# 101 Reasons for Using Cooperative Learning in Biology Teaching

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OVER the last few decades, there have been numerous studies supporting or repudiating cooperative learning as an effective means of instructing high school and college students. The promoters of cooperative learning champion such studies as McKeachie (1988), Slavin (1987), and Johnson and Johnson and Smith (1991) that state when small teams work together to solve challenges in a student-centered fashion, they not only understand the information better but they retain it for a much longer period of time than they do with teacher-centered instruction. The opponents of cooperative learning point to studies by Collins (1970), Langer & Beneventi (1978) and Hill (1982) that indicate that cooperative learning is too time-consuming, too diffuse in responsibility, and too informal to bring about high level learning of complicated material older students need to know. Since both positions were supported by what seemed to me to be good evidence, I decided to review as much cooperative learning information as I could before drawing any conclusions about using it in my teaching of biology. This resulted in months of reading monographs, texts, journals, abstracts and reprints on the topic.

The reading, however, was interesting and before long I had perused more than 300 articles concerning teaching science using cooperative learning. Some of the writings were stuffy, statistically based research reports, while others were easily understood anecdotal descriptions from science teachers and professors about how cooperative learning worked in their classes. One observation I made was that only 8% of the articles reported negative experiences using cooperative learning (i.e. the informality was a disruptive force in the classroom). The majority of the reports mentioned how active the team members were during the cooperative task. The group work increased student enthusiasm for science and generated more interest in understanding the views of colleagues. Several studies mentioned that most science teachers tend to focus on the presentation of fixed bodies of information, embrace competition, and do not engage students in the learning activity. The supportive articles indicate that cooperative learning overcomes these criticisms by creating enrichment opportunities in comfortable, nonthreatening settings.

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As I read the studies, I jotted down the positive reasons cited for using cooperative learning in biology teaching. The list grew quickly and by the time I completed my survey, several hundred outcomes supportive of cooperative learning were listed on my notepad. A review of the items revealed that some of the statements could be combined and, in the end, 11 nonoverlapping categories emerged. These included enhancement of:

1. Science thinking
2. Attitudes
3. Instruction
4. Evaluation
5. Values
6. The learning environment
7. Practical skills
8. Social skills.

Cooperative learning also was shown to:

9. Up-grade the student's reading and writing skills
10. Model real life
11. Support learning in women as well as men.

Could teaching with cooperative learning really improve all these things? I decided to explore the method further by trying it in my biology classes.

During the first year, some of the cooperative learning activities I designed did not work as well as others. However, overall I was pleased with most of what I had tried. My classes seemed to be learning as much biology as in previous years and my students were enjoying the class more than ever before. The following year I eliminated the activities that did not work with the previous classes and added new cooperative learning exercises to those that had gone well. By the end of the course, my students were eager and interested in biology and sorry to see the class come to an end. After the third year I was even more confident I had made the right decision to use cooperative learning in my teaching. Most of my students seemed not only to know more biology,

but to understand it better than students did in previous years.

During my experiment with cooperative learning, I continued to use the same unit tests that I had used with my traditionally taught classes. This gave me an opportunity to compare the exam scores of both groups. When this was done, I found the mean scores were significantly higher with the cooperative learning classes (Lord 1997). My perceptions were correct; cooperative learning had enhanced biology learning in my classes. I had become a true believer in the use of noncompetitive, student teams in the teaching of biology.

Enthused by my discovery, I began to write, hold workshops and present my findings to biology teachers as often as I could. The experience lead to presentations at several national conferences and a publication in *The American Biology Teacher* titled: ''Cooperative Learning that Really Works in Biology Teaching'' (Lord 1998). Some of the biology teachers in attendance at my presentations were interested in seeing the supportive citations that encouraged my conversion. This paper presents aspects in each of the 11 categories mentioned above and lists 101 sound reasons why every biology teacher should consider adopting cooperative learning in his or her classes.

## Cooperative Learning Enhances Thinking & Learning in Biology

A major goal for most biology instructors is to increase the level of student understanding in the discipline. To achieve this, some instructors have introduced splashy overheads and colorful charts while others have included videos, laser disks and CD-ROMS in their instruction. Many biology teachers have found that the new techniques add student notice to their presentations but do not seem to significantly raise the level of biology thinking and learning in the students. A method that was found to promote solid understanding was teaming students in small groups and having them perform challenging tasks together (Gabbert et al. 1986; Lord 1997; Yager 1991). Using such a teaching strategy, Light (1990) found the students in teams did significantly better in all measures of their biology course than students who studied alone. The researcher found that students in teams spoke more often, asked more questions, and were more engaged in biology than those in nongrouped, teacher-directed classes. Light concluded that by shifting responsibility for learning onto the students in the groups, teachers provide the learners with the opportunity to help each other through biology. According to a study done by Lorsbach and Tobin (1993), interacting with peers in cooperative learning uncovers inconsistencies in what both the explaining students and the listening students already know about the topic. As they discuss biology with their team members, students make adaptations in their understanding of the subject matter. In other words, by attempting to explain what one knows about a topic to someone else, or while trying to understand what is being explained by a colleague, students test the fit of their knowledge of the subject matter. When information being discussed does not match a student's understanding, he or she will attempt to resolve the conflict in his or her mind. When misconceptions are corrected in this way, lasting understanding of the material will result (Lorsbach & Tobin 1993).

## Cooperative Learning Enhances the Learning Environment in Biology

Research reveals that the climate for learning biology in the classroom can significantly influence the degree to which students gain new knowledge (Kohn 1986). Several studies have found that biology classes which emphasize competition for grades create more tension, self doubt, and anxiety in students than do those that employ noncompetitive learning situations (Haines & McKeachie 1967; Slavin 1990). The research reveals that as biology students attempt to solve problems or questions together in small groups, they become an active part of the class experience. The continuous encouragement of students leads to a level of empowerment that is not attainable in competitive, teacher-centered classes. Overall, the studies conclude that competition fosters a win-lose situation where superior students reap all rewards and recognition and the mediocre and low-achieving students reap none. In contrast, students in cooperative groups interact with each other, share ideas, seek additional information, and make decisions together. This enhances learning and improves the overall instructional environment in the classroom.

Furthermore, Haines and McKeachie (1967) found that as biology teachers hear the discussions of the groups, they pick up interconnective information about the students' understanding that may not have been apparent before. In fact, the less formal climate created by cooperative learning enables the biology teacher to join student teams to clarify and question ideas or statements made by the group (Alico 1997).

## Cooperative Learning Enhances the Attitudes of Biology Students

A concern of many life science teachers is the sentiment their students have for biology. Several studies (Johnson, Johnson & Smith 1991; Bligh 1972) found that biology students who were provided in-class opportunities to interact actively with classmates and instructors were happier, enjoyed biology more, and

were more satisfied with their learning experiences than were students who were taught exclusively by lecture. Bligh (1972) concluded that students find satisfaction with activities that value their abilities and include them in the learning process. Alico (1997) notes that in a cooperative system, the level of involvement of students is very intense and personal. Participants get to know each other and their instructor personally. Teachers learn about student behaviors because students have many opportunities to interact with the instructor. Lines of communication are opened and actively encouraged. Furthermore, McKeachie (1988) found that cooperative learning provides teachers with more opportunities to explain to students why specific guidelines are established by their school. In turn, student views about school policies are more easily solicited and they have more input into changing them. This sense of empowerment leads students to a positive attitude and makes for a friendlier, more casual environment within the institution.

In addition, Kessler, Price and Wortman (1985) found that when a teacher calls upon a student in a traditional biology class, the student becomes the focus of attention of the entire room. A mistake can become the subject of ridicule by the whole group. This will lead to frustration, embarrassment and anxiety in many students. In a cooperative learning situation, however, the focus of attention is diffused among the whole group. When an answer is given to the class, it represents the work of the team and, therefore, no single individual is held up to criticism. In addition, the group produces a product that its members can review prior to it being presented to the whole class. This diminishes the prospect that a mistake will occur at all. If a correction is warranted, it becomes a teaching tool instead of a public admonishment. As a consequence, the class attitude becomes one of cooperation, not condemnation.

This can be particularly important in mixed racial and ethnic classrooms. Because students in cooperative groups are actively involved in exploring issues and interacting with each other on a regular basis, they become sensitized to, and more understanding of, problems faced by other students. Hooper and Hannafin (1988) state that behaviors of one culture that might appear odd when taken out of context become understandable when nontraditional students are provided with opportunities to explain their beliefs. Very little opportunity exists for students to explain their ideas in a lecture class.

## Cooperative Learning Aids in Biology Grading & Assessment

Every biology teacher needs a fair and accurate way to evaluate the course success of his or her students. Simply computing a class member's grade from test percentages and homework assignments forfeits other important attributes students bring with them to biology class (Rosenshine & Stevens 1986). Cooperative learning offers teachers a number of ways to appraise subject understanding in students. In the safety of the cooperative team environment, students freely discuss their understandings of the biology material. This provides the instructor with many opportunities to appraise student explanations, ideas and questions.

In addition, cooperative learning increases the likelihood that all biology students will successfully complete biology assignments. Lord (1998) reports that assignments which include each team member are particularly enhanced. Tasks separated into several aspects (one for each team member) encourage team members not only to do a good job on their section of the assignment, but motivate all the participants to furnish high quality sections to the report. This team plan allows group members to read over each other's writings for errors and flow and to critique papers for understanding and substance before the overall assignment is turned in. The strategy provides each student with a different sense of audience than if he or she was writing just for the instructor. Group projects also give students a way of expressing their understanding by allowing them to first verbalize their ideas with their partners prior to turning the assignment in or taking a test. Cross and Angelo (1993) point out that group projects also present an alternative for students who are not as proficient in taking exams based upon content reproduction.

Another group evaluation technique is to have team members proportion the overall score for the assignment to each other. In this way, if the effort in completing the assignment was not evenly spread throughout the team, the student or students who did the most work on the assignment would receive a higher score. For example, if a group of four students earns 88 points on an assignment, it would multiply the 88 by 4 to get 352 points, then divide the total points into 4 scores based on the contributions of each team member to the project. Students appreciate their input into the evaluation process and find this to be an extremely fair system of determining grades for the group (Lord 1998).

## Cooperative Learning Enhances a Student's Understand of Practical Relationships

An objective of many life science teachers is to have their students be able to apply the information they're learning to everyday situations. Working cooperatively with colleagues is the way science is

done in the real world. As biologists team together to unravel scientific challenges, they employ algorithms, theories, procedures and concepts in the attempt to support or disprove their ideas. Opalka (1998) notes that when biology students in cooperating teams are similarly challenged, they follow the same discovery procedures as experienced biologists. This was rarely found with biology students working alone in competitive surroundings or partnered students following step-by-step (cookbook) procedures during the lab (Johnson, Johnson & Smith 1991).

In addition, Bean (1995) found that well-seasoned cooperative groups tend to extend their activities outside of biology. According to the researcher, it is not at all uncommon to find members of cooperative learning teams working together outside of the biology classroom on assignments from other classes, doing extra credit science and nonscience projects, and meeting in study groups at each others' homes in the evenings or weekends.

### *Cooperative Learning Enhances Reading & Writing Skills*

A realistic objective of most every school is for its students to read and write at their grade level. Biology students should be comfortable perusing books, journals and other references in the discipline; they also should be able to draft and discuss important biological issues with each other. Tannenberg (1995) found that as students learn biology in cooperative teams, they enter into the culture of the discipline. According to the researcher, when students discuss their understanding of content, figures or graphics with each other, they acquire the jargon of biology. They're drawn into the discipline's traditions, customs and practices. Tannenberg also found that, as this occurs, students become better able to understand the publications and reprints of experienced biology practitioners.

It has also been found that students in cooperative learning groups become more creative and adventurous in their writing than do students in competitive classes (DiPardo & Freedman1988; Bruffee 1993; Masqud 1980). The researchers found that when students write together in groups, they automatically critique and review each other's works and enhance the writing levels of their colleagues. The studies indicate that this was not found in any other type of instruction.

### *Cooperative Learning Enhances the Social Skills of Students*

Much of the research into teaching and learning indicates that the more social support students

receive, the higher their achievement. Many studies have found that students taught with cooperative learning receive strong social support and are psychologically and physically healthier than students taught in competitive classrooms (Johnson & Johnson 1989; Slavin 1990). Stahle and VanSickle (1992) found that in teacher-centered lecture classrooms, students tend to be primarily concerned with their individual grades and where they fit in the grade curve. Such environments emphasize doing better than everyone else and lead to a negative view of human nature (Kohn 1986). Students taught with cooperative learning, on the other hand, are more altruistic, caring, empathetic and committed than their competitively driven colleagues. Sandberg (1995) points out that cooperative learning creates a safe, nurturing environment where students freely express themselves and explore their ideas without the fear of failure or criticism.

Furthermore, cooperative learning helps students resolve their differences amicably. During a cooperative experience in biology, students learn how to challenge ideas and advocate for their positions without personalizing their statements. They also learn conflict resolution methods that are important for real life situations (Johnson, Johnson & Holubec 1984).

## Cooperative Learning Enhances the Instruction of Biology

Most teachers of biology are constantly on the lookout for ways to improve their coverage of the subject matter. Research shows that lasting knowledge can only come when students are truly involved in the learning process (Yager 1991). Cooperative learning works in biology because it encourages interaction among the learners and thus involves them in the acquisition of new knowledge (Bean 1995). As cooperative groups perform the activities designed by the teacher, the instructor can listen to their discussions and evaluate the group's understanding of the important life science concepts in the lesson. If one or more of the teams are significantly off target, the instructor can either correct the problem with the team or gain the attention of the entire room and straighten it out as a class.

In addition, cooperative strategies in biology create an environment in which students become actively involved in defining questions in their own language and working out answers together instead of reproducing material given them by the biology teacher or the textbook. This active involvement is ideal for developing critical thinking processes in students (Davis, Maher & Noddings 1990).

Cooperative learning also permits life science teachers to divide long, complicated materials into small segments. This ''chunking of information'' is more manageable for students and makes it more possible for team members to teach each other. Several studies have found that this approach (called ''jigsawing'') greatly enhances overall student understanding of the material (Johnson, Johnson & Smith 1991; Lord 1998). In a jigsaw, each student in a group joins a single representative from the other teams to learn a portion of the material. After going over the material together, the students return to their own groups to teach what they have just learned to the other members of their own team (Johnson & Johnson 1989).

An enormous hidden benefit for utilizing cooperative learning in biology teaching was noted by Stahle & VanSickle (1992). The researchers found that when students are actively involved in the learning process, they become much more interested in the subject matter. As they become more immersed in biology, it makes it difficult for troublesome individuals to gain the attention of other students.

## Cooperative Learning Enhances Student Values

Another objective of many life science instructors is to have students appreciate education and their classmates. Johnson, Johnson and Smith (1991) found that when biology students functioned in cooperative groups with other class members, the students developed more wholesome and robust educational values than students who worked alone in competitive-based classes. The researchers suggested that the cooperative environment empowered the students and increased their belief that they really could succeed in the course. This lead to an improvement of the students' attitude about biology and their overall regard for education.

Furthermore, Burnstein and McRae (1962) noted that instructing in cooperative groups improved the understanding of the diversity that exists among students of different learning styles and abilities. The researchers noted that lower level students benefited by modeling the better students and higher ability students benefited by helping their less capable teammates. The researchers found that, as this occurred, the team members became psychologically linked and helped each other through the learning process.

## Cooperative Learning Models the Real World

A major objective of education is to prepare students for the real world. Several studies found that, when properly utilized, cooperative learning encourages students to develop the skills that are needed to function in society (Houston 1991; Bruffee 1984). The research indicates that the cooperative atmosphere encourages such skills as leadership, oral and written communication, constructive inquiry, material

**Cooperative Learning Enhances Thinking and Learning in Science:** Cooperative learning . . .

1. contributes to higher grades in science. Light (1990)
2. enhances critical thinking of science concepts. Austin (1977) & Smith (1984)
3. enhances understanding of science. Sharon (1994)
4. enhances the discovery of science concepts. Yager (1991)
5. enhances retention of science. Bargh & Schal (1980)
6. enhances science information exchange. Johnson, Johnson & Smith (1991)
7. encourages teaching of science to others. Lorsbach & Tobin (1993)
8. produces high levels of science reasoning. Johnson, Johnson & Smith (1991)
9. models effective science instruction. Panitz & Panitz (1997)
10. develops problem solving strategies in science. Kulik & Kulik (1979)
11. enhances achievement in science. Johnson, Johnson & Smith (1991)
12. enhances the chance for future science success. Kohn (1986), Helmreich (1982)

**Cooperative Learning Enhances the Learning Environment in Science:** Cooperative learning . . .

13. empowers students in science. Slavin (1990)
14. creates a less tense & anxious learning environment in science. Neer (1987)
15. encourages peer tutoring in science. Slavin (1987)
16. transforms a large science class into several small classes. Lord (1997)
17. helps clarify science through group discussion. Johnson (1974)
18. encourages involvement of science professor. Alico (1997)
19. helps stimulate whole class science discussions. Peterson & Swing (1985)
20. leads to more and better science questions in class. Felder (1997)
21. promotes academic relationships beyond the science classroom. Bean (1995)
22. creates environments where students practice leadership skills. Johnson & Johnson (1990)
23. promotes the pursuit of future science courses. Sandberg (1995)
24. develops new knowledge in professors as well as students. Haines & McKeachie (1967)

**Cooperative Learning Enhances the Attitudes of Science Students:** Cooperative learning . . .

25. attitudes of science students. Johnson, Johnson & Smith (1991)
26. attitudes toward the science professor. McKeachie (1988)
27. attitudes of students toward college administrators. McKeachie (1988)
28. students' satisfaction with the science learning experience. Turnure & Zeigler (1958)
29. attitudes toward science content. Bligh (1997)
30. satisfaction with learning science. Bligh (1997)
31. attitudes between students with different values. Slavin (1987)
32. levels of self-esteem in students. Kagan (1986)
33. reduces anxiety in the science class. Kessler, Price & Wortman (1985)
34. attitudes among students of different races. Johnson & Johnson (1989)
35. attitudes in students of different ethnic groups. Hooper & Hannafin (1988)
36. attitudes between traditional and non-traditional science students. Slavin (1987)

**Cooperative Learning Aids in Science Grading and Assessment:** Cooperative learning . . .

37. offers more opportunities to assess science students. Rosenshine & Stevens (1986)
38. gives the science teacher fewer tests to grade. Lord (1998)
39. encourages team assessment techniques in science. Cross & Angelo (1993)
40. gives science teachers fewer term reports to read and grade. Lord (1998)
41. increases the likelihood that students will successfully complete assignments. Lord (1997)

**Cooperative Learning Enhances Science Learning:** Cooperative learning . . .

42. represents science as it is really done. Opalka (1998)
43. develops lab skills and learning. Johnson, Johnson & Smith (1991)
44. allows for more exploratory and fewer ''cookbook'' labs. Opalka (1998)
45. significantly reduces science test anxiety. Neer (1987)
46. provides an effective means of helping students in science. Cooper (1984)
47. sets high expectations for students in science. Johnson, Johnson & Smith (1991)
48. sets high class expectations for science teachers. Lord (1997)

**Cooperative Learning Enhances Science Reading and Writing:** Cooperative learning . . .

49. promotes high-level science writing skills. DiPardo & Freedman (1988)
50. improves oral communication skills in science. Yager (1985)
51. enhances the language of science. Tannenberg (1995)
52. encourages note-taking skills in science. Masqud (1980)
53. promotes peer editing of another's science compositions. Johnson, Johnson & Smith (1991)
54. enhances language acquisition. Bruffee (1993)
55. helps foreign students learning science. Bruffee (1994)
56. is useful in science-math understanding. Schoenfeld (1985)
57. is useful in science-social science relationships. Stahle (1992)
58. is synergistic with writing across the curriculum. Bruffee (1984)

**Cooperative Learning in Science Enhances Social Skills:** Cooperative learning . . .

59. develops camaraderie and friendship. Johnson & Johnson (1989)
60. promotes interpersonal relationships. Johnson & Johnson (1989)
61. promotes responsibility for others. Stahl (1992)
62. creates a nurturing environment. Sandberg (1995)
63. promotes strong social support. Cohen & Willis (1985)
64. enhances self management skills. Resnick (1987)
65. enhances social relationships beyond the classroom. Bean (1995)
66. develops respect for human nature. Kohn (1986)
67. establishes team-work. Deutsch (1985)
68. instills empathy for others. Yager (1990)
69. introduces other methodologies. Slavin (1990)
70. teaches how to criticize ideas, not people. Johnson, Johnson & Holubec (1984)
71. supports students' need to succeed. Johnson & Johnson (1989)
72. provides a safe environment to explore alternatives. Sandberg (1995)

**Cooperative Learning Enhances Science Instruction:** Cooperative learning . . .

73. allows teachers to see how concepts are being grasped. Johnson, Johnson & Smith (1991)
74. helps absent students get the information they missed. Johnson, Johnson & Smith (1991)
75. allows for division of information into chunks that teams can learn. Johnson & Johnson (1989)
76. creates a supportive community within the class. Johnson, Johnson & Smith (1991)
77. supports the constructivist philosophy of teaching science. Wooley et al. (1990)
78. provides a variety of ways of awarding points. Lord (1998)
79. personalizes science lectures. Bean (1996)
80. encourages better attendance. Astin (1977)
81. creates a less disruptive environment. Stahl & VanSickle (1992)
82. involves students in developing future science classes. Kort (1992)
83. breaks teacher-centered science instruction. Smith (1989)
84. enhances mega-cognitive science learning. McKeachie (1967)

**Cooperative Learning in Science Enhances Student Values:** Cooperative learning . . .

85. enhances academic values. Johnson, Johnson & Smith (1991)
86. enhances self-efficacy. Johnson, Johnson & Smith (1991)
87. addresses learning style differences. Midkiff & Thomasson (1993)
88. encourages diversity of understanding. Burnstein & McRae (1962)
89. encourages positive interdependence. Baird & White (1984)

**Cooperative Learning in Science Models Real Life:** Cooperative learning . . .

90. models employment situations. Johnson, Johnson & Holubec (1984)
91. models societal roles. Houston (1992)
92. develops work-related skills. Sandberg (1995)
93. develops skills to be effective citizens. Kohl (1986)

**Cooperative Learning in Science Teaching Is Supportive of Women and Men:** Cooperative learning . . .

94. involves women in learning science. Bean (1995)
95. develops leadership skills in women. Barns (1983)
96. promotes positive attitudes between the sexes. Bean (1995)
97. develops self-esteem in women. Johnson & Johnson (1989)
98. enhances science knowledge in women. Lararowitz (1991)
99. creates intrinsic motivation in men and women. Mergendollar & Packer (1989)
100. is favored more by women and men. Newmann & Thompson (1987)
101. creates a more enjoyable and fun science learning environment. Lord (1994)

Figure 1. Listing the 101 reasons for utilizing cooperative learning in biology teaching.

dissemination, brainstorming, and deadline completion, skills that are needed to productively function in the work world.

In an elaborate study, Kohl (1982) found that cooperative learning develops the six major qualities students need to become effective citizens. According to the researcher, the six qualities are:

1. To use language well and thoughtfully
2. To think through a problem and experiment with solutions
3. To understand scientific and technological ideas
4. To use imagination and appreciate different forms of personal and group expression
5. To understand how people function and to apply that knowledge to group problems in one's own life
6. To understand how to learn something yourself and be a learner all your life.

## Cooperative Learning Is Enjoyed Equally by Women & Men

A concern of all biology teachers is treating the males and females in the class equally. Bean (1995) found that cooperative learning activities equalize the interactions between students and remove the focus of the gender of the individual among the participants. The method is also effective at increasing the leadership skills of female students and for encouraging men and women to respect each other's views. Johnson and Johnson (1989) found that cooperation in learning groups tends to promote higher levels of self esteem in women than did competitive and individual learning. The researchers found that students in cooperative learning groups encourage each other's success, form multidimensional and realistic impressions of each other's competencies and give accurate feedback to one another. All are important self-esteem building elements for young men and women.

Furthermore, Bean (1995) found that cooperative learning enables biology teachers to observe group dynamics and intervene where necessary to encourage participation by hesitant students. If a gender problem does arise, the instructor may address it through a one-on-one discussion, or through group activities followed by a plenary class discussion.

In addition, research reveals that more students graduating from high school favored being taught with cooperative groups than by lectures in science classes (Newmann & Thompson 1987). The research found both men and women students were more motivated and interested in science when it was taught with student teams than with lecture (Mergendollar & Packer 1989). Lararowitz (1991) and Lord (1997) found that over two-thirds of the men and women graduating from high school and college learned more of the subject and enjoyed taking a student-centered (cooperative learning) science course then they did taking a teacher-centered (lecture) science course in their academic preparation.

When done correctly, cooperative learning has much more to offer biology students than traditional methods. It is hard to imagine why instructors of biology are reluctant to switch to it. If biology teachers give cooperative learning a fair trial, I'm convinced they will never return to teacher-centered lectures again!

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