Introducing a Cooperative Learning Term Project into an Introductory Food Science Course

Peter S. Murano[1] and Timothy D. Knight[2]
Texas A&M University
Department of Animal Science
College Station, TX 77843-2471

Abstract

A cooperative learning term project was implemented into an introductory food science course curriculum to enhance cooperation and learning among students. Student evaluations indicated that the project encouraged group interdependence, active learning, and higher level thinking skills. Students viewed the project as an valuable and enjoyable experience and suggested that it increased their comprehension of course material. High percentages of students used skills important to cooperative learning, including higher level cognitive skills and group coordination skills, to complete the project.

Introduction

Cooperative learning practices are finding increased importance and utilization in undergraduate agricultural curriculums. The benefits of cooperative learning have been reviewed in education literature (Bruening, 1990; Caprio, 1993). Successful university agriculture programs must develop student skills in communication, higher level thinking, and creativity while applying classroom knowledge to issues encountered in a professional career (Newcomb and Trefz, 1987). Efforts have been made to incorporate cooperative learning into courses in the food science program at Texas A&M University to strengthen these student skills.

Food processing companies were surveyed in 1990 by The Institute of Food Technologists (IFT) Committee on Education to determine if food scientists were being educated in university food science programs with sufficient depth to meet the needs of corporate research and development in the food industry. It indicated that food science undergraduates were not adequately prepared in written and oral communication, critical thinking, and creative thinking skills upon graduation. Current IFT undergraduate curriculum minimum standards address the need for providing a developmental framework for these skills to better prepare students for careers as food industry professionals (Satterlee, 1992). Cooperative learning provides an effective teaching method for strengthening these skills through teamwork activities and application of classroom theory to practical issues encountered in the food industry (Henneberry and Beshear, 1995; Iwaoka et al., 1996).

In recent years, cooperative learning has been successfully introduced into various course curricula. Retmeier (1995) introduced cooperative group work and focused discussions into an experimental foods course which resulted in positive group interdependence, improved critical thinking, and increased active learning. Also, animal science, soil science, and textiles courses have found high student satisfaction, improved project quality, and increased active learning through the introduction of cooperative learning activities (Brackelsberg and Brackelsberg, 1998; Sorensen et al., 1992).

The introductory food science course taught at Texas A&M is designed to expose students to the basic concepts of food science related to technology and the scientific principles used for the conversion of raw materials into human foods. A cooperative term project was developed based upon a review of relevant literature. It was included in the course to encourage students to learn key concepts and utilize specific skills required of food science professionals. The collection and evaluation of student perceptions regarding the term project permitted appraisal of the value of the project from both the student and instructor perspectives.

Methodology

Course Term Project

A cooperative term project in food science was developed by the instructor in advance of the first class meeting, at which time it was introduced to the class of 112 students. The class was divided into twenty-eight cooperative teams of four members each. No in-class time was allotted for project work. Students were instead required to schedule after-class team meetings, and submit the completed project on a date specified in the course calendar.

The learning objectives of the project were two-

[1] Assistant Professor
[2] Graduate-Student

fold, related to course content as well as teamsmanship (Figure 1). Students were given responsibility to conduct meetings, organize materials, and function as teams utilizing individual abilities and expertise to share the project workload.

The food science scope of the project required understanding of a basic level of food composition and food chemistry, food additive functionality, nutrition, and food safety. Students answered specific questions related to these areas as part of the project (Figure 2). Students conducted a "product tear-down" that provided facts regarding these different aspects of a food product. When coupled with library

Learning objectives:

(1) To learn facts and concepts related to the topics of food composition, food chemistry, ingredient functionality, nutrition, food processing, and food safety, and to apply these as part of a team challenge to complete a term project which includes critical thinking regarding 2 different processed food items.

(2) To learn how to work cooperatively by developing and practicing effective time management, communication, listening skills, and to take responsibility for one's own learning and ability to contribute ideas to the team effort in developing answers to the project questions. Teams should be able to complete this project with minimal help from the instructor by sharing the workload and the individual abilities, background, and expertise of team members.

Figure 1. Learning objectives and instructions of the term project.

Instructions: Obtain the labels of two canned or otherwise processed and packaged food items from among the fol any fruit juice or fruit juice-based beverage

(1) FOOD COMPOSITION:

Identify the food molecules comprising the (fresh, unspoiled) food items, listing the major molecules such as proteins, carbohydrates, and lipids, as well as trace molecules and elements such as vitamins, minerals, and additives in each food.

(2) PROCESSING, FUNCTIONALITY, and CHEMISTRY:

What specific processing does each food item require prior to retail?
If any food additives were used in these foods, identify them and their specific function (e.g. if citric acid is listed on the label, then it is being used as an acidulent to lower pH and could be considered an antimicrobial/ preservative).
If each food item was left exposed to air at room temperature for several days, what physical and chemical changes (e.g. enzymatic/ nonenzymatic changes) would occur? Be as specific and complete as you can.

(3) NUTRITION:

calculate the energy (kcal) value of one serving of each food item.

(4) FOOD SAFETY:

Do the food items show expiration dates? What can you conclude regarding shelf life?
If exposed to air at room temperature, would you expect bacterial, yeast, or mold spoilage, and why? (Be sure to comment regarding general class of microbe and specific names of possible spoilage microbes. Make sure you give valid reasons why you suggest that these microbes would have the potential to spoil the particular food item).

Figure 2. Term project instructions.

research, this provided sufficient information for teams to draw valid conclusions with which to complete the product assessments.

A detailed analysis of this nature introduced students to the diversity of food products and emphasized a multidisciplinary approach to food science. Completion of the project involved each cooperative team submitting a written report in a standardized and professional format that included not only the answers to the food science questions, but also responses to an opinion questionnaire. This questionnaire was created by the instructor (Figure 3). Each questionnaire contained twenty-three questions, which were indicators of student perceptions that related learning and the cooperative experience, including one that identified specific skills students used to complete the project. A variable opinion response form (YES= agree, NO= disagree, and NO OPINION= neutral) generated data which permitted assessment of the value of the project, effectiveness of the project, group dynamics, and learning experiences. Percentages were calculated from student response data.

Course Demographics

The students enrolled in the course were mostly

The team approach to problem solving is now the norm in many work settings. For that reason, this term project is being included in this course as it offers the potential for "real world" preparation. It will count as the equivalent to one course exam.

Provide INDIVIDUAL responses to the following questions as:
YES NO NO OPINION

1. I have worked on other teamwork projects similar to this in college.
2. Completing this project was something of a challenging experience.
3. I feel strongly that I contributed my share of the work.
4. I feel strongly that the other members of my team did their share of work.
5. I see absolutely no value in having completed this project.
6. I felt actively involved in the learning process.
7. Overall, our group worked together and we helped each other to succeed.
8. The project took to much time for the points it was worth.
9. The project helped me take responsibility for my own learning and the learning of others.
10. In our group we relied on higher thinking skills and not simply memorized facts.
11. In our group there was competition rather than cooperation.
12. I enjoyed contributing my share to this project.
13. I enjoyed the collaboration we needed to complete this project.
14. During this project, I felt isolated and not part of a team.
15. During this project, I felt like an active, contributing team member.
16. I appreciate that this project was worth as many points as an exam.
17. Working on this project reinforced my learning in some aspect of food science.
18. Working on this project helped me to learn something important about myself, or how I interact with others.
19. Overall, I consider working on this project a positive learning experience for me.
20. I'd rather work together with my peers on a project like this than have to study for an exam worth the same number of points.
21. The level of scientific knowledge required in this project was (too high, too low, just right) for this course.
22. I received feedback/ the opinion of others in my group regarding my portion of the project.
23. Which of the following specialized skills did you use in working on this project? communicating, problem-solving, organizing, critical thinking, cooperating, time management, teaching, listening, planning, conflict resolution, sales ability

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Figure 3. Term project opinion questionnaire.

food science and nutrition majors, and juniors and seniors (Table 1). In making group assignments, care was taken so that each group was balanced with respect to academic level and science background.

Table 1. Academic classification of students enrolled in the introductory food science course.

Academic level	Student responses (%)
Freshman	7.3
Sophomore	20.9
Junior	34.5
Senior	37.3

Henneberry and Beshear (1995) emphasized the need for adequate incentive for cooperative projects to motivate student participation. Therefore, the project contributed 20% of the course grade. This was equivalent to one course exam.

Results and Discussion

Project Evaluation

In general, student responses revealed that the term project successfully incorporated cooperative learning skills into course curricula. Bruening (1990) stated that positive group interdependence is paramount to the success of cooperative learning. In our course, students overwhelmingly indicated that the project encouraged succeed. We found that students also felt that the project helped them take responsibility for their own learning and the learning of others in the group.

Student responses also indicated that active learning occurred during the project. Eighty-five percent of students felt actively involved in the learning process, and an even higher percentage felt they were an active and contributing group member. Nearly every student was of the opinion that their group worked in a cooperative rather than competitive manner. In addition, students felt they did their share of the work on the project and also felt their group members did their share of the work on the project. Despite these highly positive responses, a lower percentage of students stated that they received "adequate feedback" from their group members. One strategy to encourage within-group discussion and specifically feedback which could be implemented in the future is to require feedback sessions as part of the project.

Higher cognitive skills are key components in cooperative learning (Iwaoka et al., 1996). In our course, the students believed that they relied on higher level thinking skills rather than just memorizing facts. This response suggests that students found it necessary to use higher order thinking for completion of the project.

Instructors commonly find that students enjoy working in cooperative groups (Bruening, 1990). Student evaluations indicated that the cooperative project was a positive experience, and that it reinforced their understanding of food science material. Despite the benefits of cooperative learning, only about one-half of students indicated that they had previously worked on a cooperative learning project in college. This lack of cooperative learning in college courses may be surprising to educators.

Student responses also indicated that the project was an appropriate addition to the course. Over eighty percent of students indicated the project took what they viewed as a reasonable amount of time to complete, and appreciated that the project was worth a significant portion of the course grade. The level of scientific knowledge required by the project was viewed by the students to be appropriate to the course material. Overall, responses indicated that the skills important for successful cooperative learning practices were used by a large percentage of students to complete the project (Table 2).

Table 2. Cooperative skills used to complete the term project as indicated by students enrolled in the introductory food science course.

Skill	Students Response(%)
Communication	94.3
Planning	91.0
Organizing	88.5
Cooperating	84.4
Critical thinking	79.5
Time management	75.4
Listening	74.6
Problem solving	68.9
Conflict resolution	23.8
Teaching ability	14.8
Sales ability	3.3

Higher level skills used by students to enhance cognition included communication, cooperation, critical thinking, problem solving, and listening. The fact that many students utilized these skills, as indicated by the opinion questionnaire results, suggests that the project encouraged the use of these skills for cooperative learning. In addition, students extensively used group coordination skills including planning, organizing, and time management. Several teams required the use of conflict resolution skills to settle group disputes, while only a small percentage used teaching and sales ability in group dynamics.

Student Performance

How did the students achieve with respect to project grade? All teams completed both the food science portion of the project and the opinion survey. Term project grades ranged from 78% to 100% (the latter was achieved by several groups that received bonus points for early submission). Most teams earned B and A grades for the project, which helped student course grade performance. But the value of a cooperative *team* project goes beyond a project grade or a course grade. It is likely that students succeeded in applying higher level thinking and in achieving enhanced learning about key food science concepts beyond what would have occurred without the group project component in the course. According to student responses, it is also clear that the cooperative project enabled students to develop some of the key transferable interpersonal skills which are needed in professional life.

Summary

A cooperative learning term project was successfully implemented into an introductory food science course curriculum. Overall, student evaluations indicated that the project developed and encouraged group interdependence, active learning, and higher level thinking skills. Student evaluations also suggested the project was viewed by students to be enjoyable, valuable, and increased their understanding of course material. Students utilized higher level cognitive skills and group coordination skills important to cooperative learning to complete the project. Project grades and opinion responses indicated that students gained an enhanced understanding of the course subject matter. Based on the initial success indicated by student evaluations, the cooperative learning projects will maintain use in the introductory food science course in subsequent semesters. Instructors of other science courses may consider incorporating cooperative learning to enhance student learning, understanding of concepts, and course satisfaction.

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