps in their understanding if they fail to seek help when they need it and fail to obtain effective help when they do seek it. Students may fail to seek help for many reasons (Nelson-Le Gall, 1992). Students may lack the metacognitive skills necessary to monitor their own comprehension and so may not realize that they don’t understand the material or can’t perform the task without assistance, or they may watch their teammates solve a problem or accomplish a task and assume that they can do it too.

Even if students are aware that they need help, they may decide not to seek it for fear of being judged incompetent and undesirable as a work mate, they may not want to feel indebted to those giving the help, they not want to be seen as dependent upon others, or they may not believe they are self-efficacious—that they can do well in school and can control learning through their own efforts (Newman, 1998; Schunk, 1989). A reluctance to seek help may be associated with a performance-goal or relative-ability-goal orientation, in which students are focused on looking good compared to others, performing better than others, being publicly recognized for their superior performance, and having others judge their competence positively (Ryan, Pintrich, & Midgley, 2001). These students are especially concerned about how others view them and will avoid help seeking because they feel it signals a lack of competence. (Students with a mastery-goal orientation, in contrast, are focused on learning, improving their progress, and mastering the task, and, because they are less focused on external evaluation, help seeking does not threaten their self-perceptions about their abilities.) Similarly, students who are concerned with their social status (especially if they don’t feel socially competent) may avoid help seeking because it exposes them to evaluation and scrutiny by others and threatens their self-worth (Ryan et al., 2001).

Students may believe that help-seeking is undesirable as a result of classroom norms that call for students to remain quiet and work alone, or classroom norms that value performance over learning, or sex-typed norms that view help-seeking as more appropriate for females than males. Or they may have received antagonistic or unsatisfactory responses to previous help-seeking attempts. Students may also believe that no one in the group has the competence or resources to help, or that they themselves lack the competence to benefit from help provided.

When students do seek help, they may select helpers who are nice or kind, or who have high status, rather than those who have task-relevant skills (Nelson-Le Gall, 1992). Or students may not have effective strategies for eliciting help. In particular, the kinds of questions students ask often have important consequences for the kinds of responses they receive. Requests for elaborated help that are explicit, precise, and direct, and targeted to a specific aspect of the problem or task are more likely to elicit explanations than unfocused questions or general statements of confusion (Webb & Palincsar, 1996). Asking precise questions makes it easier for other group members to identify the student’s misconceptions or nature of their confusion and to formulate appropriate and precise responses. Detailed requests for explanations may also signal to the group that the help-seeker is motivated to learn how to solve the problem, already has at least some understanding of the problem that enabled him to pinpoint a specific area of uncertainty, and will profit from the explanations provided, making it more likely that the group will put forth the effort to provide elaborated help (Webb, Nemer, & Ing, 2006).
Asking precise questions may have still another benefit for the help-seeker. The act of articulating a specific question (e.g., putting words to a confusion) may help the questioner to organize and integrate his thinking in new ways that lead to improved understanding (Roscoe & Chi, 2007).

In contrast to specific questions, general questions (“How do you do this?”) or general declarations of confusion (“I don’t get it”) leave potential help-givers with little clue about what the help-seeker does not understand. Such help-seeking behavior may also signal to the group that the help-seeker lacks ability or motivation to work or learn, especially when students seek help before expending any discernible effort on the task. Help-givers may be unwilling to work hard to generate explanations if they perceive that the help-seeker lacks the competence to be able to understand or use them, or is depending on others to do the work for him.

Even if groups are willing to help, they may not have the skills to provide effective explanations. Help-givers may be confused or have misconceptions themselves, may not be able to translate their thinking into appropriate or understandable language, may not be willing or able to use examples and language familiar to the help-seeker, may not provide enough detail or detail relevant to the help-seeker’s particular difficulty, may not be able to identify the help-seeker’s problem, or may have difficulty integrating what they know with the help-seeker’s misconceptions (Ellis & Rogoff, 1982).

Because help-givers tend not to test whether their explanations are effective for the help-seeker, for example, by asking the help-seeker to recapitulate the explanation, practice the problem, or apply it to other problems (Fuchs et al., 1997; Ross & Cousins, 1995), help-seekers must take responsibility themselves for ascertaining whether the help they receive is beneficial for improving their understanding. Help-seekers can make it more likely that they will obtain effective help and gain understanding if they persist in asking questions, for example, by repeating their questions, paraphrasing them, prefacing their question with a description of the parts of the problem they do not understand; insist on being given explanations (instead of calculations or answers); reject group members’ attempts to dictate the solution; resist group members’ invitations or commands to copy their papers; and apply help they receive to determine whether it allows them to solve the problem on their own without assistance (Webb & Mastergeorge, 2003).

Failure to seek help is not only detrimental for those who need help but may also be a missed opportunity for other students to benefit from being questioned. Responding to peers’ questions may force students to clarify confusing explanations, or to resolve contradictions or incompleteness in their explanations, leading to improved understanding (Roscoe & Chi, 2007). Moreover, deep questions (those that require reasoning and application of knowledge) may stimulate knowledge-building on the part of explainers in ways that shallow questions about basic facts do not; for example, “How does that [the structure of the blind spot] affect your vision?” vs. “The blind spot is where all the nerves are located?” (Roscoe & Chi, 2008, p. 341).

**Suppressed Participation**

Students wishing to participate actively in group collaboration don’t always have opportunities to do so. Personality characteristics may explain some effects such as extroverted, outgoing, and energetic members doing most of the talking and dominating group work. Status characteristics may also determine relative influence in the group (Cohen & Lotan, 1995). High-status students, especially those with high academic
standing or peer status characteristics (perceived attractiveness or popularity), tend to be more active and influential than low-status individuals; while low-status individuals tend to be less assertive and more anxious, talk less, give fewer suggestions and less information, and ask fewer questions than high-status individuals. Interviews of low-achieving students working in groups with high-achieving students have revealed their frustration with having their ideas ignored, being left behind by the speed with which others solved problems or completed tasks, and being left out of decision-making processes (King, 1993). Social characteristics, such as gender or race, may also operate as status characteristics in heterogeneous small groups, with boys and White students being more active than girls and students of color. Even artificially created status differences, such as classifying students’ competence on the basis of fictitious test scores (Dembo & McAuliffe, 1987) can create imbalances in individual participation and influence, with students designated as “high status” dominating group interactions and being perceived as more capable than “low status” students.

Whereas some students may be shut out of interactions, other students may choose not to participate. Students may engage in social loafing, or diffusion of responsibility, which arises when one or more group members sit back and let others do the work, possibly because they believe that their efforts can’t or won’t be identified or are dispensable. This free rider effect may turn into a sucker effect when the group members who complete all of the work discover that they had been taken for a free ride and start to contribute less to the group work in order to avoid being a sucker (Salomon & Globerson, 1989).

Students who choose not to be involved or who are excluded from group interaction will not experience the benefits of active participation described in the previous sections. And the students who do participate will not benefit from the knowledge and perspectives of the passive students, and may even lead the group off track by pursuing the wrong task or suggesting incorrect solutions that are not challenged.

**Too Little or Too Much Cognitive Conflict**

Although students can learn by resolving discrepancies in ideas, too little or too much conflict can be detrimental (Bearison, Magzamen, & Filardo, 1986). Infrequent conflict may reflect suppression of disagreements, or pseudoconsensus or pseudoagreement, in which students minimize disagreements or pretend they don’t exist. Because disagreements may be seen as threatening group members’ self-image, students may avoid disagreement to maintain positive social relationships (Chiu & Khoo, 2003). In these cases, incorrect ideas may persist and go unchallenged. Too much conflict, on the other hand, may prevent group members from seeking new information to resolve their disagreements. If they spend all of their time arguing they may never develop new insights, especially if their aim is to win the argument regardless if they are right or wrong.

**Lack of Coordination**

Opportunities to benefit from information being shared in the collaborative group may be lost when group members do not coordinate their communication. Lack of coordination of group members’ efforts and participation can impede both group functioning and individual learning (Barron, 2000). Low levels of attention to, and uptake of, group members’ suggestions may inhibit group progress on a task, even when those suggestions are correct and potentially productive. In uncoordinated conversations, students advocate and repeat their own positions and ideas, ignore others’ suggestions, reject
others’ proposals without elaboration or justification, and interrupt others or talk over
them. When students do not pay attention to what others say, they cannot learn from
their suggestions. Barron (2000) documented a number of ways in which students may
fail to attend to others’ suggestions. Students may engage in “skip connecting” in which
they do not acknowledge or reference what another speaker has just said, but instead
reassert what they had said previously. They may also reject a suggestion or idea out
of hand, without any rationale for why it was incorrect or inappropriate. Or they may
refuse to yield the floor to other speakers by continuing to talk without making eye
contact with others.

In highly coordinated groups, in contrast, members acknowledge each other’s ideas,
repeat others’ suggestions, and elaborate on others’ proposals. Speakers’ turns are
tightly connected, with group members paying close attention and responding to what
other members do and say, giving space for others’ contributions, and monitoring how
the unfolding contributions relate to the problem-solving goal. Proposals are directly
linked to the prior conversation, are acknowledged and discussed, are not ignored, and
are not rejected without reasons being given (Barron, 2000). Repeating others’ ideas,
asking questions about them, and elaborating on them are important components
of active listening. These communication behaviors may help listeners test their own
understanding of the ideas being proposed, help them identify what they fi nd confusing
or unconvincing, may help them evaluate the ideas for accuracy and completeness, and
may provide a foundation to help them link the new information to what they already
know and generate new inferences or connections they had not previously seen.

Negative Socioemotional Processes

Negative socioemotional processes, such as rudeness, hostility, and unresponsiveness,
can also impede group members’ participation. Rudeness (especially rude criticisms of
others’ ideas, such as “You’re wrong,” compared to the more polite criticism: “If 6 is mul-
tiplied by 2, we don’t get 10”) may cause students to withhold correct information and
disagree with correct suggestions posed by others, with negative effects on the quality
of groups’ solutions to problems (Chiu & Khoo, 2003, p. 507) and correspondingly, with
reduced opportunities for group members to learn. Such processes can also suppress
help-seeking, especially when students are insulted when they seek help, receive sarcas-
tic responses, or have their requests rejected or ignored. Students who carry out negative
behavior may themselves have their requests for help rejected (Webb & Mastergeorge,
2003).

APPROACHES TO PROMOTING BENEFICIAL PROCESSES AND
INHIBITING DETRIMENTAL PROCESSES

Simply asking students to collaborate will not ensure that they will engage in productive
dialogue. Therefore, researchers have designed and tested a number of approaches for
maximizing the chances that beneficial processes will occur while preventing detrimen-
tal processes, as well as investigating factors that may infl uence the quality of group dia-
logue. This section addresses how students may be prepared for collaborative work, how
group work itself can be structured to require certain student behavior, how teachers
may intervene with collaborative groups, and how teacher discourse in the classroom
more generally may infl uence student–student dialogue.


**Preparation for Collaborative Work**

A number of activities may take place before students begin their collaboration. Teachers can build students’ communication skills, arrange group membership to encourage productive communication, and design group tasks that support high-quality dialogue.

**Instructing Students in Communication, Explaining, or Reasoning Skills.** Instruction in communication, explaining, or group reasoning skills is a primary component of many small-group learning programs, and produces positive effects on the depth of collaborative group discussions and, often, group performance and student achievement. For example, preparation in communications skills is a central feature of the Social Pedagogic Research into Group work (SPRinG) program designed to help teachers create inclusive and supportive classrooms (Baines, Blatchford, et al., 2008; see also Baines, Blatchford, & Chowne, 2007; Blatchford, Baines, Rubie-Davies, Bassett, & Chowne, 2006). Students receive instruction in taking turns speaking; engaging in active listening; asking and answering questions; making and asking for suggestions; expressing and requesting ideas and opinions; brainstorming suggestions, ideas, and opinions; giving and asking for help; giving and asking for explanations; explaining and evaluating ideas; arguing and counterarguing; using persuasive talk; and summarizing conversations.

Many other programs also train students in similar constellations of communication skills. Some teach students to actively listen to each other, to provide constructive feedback for each other’s suggestions and ideas, to encourage all group members to contribute to the group task, to try to understand other group members’ perspectives, and to monitor and evaluate the progress of the group (e.g., Gillies, 2003, 2004). Others focus on joint group activity such as jointly analyzing problems, comparing possible explanations, and making joint decisions), and help students learn how to share all relevant suggestions and information, provide reasons to justify assertions, opinions, and suggestions, ask for reasons, listen to others attentively, discuss alternatives before making decisions, and accept and respond to constructive challenges (Mercer, Dawes, Wegerif, & Sams, 2004; Rojas-Drummond & Mercer, 2003). Some training programs include specific activities designed to improve students’ explanation-giving and help-seeking skills (e.g., giving explanations rather than answers, asking clear and precise questions; Veenman et al., 2005).

Still other programs focus on teaching principles of argumentation as a way of developing students’ reasoning skills. Students may receive instruction on the definition, purpose, and uses of arguments, as well as the parts of arguments, the position, the reasons supporting the position, the supporting facts, the objections that might be raised, and the responses to the objections (Reznitskaya, Anderson, & Kuo, 2007). Or they may be taught how to carry out argumentation processes such as providing reasons and evidence for and against positions, challenging others with counterarguments, and weighing reasons and evidence (Chinn, Anderson, & Waggoner, 2001).

**Assigning Students to Groups.** Also under the teacher’s control is how to compose groups. Most often compared empirically are group compositions in terms of the gender and ability mix of groups (Webb & Palincsar, 1996), but results are not sufficiently clear-cut to produce recommendations for teachers about optimal groupings. Moreover, as some studies have demonstrated, whether a particular group composition is optimal for its members depends on the group processes that ensue, and similar groupings
may produce different processes and, consequently, different outcomes for students. For example, in an investigation of why high-ability students performed better in homogeneous than in heterogeneous ability groups (as had been reported by Webb, Nemer, Chizhik, & Sugrue, 1998), Webb, Nemer, and Zuniga (2002) found that high-ability students in some heterogeneous groups performed very well whereas high-ability students in other heterogeneous groups did not. Outcomes for high-ability students corresponded to the quality of their groups’ functioning, rather than to the composition of the group, such as the level of help that high-ability students received, the level of contributions they made, and whether their group engaged in negative socioemotional behavior. Such results suggest that manipulating group composition cannot by itself guarantee optimal participation; teachers may more productively focus on ways to maximize group functioning for all students such as preparing students for collaborative work (as described above), and structuring group interaction (as described below).

**Constructing the Group-Work Task.** To encourage the participation of all group members, Cohen (1994b) recommended that teachers give groups complex tasks or open-ended problems without clear-cut answers or that require procedures that cannot be completed very well by a single individual and that utilize the combined expertise of everyone in the group. Such tasks encourage groups to recognize the multiple skills and perspectives needed in order to complete the task, and to value the different contributions that each student makes. Tasks or problems that can be completed by one student with the requisite skills, on the other hand, are more likely to limit the participation of students without those skills.

In a series of studies that supported Cohen’s views, Chizhik and colleagues (Chizhik, 2001; Chizhik, Alexander, Chizhik, & Goodman, 2003) compared group collaboration and learning on open-ended or ill-structured tasks (e.g., designing a swimming pool and estimating its volume) versus single-answer or well-structured tasks (e.g., calculating the volume of a swimming pool with given dimensions). These studies showed smaller differences in participation rates between high-status and low-status group members (whether artificially assigned status scores or social characteristics such as ethnic background) with ill-structured than with well-structured tasks.

Other research, however, raises questions about the correspondence between task type and patterns of participation within groups. Esmonde (2009) showed that groups might interpret the same task in different ways, with some groups approaching the task as if following a procedure in which one student was expert and could direct other group members, and other groups approaching the same task as a problem to solve in which all students collaborated. One task, for example, was a group quiz (e.g., a mathematics quiz asking groups to determine the number of cakes a dessert shop should bake to maximize profits, subject to certain constraints). Esmonde described the interaction in some groups as asymmetrical in which some students who positioned themselves as “experts” taught “novices” and the novices deferred to the experts. In other groups, the interaction was more symmetrical, with no students positioned as experts or novices, and all students asking for and providing help and jointly collaborating. Esmonde’s results suggest that groups’ beliefs about group members’ relative expertise and groups’ perceptions about whether the task can be completed by a small number of experts are important predictors of group participation patterns beyond how a teacher conceives the task initially.
Structuring Collaborative Work: Requiring Students to Carry Out Specific Activities or Adopt Specific Roles

Some collaborative learning approaches structure group interaction in specific ways to improve the quality and depth of discussion. Features of these methods include requiring groups to carry out certain strategies or activities, assigning students to play certain roles, or both. Research finds that these approaches have positive effects on the nature of group collaboration, on group task performance, and, often, on student achievement.

Explanation Prompts. Some peer-learning approaches give students specific prompts in order to encourage them to engage in high-level discourse about the task. Students are given written prompts to help them to construct explanations, to find patterns in experiment results, to justify answers and beliefs, to relate prior learning to the task at hand, and to use as well as distinguish between “scientific” and “everyday” definitions and explanations (Coleman, 1998; Palincsar, Anderson, & David, 1993). Coleman (1998, pp. 406–412) gave the following examples of explanation prompts: “Explain why you believe that your answer is correct or wrong. Can you compare how you used to think about this with how you think about it now? How does your explanation compare with the scientific definitions that we learned in class? Is this explanation a scientific definition or an everyday definition?”

In Mevarech and Kramarski’s (1997) metacognitive questioning method, groups answer questions to enhance their mathematical reasoning. Comprehension questions (“What is the problem/task all about?”) help students reflect on problems before solving them; strategic questions (“Why is this strategy/tactic/principle most appropriate for solving the problem/task?”) prompt students to propose and explain problem-solving strategies; and connection questions (“How is this problem/task different from/similar to what you have already solved? Explain why”) prompt students to find similarities and differences between current and past problems they have solved or tasks they have completed (Mevarech & Kramarski, 2003, p. 469).

Reciprocal Questioning. In reciprocal questioning, students are trained to ask each other high-level questions about the material to help them monitor their own and each other’s comprehension as well as to encourage students to describe and elaborate on their thinking (Fantuzzo, Riggio, Connelly, & Dimeff, 1989). For example, students may be given “how” and “why” question stems to guide their discussions of text, such as, “Why is … important? How are … and … similar?” (King, 1992, p. 113). Or students may be given questions to help them coconstruct and explain strategies for solving problems, such as “What is the problem?”, “What do we know about the problem so far?”, “What information is given to us?”, and “What is our plan?” (King, 1999, p. 101). Similarly, Fuchs, Fuchs, Kazdan, and Allen’s (1999) students were trained to ask each other questions that begin with who, what, when, where, why, or how.

Structured Controversy. In order to promote the benefits that can arise when students try to resolve conflicting ideas, Johnson and Johnson (1995) built controversy into the group’s task by subdividing groups into teams and requiring the teams to master material on different sides of an issue (e.g., should there be more or fewer regulations governing hazardous waste disposal), to present their views to the other team, to switch roles and repeat the process, and then to synthesize the two positions. Compared with
groups required to seek concurrence by working cooperatively and compromising, groups required to discuss opposing ideas often carried out more high-level discussion of the material and less description of the facts and information; they also showed higher achievement.

**Cognitive Role Specialization.** Students can be required to adopt specific roles so that they will carry out particular cognitive activities. Students may be assigned such roles as recaller (also called learning leader or summarizer) and listener (also called active listener, learning listener, or listener/facilitator; Hythecker, Dansereau, & Rocklin, 1988; Yager, Johnson, & Johnson, 1985), which can be incorporated into scripts for groups to follow (O’Donnell, 1999). The recaller summarizes the material and the listener is responsible for detecting errors, identifying omissions, and seeking clarification. Students then work together to elaborate on the material; they change roles for the next part of the task. In a variation of this scripted cooperation approach, Lambiotte et al. (1987) suggested that instead of the summarizer and listener studying the same material, students should study and teach each other different material. Lambiotte et al. hypothesized that listeners in this situation will be more likely to ask questions of clarification (because they have not already studied the material), and summarizers will be forced to organize the material more effectively and clearly, and to remember it better to present it to others (because they cannot assume that others have knowledge about the material). Finally, students in both roles will worry less about how others will evaluate their questions and summaries, and can focus better on the task.

Students can also be trained to engage in reciprocal peer tutoring, in which students playing the tutor role model strategies such as summarizing text as well as how to give explanations, corrections, and feedback about other students’ work. To promote high-level discourse during paired discussions, teachers can train tutors to give highly elaborated conceptual rather than algorithmic explanations to their partners (e.g., using real-life examples, discussing why an answer does or does not make sense; Fuchs et al., 1997). Reflecting the importance of the activity of the help-receiver, some peer tutoring models guide the tutor in helping the tutee to give high-level explanations (King, 1999). The tutor asks questions designed to encourage the tutee to provide explanations of the material, asks further questions to push the tutee to elaborate upon or justify her or his explanations as well as to correct incomplete or incorrect explanations, and asks questions to push tutees to make connections among ideas and to link new material to their prior knowledge.

It should be noted that “teacher” and “learner” role specialization was a feature of some of the earliest cooperative learning methods. In the Jigsaw (Aronson, Blaney, Stephan, Sikes, & Snapp, 1978) classroom, students are assigned responsibility for mastering a portion of the material (and discussing that material with other students assigned the same topic) and then for teaching their topic to the other members of their groups. In Group Investigation (Sharan & Hertz-Lazarowitz, 1980), in which students carry out research on their piece of a group project and then come together as a team to integrate their findings and plan their class presentations, students are involved in teaching their own project pieces to the group and in learning from their peers about the remaining portions of the project.

**Reciprocal Teaching.** In reciprocal teaching, students carry out certain strategies designed to improve their comprehension of the text, including generating questions
about the text they have read, clarifying what they don’t understand, summarizing the text, and generating predictions (Brown & Palincsar, 1989; Palincsar & Brown, 1984; Palincsar & Herrenkohl, 1999). The teacher has an explicit role during group work to help students become proficient in these strategies. Teachers initially take the leadership in small groups, explaining the strategies and modeling their use in making sense of the text. Then teachers ask students to demonstrate the strategies, but give them considerable support. For example, in order to help a student generate questions to ask her group mates, the teacher might probe what information the student gleaned from the text and help the student phrase a specific question using that information. The teacher gradually assumes the less active role of coach, giving students feedback and encouraging them. Students then carry out the text-comprehension strategies in their small groups.

**Group Processing.** Some social psychologists maintain that groups will function most effectively if they discuss their group’s interaction and how they might improve it, sometimes called “group processing.” Such discussions may help groups identify, understand, and solve general communication problems (e.g., lack of student participation, disruptive or bullying behavior) and may reinforce student collaboration (Johnson, Johnson, & Holubec, 1988). Gillies (2007) suggested sample checklists and activities that teachers and students can use in order to evaluate group processes. Ross (1995) added another group processing component. In addition to having groups complete and discuss a self-appraisal instrument, Ross provided groups with feedback about their group functioning in the form of five-page excerpts of the transcripts of their conversations, and transcript scores that rated their levels of requesting help, of giving help, and of being on task. Ross observed that groups gave more help (in terms of procedures, explanations, acknowledgments, and evaluations of each other’s work) after they received this feedback than before.

**Activities of the Teacher during Collaborative Work**

**Altering Expectations and Status Relationships.** Students don’t always participate actively in groups. While personality characteristics may explain why some students participate more actively than others (extroverted, outgoing, and energetic members may talk the most), researchers have also found that status characteristics can produce inequities in participation by determining relative activity and influence in the group (Cohen & Lotan, 1995; Mulryan, 1992, 1995). High-status students, especially those with high academic standing or peer status characteristics (perceived attractiveness or popularity), tend to be more active and influential than low-status individuals; while low-status individuals tend to be less assertive and more anxious, to talk less, and to give fewer suggestions and less information than high-status individuals (e.g., Bianchini, 1997, 1999; Esmonde, 2009). Individuals’ characteristics, such as gender or race, may also operate as status characteristics in heterogeneous small groups, with boys and White students often being more active than girls and Black students (for some specific examples of the dominance of boys over girls and high-achievers over low-achievers, see Baxter, Woodward, & Olson, 2001; King, 1993; Mulryan, 1992, 1995). Even artificially created status differences (such as classifying students’ competence on the basis of fictitious test scores) can alter group members’ participation and influence. Dembo and McAuliffe (1987) found that, regardless of actual competence and ability to give help,
students designated as “high status” dominated group interaction, were more influential, and were perceived to be more capable than “low-status” students.

To prevent low-status students from being marginalized in group interaction, Cohen and colleagues (e.g., 1995) developed two status interventions based on broadening the notions of status and student competence. In the multiple ability treatment, the teacher raises students’ awareness of the multiple skills necessary to accomplish a task. The teacher discusses with students the multiple abilities needed to solve complex problems (e.g., visual thinking, intuitive thinking, and reasoning) and stresses the fact that no single student possesses all of the needed abilities but that all students have some of them. In the second treatment, teachers assign competence to low-status students by observing groups at work to spot instances of low-status students exhibiting intellectual abilities relevant to the task, publicly identifying the contributions, and commenting on the importance and value of them. Cohen and Lotan noted that, as high-status persons, teachers’ evaluations have a strong influence on students’ beliefs about their own and others’ competence. To carry out these interventions, a teacher must have a deep and comprehensive understanding of the multiple competencies relevant to the task and must be a very astute observer to look for abilities that may not be noticed by students in the group. For example, Cohen and Lotan described how teachers might observe the work of quiet students to pick out accurate, informative, or creative work that they are doing, bring it to the group’s attention, and encourage the group to listen to the quiet students describe and explain their work.

These approaches have shown success in reducing the relationship between status (based on, for example, language background, ethnicity, race, socioeconomic status, or academic ability) and behavior in small groups (Cohen & Lotan, 1997). The more frequently teachers talk about the multiple abilities needed for a task (and the fact that no one has all of the abilities), as well as comment on the value of low-status students’ contributions, the more low-status students participate, and the smaller the gap between high-status and low-status students’ participation rates.

Other Teacher Interventions with Small Groups. Many prominent cooperative learning researchers and theorists advise teachers to monitor small-group progress and to intervene when groups seem to be functioning ineffectively (e.g., Johnson & Johnson, 2008). Conditions calling for teacher intervention may include: when no group member can answer the question, when students exhibit problems communicating with each other, when students dominate group work without allowing true dialogue, and when students fail to provide reasons for their opinions and ideas (Ding, Li, Piccolo, & Kulm, 2007; Tolmie et al., 2005).

Cohen (1994a) proposed several guidelines for how teachers should intervene, including asking open-ended questions to redirect groups’ discussions and telling students they all need to be able to explain what the task is about. Cohen cautioned teachers to carefully listen to group discussions so that they can form hypotheses about the groups’ difficulties before deciding on what questions to ask or suggestions to make. She argued that students are more likely to initiate ideas and to take responsibility for their discussions if teachers provide little direct supervision (such as guiding students through tasks, or answering individual student’s questions before the group has attempted to work collectively to solve a problem). Any help that teachers do provide should be based on careful observations of group progress and not meant to supplant group efforts. It is
important that guidance provided, such as pointing out key aspects of the task, checking for students’ understanding of what the problem is asking, and filling in missing parts of students’ knowledge, does not constitute the teacher doing the task for the group or directing them in how to carry out the task, but rather is intended to help groups to negotiate the task (Cohen, 1994a).

Research on the impact of teacher interventions on collaborative activity and student learning largely supports her recommendations. The first theme supported by research concerns the benefits of teachers listening to students’ interaction and then providing indirect guidance to help them elaborate their thinking. One set of studies showed that pushing students to explain their thinking and probing their ideas while minimizing direct instruction about how to complete the task or solve the problem promoted student explanation and achievement. Hogan, Nastasi, and Pressley (2000) found that asking a variety of questions meant to elicit the details of students’ thinking about how to create a mental model of the nature of matter (e.g., asking students to describe their initial thinking, to elaborate on specific points they made in their initial explanation, and to clarify the language they used) was beneficial for the complexity of scientific reasoning that groups attained (e.g., how well students’ ideas were supported and explained; the logical coherence of their thinking), especially when groups were not prone to engage in high-level reasoning when the teacher was not present. When teachers did make statements, they were repetitions or restatements of students’ ideas, and were intended to clarify students’ suggestions or to emphasize certain aspects of students’ proposals rather than to tell students how to carry out the task. Similarly, Webb, Franke, De, et al. (2009) found positive effects from intense probing of students’ ideas. The teacher intervention that nearly always produced more student explaining, and often resulted in groups giving correct and complete explanations about how to solve the problem, was teachers probing student thinking so that students gave further details about their problem-solving strategies beyond their initial explanations. Moreover, probing students’ explanations was most likely to result in additional student explaining (especially correct and complete explanations) when teachers used the details of students’ strategies given in initial explanations to drive their probing questions, when teachers persisted in asking questions in order to push students to clarify the ambiguous aspects of their explanations, and when teachers did not interject their own thinking (or their own assumptions about what students were thinking) into their probing questions.

Gillies (2004) reported similar results in a study in which some teachers were trained to engage in the kinds of probing interventions described above. These teachers were instructed to ask students probing and clarifying questions (“Can you tell me a little more about what you’re intending to do here?”), acknowledge and validate students’ ideas (“I can see you’ve worked really hard to find out how these items are related. I wonder what you could do now to identify a key category they can all fit into?”), identify discrepancies in students’ work and clarify the options they may take (“I wonder how you can include … when you’ve already mentioned …?”), and offer suggestions in a tentative fashion (“I wonder if you’ve considered doing it this way?”; Gillies, 2004, p. 260). Compared to teachers who did not receive training in these specific communication skills but were instructed only to set and discuss ground rules for cooperative group discussions (e.g., sharing information, giving reasons, challenging others, considering alternatives before making decisions), the specially trained teachers asked more questions, especially to ascertain students’ ideas and strategies, and carried out more
mediated-learning behaviors (e.g., challenging students to provide reasons, highlighting inconsistencies in student thinking, prompting students to focus on particular issues, asking tentative questions to suggest alternative perspectives; see Gillies, 2006). Their students provided more detailed explanations, more often expanded on other students’ suggestions, asked each other more questions, and exhibited greater learning than did the students of the teachers who did not receive the specific training.

The second theme supported by recent research is the detrimental effect of providing direct instruction to collaborative groups, especially when teachers provide suggestions before evaluating students’ progress on the problem or task. In Chiu’s (2004) study, the explicitness of teachers’ help (on a 4-point scale that included no help, focusing student attention on certain concepts or aspects of the problem, explaining a concept or a part of the problem, and giving the solution procedure) was negatively related to students being on task immediately after the teacher’s intervention and to groups’ performance on that problem. As Chiu explained, one explanation for this result was that teachers who gave explicit help and issued many directives tended not to evaluate the group’s ideas before intervening. As an example, a teacher did not inquire about the group’s work and so missed the group’s misinterpretation of a problem, told the group the steps to carry out to solve the problem (but did not stay with the group to ensure that the students could solve the problem correctly), and the group failed to make further progress after the teacher left. As this episode shows, when teachers do not have, and do not seek, information about the group’s ideas, their options for how to provide help are limited. Another unintended consequence of providing explicit content-related help may be decreased student engagement. In Dekker and Elshout-Mohr’s (2004) study, the teacher providing detailed instruction often communicated with just one student (typically the student who asked the teacher for help) and other students tended to drop out of further conversations.

There is some evidence that providing direct instruction might be effective if teachers tie their help to student thinking. Meloth and Deering (1999) described several instances of explicit teacher guidance that did not reduce productive discussion, including giving brief, direct explanations of key concepts, briefly explaining what students were supposed to learn, and providing examples of how groups could locate or apply information. After these teacher interventions, students provided further elaboration of their thinking and made new suggestions. In these cases, teachers had asked questions to determine the groups’ need for information or guidance, including soliciting details of students’ ideas, and so the teacher guidance was closely tied to the group discussions. This same study suggested that teacher direct instruction that is not closely tied to student thinking may not have a deleterious effect under one condition; namely, when groups are proceeding well and are confident in their approach to the task or problem. When teachers interrupted such group collaborations to make suggestions without having heard the groups’ discussions, these groups simply disregarded the teachers’ suggestions and returned to their conversations.

**Teachers’ Discourse with the Whole Class**

The nature of teacher discourse with students in the context of whole-class instruction and the norms teachers negotiate with the class about expected interpersonal exchanges may also influence group collaboration, especially the extent to which students explain their thinking and try to learn from others.
It is well known that teacher discourse, especially their questioning practices, plays an important role in limiting or enhancing students’ opportunities for participation during whole-class discussion (Cazden, 2001). Recitation-style discourse (Nystrand & Gamoran, 1991) in which teachers ask students questions and evaluate their responses in a rapid-fire sequence of questions and answers with little or no wait time (Black, Harrison, Lee, Marshall, & Willian, 2002; Turner et al., 2002) places limits on student discourse, especially when teacher queries consist of short-answer, low-level questions that require students to recall facts, rules, and procedures (Ai, 2002; Galton et al., 1999; Graesser & Person, 1994). In contrast, high-level teacher questions that require students to draw inferences and synthesize ideas (Hiebert & Wearne, 1993; Wood, 1998), encourage students to provide justifications for their work (Boaler, 1997), and create opportunities for argumentation that promote student explaining, listening, and evaluation of each other’s ideas and arguments (Forman, Larreamendy-Joerns, Stein, & Brown, 1998).

Emerging research suggests that these patterns of teacher discourse in the whole class, especially the extent to which teachers press students to explain their thinking, are also important for the depth of students’ discussion in collaborative groups. That is, the patterns of behavior that students exhibit during whole-class discussions carry over to their small-group collaborations. In mathematics classrooms in which teachers press students to explain beyond their initial descriptions or explanations of their problem-solving strategies, students are likely to use mathematical arguments to explain why and how their solutions work, to justify their choice of problem-solving strategy, as well as to arrive at a mutual understanding about solutions (Kazemi & Stipek, 2001; Webb, Frank, Ing, et al., 2008). Such pushing of students to explain their thinking may include asking students to justify every step in their procedure, asking specific questions about why students chose particular approaches or how they obtained their intermediate results, asking for clarification of steps in procedures even when solutions are correct, and to demonstrate procedures in different ways or using different representations (e.g., verbal descriptions, diagrams, fractions). In literature classrooms in which teachers push students to help interpret the story and ask them questions in order to encourage them to elaborate on their ideas and to generalize from the text, students in small groups engage in deep reasoning. They generalize from the text instead of describing facts or giving literal interpretations, elaborate on their ideas, and frequently ask each other to explain their reasoning (Smagorinsky & Fly, 1993).

When teachers assume responsibility for doing most of the work during whole-class instruction, students may show little initiative to explain their thinking during collaborative group work. In mathematics classrooms, when teachers set up the steps in the mathematics problems and ask students only to provide the results of specific calculations that the teachers themselves pose, students in their group work may correspondingly provide low-level information such as answers, calculations, and procedural descriptions instead of explanations, and not inquire about their peers’ thinking (Webb, Nemer, & Ing, 2006). In literature classrooms, when teachers assume responsibility for interpreting the text and do not often ask students to contribute, small-group discussions may largely consist of students giving brief interpretations of the text without elaborating on their suggestions (Smagorinsky & Fly, 1993).

Teacher discourse during whole-class instruction (especially whether they ask students to explain their thinking) sends signals about the desirability of explaining and challenging others to explain and justify their thinking versus passively accepting
others’ transmitted knowledge. Teachers can also carry out specific activities with the whole class to mutually construct classroom norms for student engagement. Yackel and colleagues (Yackel, Cobb, & Wood, 1991; Yackel, Cobb, Wood, Wheatley, & Merkel, 1990) described strategies that teachers may use to develop norms around student explanations. Teachers can invent scenarios or use specific situations that arise spontaneously during group work (e.g., one student completing the activities without his partners’ being able to understand his solutions or being able to construct their own solutions) as springboards for whole-class discussions about students’ responsibilities during group work, such as their obligations to create and explain their own meaningful problem-solving approaches, and to probe and challenge other students’ thinking and solutions. Negotiating norms for active student participation can also head off debilitating processes such as social loafing or diffusion (Salomon & Globerson, 1989). Emphasizing students’ responsibilities to explain, defend, and evaluate their own and others’ thinking (Turner et al., 2002) may also encourage them to ask for help from their peers when they need it, and to engage in more effective help-seeking.

CONCLUSION

Research on collaborative dialogue and student learning has revealed important links between group processes and students’ learning outcomes. In many cases, these results have been used in the design of specific collaborative learning approaches, with encouraging results for student learning. Much remains to be learned, however, about how collaborating with peers produces changes in student thinking and understanding. Carrying out detailed analyses of the interaction among students, especially at a sufficiently fine-grained level to detect changes in student thinking, promises to increase our understanding of how students learn in collaborative settings as well as the conditions that either promote or inhibit student learning in collaborative groups.

REFERENCES

Information Processing Approaches to Collaborative Learning


