Johnson, D. W., Johnson, R. T., & Smith, K. A. (2014). Cooperative learning: Improving university instruction by basing practice on validated theory. *Journal on Excellence in College Teaching*, *25*(3&4), 85-118.

Cooperative Learning: Improving University Instruction by Basing Practice on Validated Theory

David W. Johnson
Roger T. Johnson
Karl A. Smith
University of Minnesota

Cooperative learning is an example of how theory validated by research may be applied to instructional practice. The major theoretical base for cooperative learning is social interdependence theory. It provides clear definitions of cooperative, competitive, and individualistic learning. Hundreds of research studies have validated its basic propositions and demonstrated that cooperative learning (compared with competitive and individualistic learning) increases students' efforts to achieve, encourages positive relationships with classmates and faculty, and improves psychological health and well being. Operational procedures have been derived from the validated theory to implement cooperative learning in university classes, including those needed to implement formal cooperative learning, informal cooperative learning, and cooperative base groups.

Introduction

Imagine that time travel is possible and we could transport individuals from the Middle Ages to present day life (Spence, 2001). A Middle Ages farmer placed in a modern farm would recognize nothing but the livestock. A physician from the 13th century would probably faint from shock in a modern operating room. Galileo would be mystified by a tour of NASA's Johnson Space Center. Columbus would shake with fright

in a nuclear submarine. But a 15th-century university professor would feel right at home in many of today's classrooms. While the agriculture, medicine, science, transportation, manufacturing, and communication industries have all been transformed and improved, teaching relatively has not. The same age-old assumptions that teaching is telling, learning is absorbing what the instructor tells, and knowledge is subject matter content continue to the present day.

It is not that these assumptions have never been challenged. Educational history is a record of a steady cycle of failed reforms that were demonstrated to improve learning, but after a few years were abandoned. While there are many reasons why teaching is so resistant to change, Ewell (2001) believes one reason is that instructors fail to apply the same scientific rigor (that is, the need for underlying theory and confirmatory evidence) to their teaching as they do to their research. He believes that university instructors rely more on folklore and knee-jerk mythology than on scientific fact, arguing that everyone knows how a class should be conducted or how material should be presented to students. On the contrary, university faculty should base their teaching practices directly on theory and research.

Many educators, however, believe that well over 100 years of theorizing and research has not provided the guidance needed to teach effectively and efficiently (Blumenfeld & Anderson, 1996). Recommendations to university instructors on how to teach seem based more on stories and promising ideas than on conclusions drawn from rigorous research. Given the importance of improving university teaching, educators should respond to issues of practice with theory and rigorous data. To do so, they need to ask the following questions:

1. Is the instructional practice derived from a clearly formulated theory?
2. Does the theory behind the instruction specify the conditions necessary to structure cooperation into existing situations (in other words, have clear rules of correspondence)?
3. Is the theory confirmed and validated by rigorous research that has high generalizability?
4. Has the implementation of the practical procedures resulted in field research validating the effectiveness of the procedures in ways that guide the refinement and modification of the theory?

The power of cooperative learning lies in the interrelationship among social interdependence theory, its validating research, and the practical procedures for educators derived from the theory. This article begins with a definition of cooperative learning and then continues with a brief review of social interdependence theory (which focuses on cooperative, competitive, and individualistic efforts). Social interdependence theory illuminates the internal dynamics of cooperation so that they may be operationalized into a set of practical procedures that university instructors can actually use. Next, a meta-analysis of the research conducted at the university level is presented, revealing how the theory has been tested and validated. Finally, the instructional procedures of implementing cooperative learning are presented.

Definition of Cooperative Learning

Students' learning goals may be structured to promote cooperative, competitive, or individualistic efforts. In every classroom, instructional activities are aimed at accomplishing goals and are conducted under a goal structure. A *learning goal* is a desired future state of demonstrating competence or mastery in the subject area being studied (Johnson & Johnson, 1989, 1999). The *goal structure* specifies the ways in which students will interact with each other and the instructor during the instructional session. Each goal structure has its place (Johnson & Johnson, 1989, 1999). In the ideal classroom, all students would learn how to work cooperatively with others, compete for fun and enjoyment, and work autonomously on their own. The instructor decides which goal structure to implement within each lesson. The most important goal structure, and the one that should be used the majority of the time in learning situations, is cooperation.

Cooperation is working together to accomplish shared goals (Johnson & Johnson, 1989, 1999; Johnson, Johnson, & Smith, 2006). Within cooperative situations, individuals seek outcomes that are beneficial to themselves and beneficial to all other group members. *Cooperative learning* is the instructional use of small groups so that students work together to maximize their own and each other's learning. It may be contrasted with competitive learning (students work against each other to achieve an academic goal such as a grade of "A" that only one or a few students can attain) and individualistic learning (students work by themselves to accomplish learning goals unrelated to those of the other students) learning. In cooperative and individualistic learning, students' efforts are evaluated on a criteria-referenced basis, whereas in competitive learning, they are evaluated on a norm-referenced basis. While there are limitations

on when and where competitive and individualistic learning may be used appropriately, any learning task in any subject area with any curriculum may be structured cooperatively.

Theoretical Roots of Cooperative Learning: Social Interdependence Theory

The first question instructors need to ask is whether cooperative learning is based on a clearly formulated theory. The use of cooperative learning in university classes has its roots in the creation of social interdependence theory. Theorizing about social interdependence began in the early 1900s, when one of the founders of the Gestalt school of psychology, Kurt Koffka, proposed that groups were dynamic wholes in which the interdependence among members could vary. One of Koffka's colleagues, Kurt Lewin, refined his notions in the 1920s and 1930s while stating that (a) the essence of a group is the interdependence among members (created by common goals), which results in the group being a "dynamic whole" so that a change in the state of any member or subgroup changes the state of any other member or subgroup; and (b) an intrinsic state of tension within group members, which motivates them toward the accomplishment of the desired common goals. For interdependence to exist, there must be more than one person or entity involved, and the persons or entities must have impact on each other in that a change in the state of one causes a change in the state of the others. From the work of Lewin's students and colleagues, such as Ovisankian, Lissner, Mahler, and Lewis (Johnson & Johnson, 1989), it may be concluded that it is the drive for goal accomplishment that motivates cooperative and competitive behavior.

In the late 1940s, one of Lewin's graduate students, Morton Deutsch, extended Lewin's reasoning about social interdependence and formulated a theory of cooperation and competition (Deutsch, 1949, 1962). Deutsch conceptualized three types of social interdependence (see Figure 1):

1. *Positive interdependence* (cooperation) exists when individuals' goal achievements are positively correlated; individuals perceive that they can reach their goals if and only if the others in the group also reach their goals.

2. *Negative interdependence* (competition) exists when individuals' goal achievements are negatively correlated; each individual perceives that when one person achieves his or her goal, all others with whom he or she is competitively linked fail to achieve their goals.

Figure 1
Overview of Social Interdependence Theory*

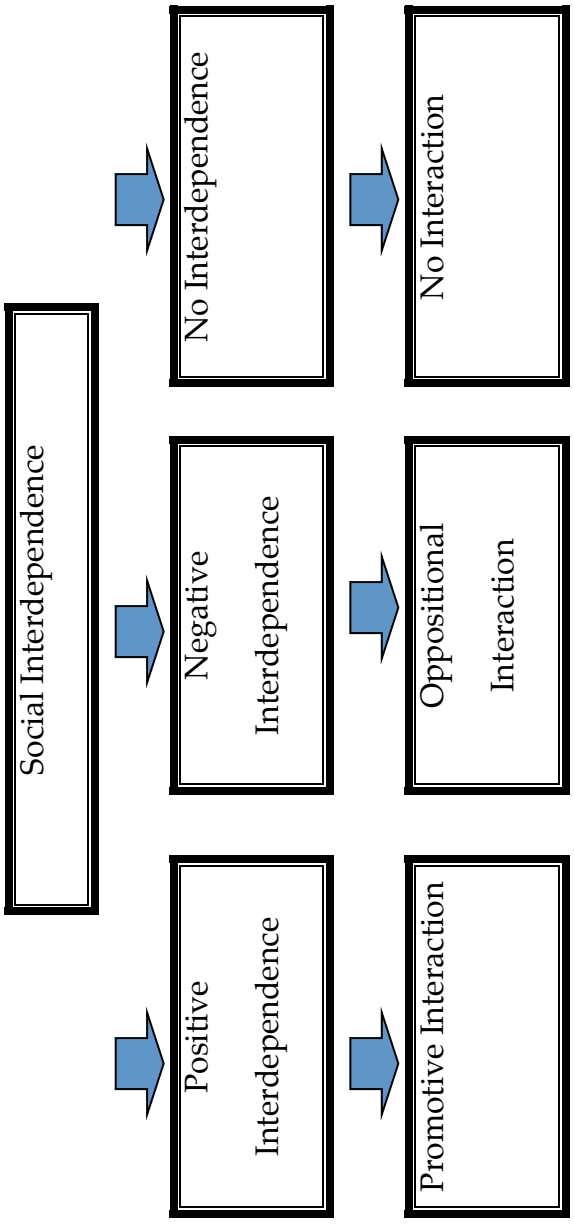
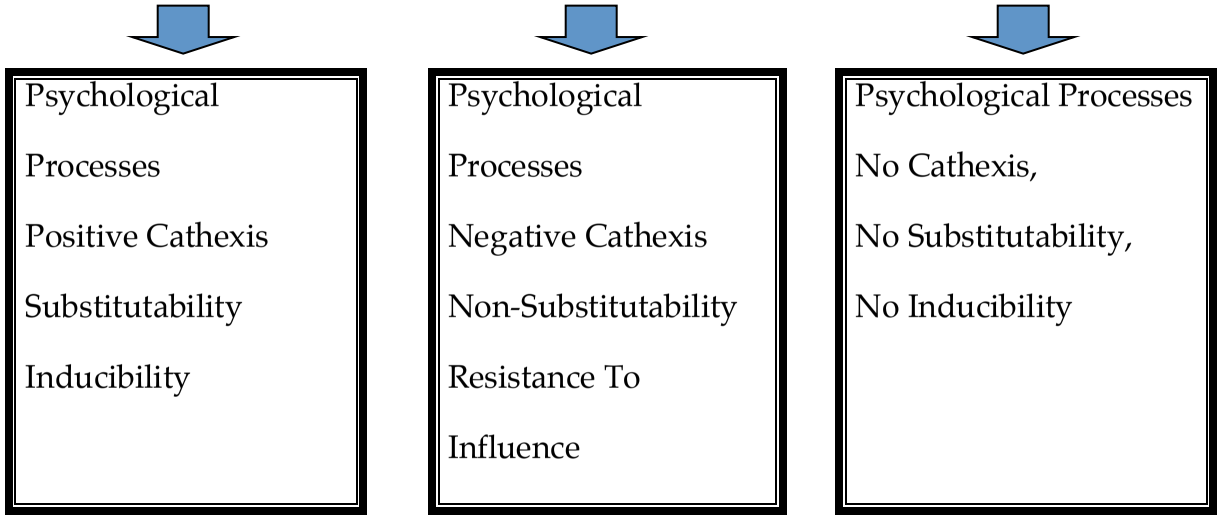
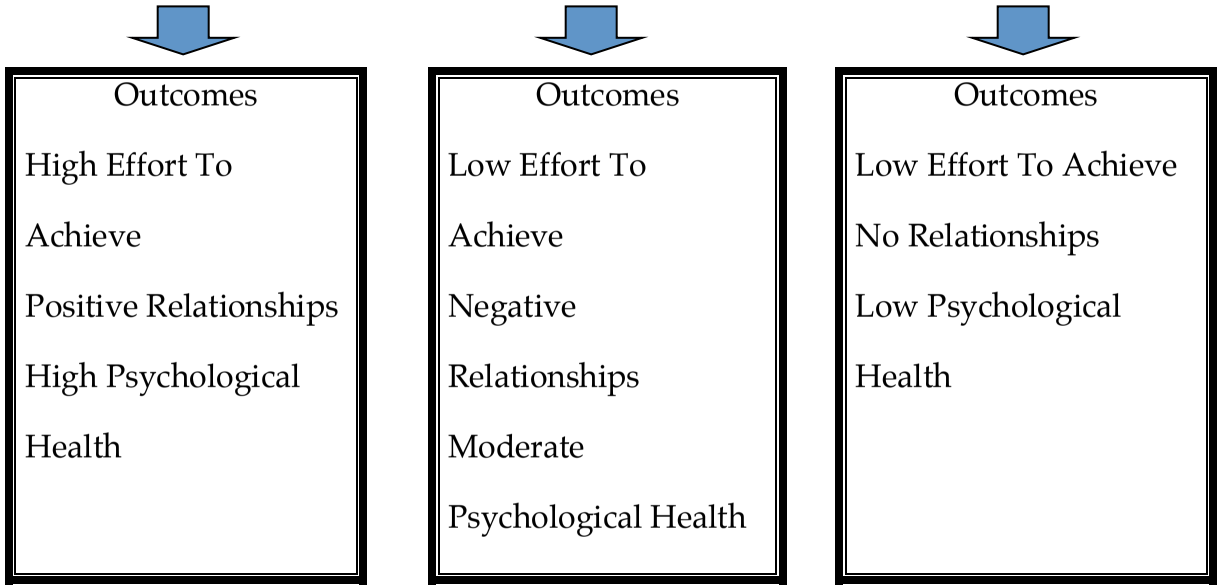


Figure 1 (*continued*)
Overview of Social Interdependence Theory*





Note. *Reprinted with permission from Johnson, D. W., Johnson, R. T., & Holubec, E. J. (2008). *Cooperation in the classroom* (8th ed.). Edina, MN: Interaction.

3. *No interdependence* occurs when a situation is structured individualistically, so that there is no correlation among participants' goal attainments; each individual perceives that he or she can reach his or her goal regardless of whether other individuals attain or do not attain their goals.

The basic premise of social interdependence theory is that the type of interdependence structured in a situation determines how individuals interact with each other, and this, in turn, largely determines outcomes (Deutsch, 1949, 1962; Johnson, 1970; Watson & Johnson, 1972). Positive interdependence tends to result in *promotive interaction*, where individuals promote each other's success; negative interdependence tends to result in oppositional or *contrient interaction*, where individuals block or obstruct each other's efforts to succeed; and no interdependence results in an absence of interaction. Depending on whether individuals promote or obstruct each other's goal accomplishments, there is *substitutability* (that is, the degree to which actions of one person substitute for the actions of another person), *cathexis* (that is, an investment of psychological energy in objects outside of oneself, such as friends, family, and work), and *inducibility* (that is, the openness to being influenced and to influencing others) (Deutsch, 1949).

In cooperative situations, collaborators' actions tend to substitute for each other, collaborators invest positive emotions in each other, and collaborators are open to being influenced by each other. In competitive situations, competitors' actions do not substitute for each other, competitors invest negative emotions in each other, and competitors are closed to being influenced by each other. In individualistic situations, there is no substitutability, cathexis, or inducibility. The relationship between the type of social interdependence and the interaction pattern it elicits is assumed to be bidirectional (Deutsch, 1962). Each may cause the other. Positive interdependence, for example, tends to result in collaborators engaging in promotive interaction (that is, helping, sharing, encouraging each other), but patterns of promotive interaction tend to result in cooperation. Social interdependence theory has served as a major conceptual structure for this area of inquiry since 1949. It has generated hundreds of research studies.

The Internal Dynamics That Make Cooperation Work

The second question instructors need to ask is whether social interdependence theory can generate the identification of the conditions necessary for structuring cooperation in actual situations. Not all group efforts are

cooperative. Simply assigning students to groups and telling them to work together does not in and of itself result in cooperative efforts. There are many ways in which group efforts may go wrong. Seating students together can result in competition at close quarters (pseudo-groups) or individualistic efforts with discussion (traditional learning groups). Whenever two individuals interact, however, the potential for cooperation exists. Cooperation, though, will develop only under a certain set of conditions. These conditions, which are identified by social interdependence theory, are positive interdependence, individual accountability, promotive interaction, social skills, and group processing (Johnson & Johnson, 1989, 2005).

The essential heart of cooperative efforts is *positive interdependence*, the perception that one is linked with others in a way that one's success is not possible unless others succeed (and vice versa) and that group members' work benefits one's and one's work benefits them (Johnson & Johnson, 1992). There are three major categories of interdependence: *outcome interdependence, means interdependence,* and *boundary interdependence* (Johnson & Johnson, 1989, 1992). When persons are in a cooperative or competitive situation, they are oriented toward a desired outcome, end state, goal, or reward. If there is no outcome interdependence (goal and reward interdependence), there is no cooperation or competition. In addition, the means through which the mutual goals or rewards are to be accomplish specify the actions required on the part of group members. Means interdependence includes resource, role, and task interdependence (which are overlapping and not independent from each other). Finally, the boundaries existing among individuals and groups can define who is interdependent with whom. Boundary interdependence consists of abrupt discontinuities that separate and segregate groups from each other, as well as unify the members of any one group.

Discontinuity may be created by environmental factors (different parts of the room or different rooms), similarity (all seated together or wearing the same color shirt), proximity (seated together), past history together, expectations of being grouped together, and differentiation from other competing groups. Boundary interdependence, thus, includes outside enemy interdependence (negative interdependence with another group), identity interdependence (which binds group members together as an entity), and environmental interdependence (such as a specific work area). These are overlapping and not independent from each other.

The second essential element of cooperative efforts is individual accountability, which exists when the performance of each individual student is assessed, and the results are given back to the group and the individual (Johnson & Johnson, 1989). Each group member has a personal

responsibility for completing one's share of the work and facilitating the work of other group members. Group members also need to know (a) who needs more assistance, support, and encouragement in completing the assignment and (b) that they cannot "hitch-hike" on the work of others. The purpose of cooperative learning is to make each member a stronger individual in his or her right. Students learn together so that they can subsequently perform higher as individuals. To ensure that each member is strengthened, students are held individually accountable to complete assignments, learn what is being taught, and help other group members do the same. Individual accountability may be structured by (a) giving an individual test to each student, (b) having each student explain what he or she has learned to a classmate, or (b) observing each group and documenting the contributions of each member.

The third essential element of cooperative efforts is *promotive interaction* (Johnson & Johnson, 1989). Students promote each other's success by helping, assisting, supporting, encouraging, and praising each other's efforts to learn. Doing so results in such cognitive processes as orally explaining how to solve problems, discussing the nature of the concepts being learned, teaching one's knowledge to classmates, challenging each other's reasoning and conclusions, and connecting present with past learning. It also results in such interpersonal processes as modeling appropriate use of social skills, supporting and encouraging efforts to learn, and participating in joint celebrations of success.

The fourth essential element of cooperative efforts is the appropriate use of social skills (Johnson & Johnson, 1989). Contributing to the success of a cooperative effort requires interpersonal and small group skills. Leadership, decision-making, trust-building, communication, and conflict-management skills have to be taught just as purposefully and precisely as academic skills. Procedures and strategies for teaching students social skills may be found in Johnson (2014), Johnson and Johnson (2013), and Johnson and Johnson (1997).

The fifth essential element of cooperative efforts is group processing, the examination of the process members are using to maximize their own and each other's learning so that ways to improve the process may be identified (Johnson & Johnson, 1989). Instructors need to focus students on the continuous improvement of the quality of the processes students are using to learn by asking group members to (a) describe what member actions are helpful and unhelpful in ensuring that all group members are achieving and effective working relationships are being maintained and (b) make decisions about what behaviors to continue or change. Group processing may result in (a) streamlining the learning process to make

it simpler (reducing complexity), (b) eliminating unskilled and inappropriate actions (error-proofing the process), (c) improving continuously students' skills in working as part of a team, and (d) celebrating hard work and success.

Understanding how to implement the five essential elements enables instructors to (a) structure any lesson in any subject area with any set of curriculum materials cooperatively; (b) fine-tune and adapt cooperative learning to their specific circumstances, needs, and students; and (c) intervene to improve the effectiveness of any group that is malfunctioning.

Validating Research: Meta-Analysis

Early History

The third question instructors need to ask is whether there has been rigorous research with high generalizability to test and confirm social interdependence theory. The investigation of the relative impact of competitive, individualistic, and cooperative efforts is the perhaps the longest standing research tradition in social psychology. It began with research studies in the late 1800s by Turner in England and Triplett in the United States and in the early 1900s by Mayer (1903) in Germany and Ringelmann (1913) in France. In the 1920s and 1930s, there were at least two major reviews of the research on cooperation and competition (Maller, 1929; May & Doob, 1937). The current focus on the use of cooperative learning in university classrooms, however, has its roots primarily in (a) Deutsch's (1949) theory development, review of research, and research study demonstrating the power of cooperation learning in a psychology class at MIT and (b) our extensions of the theory and research and our development of practical procedures (Johnson, 1970, 2003; Johnson & Johnson, 1974, 1989, 1999, 2005, 2009; Johnson et al., 2006). Before 1970, almost all of the research studies on cooperation and competition were conducted in university classrooms and in research laboratories using university students as participants. Subsequently, the research been conducted in a variety of other settings, such as pre-university education and business and industry. While the entire literature has been summarized in the past (Johnson & Johnson, 1989, 1999, 2005, 2009), a comprehensive review of only the studies conducted in universities has been done infrequently.

Meta-Analysis of University Studies

Since the 1960s, over 305 studies have been conducted comparing the relative efficacy of cooperative, competitive, and individualistic learning

on individual achievement in university and adult settings (Johnson et al., 2006). Given the number of relevant studies, meta-analysis seems to be the most appropriate procedure for summarizing the results.

Characteristics of Studies

Most of the comparative research studies were conducted in the 1960s, 1970s, and 1980s (see Table 1). Sixty-one percent of these studies randomly assigned subjects or groups to conditions, and 81% were published in journals. Eighty percent of the studies were of nine class sessions or less. The studies were conducted in numerous subject areas (science, social science, computer science, English, reading, math, psychology, health, physical education) with a wide variety of tasks (verbal, mathematical, procedural). While most of the studies were conducted in North America, studies were also conducted in Europe, the Middle East, and Asia. Different research methodologies were used. While numerous dependent variables were studied, they may be grouped into three categories: effort to achieve, quality of relationships, and psychological health (see Figure 2). In addition, there are a number of studies on attitudes toward the university experience.

Academic Success

One of the most important influences on the university experience is whether students achieve academically. University attrition is affected in numerous ways by academic success (Tinto, 1993). Some students are dismissed from the university due to academic failure. Academic failure may create uncertainty about the relevance of the university and its curricula. Academic achievement may increase students' intellectual adjustment and sense of membership in the university as well as their integration into academic life. The higher the achievement of students, the more committed they tend to be to completing a degree. Academic success may also mean greater eligibility for financial aid. For these and many other reasons, it is important to use the instructional methods that maximize student achievement.

Over 168 studies have been conducted comparing the relative efficacy of cooperative, competitive, and individualistic learning on the achievement of individuals 18 years or older. The results of these studies indicated that cooperative learning promoted higher individual achievement than did competitive (effect size = 0.49) or individualistic (effect size = 0.53) learning (see Table 2). These are significant and sub-

Table 1
Characteristics of University Studies

Characteristic	*Number*	*Percentage*
Decade		
1910-19	1	0.3
1920-29	5	1.6
1930-39	5	1.6
1940-49	2	0.6
1950-59	17	5.4
1960-69	61	19.6
1970-79	63	20.2
1980-89	94	30.1
1990-99	56	17.9
2000-09	8	2.6
Assignment		
Random by Individual	150	48.1
Random by Group	41	13.2
Nonrandom	121	38.8
Mode of Publication	**?**	**?**
Journal Article	253	81.1
Book	2	0.6
Masters Thesis	3	1.0
Ph.D. Dissertation	27	8.7
Technical Report	17	5.4
Unpublished	10	3.2

Table 1 (*continued*)
Characteristics of University Studies

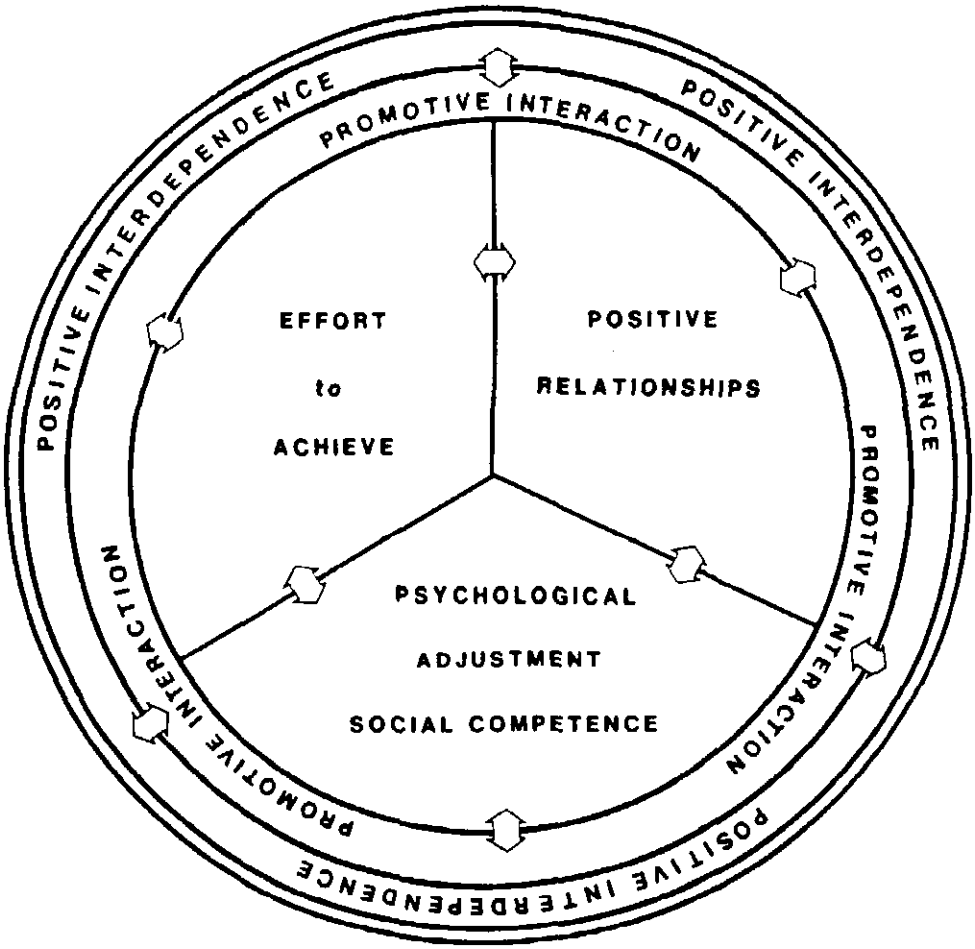
Characteristic	*Number*	*Percentage*
Duration		
1-9	249	79.8
10-19	15	4.8
20-29	13	4.2
30-39	10	3.2
40-49	14	4.5
50-99	11	3.4
Total	312	100

Note. *Reprinted with permission from Johnson, D. W., Johnson, R. T., & Smith, K. (2006). *Cooperation in the college classroom* (4th ed.). Edina, MN: Interaction.

stantial increases in achievement. The achievement measures included knowledge acquisition, retention, accuracy and creativity of problem solving, and higher-level reasoning. These results held for verbal tasks (such as reading, writing, and orally presenting), mathematical tasks, and procedural tasks (such as swimming, golf, and tennis). There are also studies finding an advantage for cooperative learning in promoting metacognitive thought, willingness to take on difficult tasks and persist (despite difficulties) in working toward goal accomplishment, intrinsic motivation, transfer of learning from one situation to another, and greater time on task (Johnson & Johnson, 1989). These results are corroborated in a meta-analysis focusing only on university level one science, math, engineering, and technology courses (Springer, Stanne, & Donovan, 1999).

These results have important implications for the findings on university effectiveness (Astin, 1993; McKeachie, Pintrich, Yi-Guang, & Smith, 1986; Pascarella, 2001; Tinto, 1993). Cooperative learning increases dramatically students' involvement and engagement in learning. Pascarella and Terenzini (2005) note that the greater a student's involvement or engagement in academic work or in the academic experience of college, the greater his or her level of knowledge acquisition and general cognitive development. Kuh and his associates (2005, 2007) conclude that cooperative learning

Figure 2
Outcomes of Cooperative Learning*



Note. *Reprinted with permission from Johnson, D. W., Johnson, R. (1989). *Cooperation and Competition: theory and research*. Edina, MN: Interaction.

encourages student engagement and invariably leads to better student learning outcomes regardless of academic discipline. Astin (1993) found that student-student and student-faculty interaction were the two major

Table 2
Mean Weighted Effect Sizes for Impact of Social Interdependence on Dependent Variables*

Variable	*Cooperation vs. Competition*	*Cooperation vs. Individualistic*
Achievement	0.54	0.51
Interpersonal Attraction	0.68	0.55
Social Support	0.60	0.51
Self-Esteem	0.47	0.29
Positive Attitudes	0.37	0.42

Note. *Reprinted with permission from Johnson, D. W., Johnson, R. T., & Smith, K. (2006). *Cooperation in the college classroom* (4th ed.). Edina, MN: Interaction.

influences on university effectiveness (academic development, personal development, and satisfaction with the university experience). He notes that this interaction must be cooperative, not competitive. McKeachie and his associates (1986) found that learning how to engage in critical thinking depends on student participation in class, instructor encouragement, and student-student interaction, all of which occur in cooperative, not competitive or individualistic, learning situations. Pascarella (2001) found in a three-year national (U.S.) longitudinal study of the influences on undergraduate student learning that a student's peer group and interaction with peers strongly affects cognitive growth.

Finally, the higher achievement resulting from cooperative efforts influences the eight causes (discussed in this paragraph) for students leaving university before they graduate (Tinto, 1993). The higher achievement promoted by cooperative learning may be hypothesized to decrease the number of students dismissed from the university due to academic failure, and their resulting academic success may decrease the uncertainty students may feel about the relevance of their university experience. When students achieve, increases may be expected in the quality of their sense of intellectual membership, intellectual adjustment, integration into academic life, commitment to completing their studies, and perception of the relevance of the curricula to their needs. Finally, higher achievement may mean greater eligibility for financial aid, which may reduce their financial cost for university study.

Quality of Relationships

The quality of university life may largely depend on the quality of the relationships among students and between students and faculty (Astin, 1993; McKeachie et al., 1986; Pascarella, 2001; Tinto, 1993). Positive interpersonal relationships may increase the quality of students' social adjustment to university life, increase the importance of social goals for students' continued attendance, reduce their uncertainty about attending the university, increase their commitment to stay, increase their integration into university life, reduce incongruences between students' interests and university curricula, and increase students' social membership in the university (Tinto, 1993).

The results of the meta-analysis indicate that cooperative efforts promoted greater interpersonal attraction among students than did competing with others (effect size = 0.68) or working individualistically on one's own (effect size = 0.55), even among university students from different ethnic, cultural, language, social class, ability, and gender groups (see Table 2). These studies included measures of interpersonal attraction, *esprit-de-corps*, cohesiveness, and trust. In addition, university students learning cooperatively perceived more social support (both academically and personally) from peers and instructors than did students working competitively (effect size = 0.60) or individualistically (effect size = 0.51).

The positive interpersonal relationships promoted by cooperative learning are the heart of the university learning community.

Psychological Adjustment

Attending a university can require considerable personal adjustments for many students. In our meta-analysis of the research, we found cooperativeness to be highly correlated with a wide variety of indices of psychological health in a wide variety of university age populations (Johnson & Johnson, 1989). Competitiveness was related to a complex mixture of indices of health and pathology; individualistic attitudes were related to a wide variety of indices of psychological pathology. One important aspect of psychological health is self-esteem. University-level studies indicate that cooperation tends to promote higher self-esteem than competitive (effect size = 0.47) or individualistic (effect size = 0.29) efforts. Members of cooperative groups also become more socially skilled than do students working competitively or individualistically.

The psychological health promoted by cooperative learning has multiple effects on the university experience. First, it increases the ability of students to initiate, form, and maintain meaningful interpersonal rela-

tionships (Tinto, 1993). In addition, psychological health may increase students' academic self-concept and self-efficacy, quality of psychological adjustment to university life, ability to formulate and achieve meaningful goals including career goals, ability to deal with uncertainty, ability to commit to goals that require a university education, integration into the university community, a better understanding of one's interests and needs and the possible relevance of the university curricula, and the ability to find ways that personal goals may be met within current situations (Tinto, 1993).

Positive Attitudes Toward the University Experience

The more positive students' attitudes toward their university experience, the more likely they are to stay at the university and participate fully in university life. Thirty-nine studies have focused on students' attitudes. Cooperative learning tends to promote more positive attitudes toward learning, the subject area, and the university than do competitive (effect size = 0.37) or individualistic (effect size = 0.42) learning (see Table 2). Furthermore, there are numerous social psychological theories predicting that students' values, attitudes, and behavioral patterns are most effectively developed and changed in cooperative groups (Johnson & Johnson, 2013). It is in cooperative group discussions that students learn the norms of university life, publicly commit themselves to adopt prosocial attitudes and behavior, are exposed to visible and credible social models, and advocate attitudes and behaviors to others. Cooperative groups are perhaps the most effective tool universities have for inculcating constructive and positive attitudes in students.

Reciprocal Relationships Among Outcomes

The outcomes resulting from cooperative efforts tend to be reciprocally related (Johnson & Johnson, 1989). The more effort students expend in working together to achieve, the more they tend to like each other. The more they like each other, the harder they tend to work to learn. The more individuals work together to learn, the more socially competent they become, the higher their self-esteem, and the greater their psychological health. The healthier individuals are psychologically, the more effectively they tend to work together to achieve. The more caring and committed relationships individuals are involved in, the healthier they will tend to be psychologically; the healthier individuals are psychologically, the more able they are to form caring and committed relationships. These multiple

outcomes form a gestalt that is central to a high-quality university experience and to creating a university learning community.

The Research Is Even More Impressive Than It Looks

The research on cooperative learning is like a diamond. The more light is focused on it, the brighter and more multi-faceted it becomes. The power of cooperative learning is clearly illuminated by the magnitude of the effect sizes, but the more we read the research and the more closely we examine the studies, the better cooperative learning looks. What follows are some of the reasons.

First, the research studies are a combination of theoretical and demonstration studies conducted in labs, classrooms, and universities as a whole. While the lab studies may have lasted for only one session, some of the demonstration studies lasted for the entire semester or academic year. Demonstration studies are usually (a) summative evaluations demonstrating that cooperative learning produces beneficial results or (b) comparative summative evaluations demonstrating that one cooperative learning procedure works better than others. The combination of scientific and demonstration studies strengthens the confidence university instructors can have in the effectiveness of cooperative learning procedures.

Second, the research on cooperative learning has a validity and a generalizability rarely found in the educational literature. It has been conducted over 11 decades by numerous researchers with markedly different orientations working in different universities and countries. Research participants have varied as to economic class, age, sex, nationality, and cultural background. The researchers have used a wide variety of tasks, subject areas, ways of structuring cooperative learning, and ways of measuring dependent variables. Vastly different methodologies have been used. The combination of the amount and diversity of the research is almost unparalleled.

Finally, cooperative learning is a very cost-effective instructional procedure. It affects many different instructional outcomes simultaneously.

Implementation of Cooperative Learning

The fourth question instructors need to ask is whether the implementation of the practical procedures resulted in field research validating the effectiveness of the procedures in ways that reveal inadequacies in the theory and guide the refinement and modification of the theory (see Johnson, 2003; Johnson and Johnson, 2005, 2009; Johnson, Johnson, and Holubec,

2008; Johnson et al., 2008). In the cycle of theory-research-practice, it is necessary to operationalize the theory into a set of practical procedures that university instructors may actually use. Actually, professors have been using cooperative learning throughout history. For thousands of years, it has been understood that in order to understand the Talmud, one must have a learning partner. Socrates taught students in small groups, engaging them in dialogues in his famous "art of discourse." As early as the first century, Quintilian argued that students could benefit from teaching one another, and the philosopher Seneca advocated cooperative learning through such statements as "*Qui Docet Discet*" ("When you teach, you learn twice."). Johann Amos Comenius (1592-1679) believed that students would benefit both by teaching and being taught by other students. Throughout history, then, cooperative learning has been used. What is new is the systematic development of cooperative instructional procedures based on theory validated by research. It is only recently that the procedures for using cooperative learning have been derived from social interdependence theory and its validating research.

Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning (Johnson et al., 2008). Within cooperative learning groups, students discuss the material to be learned, help and assist each other to understand it, and encourage each other to work hard. Any assignment in any curriculum for any student can be done cooperatively. There are basically three ways in which cooperative learning may be structured in the university classroom (Johnson et al., 2008). Instructors may use formal cooperative learning, informal cooperative learning, and cooperative base groups.

Formal Cooperative Learning

Formal cooperative learning consists of students working together, for one class period to several weeks, to achieve shared learning goals and complete jointly specific tasks and assignments (such as decision making or problem solving, completing a curriculum unit, writing a report, conducting a survey or experiment, reading a chapter or reference book, learning vocabulary, or answering questions at the end of the chapter) (Johnson et al., 2008). Any course requirement or assignment may be structured cooperatively. In formal cooperative learning groups, instructors do the following:

1. **Make a number of pre-instructional decisions.** Instructors specify the objectives for the lesson (both academic and social skills) and decide on the size of groups, the

method of assigning students to groups, the roles students will be assigned, the materials needed to conduct the lesson, and the way the room will be arranged.

2. **Explain the task and the positive interdependence.** Instructors clearly define the assignment, teach the required concepts and strategies, specify the positive interdependence and individual accountability, give the criteria for success, and explain the expected social skills to be used.

3. **Monitor students' learning and intervene within the groups to provide task assistance or to increase students' interpersonal and group skills.** Instructors systematically observe and collect data on each group as it works. When needed, instructors intervene to assist students in completing the task accurately and in working together effectively.

4. **Assess students' learning and helping students process how well their groups functioned.** Instructors carefully assess and evaluate students' learning performance. Members of the learning groups then discuss how effectively they worked together and how they can improve in the future.

Informal Cooperative Learning

Informal cooperative learning consists of having students work together to achieve a joint learning goal in temporary, ad-hoc groups that last from a few minutes to one class period (Johnson et al., 2008). During a lecture, demonstration, or film, informal cooperative learning can be used to focus students' attention on the material to be learned, set a mood conducive to learning, help set expectations as to what will be covered in a class session, ensure that students cognitively process and rehearse the material being taught, summarize what was learned and pre-cue the next session, and provide closure to an instructional session. During direct teaching, the instructional challenge for the instructor is to ensure that students do the intellectual work of organizing material, explaining it, summarizing it, and integrating it into existing conceptual structures. Informal cooperative learning groups are often organized so that students engage in three-to-five-minute focused discussions before and after a lecture

and two-to-three-minute turn-to-your-partner discussions interspersed throughout a lecture.

Cooperative Base Groups

Cooperative base groups are long-term, heterogeneous cooperative learning groups with stable membership (Johnson et al., 2008). Base groups give the support, help, encouragement, and assistance each member needs to make academic progress (attend class, complete all assignments, learn) and develop cognitively and socially in healthy ways. Base groups are permanent (lasting from one to several years) and provide the long-term, caring peer relationships necessary to influence members consistently to work hard in school. The use of base groups tends to improve attendance, personalize the work required and the school experience, and improve the quality and quantity of learning. Positive development is enhanced when base groups are given responsibility—for example, the responsibility for conducting a year-long service project to improve the school.

The three types of cooperative learning complement and support each other. A typical 90-minute class session, for example, begins with a base group meeting of 5-10 minutes in which members welcome each other and check each member's homework to ensure it is completed and understood. Second, the instructor gives a short lecture with informal cooperative learning to introduce the objectives, schedule and topic of the class session. Third, the instructor uses formal cooperative learning to conduct an instructional activity focused on the topic of the session. Fourth, near the end of the class, the instructor summarizes (using informal cooperative learning) what has taken place, notes interesting ideas that were generated by the formal cooperative groups, and explains how the lesson leads into the assignment for the next class session. Fifth, the class session ends with a base group meeting, in which students review what they have learned, what homework has been assigned, and what help each member needs to complete the homework.

What Makes Universities Successful

There is more to university life than attending classes. For many students, attending a university is the first time they have lived away from home. They leave their family, friends, and acquaintances to create a new life among strangers and become members of a new community. The experience is a success, for the student and for the institution, if the student completes a degree within three to five years and views his or

her university experience fondly and positively. Correspondingly, the experience is a failure for the student and the institution if the student leaves the university before graduation or remembers his or her university experience with bitterness or indifference. Tinto (1993) identified eight causes for leaving the university before graduating: low academic performance, poor adjustment to university life, uncertainty about personal goals, lack of commitment to completing a degree, financial hardship, lack of academic and social integration into university life, incongruence between university curricula and students' interests, and social and intellectual isolation (see Table 3).

It is reasonable to predict that the more frequently cooperative learning is used in the university, the more successful the university will be. The academic achievement promoted by cooperative learning may increase students' academic success (thus reducing failure), enhance intellectual adjustment and intellectual integration into the university, help students set academic goals and enlarge the possibilities of what they may accomplish academically, increase academic commitment, increase chances for financial aid, and increase congruence between intellectual interests and the university's curricula. The positive interpersonal relationships fostered by cooperative experiences may increase students' desire and ability to learn and achieve, to adjust to new relationships and become socially integrated into campus life, to set social goals, to reduce uncertainty about these goals, to increase commitment to other students, and to increase the sense of congruence between attending the university and relationship goals. The increased psychological health promoted by cooperative experiences may increase students' academic self-esteem, self-efficacy, and psychological adjustment; increase their ability to clarify personal goals, cope with uncertainty, maintain constructive relationships with diverse schoolmates, form coalitions to achieve goals, and ability to adapt personal goals to current situations.

Building a Learning Community

Retaining students depends primarily on integrating them into the social and academic university community and helping them acquire the skills and knowledge needed to become successful learners (Tinto, 1997). In addition, in programs such as engineering, medicine, and many others, students are expected to be socialized into a community of practice (Lave & Wenger, 1991). In addition, many universities try to create learning communities through learning clusters and linked courses. By definition, a community rests on a foundation of cooperation. A *community* is a lim-

Table 3
Outcomes of Cooperative Learning and Factors Influencing Continued Attendance

Factors (Tinto, 1993)	*Achievement*	*Interpersonal Relationships*	*Psychological Health*
Academic Failure	Academic Success	Social Pressure to Achieve	Self-Concept, Self-Efficacy
Adjustment	Intellectual Adjustment	Social Adjustment	Psychological Adjustment
Relevance of University to Goals	Academic Goal Setting	Social Goal Setting	Setting & Achieving Meaningful Goals
Uncertainty About Life Goals	Academic Success Creates Possibilities	Friends Create Possibilities	Ability to Deal With Uncertainty
Commitment to University Education	Academic Commitment	Social Commitment to Be With Friends	Ability to Commit to Goals

Finances	Increases Eligibility for Financial Aid		
Integration Into University Life	Intellectual Integration	Social Integration	Develop & Maintain Relationships
University Life & Needs Incongruent	Intellectual Interests & Curricula Congruent	Relationship Goals & Attending University Congruent	Ability to Adapt Personal Goals to Current Situations
Academic & Social Isolation	Intellectual Integration	Social Integration	Form Coalitions to Achieve Goals

Note. *Reprinted with permission from Johnson, D. W., Johnson, R. T., & Smith, K. (2006). *Cooperation in the college classroom* (4th ed.). Edina, MN: Interaction.

ited number of people who share common goals and a common culture (Johnson & Johnson, 2008). For a community to exist and sustain itself, members must share common goals and values that define appropriate behavior and increase the quality of life within the community. Within a community, everyone should know everyone else and realize that relationships are long-term (as opposed to temporary, brief encounters). Creating a learning community requires emphasizing the overall positive interdependence among members. Faculty, administrators, staff, and students should believe that they are striving to achieve mutual goals, such as delivering quality education, preparing for careers, promoting the intellectual and social development of students, increasing knowledge, applying knowledge to solve social problems, and searching for truth. Such goals tend to be accomplished only through cooperative efforts.

Once the overall cooperative structure of the university is established, there is a need to make the epistemology and the pedagogy used congruent. For most universities and for most students, the primary contact among students and between students and faculty occurs in the classroom. Any attempt to create an academic and social community, thus, begins in the classroom. If students do not engage with each other and with the faculty in the classroom, they tend not to engage elsewhere. The epistemology resulting from (a) creating a competitive environment in which students are ranked from highest to lowest performer and (b) making students passive recipients of instruction (such as lectures) mitigates against the formation of a learning community. Developing a learning community requires an epistemology based on cooperation, that is, the use of formal and informal cooperative learning and cooperative base groups.

Cooperative Learning as a Foundation for Other Forms of Active Learning

It should be noted that there are numerous types of active learning, but each one assumes that students understand how to operate within a cooperative group. Cooperative learning underlies all successful use of the types of active learning, such as problem-based learning, case-based learning, project-based learning, learning by design, inquiry learning, anchored instruction, team-based learning, and collaborative learning (Johnson et al., 2006). With each of the procedures for making learning active, however, there is a change in the instructor's role. The instructor becomes a designer, an engineer, of learning experiences, not just a presenter of information. Three of these active learning procedures are discussed in more detail next.

Problem-Based Learning

Problem-based learning (PBL) may be defined as giving students a problem to understand and solve with the goal of having them learn relevant information and procedures (Allen & Duch, 1998; Barrows & Tamblyn, 1980; Smith, Sheppard, Johnson, & Johnson, 2005). Solving the problem correctly is less important than participating in the process of gathering and learning the information and procedures relevant to solving the problems. PBL was developed for small groups of students to work together to ensure that the relevant information and procedures are discovered and mastered by all members of the group. It is inherently a cooperative enterprise where the instructor is a facilitator or guide (not a lecturer). Obviously, if the groups are structured competitively or individualistically, the resulting learning would be significantly reduced. PBL groups need to be structured cooperatively, thus making cooperative learning the foundation on which problem-based learning is built. When this connection between cooperative learning and problem-based learning is explicit, it is known as cooperative problem-based learning or problem-based cooperative learning. The influence of cooperative learning on engineering education is summarized in Smith's (2011) refection on 30 years of championing this research-based practice.

Team-Based Learning

Team-based learning (TBL) is an instructional strategy using learning teams to enhance the quality of student learning (Michaelsen, Watson, Cragin, & Fink, 1982). The instructor assigns students with diverse skill sets and backgrounds to permanent groups of five to seven members. Students are individually accountable for homework assignments and for contributing to team efforts in class. Significant credit is given for in-class team activities and application exercises. These in-class activities are aimed at promoting both academic learning and team development and are structured to give students frequent and timely feedback on their efforts. Obviously, the teams in TBL have to be structured cooperatively. Competitive and individualistic goal structures will serious damage the productivity of learning teams. Team-based learning is, in effect, another form of cooperative learning.

Collaborative Learning

Collaborative learning has its roots in the work of Britton and others in England in the 1970s (Britton, 1990). Based on the theorizing of Vygotsky

(1978), Britton notes that just as the individual mind is derived from society, a student's learning is derived from the community of learners. This community is developed by the students. Britton is quite critical of educators who provide specific definitions of the teacher's and students' roles. He recommends placing students in groups and letting them generate their own culture, community, and procedures for learning. Britton believed in *natural learning* (learning something by making intuitive responses to whatever efforts produce) rather than *training* (the application of explanations, instructions, or recipes for action). The source of learning in collaborative learning is interpersonal; learning is derived from dialogues and interactions with other students and sometimes the teacher.

Britton viewed the structure imposed by teachers as manipulation that leads to training, not learning; therefore, he felt teachers should assign students to groups, provide no guidelines or instructions, and stay out of their way until the class is over. As an educational procedure, therefore, collaborative learning has historically been much less structured and more student directed than cooperative learning, with only vague directions given to teachers about its use. Cooperative and collaborative learning both stress the centrality of interdependence; however, the vagueness in the role of the teacher and students results in a vagueness of definition of the nature of collaborative learning.

While Britton was committed to the unstructured nature of group learning, cooperative learning provides a clear conceptual structure and a set of clear procedures for instructors who wish more direction. Cooperative learning could, thus, be a foundation on which collaborative learning could be made more specific.

Peer-Assisted Learning

Recently, *peer-assisted learning* (PAL) has been adopted by university instructors in the U.S. PAL may be defined as students acquiring knowledge and skills through active helping among equal classmates (Topping & Ehly, (1998). It subsumes *reciprocal peer tutoring*, which involves same-age student pairs of comparable ability whose responsibility is to keep each other engaged in constructive academic activity (Fantuzzo & Ginsburg-Block, 1998). PAL is different from traditional peer tutoring, which tends to involve students of different ages or different achievement levels. Clearly, PAL is based on cooperation, as assistance and encouragement tends not to take place in competitive interaction.

Summary

What differentiates cooperative learning from these other group-based instructional methods is that it is tied directly to social-psychological theory and the research conducted to validate or disconfirm the theory. It is the interrelationship between theory, research, and practice that sets cooperative learning apart. It is this relationship that makes cooperative learning the foundation on which other forms of small-group instruction are based.

Conclusions

There have been many attempts to change university teaching, some successful, many unsuccessful. One of major change in university teaching occurred in Scotland in 1729, when "the never to be forgotten" (according to Adam Smith) Francis Hutcheson started lecturing in Scottish rather than in Latin. While considered a scandal, eventually all other professors in the Western World started lecturing in the language of their students rather than in Latin. One explanation for the resistance of teaching to change is that instructors fail to apply the same scientific rigor to their teaching as they do to their research. Professors as scientists and intellectuals typically ask for proof when a colleague presents a scientific conclusion, yet when it comes to what constitutes good teaching, professors often accept uncontested folklore and mythology. Many of the recommendations made about teaching, furthermore, are based more on stories and promising ideas than on theory and conclusions from rigorous research. What is lacking is the successful application of theory and research to instructional methods.

This article presents cooperative learning as one example of an instructional practice based on theory validated by research that has been operationalized into instructional procedures. First, there is a rich theoretical base for cooperative learning in social interdependence theory. The theoretical base allows cooperative learning to be defined, refined, and continuously improved. From social interdependence theory and its application to cooperative learning, the internal dynamics that make cooperation work have been identified. Faculty need to structure cooperative lessons so that students are positively interdependent, are individually accountable, promote each other's success, appropriately use social skills, and periodically process how they can improve the effectiveness of their efforts. Understanding these basic elements allows precise cooperative learning procedures to be engineered (that is, designed) and gives faculty a set of tools for intervening in ineffective learning groups. It is these es-

sential elements that differentiate cooperative learning from other groups, such as pseudo groups and traditional learning groups.

Second, there is considerable evidence (a) indicating that social interdependence theory, which underlies cooperative learning, is valid and (b) demonstrating that cooperative learning will work in university classes. Over 305 research studies have been conducted on cooperation at the university level. Cooperative learning is the instructional procedure of choice whenever faculty wish to maximize student learning, ensure that highly complex or difficult material is understood and mastered, and maximize long-term retention. In addition, cooperative learning creates positive interpersonal relationships characterized by personal and academic support and promotes greater psychological health and well-being (including self-esteem and social competencies). It also creates positive attitudes toward the university experience.

Third, social interdependence theory provides the basis on which to define cooperative learning and differentiate from other instructional methods, such as competitive and individualistic learning. It gives guidance for defining the instructor's role in using (together or separately) formal cooperative learning, informal cooperative learning, and cooperative base groups.

Fourth, the use of cooperative learning groups creates certain opportunities that do not exist when students work competitively or individually. In cooperative groups, students can engage in discussions in which they construct and extend conceptual understanding of what is being learned and develop shared mental models of complex phenomena. Group members can hold students accountable to learn, provide feedback on how well they are doing, and give support and encouragement for further attempts to learn. Students can observe the most outstanding group members as behavioral models to be emulated. It is through discussions in small groups that students acquire attitudes and values (such as the need for continuous improvement). Finally, it is within cooperative groups that students establish a shared identity as members of the university. These, and many other opportunities, are lacking when students learn competitively or individualistically.

References

Allen, D., & Duch, B. (1998). *Thinking toward solutions: Problem-based activities for general biology.* Fort Worth, TX: Saunders.

Astin, A. (1993). *What matters in college: Four critical years revisited*. San Francisco, CA: Jossey-Bass.

Barrows, H. S., & Tamblyn, R. N. (1980). *Problem-based learning: An approach to medical education.* New York, NY: Springer.

Blumenfeld, P., & Anderson, L. (Eds.). (1996). Teacher talk. Special issue of the Educational Psychologist: Instructor education and educational psychology. *Educational Psychologist, 31*, 1-4.

Britton, J. (1990). Research currents: Second thoughts on learning. In M. Brubacher, R. Payne, & K. Richett (Eds.), *Perspectives on small group learning: Theory and practice* (pp. 3-11). Oakville, Ontario: Rubicon.

Deutsch, M. (1949). A theory of cooperation and competition. *Human Relations, 2*, 129-152.

Deutsch, M. (1962). Cooperation and trust: Some theoretical notes. In M. R. Jones (Ed.), *Nebraska symposium on motivation* (pp. 275-319). Lincoln, NE: University of Nebraska Press.

Ewell, P. (2001). Questioning our assumptions. *Change, 33*(6), 4-5.

Fantuzzo, J., & Ginsburg-Block, M. (1998). Reciprocal peer tutoring: Developing and testing effective peer collaborations for elementary school students. In K. Topping & S. Ehly (Eds.), *Peer-assisted learning* (pp. 121-145). Mahwah, NJ: Erlbaum.

Johnson, D. W. (1970). *Social psychology of education*. New York, NY: Holt, Rinehart, & Winston.

Johnson, D. W. (2003). Social interdependence: The interrelationships among theory, research, and practice. *American Psychologist, 58*(11), 931-945.

Johnson, D. W. (2014). *Reaching out: Interpersonal effectiveness and self-actualization* (11th ed.). Boston, MA: Allyn & Bacon.

Johnson, D. W., & Johnson, F. (2013). *Joining together: Group theory and group skills* (11th ed.). Boston, MA: Allyn & Bacon.

Johnson, D. W., & Johnson, R. (1974). Instructional goal structure: Cooperative, competitive, or individualistic. *Review of Educational Research, 44*, 213-240.

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

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

Johnson, D. W., & Johnson, R. (1997). *Learning to lead teams: Developing leadership skills.* Edina, MN: Interaction.

Johnson, D. W., & Johnson, R. (1999). *Learning together and alone: Cooperative, competitive, and individualistic learning* (5th ed.). Boston, MA: Allyn & Bacon (First edition published 1975).

Johnson, D. W., & Johnson, R. T. (2005). New developments in social interdependence theory. *Psychological Monographs, 131*(4), 285-358.

Johnson, D. W., & Johnson, R. T. (2008). Social interdependence, moral character, and moral education. In J. Nucci & D. Narvaez (Eds.), *Handbook on moral and character education* (pp. 204-229). Mahwah, NJ: Erlbaum.

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher, 38*(5), 365-379.

Johnson, D. W., Johnson, R. T., & Holubec, E. J. (2008). *Cooperation in the classroom* (8th Ed.). Edina, MN: Interaction.

Johnson, D. W., Johnson, R., & Smith, K. (2006). *Active learning: Cooperation in the university classroom* (3rd ed.). Edina, MN: Interaction.

Kuh, G. D. (2005). Student engagement in the first year of college. In L. M. Upcraph, J. N. Gardner, & B. O. Barefoot (Eds.), *Challenging and supporting the first year student* (pp. 86-107). San Francisco, CA: Jossey-Bass.

Kuh, G. D., Kinzie, J., Buckley, J., Bridges, B., & Hayek, J. C. (2007). *Piecing together the student success puzzle: Research, propositions, and recommendations* (ASHE Higher Education Report, No. 32). San Francisco, CA: Jossey-Bass.

Lave, J., & Wenger E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, UK: Cambridge University Press.

Lewin, K. (1935). *A dynamic theory of personality.* New York, NY: McGraw-Hill.

Maller, J. B. (1929). *Cooperation and competition: An experimental study in motivation* (Contributions to Education, No. 384). New York, NY: Teacher's College Bureau.

May, M., & Doob, L. (1937). *Competition and cooperation* (Social Science Research Council Bulletin, No. 25)**.** New York, NY: Social Science Research Council.

Mayer, A. (1903). Uber einzel-und-gesamtleistung des schulkindes. *Archiv fur die Gesamte Psychologie, 1,* 276-416.

McKeachie, W., Pintrich, P., Yi-Guang, L., & Smith, D. (1986). *Teaching and learning in the university classroom: A review f the research literature.* Ann Arbor, MI: The Regents of the University of Michigan.

Michaelsen, L. K., Watson, W. E., Cragin, J. P., & Fink, L. D. (1982). Team-based learning: A potential solution to the problems of large classes. *Exchange: The Organizational Behavior Teaching Journal, 7*(4), 18-33.

Pascarella, E. (2001). Cognitive growth in university. *Change, 33*(6), 21-27.

Pascarella, E., & Terenzini, P. T. (2005). *How college affects students: A third decade of research* (Vol. 2). San Francisco, CA: Jossey-Bass.

Ringelmann, M. (1913). Recherches sur les moteurs animés: Travail de l'homme [Research on animate sources of power: The work of man]. *Annales de l'Institut National Agronomique, 2*(12), 1-40.

Smith, K. A. (2011). Cooperative learning: Lessons and insights from thirty years of championing a research-based innovative practice. *Proceedings of the ASEE/JEEE Frontiers in Education Conference, No. 41.* Rapid City, SD: ASEE.

Smith, K. A., Sheppard, S. D., Johnson, D. W., & Johnson, R. T. (2005). Pedagogies of engagement: Classroom-based practices (cooperative learning and problem-based learning). *Journal of Engineering Education, 9*4(1), 87-102. [Special issue on the State of the Art and Practice of Engineering Education Research]

Spence, L. (2001). The case against teaching. *Change, 33*(6), 10-19.

Springer, L., Stanne, M. E., & Donovan, S. S. (1999). Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. *Review of Educational Research, 69*(1), 212-51.

Tinto, V. (1993). *Leaving university: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago, IL: University of Chicago Press.

Tinto, V. (1997). Colleges as communities: Exploring the educational character of student persistence. *Journal of Higher Education, 68*, 599-623.

Topping, K., & Ehly, S. (Eds.). (1998). *Peer-assisted learning.* Mahwah, NJ: Erlbaum.

Vygotsky, L. (1978). *Mind and society.* Cambridge, MA: Harvard University Press.

Watson, G., & Johnson, D. W. (1972). *Social psychology: Issues and insights.* Philadelphia, PA: Lippincott.

David W. Johnson *is an emeritus professor of educational psychology at the University of Minnesota. He is co-director of the Cooperative Learning Center. He received his doctoral degree from Columbia University. He has authored over 500 research articles and book chapters. He is the author of over 50 books and a past editor of the* American Educational Research Journal*. He held the Emma M. Birkmaier Professorship in Educational Leadership at the University of Minnesota from 1994 to 1997. He has received numerous awards from many different professional organizations. For the past 45 years, Dr. Johnson has served as an organizational consultant to schools and businesses throughout the world.* **Roger T. Johnson** *is an emeritus professor of education at the University of Minnesota and is co-director of the Cooperative Learning Center. He holds his doctoral degree from the University of California in Berkeley. In 1965, Dr. Johnson received an award for outstanding teaching from the Jefferson County Schools, and has since been honored with numerous national awards. He was a curriculum developer with the elementary science study at Harvard University. For three summers he taught classes in the British primary schools at the University of Sussex. He has consulted with schools throughout the world. Dr. Johnson is the author of numerous research articles, book chapters, and books.* **Karl A. Smith** *is cooperative learning professor of engineering education, School of Engineering Education, at Purdue University. He is also emeritus professor of civil engineering, Morse-Alumni Distinguished Teaching Professor, executive co-director of the STEM Education Center, and faculty member, Technological Leadership Institute at the University of Minnesota. Karl consults with thousands of faculty all over the world on pedagogies of engagement. His interests include building research and innovation capabilities in engineering education; the role of cooperation in learning and design, modeling, and knowledge engineering; and project and knowledge management and leadership. He is a fellow of the American Society for Engineering Education and past chair of the Educational Research and Methods Division.*