Cooperative Learning Returns To College: What Evidence Is There That It Works?

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"Individual commitment to a group effort: this is what makes a team work, a company work, a society work, and a civilization work."
--Vince Lombardi, Former Green Bay Packers Coach

The myth of individual genius and achievement--as opposed to cooperative efforts--is deeply ingrained in American culture. Americans seem deeply committed to the idea of the individual hero---a rugged self-starter who meets challenges and overcomes adversity. Sports, for example, are more often defined by individual superstars than by the quality of teamwork. Academic excellence is more often personified by the valedictorian than by academic teamwork.

College educators usually ignore the power of academic teams. They should think about the example of David Kroetsch and Pawel Lukaszynski of Resurrection Catholic Secondary School in Kitchener, Ontario. These high schoolers decided to combine their talents to build a robot for the 1997 International Aerial Robotics Competition. The robot had to take off from a small area, fly over a field, recognize objects lying in it, pick some of them up, and return to and land at the original site. The two students were looking for a challenge; the problem reflected their combined interests (flying, hardware, software) and dealt with cutting-edge issues. Their nine months of work together paid off: their robot received 182 out of 200 points for innovativeness; as the only high school entrants, they won!

The college winner was a Camegie Mellon student team. It created a robot with a video-processing unit so fast and reliable that the robot could steer visually, identify objects on the ground, bank and fly over a specific object, hover, descend straight down the line of sight, and follow the object around if it moved. Achievements such as these are beyond the capacities of an individual student

James Watson, who won a Nobel Prize as co-discoverer of the double-helix DNA molecule, recognized this when he stated, "Nothing new that is really interesting comes without collaboration." Despite the remarkable achievements of academic teams, the myth of the genius

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individual still exists; it underlies educational practice that assumes each student should work separately and apart from classmates. While the authors support wholeheartedly the development of individual talents, isolation is not the best path for nurturing them. As Watson noted, creative genius is the product of, and best develops within, cooperative efforts.

The truth of this assertion can be seen in the rich theory, research, and practice surrounding cooperative learning. There can now be little doubt that cooperative learning is appropriate to higher education; it works. While it is never easy to implement, when all the critical elements are in place, it is very powerful. In this article, we review the theory underlying the use of cooperative learning, the research on it conducted at the college level, and the ways it may be used appropriately in college classes.

What Is Cooperative Learning?

Two of the authors, Roger and David, spent several years of their childhood living on a farm in central Indiana. The third, Karl, grew up in a town of under 400 people in northern Michigan, helping his family grow vegetables on a track farm. The three of us grew up in a time when children were part of the economic unit of the family. We worked alongside our parents and grandparents; we learned cooperation through the ebb and flow of daily family life. This is not true of many college students today. Consequently, they little understand the differences between competitive, individualistic, and cooperative efforts.

There are still colleges today in which faculty are required to grade on the curve. This norm-referenced approach to student evaluation requires students to compete with each other for grades, which has many unfortunate consequences for academic life. Many professors seek to avoid the pitfalls of such competition by using an individualistic approach to instruction. Each student's efforts are evaluated on a criterion-referenced basis. Yet students are expected to work individually to accomplish learning goals unrelated to those of the other students.

In contrast to competitive and individualistic learning, students can work together cooperatively to accomplish shared learning goals. Each student achieves his or her learning goal if and only if the other group members achieve theirs. Students work together in small groups to ensure that all group members achieve up to a preset criterion. When all group members reach criteria, each member may receive bonus points.

Cooperative learning is the heart of problem-based learning. It is related to collaborative learning, which emphasizes the "natural learning" (as opposed to training resulting from highly structured learning situations) that occurs as an effect of community in which students work together in unstructured groups and create their own learning situation.

Not all that glitters is gold, of course, and 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 talking (traditional learning groups). The complexity of cooperative learning may partially explain why

it tends to be used less than competitive and individualistic learning in college classes, even though it is by far the most effective of the three alternatives.

Cooperative learning is also underused because many students do not understand how to work cooperatively with others. The prevailing culture and reward systems of our society (and our colleges) are oriented toward competitive and individualistic work; the schools students came from emphasized class rank and required teachers to evaluate students on norm-referenced bases.

In addition, in most colleges, few resources are allocated for faculty development, meaning that most faculty have to learn how to use cooperative learning on their own. In large classes, underprepared faculty assign students to groups and sometimes find the outcome chaotic. Finally, students may resist changes in instruction and pressure faculty to continue to lecture. Some, when first exposed to cooperative learning, may say, "I paid to hear you, not my classmates!"

As more experienced practitioners have found, none of these barriers is insurmountable. They weaken as knowledge increases of the theory, research, and practical procedures underlying cooperative learning.

The Theoretical Roots of Cooperative Learning

Theory, research, and practice are Siamese triplets, each with a life of its own but joined inseparably to the others. The power of cooperative learning lies in the interrelationship among its theory, research, and practice. Theory is to practice what the soil is to plants. If the soil is appropriate and the conditions are right, the plant will grow and flourish. If the theory is valid and the conditions for effective implementation are identified, practical procedures develop and continuously improve. Without an appropriate theory, practice becomes static and stagnant. Some of the greatest theorists of the 20th century have focused on cooperation. The use of cooperative learning in college classes has its roots in the creation of social interdependence, cognitive-developmental, and behavioral learning theories.

Social interdependence theory views cooperation as resulting from positive interdependence among individuals' goals. Kurt Koffka (one of the founders of the Gestalt School of Psychology) proposed in the early 1900s that groups were dynamic wholes in which the interdependence among members could vary. Kurt Lewin stated that the essence of a group lies in the interdependence of its members (created by common goals); groups are "dynamic wholes" in which a change in the state of any member or subgroup changes the state of the other members or subgroups. Morton Deutsch (one of Lewin's students) first formulated social interdependence theory in the 1940s, noting that interdependence can be positive (cooperation), negative (competition), or nonexistent (individualistic efforts).

We (David was one of Deutsch's students) published a comprehensive formulation of the theory in the 1980s. The basic premise of social interdependence theory is that the way social interdependence is structured determines how individuals interact, which in turn determines outcomes. Positive interdependence (cooperation) results in promotive interaction as individuals encourage and facilitate each other's efforts to learn. Negative interdependence (competition)

typically results in oppositional interaction as individuals discourage and obstruct each other's efforts to achieve. In the absence of a functional interdependence (that is, individualism) there is no interaction as individuals work independently without interchange with each other.

Cognitive-developmental theory views cooperation as an essential prerequisite for cognitive growth. It flows from the coordination of perspectives as individuals work to attain common goals. Jean Piaget taught that when individuals co-operate on the environment, healthy socio-cognitive conflict occurs that creates cognitive disequilibrium, which in turn stimulates perspective-taking ability and cognitive development. Lev Vygotsky believed that cooperative efforts to learn, understand, and solve problems are essential for constructing knowledge and transforming the joint perspectives into internal mental functioning. For both Piaget and Vygotsky, working cooperatively with more capable peers and instructors results in cognitive development and intellectual growth.

From the cognitive science viewpoint, cooperative learning involves modeling, coaching, and scaffolding (conceptual frameworks that provide for understanding what is being learned). Cooperative learners cognitively rehearse and restructure information to retain it in memory and incorporate it into existing cognitive structures.

More recently, we (the authors) have developed controversy theory, which posits that when students are confronted with opposing points of view, uncertainty or conceptual conflict results, which creates a reconceptualization and an information search, which in turn results in a more refined and thoughtful conclusion. The key steps for the student are to organize what is known into a position; to advocate that position to someone who advocates an opposing position; to attempt to refute the opposing position while rebutting attacks on one's own; to reverse perspectives so that the issue is seen from both points of view simultaneously; and, finally, to create a synthesis to which all sides can agree.

The behavioral learning theory assumes that students will work hard on those tasks for which they secure a reward of some sort and will fail to work on tasks that yield no reward or yield punishment. Cooperative learning is designed to provide incentives for the members of a group to participate in the group's effort. Skinner focused on group contingencies, Bandura focused on imitation, and Homans as well as Thibaut and Kelley focused on the balance of rewards and costs in social exchange among interdependent individuals.

Differences Among Theories

These three arenas of theory provide rich soil for cooperative learning. They all predict that cooperative learning will promote higher achievement than will competitive or individualistic learning. Each theory has generated a research base. There are, however, basic differences among them.

Social interdependence theory assumes that cooperative efforts are based on intrinsic motivation generated by interpersonal factors and a joint aspiration to achieve a significant goal. Behavioral learning theory assumes that cooperative efforts are powered by extrinsic motivation to achieve rewards. Social interdependence theory focuses on relational concepts dealing with what happens

among individuals (for example, cooperation is something that exists only among individuals, not within them), whereas the cognitive-develop-mental perspective focuses on what happens within a single person (for example, disequilibrium, cognitive reorganization). The differences across these theoretical assumptions have yet to be fully explored or solved.

The Internal Dynamics That Make Cooperation Work

There are seeds that lie in the desert for years, waiting. Only under the right conditions will they grow and flourish. When the rain comes, the temperature is right, or the seed is carried to fertile earth, then its potential is unleashed and it grows. The same is true of cooperation. Whenever two individuals interact, the potential for cooperation exists. But it is only under certain conditions that cooperation will actually exist.

As the research on cooperative efforts has evolved over the past four decades, five key elements have emerged as critical to actual cooperation: positive interdependence, individual accountability, promotive interaction, social skills, and group processing. Here is what each of these has come to mean for faculty members.

First, you (the instructor) ensure that each student perceives that he or she is linked with others in such a way that the student cannot succeed unless the others do. In every lesson, you structure positive interdependence so every student embraces a responsibility for learning the assigned material and for making sure that all members of the group learn it, too. You may supplement this positive interdependence by adding joint rewards (if all members of a group score 90 percent correct or better on the test, each receives five bonus points), divided resources (giving each group member a part of the total information required to complete an assignment), and complementary roles (reader, checker, encourager, elaborator). For a learning situation to be cooperative, students must believe that they sink or swim together.

Second, you structure individual accountability so that the performance of each student is assessed by a) giving an individual test to each student, b) having each student explain what he or she has learned to a classmate, or c) observing each group and documenting the contributions of each member. The purpose of cooperative learning is to make each member a stronger individual in his or her own right. Students learn together so that they can subsequently perform better as individuals.

Third, you ensure that students promote one another's success (helping, assisting, supporting, encouraging, and praising one another's efforts to learn) face to face. Doing so entails cognitive processes such as verbally explaining how to solve problems, teaching one's knowledge to classmates, and connecting present with past learning. It also leads to such interpersonal processes as challenging one another's reasoning and conclusions, modeling, and facilitating efforts to learn. The verbal and nonverbal responses of other group members provide important feedback as to a student's performance. Students also get to know each other on a personal as well as a professional level. To obtain meaningful face-to-face interaction, the size of groups needs to be small (two to four members).

Fourth, you teach students the needed social skills and ensure that they are used appropriately. The success of a cooperative effort requires interpersonal and small-group skills. Asking unskilled individuals to cooperate tends to be futile. 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 such skills may be found in David Johnson's Reaching Out, David and F. Johnson's Joining Together, and David and Roger Johnson's Learning to Lead Teams (see box).

Fifth, you ensure that students take the time to engage in group processing --- the identification of ways to improve the processes members have been using to maximize their own and each other's learning. Students focus on the continuous improvement of these processes by a) describing what member actions were helpful and less helpful in ensuring effective working relationships and that all group members achieved learning goals,and b) making 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) continuously improving students' skills in working as part of a team, and d) giving group members an opportunity to celebrate their hard work and successes.

Just as knowing the conditions essential to plant growth enables farmers to prosper, understanding how to implement the five essential elements enables instructors to a) structure any lesson in any subject area cooperatively, b) adapt cooperative learning to their specific circumstances, needs, and students, and c) intervene to improve the effectiveness of any group that is malfunctioning.

The Research

Even the most appropriate soil and best conditions will not produce a harvest unless the crop is carefully tended. Likewise, theories of cooperation will not bear fruit without careful research to validate and refine them.

Early History

The investigation of the relative impact of competitive, individualistic, and cooperative efforts is the longest-standing research tradition in American 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 in Germany and Ringehnann in France; two major reviews of the research on cooperation and competition were published in the 1920s and 1930s.

Today's focus on the use of cooperative learning in college classrooms, however, has its roots in Deutsch's work in the late 1940s demonstrating the power of cooperative learning in a psychology class at MIT. By 1970, we were able to compile a research review specifically focused on education.

Before 1970, almost all the reported studies had been conducted in college classrooms and laboratories using college students as participants. Starting in the early 1970s, K-12 educators

became curious as to whether the benefits of cooperative learning so powerfully demonstrated with college students would apply also to elementary and secondary school students, and a robust literature developed at that level. In the 1990s, the interest in investigating the use of cooperative learning at the college level has been rekindled.

Meta-Analysis of College Studies

Since the 1960s, we have been developing a comprehensive library of all the research conducted on cooperative learning. We've found over 305 studies that compare the relative efficacy of cooperative, competitive, and individualistic learning on individual achievement in college and adult settings. The first study was conducted in 1924; 68 percent of the studies have been conducted since 1970. Sixty percent randomly assigned subjects to conditions, 49 percent consisted of only one session, and 82 percent were published in journals.

We classified the results of the research comparing cooperative, competitive, and individualistic efforts into three broad categories relating to quality of the college experience: academic success, quality of relationships, and psychological adjustment to college life. In addition, there are a number of studies on students' attitudes toward the college experience.

Academic Success. One of the most important influences on the college experience is whether students achieve academically. Academic success is, above all, the college's aim and the student's aim. It also, as Tinto documents, has numerous effects on college attrition: the higher the achievement of students, the more committed they tend to be to completing college. Academic success is also tied to eligibility for financial aid. For these and many other reasons, it is important to turn to instructional methods that maximize student achievement.

Between 1924 and 1997, over 168 studies were conducted comparing the relative efficacy of cooperative, competitive, and individualistic learning on the achievement of individuals 18 years or older. These studies indicate that cooperative learning promotes higher individual achievement than do competitive approaches (effect size = 0.49) or individualistic ones (effect size = 0.53). Effect sizes of this order describe significant, substantial increases in achievement. They mean, for example, that college students who would score at the 50th percentile level when learning competitively will score in the 69th percentile when learning cooperatively; students who would score at the 53rd percentile level when learning individualistically will score at the 70th percentile when learning cooperatively.

The relevant measures here include knowledge acquisition, retention, accuracy, creativity in problem-solving, and higher-level reasoning. The results hold for verbal tasks (such as reading, writing, and oral presentations), mathematical tasks, and procedural tasks (such as swimming, golf, and tennis). There are also studies finding advantages for cooperative learning in promoting meta-cognitive thought, willingness to take on difficult tasks, persistence (despite difficulties) in working toward goal accomplishment, intrinsic motivation, transfer of learning from one situation to another, and greater time on task. These results were recently corroborated in a meta-analysis focused on college level-one science, math, engineering, and technology courses.

Outcomes such as these have multiple, far-reaching impacts on students' experiences of college. Astin (see box), for example, concludes that cooperative student-student interaction and student-faculty interaction are the two major influences on college effectiveness (academic development, personal development, and satisfaction with the college experience). McKeachie and his associates (see box) find that learning how to engage in critical thinking depends on student participation in class, teacher encouragement, and cooperative student-student interaction.

Quality of Relationships. A host of researchers have investigated the quality of the relationships among students and between students and faculty. Our meta-analysis of the research using students 18 years or older found that cooperative effort promotes greater liking among students than does competing with others (effect size = 0.68) or working on one's own (effect size = 0.55); this finding holds even among students from different ethnic, cultural, language, social class, ability, and gender groups. The relevant studies include measures of interpersonal attraction, esprit de corps, cohesiveness, and trust: College students learning cooperatively perceive greater social support (both academically and personally) from peers and instructors than do students working competitively (effect size = 0.60) or individualistically (effect size = 0.51).

The positive interpersonal relationships promoted by cooperative learning are crucial to today's learning communities. They increase the quality of social adjustment to college life, add social goals for continued attendance, reduce uncertainty about attending college, increase commitment to stay in college, increase integration into college life, reduce incongruencies between students' interests and college curricula, and heighten social membership in college (see Tinto, in box):

Psychological Adjustment. Attending college requires considerable personal adjustment for many students. In reviewing the research, we found cooperativeness to be highly correlated with a wide variety of indices of psychological health; individualistic attitudes are related to a wide variety of indices of psychological pathology; competitiveness seems related to a complex mixture of indices of health and pathology. One important aspect of psychological health is self-esteem. College-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.

Attitudes Toward the College Experience

The more positive a student's attitude toward his or her college, the more likely he or she is to stay in that college and participate fully in its life. A number of studies find that cooperative learning promotes more positive attitudes toward learning, the subject area, and the college than does competitive or individualistic learning. There are numerous social psychological theories, furthermore, that predict that students' values, attitudes, and behavioral patterns are most effectively developed and changed in cooperative groups.

Reciprocal Relationships Among Outcomes

There tends to be a reciprocal relationship among these outcomes. The more effort students expend in working together, 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, the greater their social competence, self-esteem, and general psychological health. The healthier individuals are psychologically the more effectively they tend to work together. The greater the number of committed relationships individuals are involved in, the healthier they will be psycho1ogically; healthier individuals, in turn, are abler to form caring and committed relationships. These multiple outcomes form a gestalt central to a high-quality college experience.

The Research Is Even More Impressive Than It Looks

The research on cooperative learning is like a diamond. The more light you focus on it, the brighter and more multifaceted it becomes. The power of cooperative learning is brightened by the magnitude of its effect sizes, but the more you read the research and examine the studies, the better cooperative learning looks. Here are some of the reasons.

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

The research studies are a combination of theoretical and demonstration studies conducted in labs, classrooms, and colleges as a whole. While the lab studies may have lasted for only one session, some of the demonstration studies lasted for an entire semester or academic year. The combination of scientific and demonstration studies strengthens the confidence college instructors can have in the effectiveness of cooperative-learning procedures.

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

Ways To Use Cooperative Learning

Rich soil and a careful nurturing and tending of the crop tends to result in a bountiful harvest. The theory underlying cooperative learning and the number of research findings surrounding it create the potential for powerful instructional practices.

The Use of Cooperative Learning: A Short History

There is a rich tradition of cooperative learning in higher education. Thousands of years ago, the Talmud stated 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, Quintillion argued that students could benefit from teaching one another. The Roman philosopher Seneca advocated cooperative learning when he said, "Qui Docet Discet [When you teach, you learn twice]." Johann Amos Comenius (1592-1679) believed that students would benefit by both teaching and being taught by other students.

Throughout the Middle Ages, craft guilds had apprentices working together in small groups, with the most skilled working with the master and then teaching their skills to the less experienced. In the late 1700s, Joseph Lancaster and Andrew Bell made extensive use of cooperative-learning groups in England and India to provide education to the "masses"; a Lancastrian school was opened in New York in 1806. In colonial Boston, young Benjamin Franklin (living in poverty) organized learning groups in order to gain an education. Within the Common School Movement in the United States in the early 1800s there was a strong emphasis on cooperative learning. In the last three decades of the 19th century, Colonel Francis Parker's use of cooperative learning dominated American education. Throughout the early decades of this century, John Dewey promoted the use of cooperative-learning groups as part of his project method.

Continuing this rich history, there are several colleges in which cooperative learning is being used today in exemplary ways. Florida Community College at Jacksonville, for example, has implemented cooperative learning on a wide-scale basis. Michigan State is implementing cooperative learning throughout the whole university. To help practitioners, James Cooper at California State University-Dominguez Hills publishes a newsletter on the use of cooperative learning at the college level. The growing interest in cooperative learning is reflected in the number of presentations at conferences on the topic. In addition, there are related areas of work that validate the use of cooperative learning, including work on collaborative learning, problem-based learning, learning communities, and retention of students until graduation.

To increase the use of cooperative learning, however, it is necessary to understand the ways in which it can be used in college classrooms.

Using Cooperative Learning in College Classes

By the mid-1960s, we had left the farm for the university and began translating the habits of cooperation we had learned earlier into practical procedures for our own teaching at the University of Minnesota and the University of California at Berkeley. In time, we developed three interrelated ways to use cooperative learning: formal cooperative learning, informal cooperative learning, and cooperative base groups.

Formal cooperative learning is students working together, for one period to several weeks, to achieve shared learning goals aimed at joint completion of specific tasks and assignments. Any course requirement or assignment may be structured for formal cooperative learning. Groups formed on this basis provide the foundation for all other cooperative-learning procedures. In formal cooperative-learning groups, instructors

- make a number of preinstructional decisions. An instructor has to decide on the academic and social-skill objectives, 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.

- explain to students the task and the concept of positive interdependence.An instructor defines the assignment, teaches the required concepts and strategies, explains positive interdependence and individual accountability, gives the criteria for success, and specifies the expected social skills.

- monitor students' learning and intervene to assist students with tasks or with interpersonal and group skills. An instructor systematically observes and collects data on each group as it works. When needed, the instructor intervenes to assist students in completing the task accurately and in working together effectively.

- assess and evaluate students' learning and help students process how well their groups functioned. Students' learning is carefully assessed and the performance of each is evaluated. Members of the learning groups then process how effectively they worked together.

Informal cooperative learning groups are used primarily to enhance direct instruction (presentations, demonstrations, films, videos); they are typically temporary and ad hoc, formed for a brief period of time (such as intermittent two- to four-minute discussions during a class session). Instructors may use informal cooperative-learning groups during a class by having students turn to a classmate near them to discuss briefly a question posed by the instructor or to summarize what their instructor has just presented. Doing so focuses student attention on the material and ensures that students process it cognitively.

Cooperative base groups are longer-term groups (lasting for at least a semester) with stable membership whose primary responsibility is to provide each student the support and encouragement he or she needs to make academic progress and to complete the course(s) successfully.

The three types of cooperative learning complement and support each other. They might all be used in a single class session. The following is an example of such integrated use. First, class begins with a base group meeting that typically lasts for five to 10 minutes. Members welcome each other, complete a self-disclosure task (such as answering, "What is each member's favorite author?"), and check each member's homework to ensure that it is complete and understood. The meeting can be lengthened (to 15 minutes) to include activities such as quizzes on reading assignments or peer editing of topical papers. The instructor systematically observes the base groups and notes which parts of the homework caused difficulty.

Second, the class session itself can be introduced through direct teaching with informal cooperative learning. The instructor explains what will take place in today's class, outlining its objectives and schedule. The instructor then gives a short lecture to introduce or provide new material about the topic, or to excite students about it. The lecture begins and ends with a

discussion between pairs of students. In longer lectures, a pair discussion might be held every 10 or 15 minutes.

To play out an example, consider a lesson focused on human limitations and the ways we compensate for them. The instructor begins by having students turn to a partner and in four minutes answer the question, "What are the advantages and disadvantages of being human?" Students a) formulate an answer, b) share their answer with the partner, c) listen to their partner's answer, and d) create a synthesis that is better than either one.

The instructor next gives a 10-minute lecture explaining that while the human body is a marvelous system, we (like other organisms) have very specific limitations. We cannot see bacteria in a drop of water or the rings of Saturn unaided; we cannot hear as well as a deer or fly like an eagle. Humans have never been satisfied with being so limited and, therefore, have invented microscopes, telescopes, and our own wings. The instructor then tells students to turn to the person next to them and answer the questions, "What are three limitations of humans? What have we invented to overcome these limitations?"

Third, the instructor might use formal cooperative learning to address the questions "What are other human limitations? What are ways we can overcome them?" The 30 students count off from one to 10 to form groups of three. Positive goal interdependence is established by requiring from the group one set of answers with which everyone in the group must agree; each member must be able to explain that limitation and the ways to overcome it. Role interdependence is established by assigning each member a role: encourager of contributions, summarizer, or recorder. The criteria for success are to complete the assignment in the time specified, to agree on at least three human limitations, and to design a reasonable way to overcome each one. The expected social skills to be used by all students include contributing ideas, encouraging each other's participation, and generating divergent ideas.

As students do this work, the instructor systematically monitors each group and intervenes to provide academic assistance and help with small-group skills. The instructor structures individual accountability by a) observing each group to determine if members are fulfilling their roles and b) giving random individual oral exams to ensure that any member can explain the limitations and solutions.

At the end of the lesson, each group hands in its work to be evaluated. If there is time, each group may share its work with the entire class. Group members then process how well they worked together by identifying member actions that helped the group succeed and one step that could improve their work next time.

Fourth, the instructor might summarize the most interesting ideas generated by formal cooperative groups and explain how today's lesson leads the next assignment. Informal cooperative learning is used to have students discuss, "What questions do you have about overcoming human limitations that still need to be answered?"

Finally, the class session ends with a base group meeting. Group members review what they learned, ask how it applies to other assignments and situations, review homework assignments, and determine what help each member needs to complete it.

Conclusion

"We are going to have to find ways of organizing ourselves cooperatively, sanely, scientifically, harmonically, and in regenerative spontaneity with the rest of humanity around the earth .... We are not going to be able to operate our spaceship earth successfully nor for much longer unless we see it as a whole spaceship and our fate as common. It has to be everybody or nobody."

---R. Buckminster Fuller

Faculty who use cooperative learning are on safe ground. There is a rich theoretical base for cooperative learning. As the research has evolved over the past 35 years, five basic elements have emerged as critical to cooperative work in classrooms: positive interdependence, individual accountability, face-to-face promotive interaction, social skills, and group processing. The research evidence itself indicates that a) the theories underlying cooperative learning are valid and b) cooperative learning does indeed work in college classrooms.

Three interrelated types of cooperative learning have been developed formal cooperative learning, informal cooperative learning, and cooperative base groups. Used together, they provide a framework for effective teaching at the college level.

In many college classes, however, more attention is paid to developing Lone Rangers than to creating learning communities within which the achievement of all students is enhanced. The power of cooperative efforts is widely ignored. The whole instructional system aims to pluck out and nurture solitary individual genius--to find the next Michelangelo, for example.

As academic myth would no doubt have it, the great Michelangelo painted the ceiling of the Sistine Chapel, laboring alone on scaffolding high above the chapel floor. In fact, 13 people helped Michelangelo paint the work. As biographer William E. Wallace notes, Michelangelo was the head of a good-sized entrepreneurial enterprise that collaboratively made art that bore his name.

The powerful blend of individual and collective effort found in Michelangelo's cooperative team can be harnessed in any college class.

Resources

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