Cooperative learning in a college classroom: a survey emphasizing individual accountability

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Introduction

over 600 studies in the past 90 years have been dedicated to validating the assertion that students learn better when working together in small groups (ERIC, 1992). Whether referred to as collaborative learning, cooperative learning, or simply group work; the results of the research are consistent: students retain information longer, students perform better during evaluations, and students appear more satisfied with the course material (Davis, 1993). Superficially these results would strongly suggest adopting cooperative learning in the classroom, but they do not indicate the amount of detailed thought, preparation, and maintenance required for students to successfully learn in such an environment. Establishing the appropriate conditions for learning in a group setting is a critical component for success.

One of these conditions requires teachers to ensure that individual members of a group actually learn the material instead of simply taking credit for the efforts of their teammates. After all, one of the primary purposes of cooperative learning groups "is to make each member a stronger individual" (Johnson, 1999). Exploring cooperative learning as a pedagogical approach, then, implies that you must also explore the methods for enforcing individual accountability for learning. How do you make sure that each individual learns each course objective when the students work in teams? How do you prevent the "social loafer" who is content to let everyone else do the work while receiving the same grade? How do you prevent the over-bearing member who so dominates group discussions that others stop attempting to contribute? The answers to these questions have been explored in recent research and will be the focus of this survey.

Description of Cooperative learning

Cooperative learning occurs when students work together in small groups to accomplish a collective task (Slavin, 1980). Research has shown that, when employed properly, cooperative learning can result in improved conventional academic achievement such as performance on standardized tests. Of equal or more importance, the research also reports that a well constructed cooperative learning environment can contribute to developing conceptual skills needed for problems requiring critical thought. It can also improve social and leadership skills gained through group member interaction. These benefits, however, are not automatically achieved, but rather instructors must place considerable thought into how they implement the technique. Several key elements that must be present in order for students to learn in a cooperative environment (Johnson, 1991):

1. Positive interdependence. Students within a group must be forced to rely on one another to be successful on their project or homework. The scope of the work must be such that it is impossible for the team to do well (finish the work and receive a good grade) without considerable contributions from each member.

2. Individual Accountability. Instructors and team members must have a method of holding each person accountable for his or her contribution. Moreover, each student must learn all of the course objectives; learning only a subset is not sufficient.

3. Face-to-face interaction. Some work can, and should, be separated out and completed in parallel, but students must still be forced to interact directly with one another. The nature of the tasks for the work should allow for a division of labor, but they must also require a degree of integration that can only be accomplished collectively.

4. Appropriate use of collaborative skills. Students must learn how to interact with others and develop leadership, decision-making, communication, and conflict-resolution skills that will be required by students upon graduation.

5. Group processing. The team has to approach the overall work from a group perspective. The members must establish mutual goals, a collective timeline, and group policies to keep the team focused. Additionally, they must periodically assess their collective performance and make adjustments as necessary.

Discussion of potential problems associated with cooperative learning

To establish an environment that includes all of these components is ambitious considering the population of students. Most students will have been raised in a classroom environment that is very individually focused where they have only been responsible for themselves. They will have limited experience in working with, helping, and relying on others. Inevitably there will be some resistance to a cooperative learning strategy from a subset of the student population. Strong students may resent having to "pull weaker students along," team members may have considerably divergent goals (one member may be striving for an A in the course while others may be content earning a C), a subset of the group members may be overly assertive to the point that they dominate all group activity, or select individuals may not put forth the degree of effort expected by the team. Identifying and understanding the potential problems in a cooperative learning environment is a critical step in determining how to minimize the impact that they may have on individual accountability. It is the instructor's job to develop an environment that prevents or minimizes the effects of these potential problems. This responsibility begins with team creation and persists throughout the course via continual assessment and evaluation.

Avoiding Problems that Impact Individual Accountability

Creating Groups

The first step in promoting individual accountability in an environment suitable for cooperative learning is to build the teams in a productive manner. Placing students in effective teams requires considerable forethought in order to account for each of the elements of a successful cooperative learning endeavor. The research is consistent in recommending instructor picked, heterogeneous groups of 3-5 students (Oakley, 2004). Teams should be selected by the teacher, who can examine the students' backgrounds and interests to determine the best possible combinations of team members. If left to select team members by themselves, students would not necessarily keep their individual learning as their primary goal. Stronger students may gravitate to one another leaving the weaker students to flounder, or students may overly weight the significance of friendships and social acquaintances. Instructors can leverage insight regarding the students' past performance to develop a team with varying academic backgrounds, providing opportunities for stronger students to help weaker students. This, in turn, provides the added benefit of the experience gained while explaining difficult concepts to others. Research has shown that the student who is serving as the tutor actually learns more than the one being tutored (Slavin, 1980). The teacher can also structure a proper heterogeneous mix that accounts for other types of diversity such as differences in academic interests, gender, and ethnic background. This provides opportunities for students to apply their strengths toward the group effort and increases positive interdependence that helps promote a sense of satisfaction and motivation to continue learning.

The actual size of the group also has a critical impact on individual accountability. The right sized team can maximize collaborative effort while minimizing potential problems. If the group is too small, individuals can easily dominate group sessions, or there may be insufficient diversity of insight or skills to enhance learning. On the other hand, if the group is too large then select members can easily avoid working, some quieter members may simply be ignored, or there may be insufficient work to keep all members occupied. The research community agrees that 3-5 is the proper size (Oakley, 2004).

Using Peer Assessments

After initially assigning students to groups, instructors must then provide direction, guidance, and continual observation of the teams' progress. As part of the guidance, instructors should ensure that each group has a method for policing itself in the form peer assessments. In order for students to embrace the cooperative learning environment, they must feel that there is a method of ensuring fairness in grading. Nothing will demoralize students faster than for a non-contributing student to receive a high grade based solely on the other group members' efforts.

Research shows that students derive a much greater sense of satisfaction and higher test scores from groups that have the ability to provide a peer assessment that is factored into grade calculation (Kaufman, 2000). The peer assessment should reflect the degree of contribution each team member makes toward the collective effort, but what should the measure of the contribution be? Intuitively one would consider the amount of actual work accomplished, but this may unfairly benefit a stronger student and create an unintended sense of competition within the group. In place of accounting strictly for academic ability, instructors may use a concept of *team citizenship* that measures an individual's cooperation with the team and the willingness to help others (Felder, 1994). This promotes teamwork that will foster a constructive cooperative setting and benefit learning.

In addition to avoiding conflict in peer assessments, courses should not use a relative grade curve in a cooperative setting (Cooper, 1990). By nature, a curve discourages cooperation since few students will want to help their peers if they view their efforts as a potential means for decreasing their own grade.

The peer assessments can be used to adjust individual grades from the group's assigned grade. The degree by which an individual's grade should be adjusted is calculated based on the peer assessments provided by all teammates. Several studies suggest varying methods for integrating the peer assessments into an individual's overall grade, but they consistently propose limiting the scope of the adjustment to one letter grade above or below the group's grade. As additional guidance, the instructors should provide the students with multiple opportunities to conduct peer assessments over the course of the semester so that an individual can overcome an initial negative rating. Since negative ratings may cause unwanted conflict between group members, the assessments should be conducted anonymously. This also increases the likelihood that individuals will provide an honest assessment.

Another benefit to periodic peer ratings is the insight into the team dynamics that they provide to the instructor. The instructor gains a perspective on how the group interacts while they are away from the classroom and can then help focus and guide the team. The instructor can also address anomalous ratings and help the group resolve problems with specific individuals who refuse to cooperate.

Peer assessments can be a valuable tool, but instructors must keep in mind that students will likely have very little experience working constructively in groups and they won't know how to best employ the tool; instructors must provide considerable guidance. Students will probably lack sufficient social and leadership skills required for conflict management, so they will need help determining a plan for their group interaction. A recommendation is to have the teams develop both a team policy document and an expectations document at the beginning of the course that provide a foundation for handling future problems (Oakley, 2004). The team policies address the administrative rules for the team's operations: roles with associated responsibilities, procedures for group meetings, methods for submitting assignments, and strategies for dealing with uncooperative team members. The expectations document permits the team to collectively determine a realistic goal for the course. The documents then help students determine an appropriate peer rating by judging whether an individual has complied with the operations and lived up to the expectations. They also provide a guide for holding each other accountable prior to when a potential conflict arises.

Giving Individual Exams

Peer evaluations will assist an instructor in determining if all individuals are contributing to the group effort, but they can be misleading. Group members may find it socially difficult to provide an accurate assessment of their peers (even in an anonymous setting) resulting in peer evaluations that provide a false representation of the individual effort. Also, while the peer assessments help to ensure that everyone is contributing toward the group goals, this does not necessarily mean that each student understands each objective for the course. Instructors need additional tools to enforce individual accountability. A proven method is to administer individual exams that test all of the objectives. This prevents the situation where there is "only a group product, demonstration, or performance to be evaluated, [leaving] no mechanism for individual accountability." (Cooper, 1990) The pressure of an impending exam, will motivate individual students to look at all of the testable course material. The results of the exam will serve as a clear indicator of who understands the material and who does not.

Using Group Roles

In order for students to succeed while taking a comprehensive exam, instructors need to make certain that individuals are learning each objective. Students must assume some responsibility for their own learning, but teachers must steer their group interaction in a positive direction. The teacher should mentor the teams to ensure that they are properly distributing the work instead of isolating tasks to particular individuals. Keeping in mind that many students will naturally gravitate toward a "divide and conquer" approach, instructors can dictate that team members assume particular roles during portions of the course and that they rotate periodically. This forces students to be exposed to the breadth of the problem that the group is trying to solve. Each individual should assume each of

the following roles or some suitable variation during the course of the assignment: coordinator (organizes tasks and assigns responsibilities), checker (monitors the team's solution for correctness, completeness and accuracy), recorder (writes the solution), skeptic (plays devil's advocate to ensure various perspectives are considered in determining the final solution) (Johnson, 1999). These administrative responsibilities are in addition to performing work toward the actual solution, but they are essential to reinforce the use of collaborative skills.

Instructors can also mandate that different group members present the solution. Presenting the group's work implies that the briefer has a thorough understanding of the entire solution and not just the part that he or she worked on directly. To develop this understanding requires considerable face-to-face collaboration within the group where each member explains the portion that he or she worked on.

Student Motivation

A final method that instructors can use to provide a cooperative learning environment that promotes individual accountability is to factor in student motivation. Motivation should be derived from both internal and external factors. The importance of a student being truly interested in a particular topic cannot be overstated. Instructors can provide students with a degree of autonomy in selecting a project to work on so that the students can select a topic that will keep them involved and motivated throughout the semester. If a student is forced to work on a problem that he or she finds uninteresting, it will require considerable self discipline just to get the work done. If the student has the flexibility of selecting a problem the he or she finds intriguing, working toward the solution will be less of a chore and there is increased potential for insightful discussion, deeper research, and true learning.

Instructors can also provide external motivation by offering incentives for exercising effective teamwork. Instructors should be creative in assigning grades and rewards such that evidence of collaboration and teamwork may raise or lower a grade. Individual accountability and group goals must be intertwined so that there is an incentive for individuals to put forth their best effort (Slavin, 1995). For example, one individual may present a group's work and all members of the group receive the same grade.

Conclusion and Future Work

Many researchers have addressed the benefits of cooperative learning and how to maximize the potential for these benefits by creating the best possible environment. A key component to this environment is ensuring individual accountability in a group setting. The research addresses several methods that instructors may use to construct a suitable environment, but the research is not exhaustive. Specifically, there is no research that focuses on courses that do not lend themselves to comprehensive individual examinations. There are some project-based courses where instructors cannot accurately assess an understanding of the course objectives during a test; the objectives are larger in scope and require students and teams to try, fail, and re-try before they learn. Without the benefit of an individually based exam, instructors may be left without a comprehensive means of ensuring individual accountability. My future research will address problems with establishing a constructive cooperative learning environment in an exam-less, project-based course.

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Walker, A., "Cooperative Learning in the College Classroom," *Family Relations*, Vol . 45, No. 3 (1996), 327-335.

Summary of Selected Writings:

Cohen, E. (1994) "Restructuring the Classroom: Conditions for Productive Small Groups," *Review of Educational Research*, Vol 64, No. 1 1994.

Cohen explains that a productive environment requires much more than just placing students into groups. The benefits of cooperative learning can only be gained if the groups are subjected to an appropriate set of conditions; the same conditions discussed previously. She uses empirical methods and studies by other researchers to defend her conclusions. She asserts that groups should be structured to foster interaction, but the required degree and type of interaction may differ depending on the type of problem being solved. Teachers must understand the types of problems that they are requiring a group to solve, then determine the type of interaction required, and then structure the group accordingly.

She makes additional points regarding the design of groups:

- Students need both cognitive and social skills to be effective members; students must be forced to talk to one another.
- If students are not taught differently, they tend to operate at the most concrete level. The instructor must force the groups to develop further.
- Ill-structured problems are well suited for cooperative learning because they require interaction.
- She discusses the composition of groups and whether they should be homogenous or heterogeneous in regard to achievement potential. High-achieving students *may* benefit from explaining complex topics to other group members, but her research shows that the only low-achievers unconditionally benefit from heterogeneous groups.
- Positive interdependence must apply to both group goals and resources in order to foster group participation

Cooper, J., Prescott, S., Cook, L., Smith, L., Mueck, R., "Cooperative Learning and College Instruction: Effective Use Of Student Learning Teams," California State University Foundation, 1990.

This is a 50-plus page workbook that takes a comprehensive look at cooperative learning in a college environment. It promotes the benefits of cooperative learning, defines its critical elements, and suggests how to successfully implement the technique in a college classroom. In addition to recommendations for enforcing positive interdependence and individual accountability, the workbook also suggests experimental approaches for employing cooperative learning in courses that have a more traditional lecture setting. An appendix provides examples of suggested exercises suitable for a cooperative learning environment.

Felder, R., Brent, R., "Cooperative Learning in Technical Courses: Procedures, Pitfalls, and Payoffs," *ERIC Document Reproduction Service Report ED 377038*, (1994).

Dr. Felder and Dr. Brent analyzed the results of a longitudinal study that looked at 5 semesters worth of chemical engineering courses to develop procedures for implementing cooperative learning in courses that require quantitative problem solving. They used a combination of in-class and out-of-class exercises that students conducted in teams and describe their lessons learned in turn. They provide examples of how to structure an individual class such that activities and questions promote the benefits of cooperative learning. They then discuss how to develop an effective out-of-class assignment that requires students to solve problems jointly. They dedicate the remainder of the paper to a review of the details from their case study and to addressing potential concerns from an instructor's perspective.

George, P. "Using Cooperative Learning in the College Classroom," *The NEA Higher Education Journal* (1999), 33-38.

Dr. George's article provides a study of undergraduate classes at a mid-sized university. Using empirical methods, she set out to prove that students have both a higher measure of achievement and greater satisfaction from a course that uses cooperative learning. She divided her student population into different classrooms and employed cooperative learning in one, and a more traditional lecture environment in the other. In her cooperative classroom, she employed a technique called "Think-Pair-Share" where students were organized in pairs to listen to a question and then collaborate before answering. She used her quiz and exam grades as a measure of academic achievement and she used the results of an end-of-course survey to measure the degree of satisfaction. She found that the grades were in fact higher in the cooperative group and that they also reported a greater interest in the course material while rating the instruction quality higher.

Johnson, D., Johnson, R., Smith, K., "Cooperative Learning: Increasing College Faculty Instructional Productivity", *ASHE-ERIC Higher Education Report* No. 4, George Washington University, 1991.

This work emphasizes the role of the professor in developing a suitable cooperative learning environment. In addition to selecting, developing, and monitoring the teams themselves, the professor must also design assignments and projects that are suitable for group effort. The assignments must be structured such that they require all five components outlined earlier. The paper also discusses formal (one class period to several weeks where group works on one assignment), informal (one discussion to one class period), and base (course long team) cooperative learning groups.

Kaufman, D.; Felder, R. "Accounting for Individual Effort in Cooperative Learning Teams, " J. *Engineering Education*, (2000), 133-140.

Kaufman used an "autorating" tool to assist her students in making peer evaluations. She used the tool to adjust grades based on the "responsibility of performance" of her students. She provides detailed empirical data to explain her methods and provides analysis of how students rated one another.

Oakley, B., Felder, R., Brent, R., & Elhajj, I. (2004) "Turning Student Groups into Effective Teams," *Journal of Student Centered Learning*, Volume 2, No. 1, New Forums Press, Inc, 2004.

As the title suggests, this work focuses on the team aspect of cooperative learning. Students do not automatically come together as an effective group that promotes learning; they must be taught and coached into becoming strong teams. Collaborative skills such as project management, inter-team communication, and conflict resolution require emphasis if an instructor expects teams to work productively. This paper provides a detailed analysis of how to form teams at the beginning of the semester, how to take a raw team and convert it into an effective one that promotes learning, and how to properly employ peer assessments so that the keep the team on course. The paper also provides several worksheets that the authors use for helping to structure team development and peer assessments.

Occhipinti, J., "Active and Accountable: Teaching Comparative Politics Using Cooperative Team Learning," *PS: Political Science and Politics,* Vol. 36, No. 1 (2003), 69-74.

In one of the few case studies conducted recently in the college classroom, Occhipinti emphasizes the use of daily, individual quizzes to enforce individual accountability.

Prey, J. "Cooperative Learning in an Undergraduate Computer Science Curriculum," *Frontiers in Education Conference*, 1995.

At the University of Virginia, the Computer Science Department has adjusted the first four courses in the CS undergraduate curriculum to employ a cooperative learning environment in the computer labs. The department's goal is to educate students using a model that more closely resembles how software is developed in industry. Traditionally, students write small, simple programs to learn the fundamentals of computer science. If the students follow this model throughout their education, they will graduate and have a dramatically different view of the discipline than what is employed in the real world. The paper relies on student feedback to justify the initial success of the program. Students overwhelmingly responded favorably to the method.

Slavin, R. "Cooperative Learning." *Review of Educational Research*, (1980) 315-342.

This is one of the fundamental, modern works that explains cooperative learning. Slavin's research was focused on elementary and secondary school classrooms.

Slavin, R. "Research on Cooperative Learning: What We Know, What We Need to Know." *Office of Educational Research and Improvement*, (1995).

This is a republication of a previous work that provides empirical evidence to support the benefits of cooperative learning. Slavin identifies and explains four theoretical perspectives from which to explain the positive effects of cooperative learning: motivational perspective (students help each other because their success or failure is dependent on one another), social cohesion perspective (students help each other because they care about one another), a cognitive developmental perspective ("interaction around appropriate tasks increases mastery of critical concepts"), and a cognitive elaboration perspective (students who are forced to explain concepts to one another develop an increased mastery of the subject).