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Cooperative Learning: Group Activity Projects in Reproductive Biology Instruction[1]

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Abstract

Course and instructor evaluations from a reproductive biology course that included group activity projects were analyzed. Group activity projects consisted of four to eight students responsible for an objective such as establishing pregnancy in a ewe by embryo transfer. At the conclusion of the project students gave a class presentation. Although the majority of students believed they learned the most from the lecture section, the majority believed the group activity projects were the most challenging and enjoyable. Ninety-four percent of the students believed the group activity projects complemented and heightened interest in the other sections and 97% of students believed the time required for the group activity projects was worthwhile. Group activity projects 1) stimulated student interest in the subject, 2) taught teamwork, 3) encouraged competition, 4) taught responsibility, 5) encouraged development of public speaking skills, and 6) motivated students by involving and challenging them in an enjoyable peer-learning environment.

Introduction

One objective of higher education is to provide students with the ability to critically evaluate ideas and information from many sources, creatively solve problems, and/or discover new concepts. Accomplishing this objective, however, requires more than just dispensing knowledge to students. Students must be involved in the processes described by the instructor. In other words, they must get their hands dirty. One method of allowing extensive student involvement is through activity/special projects, either on an individual or group basis (Kauffman et al., 1989).

Group activity projects that stimulate analysis and thought have been successfully incorporated into higher education courses (Buhr and Knauft, 1984; Hall, 1989). Individual and group activity projects that involve practical problems and procedures stimulate higher-level thought and improve student understanding and are generally regarded by students as valuable learning experiences (Howe and Durr, 1982; Hall, 1989). Student activity projects stimulate student interest by encouraging them to take responsibility for obtaining information and creating ideas (Schaefer and Kauffman, 1975).

This article describes a course that incorporated

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group activity projects as a required section. The purpose of writing this article was to demonstrate to faculty how this cooperative learning method was administered to and received by students.

Materials and Methods

The Course

The course was a 3 credit, 3 section introductory reproductive biology course at the University of Illinois. Laboratories met once a week and consisted of a combination of "hands-on" and demonstration laboratories. All students were assigned to a group activity project during the first organizational laboratory. Each group consisted of four to eight students and a teaching assistant. Students were given an objective, animals, necessary materials, and were instructed to complete their group activity project and give a class presentation in approximately 12 weeks. No class time was provided to complete the group activity projects.

Selected group activity projects are described in Table 1. Students in the sheep embryo transfer group were assigned a group of six to eight ewes and a ram and were provided with progestin implants for synchronization (Kesler and Favero, 1997) and all the necessary surgical facilities and equipment needed to conduct an embryo transfer. Approximately 30 days after the embryo transfers, ewes were euthanized and their reproductive tracts examined. Students in the pig embryology group were assigned a group of six to eight gilts and a boar. All the necessary surgical facilities and equipment needed to unilaterally ovariectomize one-half of the gilts were provided (Brinkley et al., 1964). Approximately 30 days after breeding by AI, the gilts' reproductive tracts were collected from the abattoir and examined. Students in the chick implant group were assigned a group of 20 chicks (10 males and 10 females) and materials necessary to surgically implant testosterone into one-half of the chicks (Kesler et al., 1996a). Sexual behavior was observed throughout the experiment. Approximately 30 days after implanting testosterone, chicks were euthanized and the testes and secondary sex characteristics observed (Zarrow et

Table 1. Selected Group Activity Projects Included in a Reproductive Biology Course Taught at the University of Illinois.

Project	Objective
Sheep Embryo Transfer	To establish pregnancy in a ewe via transfer of an embryo to another ewe.
Pig Embryology	To demonstrate ovulatory compensation in gilts unilaterally ovariectomized and artificially inseminated.
Chick Implant	To demonstrate the effect of testosterone on testes development and secondary sex characteristics of male chicks.
Heifer Synchronization	To establish and verify pregnancy in synchronized heifers bred by artificial insemination.

al., 1964). Students in the heifer synchronization group were assigned a group of 30 heifers and provided with materials necessary to synchronize estrus and establish and verify pregnancy (Kesler and Favero, 1996b). Students inseminated the heifers and determined pregnancy by progesterone concentrations, ultrasound, and/or palpation of the reproductive tract (Kesler et al., 1990).

Teaching assistants served as facilitators and resource persons for their group and provided instruction on and supervised all surgical procedures. The teaching assistants were also required to monitor individual, as well as group, activity and progress.

Grades assigned in the course were based on three examinations (each 20% of the final grade), four highest of six quizzes (20% of the final grade), and the group activity project (20% of the final grade). The examinations and five of the quizzes covered lecture and laboratory material. One quiz covered the group activity project presentations. The group activity project grade was assigned by the teaching assistant and was based on their individual participation, thoroughness in execution of the project, responsibility to the project, and comprehension of the results (60%), presentation of results (20%), and cooperation with and accomplishments of the group (20%). Group activity project assistants met before assigning grades to ensure equality of grading among groups.

Group activity project presentations were given by all members of the group. Each group was given 20 to 30 minutes for presenting results, interpretation of results, and answering questions. Students received presentation grades based on their component of the presentation.

Evaluation and Analysis

At the end of the semester, each student completed a course and instructor evaluation form consisting of 12 questions. The evaluation was completed by 216 students over four years (Table 2). Questions 1 and 2 were summarized by the University of Illinois Office of Instructional Resources. For these questions students gave the instructor and the course in general a score based on six as excellent and one as very poor. Results from question two were compared with all other university courses and grouped in one of five categories: top 10%, next 20%, middle 40%, next 20%, and bottom 10%. Data (questions three to five) from each year were analyzed by chi-square analysis as described by Mendenhall (1971) to determine whether the students had a preference for a section. Because results were similar for all four years, the data were then combined for additional analysis and presentation (Table 2). The analysis identified whether a section preference existed: if students preferred one or two section(s) over other section(s). If section preference did not exist ($P > .10$), then the probability that students preferred a section was equivalent to chance.

Results and Discussion

For some students, group activity projects seemed overwhelming at the beginning, but anxiety generally subsided as they became actively involved. Most students did their share of the project because individual accountability was the major component of the group activity grade and because a portion of the group activity project grade was based upon group success.

Analysis of the course evaluations demonstrated there was a section preference ($P < .01$). Although the majority (71%) believed they learned the most from the lecture section, the majority also believed the group activity projects were the most challenging (52%) and the most enjoyable (54%) (Table 2). Clearly, courses must include a cognitive domain-objectives that deal with the recall or recognition of knowledge and the development of intellectual abilities and skills (Shillo, 1997). However, students must do more than just memorize facts; they must be involved in the lecture material (Kauffman, 1989). The group activity projects motivate students to learn by providing a greater opportunity for active, rather than passive, learning in an enjoyable peer-learning environment.

This approach to learning, often referred to as cooperative learning (Parker, 1985; Watson, 1992), produces increased learning and retention but requires increased student effort (McKenzie and Fuller, 1987). Most students (94%) believed group activity projects complemented and heightened in other sections. Although the group activity projects required significantly more time, 97% of the students believed it was worthwhile (Table 2). Buhr and Knauft (1984) reported 86% of a group of plant science students agreed laboratories were an important learning tool and 73% indicated they would prefer more "hands-on" experience. However, this approach may not be appropriate for students who prefer to memorize material from lectures, who are antisocial, or who habitually skip class (McKenzie and Fuller, 1987). Eighty-four percent of the students rated the course as either "the best course" or "better than other courses" they had taken (Table 2). Compared with other University of Illinois courses, student's rated the course in the top 30% of all university courses (in the top 10% for one offering).

The teacher's role as a facilitator of student learning remains unchanged in the group activity project environment. However, the teacher of the group activity project is no longer seen as the authority who dispenses knowledge to students to absorb (Artzt and Newman, 1990). Instead, students become important resources for one another in the learning process (Artzt and Newman, 1990). Students

Table 2. Summary of Course and Instructor Evaluation Responses by Students Completing a Reproductive Biology Course over Four Years

Question			Mean ± SE/%[z]
1.	Rate the Instructor		5.63 ± .04[y]
2.	Rate the Course in General		5.33 ± .08[y]
3.	From which section of the course did you learn the most?**	lecture	71%
		laboratory	4%
		project	25%
4.	Which section of the course did you find most challenging?**	lecture	40%
		laboratory	8%
		project	52%
5.	Which section of the course did you find most enjoyable?**	lecture	27%
		laboratory	19%
		project	54%
6.	Did the laboratories complement the lectures?	Yes	99%
7.	Did the group activity projects complement the lectures?	Yes	94%
8.	Did the group activity project cause you to be more interested in the other sections of the course?	Yes	94%
9.	In comparison to other courses, how would you rate this course?	Best	21%
		Better than others	63%
		About the same	13%
		Poorer than others	3%
10.	Would you recommend this course to other students?	Yes	97%
11.	Based on what you learned from this course, do you think that the extra time required for the group activity projects was worthwhile?	Yes	97%
12.	What would you recommend to improved the course?	Recommendations	[x]

** Students had a preference for a section ($P < .01$): students preferred one or two section(s) over the other section(s).

[z] Percentage of students response

[y] Based on 6 = excellent to 1 = very poor

[x] Individual responses are discussed within the text.

function as active workers as well as learners (Willimon and Naylor, 1995).

Although researchers agree that some form of cooperative incentive is necessary for effective cooperative learning, individual mastery of the material is the purpose of cooperative learning and individual student performance should be assessed (Watson, 1992). Therefore, grades for the group activity project were based on both group and individual performance.

Group activity projects have more than a transient effect on students. Several years after completing this course, former students have indicated that their group activity project was their most memorable course work and indicated that it often had a major impact on their careers. Buhr and Knauft (1984) reported students felt better prepared for the job market as a result of group activity projects.

Advantages of Group Activity Projects

1. One of the greatest advantages of teaching with group activity projects is stimulation of student interest in the subject matter (McKenzie and Fuller, 1987).

2. Since the group activity projects require teamwork, students acquire important skills regarding working with others, responsibilities to their group, interpersonal behavior, cooperative compromise, and communication with others (Schaefer and Kauffman, 1975; Artzt and Newman, 1990).

3. Having several group activity projects encourages competition among groups, which motivates students to excel (Kauffman, 1989).

4. The group activity projects gives the students a sense of responsibility. The students were responsible for obtaining information and ensuring the success of the project-they assumed the responsibility for a portion of their own learning (Schaefer and Kauffman, 1975; McKenzie and Fuller, 1987). Furthermore, they had control over the quality and quantity of effort they exerted to accomplish the objectives of the project.

5. The presentation of results to other groups at the end of the semester provided students an opportunity for development and use of the students' public speaking skills, which is an essential skill of graduates (Kauffman, 1992).

6. The group activity project motivates the students to learn and increases knowledge retention by involving and challenging them. It permits students to enjoy learning which encourages them to excel (McKenzie and Fuller, 1987).

In addition, group activity projects present one-on-one opportunities to get to know students and provide career or curriculum advice that otherwise is often not requested by students (Campbell, 1989). Other formats for one-on-one interaction have been demonstrated to improve the quality of students' college experience (Kesler, 1997a, 1997b).

Disadvantages of Group Activity Projects

Benefits gained from an approach seldom come without sacrifice and disadvantages. This approach is monetarily expensive and expensive in terms of instructor and graduate student time.

There is always a possibility for procrastination on the part of students. This is inherent in any teaching situation when independence is emphasized (Schaefer and Kauffman, 1975) and will be greater for some students than others. This leads to another problem: some students will conduct larger amounts of work than others. This may lead to frustration by some students. One way to avoid this problem is to offer the group activity projects as a separate and optional section that may be taken concurrently with, or subsequent to, the lecture and laboratory portion of the course. Therefore, students that are unable or have no interest in spending the extra time required of the group activity projects will not dampen the excitement of others.

Also, there is no single source from which students can obtain all necessary information in order to satisfactorily complete a project (Schaefer and Kauffman, 1975). This approach requires students to go beyond a textbook and lecture environment to ensure success of the project and may cause some frustration, particularly if this is the first time students have encountered this situation.

Additionally, because this is usually the students' first exposure to the conduct and interpretation of research, they have minimal understanding of hypothesis testing, experimental design, animal welfare regulations, etc. Therefore, it may be prudent to separate the group activity projects into an optional section, as previously discussed, and provide information on such subjects.

Implications

Offering group activity projects will improve the quality of instruction for most students. They may not only enhance learning and retention, but may revive teachers. Group activity projects should be incorporated in a wide variety of courses as classroom learning is simply no longer sufficient-it must be supplemented by other kinds of experience. Similar projects can be developed in other areas of agricultural and biological sciences (Buhr and Knauft, 1984; Hall, 1980).

Kauffman (1992) stated that "every teacher should make every effort to include the following in the learning

process: 1) thinking, 2) decision making, 3) problem solving, 4) skills development. 5) communications, 6) cooperation, 7) information retrieval, and 8) wisdom and common sense." Cooperative learning via group activity projects includes all of these characteristics. Although this method of teaching is expensive, it is one of the more effective methods in encouraging cooperation and problem solving. Furthermore, group activity projects encourage students to think independently and analytically about scientific claims as advocated by Shillo (1997). Therefore, the benefits greatly exceed the cost but administrators must be cognizant of their demand on time.

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