Cooperative Learning in an Introductory Course

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A new course design for Introductory Soil Science was conceived and implemented to remedy shortcomings of the lecture-laboratory-recitation format. Collaborative learning in small groups using active learning exercises largely replaced the more passive lecture method. The background and nature of these changes and a description of the new format are discussed.

Introduction

In the fall of 1989 the design of the introductory soils course at the University of Nebraska was greatly changed. The new design was based on considerable analysis of the characteristics of students, teachers, and the course itself. In an attempt to improve student learning, the lecture-laboratory-recitation format was changed to group work sessions using instructor-prepared programmed exercises. A small amount of lecture was retained to provide time for testing, test discussion, and logistical procedures. This paper is a report of the rationale, nature, and outcomes of these changes.

Reasons for change

The senior author has taught the introductory soil science course in the first semester at the University of Nebraska for 26 years. During this time, the course has been continually updated according to good instructional practice. Educational objectives were incorporated early and improved over the years (Mager, 1975). Excellent textbooks have been available. Assessment procedures have been criterion-referenced and closely related to the course objectives. Procedures have been developed and improved to provide individual students with the help they needed. A study of personality types (Lawrence, 1982) helped the instructors address student diversity in learning styles.

In recent years, student evaluations of the course have been very high. Grades in the course, which were never scaled, were good (B average) with few failures. On the basis of grades received, learning seemed to be occurring in both lecture and laboratory. The satisfaction level for both students and instructors seemed to be high.

Serious concerns about learning in the course arose, however, when the instructor was assigned to teach an advanced course which had, as a prerequisite, the introductory soils course described above. It rapidly became evident that, even though students had received good grades in the soils course, many were neither very competent with the material they were supposed to have learned nor able to apply soils information to practical problems at an advanced level. On this very disconcerting note, a project was begun to find out why learning was not occurring at the level expected.

On the basis of considerable analysis, two main problems surfaced which could have contributed to inadequate learning. One was the failure of students to take responsibility for their own learning. They expected to be, and were, passively involved in the typical lecture. Students perceived that most important information was provided in the lecture and use of the textbook was often unnecessary. Hence, many students apparently used it sparingly. Study appeared to occur immediately before tests with the result that much information never entered long-term memory. Problem-solving procedures were memorized for immediate use on tests rather than understood.

A second problem was related to the first. There simply was too little involvement of the students with the material to be learned. This problem has been discussed by Astin (1984, pg. 27). Passive transfer of information in the lecture with limited additional involvement did not give students the "feel" of the material. Students did not have a chance to try out concepts, ideas, and skills they had learned by applying them to practical situations in a supportive environment. They needed opportunities to transfer information from short-term to long-term memory.

Several possibilities showed promise for solving these problems and others. More interaction among students and between students and teachers seem to be desirable (Astin, 1984, pg. 29). Students are often able to provide explanations to other students which are more useful than those of the teacher. Also, in today's specialized world, teamwork is often needed to prepare strategies, solve problems, and plan. More effort toward development of critical and creative thinking was indicated. Cooperative learning practices (Johnson, et al., 1984) seemed to have much to offer.

Cooperative learning does not have a commonly-held definition. The essentials are that students work together, normally in small groups, using various types of learning activities. They are responsible to gather their own information, set their own pace, and produce their own outcomes independently of the other groups. In some forms, a student's grade depends on the performance of the entire group.

A decision was made to redesign the course giving greater emphasis to student responsibility for learning, methods of instruction which promote active learning, cooperative learning, and critical and creative thinking. The senior author requested and was allotted partial release time during one semester to create the course design and prepare the materials. (Continued on page 33.)

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The New Design

One hour of lecture per week is used for announcements, testing, test discussion, and course evaluation. During this hour, pretests over the reading assignments for the week are given. The objective of the pretests is to encourage the students to take responsibility for their own learning by gathering written information from the text and other materials provided. Grades on these tests provide about 25 percent of the students' final grade.

The major learning activities occur in two 2-hour sessions per week in which groups of 3 or 4 students work through programmed exercises. The instructor and occasionally one other graduate or undergraduate assistant are present to promote questions, provide explanations and discuss observations. One class section is comprised of 5 or 6 groups. Six sections per semester accommodate up to 120 students.

The programmed exercises provide questions, situations, and problems for the group to work on together. These exercises are highly structured and approach each subject in several different ways. Included are activities ranging from simple memory to complicated practical problems. Traditional laboratory experiments are parts of some modules. Students are expected to work together, providing information and opinions to each other, correcting erroneous assumptions and facts, confirming each other's work, and sharing ideas. Most periods end with a posttest over the subject matter presented in that period or a written report. The scores on posttests provide about half the student's grade.

Two group projects, one in which students describe and analyze a field soil and another in which students design a county fairground, occupy two periods each. Grades are derived from reports for these projects and three problem-solving exercises modelled after the guided designs of Wales and Stager (1977) and Wales, et al. (1981). These exercises include diagnosis of a crop growth problem, design of water quality legislation, and specification of uses of land. In each of these exercises, a problem is posed. Then students are systematically led through a problem-solving procedure in which they make each decision. Immediately after each decision, they receive feedback from the instructor.

For a change of pace, the last two sessions of the semester are used for competitive activities. One is the presentation of an oral summary of a printed article prepared by each group. Questions on their presentation are prepared by each group and the collection of the questions from all groups becomes the posttest. The second is a "quiz bowl" contest where groups respond to questions asked by the instructor. The group answering the most questions gets the highest grade. The objectives of this exercise are to give practice in answering client questions, and to serve as a review for the final test.

A comprehensive objective final test accounts for 10 percent of the grade. At the end of the course the student will have been graded on 41 different activities; 16 pretests, 18 posttests, 6 projects, and one final test. Opportunities should be available for students with diverse strengths to find a place to "shine."

Outcomes

Although the jury is still out on whether this design produces more effective learning, several outcomes are already evident. Most students enjoy working together. Some students have shown marked improvement in their ability to work together during the semester. Compared to previous semesters, fewer absences have occurred. Substantially more interaction has developed between students and instructors. Learning problems have been identified and corrected immediately. Project outcomes have shown collaborative pride in accomplishment. New friends have been made.

Rather than simply memorizing the lecture notes as was done by most students in the past, these students seem to be more able to integrate terms, ideas and concepts into a coherent body of information which they can apply to new situations. Their ability to use the text, other references and instructors to identify and locate needed information has appeared to improve. Because of the rigor and diversity of the performance evaluation procedure, fewer A+ grades have been given. However the percentage of A and particularly B+ and B grades have significantly increased with fewer C and D grades.

On the other hand, a few problems remain to be solved. Some students, accustomed to passive learning techniques, have difficulty with being held accountable for their own preparation. Rarely, a student is disruptive in a group. Some students are slow in learning how to contribute effectively to a group and how to ask for help in group activities. Instructors still have much to learn about the group process and its application in the classroom. A large amount of planning and development time is needed to design and prepare modules and assessment tests. However, all of these difficulties are amenable to management if not solution.

Continuing Challenges

Maximum success of any activity requires continued attention to areas where the process might be improved. With the current status of this system of instruction, several challenges present themselves. They include:

1. More incentives for adequate preparation for programmed sessions are needed. For some students, pretests do not provide adequate motivation.
2. Some modules themselves need improvement. Since the modules are the central basis for learning, their content, clarity, organization, and length are critical.
3. More explicit rewards for cooperative efforts in groups are needed. Although many intrinsic rewards are gained by contribution to group activity, most students value extrinsic rewards.
4. Instructors must continually reevaluate and improve assessment procedures. Tests should reflect desired learning activities, and be valid and reliable. Grading should be accurate, defensible and consume as little time as

Agricultural Literacy: Providing a Framework For Agricultural Curriculum Reform

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Abstract

A desired outcome for college of agriculture graduates is a broad understanding of the agriculture industry. Identifying agricultural literacy subjects that should be addressed within any college of agriculture curriculum can assist faculty in developing activities that promote a broader knowledge base of the food and fiber system. Ensuring student exposure to these subjects, regardless of the major, can better prepare graduates for work in today's agriculture industry.

Introduction

A national agricultural education study, conducted by the National Academy of Sciences (NAS) (1988) recommended that "new curriculum components must be developed and made available to teachers addressing the science basic to agriculture, food, and natural resources (Aldrich, et al., 1988, p. 35). The publication recommended that agricultural education go beyond the scope and content of traditional programs. According to the NAS committee, agriculture was too important a topic to be taught to such a very small percentage (4.5%) of high school students. Douglass (1984) also reported that 90% of our population has been off-farm for over 30 years. Thus, the NAS committee developed the idea of "agricultural literacy" -- the goal of education about agriculture.

The NAS (1988) study also suggested that faculty in colleges of agriculture should become more involved in teacher preparation, in-service education programs, curriculum reform, and the development of instructional materials and media. Colleges of agriculture addressing these recommendations can directly affect the "agricultural literacy" level of current and future students. Providing a consensus definition and identifying the concepts which constitute agricultural literacy can expedite the process of developing effective educational strategies to improve our nation's agricultural literacy level.

The magnitude and seriousness of the agricultural illiteracy within our society was substantiated in Horn and Vining's 1986 finding that less than 30 percent of a sample of Kansas students could give correct answers to basic agricultural questions. The public's misunderstanding of the mission or importance of publicly supported institutions such as the cooperative extension service, colleges of agriculture and U.S.D.A. research centers can be tied to the nation's low level of agricultural literacy. Thompson (1986, p. 1) stated, "If even well-informed citizens remain ignorant of basic facts about food, agriculture and natural resource sys-

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possible. This last point is not trivial given the demands of a large class with many grades to be handled.

5. Reassessment of the subject matter is necessary. Are the concepts, facts, skills, and behaviors being taught the ones that will contribute the greatest amount to attainment of student potential? Does the ever-present urge to "cover material" cause other important development activities such as problem-solving, writing, collaboration, and communication to receive inadequate attention?

Implications

In the opinion of the instructors, the course design described herein has provided effective, broad-based, improvement in student learning and development. Most of the changes made are supported by research in education. This system, of course, is not adapted to all courses. However, many parts, if not the whole, may be adapted to a wide range of learning situations.

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