Chapter 1

The Case for Collaborative Learning

MAKING THE CASE FOR collaborative learning seems almost too easy. More research on learning in small groups exists than on any other instructional method, including lecturing (Johnson, Johnson, & Smith, 1991; Slavin, 1989–90). While most of this is credible and positive, it is dominated by research and investigation in K–12, and higher education is coming late to the scene.

Exploding research on cognition and the brain confirms so much of what we have learned about the effectiveness of peer interaction in promoting active learning that college teachers need not fear that experimenting with collaborative learning in their classrooms will plunge them into uncharted territory. Unlike much research in higher education that is often reported in unrelated studies, scholars studying collaborative learning have mapped the terrain and conducted helpful meta-analyses that synthesize findings across topics and institutions.

The purpose of this introduction to the extensive literature on interactive group learning is to glean from experience and research information that is useful to college teachers in deciding whether collaborative learning will be effective in accomplishing their teaching goals. Specifically, this introduction addresses the following questions:

- What do we mean by *collaborative learning?*
- What is the difference between collaborative learning and cooperative learning?
- What are the defining characteristics of effective learning groups?
- What is the pedagogical rationale for collaborative learning?
- What is the evidence that collaborative learning promotes and improves learning?

- Which students gain the most from collaborative learning?
- Is everyone happy with collaborative learning?

Thus, Part One of this handbook provides an overview of the theoretical and research bases for collaborative learning.

What Do We Mean by *Collaborative Learning?*

To *collaborate* is to work with another or others. In practice, collaborative learning has come to mean students working in pairs or small groups to achieve shared learning goals. It is learning through group work rather than learning by working alone. There are other terms for this kind of activity, such as *cooperative learning, team learning, group learning,* or *peer-assisted learning.* In this handbook, however, we use the phrase *collaborative learning* to refer to learning activities expressly designed for and carried out through pairs or small interactive groups. While we believe that a flexible definition of collaborative learning is best, there are some features that we see as essential.

The first feature of collaborative learning is intentional design. All too often, teachers simply tell students to get into groups and work. In collaborative learning, however, faculty members structure intentional learning activities for students. They may do this by selecting from a range of pre-structured activities, such as those we have included in Part Three of this text, or they may do this by creating their own structures. Whether using existing or new structures, the focus is on *intentional* structure.

In addition to intentional design, co-laboring is an important feature of collaborative learning. The meaning of the Latin-based term *collaborate* shines through as clearly today as in antiquity: to co-labor. All participants in the group must engage actively in working together toward the stated objectives. If one group member completes a group task while the others simply watch, then it is not collaborative learning. Whether all group members receive the same task, or whether members complete different tasks that together comprise a single, large project, all students must contribute more or less equally. Equitable engagement is still insufficient, however.

The third feature of collaborative learning is that meaningful learning takes place. As students work together on a collaborative assignment, they must increase their knowledge or deepen their understanding of course curriculum. The task assigned to the group must be structured to accomplish the learning objectives of the course. Shifting responsibility to students, and

having the classroom vibrate with lively, energetic small-group work is attractive, but it is educationally meaningless if students are not achieving intended instructional goals, goals shared by the teacher and students. Collaborative learning, then, is two or more students laboring together and sharing the workload equitably as they progress toward intended learning outcomes.

What Is the Difference Between Cooperative and Collaborative Learning?

Although to most educators—and indeed to the lexicographers who compile dictionaries—the terms *collaborative* and *cooperative* have similar meanings, there is considerable debate and discussion as to whether they mean the same thing when applied to group learning. Some authors use the terms *cooperative* and *collaborative* interchangeably to mean students working interdependently on a common learning task. Others, however, insist on a clear epistemological distinction (Bruffee, 1995). Advocates for distinguishing between the two suggest that cooperative learning differs from collaborative learning in that, in cooperative learning, the use of groups supports an instructional system that maintains the traditional lines of classroom knowledge and authority (Flannery, 1994). To other authors, cooperative learning is simply a subcategory of collaborative learning (Cuseo, 1992). Still others hold that the most "sensible approach" is to view collaborative and cooperative learning as positioned on a continuum from most structured (cooperative) to least structured (collaborative) (Millis & Cottell, 1998). Since those who insist on a sharp distinction between cooperative and collaborative learning do so for epistemological reasons, it may help to clarify the nature of the argument.

Cooperative Learning

The most straightforward definition of cooperative learning is "the instructional use of small groups so that students work together to maximize their own and each others' learning" (Smith, 1996, p. 71). Cooperative learning arose primarily as an alternative to what was perceived as the overemphasis on competition in traditional education. Cooperative learning, as the name implies, requires students to work together on a common task, sharing information and supporting one another. In cooperative learning, the teacher retains the traditional dual role of subject matter expert and authority in the classroom. The teacher designs and assigns group learning tasks, manages time and resources, and monitors students' learning, checking to

see that students are on task and that the group process is working well (Cranton, 1996; Smith, 1996).

Most research and most discussion of group learning assumes a traditional view of the nature of knowledge, namely that there is a "correct" answer or at least a "best solution," and that different students will have knowledge about different aspects of the task. There is also the assumption that the teacher is an expert in the subject matter, knows the correct answers, and that ultimately the group should arrive at "the best" or "most logical" or "correct" conclusion. Most teachers using interactive student learning in their classrooms and writing about their experiences are talking about cooperative learning. Knowingly or not, they are capitalizing on the research findings that students who establish social relationships with faculty and other students in the community are more actively involved in learning, report greater personal and academic growth, and are better satisfied with their education than are students who are more isolated (Astin, 1993; Light, 2001; Pascarella & Terenzini, 1991).

Collaborative Learning

Collaborative learning is based on different epistemological assumptions, and it has its home in social constructivism. Matthews captures the essence of the philosophical underpinnings of collaborative learning: "Collaborative learning occurs when students and faculty work together to create knowledge. . . . It is a pedagogy that has at its center the assumption that people make meaning together and that the process enriches and enlarges them" (Matthews, 1996, p. 101).

Rather than assuming that knowledge exists somewhere in reality "out there," and that it is waiting to be discovered by human endeavors, collaborative learning, in its tightest definition, assumes that knowledge is socially produced by consensus among knowledgeable peers. Knowledge is "something people construct by talking together and reaching agreement" (Bruffee, 1993, p. 3). Bruffee, the most ardent advocate of collaborative learning, wants to avoid having students become dependent on the teacher as the authority on either subject matter content or group process. Thus, in his definition of collaborative learning, it is not up to the teacher to monitor group learning, but rather the teacher's responsibility is to become a member, along with students, of a community in search of knowledge.

Collaborative Versus Cooperative Learning

In an article for *Change* magazine, subtitled, "Cooperative Learning *versus* Collaborative Learning" (Bruffee, 1995, emphasis added), Bruffee contends, "Describing cooperative and collaborative learning as complementary

understates some important differences between the two. Some of what collaborative learning pedagogy recommends that teachers do tends in fact to undercut some of what cooperative learning might hope to accomplish, and vice versa" (p. 16).

The essence of his position is that, whereas the goal of cooperative learning is to work together in harmony and mutual support to find the solution, the goal of collaborative learning is to develop autonomous, articulate, thinking people, even if at times such a goal encourages dissent and competition that seems to undercut the ideals of cooperative learning.[1] While cooperative education may be appropriate for children, he says, collaborative learning is more appropriate for college students.

Bruffee has made something of a brand name of collaborative learning in higher education circles. He intends the role of the teacher to be less the traditional expert in the classroom and more the peer of students. Knowledge at the college level, he says, is "likely to address questions with dubious or ambiguous answers, answers that require well-developed judgment to arrive at, judgment that learning to answer such questions tends, in turn, to develop. . . . The authority of knowledge taught in colleges and universities should always be subject to doubt" (p. 15).

As a practical matter in planning and operating college classroom learning groups, most teachers will not be much concerned with the philosophical and semantic distinctions between cooperative and collaborative learning, but will use the level of authority and control that feels comfortable for them and that accomplishes their goals. If there is a trend in clarifying the nomenclature of interactive group learning, however, it seems to be in the direction of using the term *collaborative learning* in higher education and *cooperative learning* in K–12 education.

In this handbook, we have labeled our techniques *CoLTs, Co* standing for either "Cooperative" or "Collaborative" and *LT* standing for "Learning Techniques," because the techniques described come from the literature of both cooperative and collaborative learning. Inventing a new term would free us from the baggage accumulated by the advocates of the postmodern version of collaborative learning, but it would also add to the jargon of education. Instead, we follow the growing practice of using the term *collaborative learning* to refer to interactive learning groups in higher education, from structured to unstructured. It is important to be aware, however, that massive confusion reigns in the literature of higher education over terminology. Some authors writing today in higher education use the term *cooperative learning*, and where this is the case, we will use their terminology when discussing their work.

What Are the Defining Characteristics of Effective Learning Groups?

Learning groups exist in many sizes and forms and are created for a wide variety of purposes. Some learning groups are ad hoc, in-class arrangements of convenience that last only a few minutes. For example, in *CoLT 1: Think-Pair-Share,* the instructor asks students to turn to a nearby neighbor to discuss briefly a point made in the lecture. Other teachers may use *CoLT 3: Buzz Groups,* consisting of four to six students grouped for ten to fifteen minutes. This CoLT gives students an opportunity to explore other learners' reactions to course-related questions. There are also more intentionally structured groupings, often organized around specific assignments, such as *CoLT 15: Case Studies* or *CoLT 18: Group Investigation.* In these activities, students may work together for days or weeks until the assignment is completed.

Sometimes groups work together on a course-long project. Membership can remain the same or change depending on the learning goals. There are also long-term "learning communities" that may last a semester or an academic year. Learning communities typically involve integration of curricula, team teaching, and other institutional changes designed to give students a feeling of belonging to a "community" of learners (Gabelnick, MacGregor, Matthews, & Smith, 1990; Matthews, Smith, MacGregor, & Gabelnick, 1997; Tinto, Love, & Russo, 1994).

Groups may be identified with particular teaching methods—such as the case-study method or problem-based learning—in which the purpose is to accomplish specified cognitive goals such as critical thinking and problem solving. There are groups based on an epistemology, such as Bruffee's purist definition of collaborative learning. When interacting, these groups purposely implement social constructivist learning theory, a theory contending that knowledge is socially constructed by consensus among knowledgeable peers (Bruffee, 1995; Vygotsky, 1978).

Johnson and colleagues (Johnson et al., 1991) distinguish types of groups on the basis of duration and purpose. *Formal* learning groups last from one class period to several weeks, whatever it takes to complete a specific task or assignment. The purpose is to use the group to accomplish shared goals, to capitalize on different talents and knowledge of the group, and to maximize the learning of everyone in the group. *Informal* groups are temporary groups that last for only one discussion or one class period. Their major purpose is to ensure active learning. They might be used, for example, to break up a lecture with peer exchanges that require students to organize, explain, and otherwise cognitively process their learning. *Base* groups are long-term groups with a stable membership, more like learning

communities. Their main purpose is to provide support and encouragement and to help students feel connected to a community of learners.

In the extensive literature on cooperative learning in K–12, there are dozens of "brand-name" types of cooperative learning groups, each endowed by its creator with particular structural elements that are thought (or demonstrated through research) to enhance learning. Slavin (1996), for example, describes in some detail five methods that have been developed and extensively researched. Although there are distinctive differences in the purposes and philosophies guiding the formulation and operation of groups for learning, it is nevertheless true that all groups share two fundamental purposes: to engage students actively in their own learning and to do so in a supportive and challenging social context.

There is substantial agreement in the literature on what interactive group learning is, as well as what it is not. Karl Smith captures nicely some common misunderstandings about the nature of cooperative/collaborative learning.[2]

> *Many faculty who believe they are using cooperative learning are in fact missing its essence. There is a crucial difference between simply putting students in groups to learn and structuring cooperation among students. Cooperation is not having students sit side by side at the same table to talk with one another as they do their individual assignments. Cooperation is not assigning a report to a group of students, on which one student does all the work and the others put their names. Cooperation is not having students do a task individually and then having the ones who finish first help the slower students. Cooperation is much more than being physically near other students, discussing material with other students, or sharing material among students, although each of these is important in cooperative learning (Smith, 1996, p. 74).*

In contrast to what cooperative learning is *not*, Smith (1996, pp. 74–76) identifies what it *is* by listing five elements that he considers essential for successful cooperative learning groups (see also Johnson, Johnson, & Smith, 1998, pp. 21–23).

1. *Positive interdependence:* The success of individuals is linked to the success of the group; individuals succeed to the extent that the group succeeds. Thus students are motivated to help one another accomplish group goals.
2. *Promotive interaction:* Students are expected to actively help and support one another. Members share resources and support and encourage each other's efforts to learn.
3. *Individual and group accountability:* The group is held accountable for achieving its goals. Each member is accountable for contributing his or her share of the work; students are assessed individually.

4. *Development of teamwork skills:* Students are required to learn academic subject matter (task work) and also to learn the interpersonal and small-group skills required to function as part of a group (teamwork). Teamwork skills should be taught "just as purposefully and precisely as academic skills" (p. 75).
5. *Group processing:* Students should learn to evaluate their group productivity. They need to describe what member actions are helpful and unhelpful, and to make decisions about what to continue or change.

Virtually all collaborative learning methods emphasize the importance of *promotive interaction* and *individual accountability.* Students must not only learn to work together, but they must also be held responsible for their teammates' learning as well as their own. Slavin, in particular, has been insistent that successful groups must endorse individual accountability and team rewards. "It is not enough," he says, "to simply tell students to work together; they must have a reason to take one another's achievement seriously" (Slavin, 1996, p. 21).

Collaborative learning, then, is a structured learning activity that addresses major concerns related to improving student learning. It involves students actively, thereby putting into practice the predominant conclusion from a half-century of research on cognitive development. It prepares students for careers by providing them with opportunities to learn the teamwork skills valued by employers. It helps students appreciate multiple perspectives and develop skills to collaboratively address the common problems facing a diverse society. And it engages all students by valuing the perspective each student can contribute from his or her personal academic and life experience. That said, collaborative learning is not an educational panacea. Collaborative learning is an appropriate method for achieving some learning goals and tasks, but not for others. In most cases, we see collaborative learning not as a replacement for lecture, discussion, or other traditional methods, but rather as a useful complement.

What Is the Pedagogical Rationale for Collaborative Learning?

The closing decades of the twentieth century were exceptionally rich in producing a better understanding of the learning process. Critical to our understanding of that process is the basic tenet of modern cognitive theory: learners must be *actively engaged* in learning. Neurologists and cognitive scientists agree that people quite literally "build" their own minds throughout life by actively constructing the mental structures that connect and

organize isolated bits of information. Much as we would like to think that we as teachers can "tell" students what we have learned and thus transfer it into their heads efficiently and accurately, the evidence is clear that we cannot "transfer" our knowledge ready-made into student minds. Instead, students must do the work of learning by actively making connections and organizing learning into meaningful concepts.

The Importance of Making Connections

There is growing evidence that learning is about making connections—whether the mental connections are established by firing synapses in the brain, the "ah ha" experience of seeing the connection between two formerly isolated concepts, or the satisfaction of seeing the connection between an academic abstraction and a "hands-on" concrete application. The important concept is that learners must actively make the connections in their own brains and minds that produce learning for them (Cross, 1999).

Neurological Connections

Stunning new research on the brain by neuroscientists is adding a new dimension to our knowledge about learning, and it is reinforcing rather than changing the tentative conclusions from cognitive science. Neuroscientists have developed a rich imagery about how the brain works. Children do not come into the world with a brain that is hard-wired like a computer. Rather, throughout life, they "grow" their own brains by constantly making connections in the circuitry of the brain through experience and learning. Research is showing that the circuitry of the brain is wired by neurons that spin out axons. These axons connect with many targets to form the transmission lines that carry electrical impulses. At the end of each "wire" is a bulb-and-button unit called a *synapse*. When an electrical signal reaches the button-like ending, a chemical message crosses the gap in the synapse to connect with the receiving cell. Scientists believe that at birth a baby's brain contains 100 billion neurons. Sensory stimulation strengthens connections. Alternatively, "through a process that resembles Darwinian competition, the brain eliminates connections or synapses that are seldom or never used" (Nash, 1997, p. 50). "Use it or lose it" appears to be quite true when applied to the "brain work" of learning. Researchers find that children who are deprived of sensory stimulation develop brains that are 20–30 percent smaller than normal for their age. Although much remains to be learned about the neurological growth of the brain, new insights into the physical development of the brain closely parallel what we are learning about the mental processes of learning.

Cognitive Connections

The parallels between the neurological brain and the working mind envisioned by cognitive scientists are quite remarkable. Modern cognitive science postulates a structure of the mind known as the *schema*—or in plural form, *schemata*, since the brain develops many schemata for different topics. A schema is a cognitive structure that consists of facts, ideas, and associations organized into a meaningful system of relationships. People have schemata for events, places, procedures, and people, for instance. A person's schema for a place, such as a college, might include concepts such as location, reputation, the characteristics of the student population, style of campus architecture, even the location of campus parking lots. Thus, the schema is an organized collection of bits of information that together build the concept of the college for each individual. When someone mentions the college, we "know" what he or she means, but the image brought to mind may be somewhat different for each individual.

What students can learn depends, to a larger extent than previously assumed, on what they already know. It is easier to learn something when we already have some background than it is to learn something completely new and unfamiliar. For example, advanced courses in a subject are often easier to teach and to learn than introductory courses. Cognitive theory would explain that paradox by observing that if the schema is very sparse with respect to a particular subject, connections are hard to find and make, whereas if the schema already has a dense network of vocabulary, terms, and concepts, it is easier to make the connections that constitute learning.

This fundamental assumption about the role of prior knowledge in learning was tested in a classic experiment that compared novice and expert chess players' ability to memorize the layout of chess pieces (de Groot, 1966). Chess players of different skill levels were shown the game pieces on a chessboard for a few seconds and then asked to recall the position of the pieces. The novice players were able to place only five or six pieces correctly, but the experts could recreate nearly the whole board. However, when these players were shown the pieces placed randomly on the board (rather than positions from a real game), novices and experts performed about the same. The conclusion from this rather simple experiment is that the superior performance of experienced chess players in recalling chess positions was not due to higher IQs or to better memories, but rather to a schema for chess that enabled experienced players to associate the patterns shown with those already in memory. The point is that what one knows about a given subject has a substantial impact on the learning process. When teachers complain

that students "can't read," they refer not only to the lack of reading skills, but also to the density of the schema for a particular subject matter.

Much of traditional instruction is based on the old images of the mind as an empty vessel, in which the teacher opens the heads of students and pours in new information that adds to their knowledge. Thus we speak erroneously of students knowing "more" as we add to their storehouse of information. Paulo Freire (1970) refers to the "banking model" of education, in which the teacher deposits information that students store to withdraw later. The new cognitive science rejects the notion that real learning occurs when new information simply rests on top of the existing cognitive structure. Alfred North Whitehead (1929) captured the wisdom of active learning in these words: "Beware of inert ideas—ideas that are merely received into the mind without being utilized, or tested, or thrown into fresh combinations."

Some researchers refer to "deep" and "surface" learning to distinguish between learning that makes the connections that lead to deeper *understanding* versus *information*, which rests lightly on the surface, inert and unassimilated (Ramsden, 1992). A finer distinction was made by Säljö, who asked adult learners what they understood by "learning" (Säljö, 1979, cited in Ramsden, 1992, pp. 26–27). Säljö categorized their answers in a hierarchical pattern, observing that each higher conception implied all that preceded it:

1. Learning is acquiring information or "knowing a lot."
2. Learning is memorizing or "storing" information.
3. Learning is acquiring facts and skills that can be used.
4. Learning is making sense or "making meaning" of the various parts of information.
5. Learning involves comprehending or understanding the world by reinterpreting knowledge.

We find, in the literature of learning, all of these conceptions of learning—and to some extent, none—are completely inappropriate. But Berkeley researchers Lyman and Varian note that worldwide information production increased by 30 percent *each year* between 1999 and 2002. "All of a sudden," says Lyman, "almost every aspect of life around the world is being recorded and stored in some information format" (Lyman & Varian, 2003). The computer is so far superior to the human brain in storing and retrieving information that most instruction and learning at the college level is addressing Säljö's definitions 3, 4, and 5.

Social Connections

Vygotsky invented the awkward term "zone of proximal development" (ZPD) to indicate "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). The theory, applied to cooperative learning, is that students come to the group with diverse backgrounds, but enough overlap to form a common base for communication. Exposing all students to concepts and understandings that are within their ability to grasp, but not yet part of their personal understanding, enables each to learn from other students those concepts that are just beyond their current level of development. Thus, theoretically at least, academically poor students would stand to learn more from better-prepared students than vice versa. Some would claim that the better students are wasting their time, explaining things that they already know. However, ample evidence suggests that peer tutors gain a great deal from formulating and explaining their ideas to others.

What Is the Evidence That Collaborative Learning Promotes and Improves Learning?

To answer this question, we look at the research on peer influence, college environments, collaborative learning in the classroom, and student satisfaction.

Research on Peer Influence

Research support for the impact of peers on student learning is extensive, and it comes from broad-scale studies of college environments as well as from studies directed more specifically to the effects of collaborative learning in the classroom. To date, there is an impressive amount of research, and it comes from highly credible sources.

In 1969, Feldman and Newcomb synthesized the findings of more than 1,500 studies in their now-classic book, *The Impact of College on Students*. In 1991, Pascarella and Terenzini set for themselves the ambitious task of updating the research that had accumulated since Feldman and Newcomb. In a nearly 1,000-page treatise entitled, *How College Affects Students*, they reviewed more than 2,500 publications, concluding basically that "students not only make statistically significant gains in factual knowledge and in a range of general cognitive and intellectual skills, they also change on a broad array of values, attitudinal, psycho-social, and moral dimensions" (p. 557). A large part of this documented change, Pascarella and Terenzini

conclude, is determined by the extent to which students interact with faculty members and student peers in and out of the classroom (p. 620).

The demonstrated effect of the social impact of college has stimulated sophisticated theory building on student development as well as further research on learning in the classroom, including the effect of cooperative and collaborative learning. Colleges, under the gun to hold themselves accountable for student learning and to present evidence of such,[3] are collecting their own data about student engagement with the people and activities of the college via such well-known instruments as the National Survey of Student Engagement (NSSE) and the Community College Survey of Student Engagement (CCSSE) (Community College Leadership Program, 2003; Kuh, 2000). The current high interest in student engagement derives in part from cognitive research on the importance of active or engaged learning in the classroom, but it also springs from a long history of interest in the impact of college environments on student attitudes, values, persistence, satisfaction, and motivation for learning (Astin, 1968; Chickering, 1969; Jacob, 1957).

Research on College Environments

Alexander Astin's large-scale statistical studies across hundreds of colleges and thousands of students, using twenty-two measures of student learning outcomes, concluded that two factors had a special potency in academic achievement, personal development, and student satisfaction with college: interactions with fellow students and interactions with faculty members. Astin concluded, "Research has consistently shown that cooperative-learning approaches produce outcomes that are superior to those obtained through traditional competitive approaches, and it may well be that our findings concerning the power of the peer group offer a possible explanation: Cooperative learning may be more potent than traditional methods of pedagogy because it motivates students to become more active and more involved participants in the learning process" (1993, p. 427).

Richard Light, using a different approach to the study of student learning in college, studied one college intensively. He and his colleagues interviewed 570 Harvard undergraduates to see what learning experiences they valued most in their college years. He concluded, "All the specific findings point to, and illustrate one main idea. It is that students who get the most out of college, who grow the most academically, and who are happiest, *organize their time to include interpersonal activities with faculty members, or with fellow students built around substantive, academic work*" (Light, 1992, p. 6, emphasis in the original).

The grand synthesis of research on learning in college is widely known as the *Seven Principles for Good Practice in Undergraduate Education.* The principles "rest on 50 years of research on the way teachers teach and students learn, how students work and play with one another, and how students and faculty talk to each other" (Chickering & Gamson, 1987). The first three principles are

1. Good practice encourages student–faculty contact.
2. Good practice encourages cooperation among students.
3. Good practice encourages active learning.

These three principles apply to both the college environment and the classroom, and they are the backbone of collaborative learning.

Research on Collaborative Learning in the Classroom

Light's (1992) conclusion from the Harvard studies on the productivity of interactions built around substantive academic work is especially important to classroom teachers, and it is vital to our discussion of collaborative learning in college classrooms. While broad studies of the impact of college on students offer evidence that learning in a social context makes positive contributions to a student's college education, the claims for collaborative learning go further. In particular, there is high interest in two important outcomes: (1) What group learning contributes to content mastery, critical thinking, problem solving, and other cognitive attributes, and (2) what group learning contributes to the development of interpersonal skills and other noncognitive factors that are valued in careers and citizenship.

Teachers over the generations have searched for the "best" method of teaching, and there has been considerable research comparing various teaching methods. Psychologists at the University of Michigan reviewed more than five hundred research studies pertaining to teaching and learning in college classrooms. When asked what is the most effective teaching method, McKeachie and his colleagues answered that it depends on the goal, the student, the content, and the teacher—but the next best answer is, "Students teaching other students" (McKeachie, Pintrich, Lin, & Smith, 1986, p. 63).

Collaborative learning, capitalizing on the value of peer interaction, has produced a huge amount of research comparing collaborative learning with other teaching/learning methods as well as attempting to identify the most effective models of cooperative/collaborative learning. As of November 2003, there were 6,887 items listed in ERIC under the descriptor "cooperative learning," and 3,537 of these were published journal articles. While many of these relate to the extensive interest in cooperative learning in

K–12, more than 1,979 of the items on cooperative learning were indexed to higher education. In addition, there were 909 published journal articles on "collaborative learning," 432 of these specifically keyed to collaborative learning in higher education (accessed November 12, 2003). With such an extensive body of literature, it is helpful to have available a large number of syntheses and meta-analyses taking on the task of synthesizing the research on cooperative/collaborative learning.

Virtually all of the compilers and synthesizers of research findings regarding group learning come to largely positive conclusions (Cuseo, 1992; Johnson et al., 1991; Johnson, Johnson, & Stanne, 2000; Millis & Cottell, 1998; Natasi & Clements, 1991; Slavin, 1990; Springer, Stanne, & Donovan, 1998). Natasi and Clements reflect the nature and tone of much of the research, concluding, "Cognitive-academic and social-emotional benefits have been reported for students from early elementary through college level, from diverse ethnic and cultural backgrounds, and having a wide range of ability levels. . . . Furthermore, cooperative learning has been used effectively across a wide range of content areas, including mathematics, reading, language arts, social studies and science" (1991, p. 111, quoted in Millis & Cottell, 1998, pp. 8–9).

There are, by this time, literally dozens of different models of cooperative/collaborative learning groups. Data are presented in exhausting detail by Slavin (1989–90, 1990, 1996) and the Johnson brothers (Johnson & Johnson, 1994; Johnson et al., 1991; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981), who have been the most prodigious compilers and reviewers of research on cooperative learning groups in K–12. (The term *cooperative learning* is used in reporting research results from K–12 because that is the term and conditions used by the researchers.)

Johnson and his colleagues at the University of Minnesota have concentrated largely on comparing learning outcomes from three types of learning structures: cooperative, competitive, and individualistic. *Cooperative learning* involves "promotive interaction," in which students encourage the achievement of other members of the group while also working on their own achievement in order to accomplish group goals. *Competitive structures* are found in environments in which students focus on "increasing their own achievement and on preventing any classmate from achieving higher than they do." And *individualistic structures* are more like mastery learning in which no interaction exists; "students focus only on improving their own achievement and ignore as irrelevant the efforts of others" (Johnson et al., 1991, p. 31).

In extensive meta-analyses across hundreds of studies, cooperative arrangements were found superior to either competitive or individualistic

structures on a variety of outcome measures, generally showing higher achievement, higher-level reasoning, more frequent generation of new ideas and solutions, and greater transfer of what is learned in one situation to another. The Johnson team concluded, "Cooperative learning is indicated whenever the goals of learning are highly important, mastery and retention are important, the task is complex or conceptual, problem solving is desired, divergent thinking or creativity is desired, quality of performance is expected, and higher level reasoning strategies and critical thinking are needed" (1991, p. 40). Given that conclusion, it is hard to think of any educational situation in higher education in which cooperative learning would *not* be recommended by the Johnson team.

Robert Slavin at Johns Hopkins University also reported highly positive results (1989–90, 1990, 1996). Slavin's particular research interest is in comparing the outcomes from various models of cooperative learning as well as comparing cooperative learning groups with traditional control groups. He located ninety studies that met his rigorous criteria for research design. His analysis of these studies is set forth in extensive tables (Slavin, 1996) and in more detail than is appropriate to report here, but Slavin, like the Johnson team, concluded that achievement under cooperative learning structures was significantly positive. The size of the effect differed depending on the particular type of cooperative learning structure. Slavin's most important conclusion is that "cooperative learning has its greatest effects on student learning when groups are recognized or rewarded based on the individual learning of their members" (Slavin, 1996, p. 52). Students must have an incentive, he says, to help each other put forth maximum effort. "If a group member wants her group to be successful," reasons Slavin, "she must teach her group mates (and learn the material herself). If she simply tells her group mates the answers, they will fail the quiz that they must take individually" (p. 53). Slavin's conclusion, after extensive review of research on cooperative learning in K–12, is that "cooperative learning methods can be an effective means of increasing student achievement, but only if they incorporate group goals and individual accountability" (Slavin, 1990, p. 32).

Research on group learning in higher education is more limited, but recently Springer, Stanne, and Donovan (1999) conducted an impressive meta-analysis of the effects of small-group learning on student achievement, persistence, and attitudes in classes in undergraduate science, mathematics, engineering, and technology (SMET). Their work directs research attention to assessing student learning under the conditions of live classroom settings. They located 383 reports related to small-group learning in postsecondary SMET from 1980 or later. Thirty-nine of the studies met their

exacting requirements for providing adequate research data on achievement, persistence, and/or attitudes. In condensed form, their major conclusions are as follows:

- SMET students who learned in small groups demonstrated greater achievement than students in traditional instruction (d = .51, which is roughly equivalent to moving a student from the 50th to the 70th percentile on a standardized test).
- The effects of small-group learning on achievement were significantly greater when measured on instructor-made exams or grades than on standardized instruments.
- Student persistence was significantly higher in small-group learning classes than in traditional classes (d = .46, which is enough to reduce attrition from SMET classes by 22 percent).
- The findings were equally positive for women and men, SMET majors and non-majors, first-year and other students, and for underrepresented minorities (African Americans and Latinas/Latinos).
- Small-group learning leads to more favorable attitudes toward learning of the material.
- Out-of-class meetings (typically study sessions) have greater effects on achievement than in-class collaboration, but in-class collaborations have more favorable effects on student attitudes than out-of-class meetings.

In a succinct summary of their meta-analysis, the researchers offer this conclusion: "Students who learn in small groups generally demonstrate greater academic achievement, express more favorable attitudes toward learning, and persist through SMET courses or programs to a greater extent than their more traditionally taught counterparts. The reported effects are relatively large in research on educational innovation and have a great deal of practical significance" (Springer et al., 1999, p. 42).

Research on Student Satisfaction

The evidence is strong and quite consistent across a broad array of educational research studies that students who study under various forms of peer interaction, including class discussion (versus lecture), have more positive attitudes toward the subject matter, increased motivation to learn more about the subject, and are better satisfied with their experience than students who have less opportunity to interact with fellow students and teachers (Johnson et al., 1991; Light, 1992; Springer, Stanne & Donovan, 1998). The data also indicate that students working in learning groups like the instructor better and perceive the instructor as more supportive and

accepting academically and personally (Fiechtner & Davis, 1992; Johnson et al., 1991).

Cabrera (1998) found, in a study of more than two thousand students completing their second year of study at twenty-three campuses, that participation in cooperative learning groups was positively related to perceived gains in personal development, appreciation for fine arts, analytical skills, and understanding of science and technology as measured by the College Student Experiences Questionnaire (CSEQ). Fiechtner and Davis (1992) sought student reactions to cooperative learning experiences in upper-division classes at two universities. Asking students to rate the effectiveness of their group experiences on an eighteen-item survey, they found, in four different administrations of the survey, that 74–81 percent of the students rated their cooperative learning experience "significantly" or "somewhat more effective" than traditional college instruction in general academic achievement; 70–82 percent felt that their group experience was superior in promoting higher-level thinking skills; and 75–86 percent claimed it promoted greater interest in the subject matter. A striking 83–90 percent claimed better class morale under conditions of group learning.

Which Students Gain the Most from Collaborative Learning?

Although most studies evaluating the effects of group learning for different kinds of students claim equal benefits for students across a wide range of backgrounds and abilities, some researchers report that underprepared students may benefit more from student-led discussions than better students (Gruber & Weitman, 1962). The explanation offered is that when a group contains sufficient student resources of knowledge and higher-level thinking skills, less skilled students may be helped to restructure and deepen their understanding.

However, there is also ample research and experiential evidence to suggest that in peer tutoring, students *doing* the teaching learn more, especially at a conceptual level, than students receiving the tutoring (Annis, 1983; McKeachie et al., 1986). Teachers who have spent many hours preparing a lecture or designing a learning exercise know firsthand that organizing knowledge to explain it to others is a powerful learning experience. Thus, there should be considerable value to good students in having to organize and articulate their own learning to make it understandable to others. Indeed, Slavin (1996, p. 53) found in his review across hundreds of research studies that "students who give each other elaborated explanations (and, less consistently, those who receive such explanations) are the students who learn the most in cooperative learning."

Taken as a whole, the research appears to substantiate the claim that both underprepared and well-prepared students benefit from group learning, but perhaps for different reasons. Good students may benefit from having to formulate their thoughts and knowledge into concepts understandable to others, while academically poorer students may benefit from the explanations of their peers.

Other categories of students in which there is high interest is any group that has been underrepresented in higher education in the past. Obtaining diversity in student populations is appealing to colleges for pedagogical as well as social reasons. The evidence is strong—for a variety of reasons—that students who might be considered nontraditional college students prefer cooperative group learning and stand to benefit more from it than traditional students. Women, members of underrepresented racial and ethnic groups, adult and re-entry students, commuters, and international students have been identified as students for whom peer and group learning seem especially valued and valuable.

In a study of 2,051 students at twenty-three institutions, Cabrera (1998) found that minority students expressed a greater preference for learning in groups than did majority students, and Treisman (1985) found that the five-year retention rate for African American students majoring in mathematics or science at Berkeley was 65 percent for those who were involved in collaborative learning groups, compared with 41 percent for African American students not involved. In an intensive study of a special program for ethnically diverse calculus students at the University of Wisconsin, Millar (1999) reported positive findings on the effectiveness of learning in groups. The Wisconsin learning groups emphasized three factors: intensive group work, carefully chosen and very difficult problems, and instructors who function as guides. Students learning under these conditions were about twice as likely as other students to receive a B or above in calculus, and they "showed higher levels of confidence in their mathematical ability and greater comfort in performing calculus problems; learned to value multiple and creative ways of problem solving; and developed the interest and ability to acquire a deeper, more conceptual understanding of calculus" (pp. 8–9).

This finding is consistent with the Harvard studies that found that students who persist to degree completion in science tend to work in small, student-centered study groups, whereas students who leave science rarely report working with other students (Light, 1992). These findings may be especially significant for women, who tend to transfer out of the sciences more frequently than men (Tobias, 1990) and who tend to favor the more collaborative learning styles that are associated with "connected knowing"—in other words, gaining access to knowledge through other people (Belenky, Clinchy, Goldberger, & Tarule, 1986).

The simple answer to the question, *Who benefits from group learning situations?* seems to be "Almost everyone." Furthermore, it appears that group work enhances and enriches a goal that many colleges consider paramount for students today: learning from diversity. Cuseo notes, "Cooperative learning has the potential to capitalize on the contemporary wave of student diversity—converting it from a pedagogical liability (which instructors must somehow adapt to or accommodate) into a pedagogical asset—by capitalizing on the multiple, socio-cultural perspectives that can be experienced when students from diverse backgrounds are placed in heterogeneously-formed cooperative learning groups" (1996, p. 24).

Is Everyone Happy with Collaborative Learning?

Research on instructional methods is sometimes criticized for comparing carefully designed experimental methods with average, across-the-board, traditionally taught classes. This is, in a sense, "stacking the cards" in favor of the experimental method. It may be that the reason for the generally positive findings in the published reports of the contributions of group learning to achievement is that the groups studied are usually carefully structured to accomplish student learning. Research on lectures that were carefully planned to raise questions and involve students in actively thinking about what was being said would also show more positive results than across-the-board studies of the efficacy of active lecturing.

To answer the criticism of comparing well-designed collaborative learning methods with average, across-the-board traditional teaching, Wright and colleagues (Wright, Millar, Kosciuk, Penberthy, Williams, & Wampold, 1998) conducted an interesting and powerful comparison of the "best" lecture/discussion classes with the "best" cooperative learning classes in analytical chemistry at the University of Wisconsin. They placed considerable emphasis on careful assessment of the learning that was taking place. In their words, their assessment strategy "emerged from an ad hoc committee of skeptical chemistry faculty who met prior to the 1995 course. They concluded that the only type of assessment data they would find credible would be faculty-conducted oral examinations of all students. It was important that the assessment be done orally in order to probe student understanding and problem-solving ability. It was also important that the assessment involve external faculty who are independent of the course faculty" (p. 987).

Their findings left little doubt that students in the cooperative learning classes "had quantifiably better reasoning and communication skills" than

students taught in lecture/discussion classes. Moreover, both student and faculty questionnaires showed "very significant differences in the perception of the students' preparation for future science courses" (p. 989). This study, published in the *Journal of Chemical Education*, is one of the most carefully designed research studies of instructional methods that we found in our search of the research on collaborative learning in higher education.

Issues on Which Research Is Lacking

The aggregated evidence from research studies appears highly positive, but we found student criticism or dissatisfaction with group work strangely lacking in the research reports. The research just did not seem to report on or take cognizance of the student criticisms that every instructor who has tried group work hears from time to time. We found that any criticisms of learning groups were enumerated largely in the work of practitioners. Miller and her colleagues reported their experiences in teaching a biology class: "Some groups literally crackle with excitement and creativity. All members seem to live, breathe, eat, and sleep the current project and are ecstatic with their working arrangements. . . . At the opposite end of the spectrum, there are groups in which one or more members cannot be reached by telephone, do not show up for meetings, break commitments to their group and in the worst case disappear for several weeks with the entire group's work in their possession" (Miller, Trimbur, & Wilkes, 1994, p. 34).

We also found a report of negative as well as positive student reactions on a Web site (http://www.wcer.wisc.edu/nise/CL1/CL/story/middlecc/TSCMA.htm). Cathy Middlecamp asked two hundred students in a chemistry class for non-majors at the University of Wisconsin to give advantages and disadvantages of the group work that she had used from time to time in the class. While she disavows a systematic research approach to the collection of data, her posting on the Web of a sample of student comments regarding cooperative learning groups will ring true to many practitioners. The advantages listed by students consist of those that appear commonly in the literature of cooperative and collaborative learning. They include recognition that different members of the group bring different knowledge and talents to bear, that deeper learning results from the discussion, that students are less hesitant to speak or raise questions in small peer groups than in a large class or with the instructor, and that working in groups is more fun and gives students an opportunity to know their fellow students better. Some students, especially business majors, were also likely to mention the career value of learning to work on teams.

The disadvantages listed by students included recognition that people need to go at different speeds, that some students dominate the group while

others are "easy riders" who fail to pull their fair share, that discussion gets off the topic and wastes time, and that some groups "just don't get along." The advantages listed by students appear to represent the outcomes of groups that are productive, well planned, and carefully monitored. The disadvantages represent groups that are dysfunctional for one or more reasons, most of which are probably correctable. The purpose of this handbook is to help faculty capitalize on the advantages and defuse the disadvantages inherent in group work (see "Addressing Problems" in Chapter Five, Facilitating Student Collaboration).

There is almost no research on groups that fail, and more specifically, how that experience impacts the learning of its members. Does collaborative learning carry risks if done poorly? We assume so, but we just don't know what students learn from a poorly run group. The evidence, however, is so strong that collaborative learning has multiple advantages if done well, that it would be folly not to learn how to operate collaborative learning groups productively.

Much to our surprise, we found no attempt to systematically study the impact of collaborative learning on teachers. Does it take more time? Does it sacrifice "coverage" of material? Does it result in greater satisfaction in the profession of teaching? What are the rewards, intrinsic and extrinsic? We just don't know via systematic research study the answers to these questions. There are scattered testimonials to the satisfaction of working closely with colleagues, and a growing band of devotees offer anecdotes on their increased interest in teaching via collaborative learning. Certainly centers established on campuses to improve teaching and learning are increasingly using workshops, faculty mentors, team teaching, and what could be called "collaborative learning for teachers" as the basic formula for their work.

In 1993, TIAA/CREF established the Hesburgh Awards "to acknowledge and reward successful, innovative faculty development programs that enhance undergraduate teaching." A review of 450 Hesburgh finalists between 1993 and 2001 illustrated the impact of collaborative learning for faculty development (Cross, 2001). A predominant feature of these cutting-edge programs was the emphasis on collaborative learning for faculty: faculty members were collaborating across disciplines and generations to share the "wisdom of practice." As faculty find satisfaction and professional growth in collaboration, perhaps they will carry their experiences with their own learning into their classrooms. But the fact remains that there is little research to document advantages and disadvantages to teachers of collaborative learning.

Conclusion

Collaborative learning seems to be a teaching/learning innovation whose time has come. Done well, it puts into practice the major conclusions from modern cognitive learning theory, specifically, that students must be actively engaged in building their own minds. Research to date supports and enriches the theory. There is a large amount of empirical evidence that small groups of peers learning together have advantages for academic achievement, motivation, and satisfaction. As Millis and Cottell (1998, p. 24) conclude, "The good news is that the research consistently shows that structured small-group work that builds on positive interdependence and individual accountability also raises student achievement." There does not seem to be much "bad news" in the research findings. But most of the research reported in the literature is on carefully structured groups, designed to accomplish learning. The critically important qualifications that have emerged from that research are that positive interdependence and individual accountability are factors that make for success.

As more and more faculty in higher education introduce collaborative learning into their classrooms, the accumulation of research and wisdom will grow. But there is already plenty of experience to help classroom teachers avoid the pitfalls and capitalize on the potential of collaborative learning. A major purpose of this handbook is to pull together information from both research and experience to help teachers design creative, challenging, and effective group assignments.

Notes

1. While Bruffee (1995) assumes that cooperative learning does not involve conflict, Johnson and Johnson (1994, p. 67) assert that "within cooperative learning groups, intellectual conflict should be encouraged and nurtured, rather than suppressed or avoided."
2. Karl Smith and the Johnson brothers have spent many years leading the cooperative learning movement in K–12. In turning their attention recently to higher education, they have brought with them the term *cooperative learning.*
3. The *Handbook of Accreditation* of WASC sets forth standards that require "evidence of educational effectiveness, including student learning" (Western Association of Schools and Colleges, 2001, p. 29).