

Student-Centered Learning in Agriculture and Natural Resources at The Ohio State University

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Abstract

Student-centered learning (SCL) is an active form of learning used in agricultural and natural resources courses at The Ohio State University. Students assume responsibility for much of their learning in SCL classes. In return, students have great input in determining what they learn as well as planning for the evaluation of their learning. The level (freshman, sophomore, etc.) of a class determines student involvement in the teaching and learning process. The higher the level, the more students are involved. In all classes students help set the goals and objectives, evaluation criteria, and code of conduct. Students in upper level classes choose much of the course content and are responsible for gathering and disseminating the information for many of the selected topics. Teachers have the responsibility to facilitate learning and provide, at minimum, introductory information. Students and teachers work together to structure the class in a way that best suits the needs of the students and accomplishes the goals and objectives of the class. In the process students learn the subject and develop the skills of teamwork, critical thinking, and decision making. Student-centered learning has successfully become a part of agriculture and natural resources classes at The Ohio State University.

Introduction

Teachers of agriculture and natural resources often teach the same way they were taught, *i.e.* in a teacher-centered classroom using lectures, demonstrations, and labs to disseminate information, then giving tests to evaluate learning. Barr and Tagg (1995) refer to teacher-centered methods as the instruction paradigm. Judging from student information garnered by the author, many students say they prefer teacher-centered instruction and are content with having information given to them, tests administered to prove they have heard or read the information, and grades issued so that they can proceed to the next class. But when questioned about his or her learning, the same student often complains that she or he only memorized facts for a test, that little was

learned or retained from the class, and the grade did not reflect what effort was invested in the class. The students do not feel they have participated in the learning process. From conversations with colleagues around the country, the author has learned that teachers of all levels of courses in agriculture and natural resources are looking for alternative methods of teaching that encourage students to become actively involved in the learning process, to take responsibility for their learning, and to allow for meaningful, effective evaluation of student learning. Barr and Tagg (1995) refer to learning-centered instruction as the learning paradigm.

Student-centered learning (SCL) encourages students to become more active, cooperative, and responsible learners in agriculture and natural resources classes at The Ohio State University (OSU). Active, cooperative learning is effective learning (Barr and Tagg, 1995; Davis, 1993). In SCL students help to create and evaluate their learning.

In SCL, the focus in the classroom shifts from the teacher to the student. The development of the structure for each class is accomplished via a cooperative effort of students and teacher. Students are given a voice in determining to varying degrees what and how they learn and how their learning is evaluated. In exchange for that right, they assume an appropriate level of responsibility for taking a more active role in their learning. When using the principles associated with SCL, the teacher relinquishes some control and "be open to outcome, not attached to outcome" (Arrien, 1993).

Students begin accepting responsibility for learning the first day of class when they help with syllabus development. In the classes taught by the author the amount of student involvement depends somewhat on the level and size of the class, with greatest involvement in small, upper level classes. Large (over 60), introductory classes have 10-15% input into syllabus development while smaller (under 30), upper level classes have 50-75% input. In all classes students participate in setting the goals and objectives for the class and establishing evaluation criteria. Upper level students assume some responsibility for selecting topics and then researching much of the content of the course. Once topics are selected and researched, students are responsible for sharing their learning through in-class presentations, writ-

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ten analyses, or other methods. Students also contribute to the evaluation of the presentations of their peers.

The techniques associated with SCL help students develop the skills to become life-long learners and better prepared for a world where Total Quality Management (TQM), and Continuous Quality Improvement (CQI) have become leadership and management strategies in every occupation. A demonstrated ability by students to lead and manage is sought by employers as they screen candidates (Anon., 1998). Just as TQM and CQI are accepted as high contributors to management, SCL contributes to high quality learning (Langford, 1996a).

Student-centered learning is not teacher-absent learning. The teacher provides at minimum introductory or baseline information. The teacher assures accuracy of the information obtained by the students, and that information is meaningful, current and effectively presented to the class. Guiding students through the process and facilitating learning become the roles of the teacher. While students are more accountable than ever, the teacher remains as accountable as ever.

Student acceptance of SCL is crucial to successful implementation of the technique. Perhaps the most important factor in gaining student acceptance of SCL is developing trust from the beginning. Trust in a teacher is necessary for learning, no matter what style of teaching is used (Arrien, 1993). Students have to know that the teacher is sincere. Informing the students of the process, how the students will benefit, and that student input will be taken seriously are critical to successfully using SCL.

Successfully implemented student-centered learning has become an effective method of teaching agriculture and natural resources classes at OSU.

The objectives of this paper are:

1. to present a description of some of the SCL methods used in agriculture and natural resource classes at The Ohio State University.
2. to document the effectiveness of SCL based on teacher observations and student comments and evaluations.
3. to give all teachers of agriculture and natural resource classes an idea of how these methods may be utilized in their classrooms and what to expect from that utilization.

Background

The Student-Centered Learning Initiative (SCLI) is a large-scale project of the College of Food, Agricultural, and Environmental Sciences at The Ohio State University to improve the quality of undergraduate education. Nearly 60 faculty from the College and branch OSU campuses are participating in the initiative as a means to improve teaching and learning.

The techniques described and comments and information given in this paper came from seven sections of three OSU agriculture classes where SCL was used for one or more years from 1996 through 1998. One class was introductory crop science with an enrollment of 59 the first year and 90 the second year. Each year, the class is composed of approximately 25% sophomore, 50% juniors, and the remainder seniors. Because the first year it was a new class for the instructor and somewhat out of her area of focus, she used very little SCL. The second year many of the SCL techniques described were used. The second class is an elective, senior-level floriculture production class of approximately 15 students. The class was taught for 2 years without SCL then for 2 years using SCL. The third class is a senior capstone class required for crop science (including agronomic and horticulture crops), and turfgrass science majors. The class had 20 students the first year SCL was used. That year was also the first time the author had taught the class. During the next two years, the class had 30 students.

Most student comments reported were taken from a questionnaire prepared by the instructor to assess student opinions of student-centered learning and administered at the end of the term. The remaining comments came from conversations or written communications between the instructor and students.

Information presented on the percent of students sharing an opinion of a class or technique were estimated from the written evaluations or taken directly from standard course evaluations issued by the university. Standard evaluations require students to numerically evaluate the instructor and course in several categories, from lowest (1) to highest (5). The introductory course had \approx 75-85% of the enrolled students completing the evaluations, the other classes had \approx 85% completing.

Student-Centered Learning Techniques and Methods

The transformation from teacher-centered to student-centered learning begins with involving students in syllabus development and securing teacher and student approval of the syllabus. Using the words of the students themselves in the syllabus helps to convince students that their words and thoughts are important. Sections of the syllabus that can incorporate student involvement include goals and objectives, topics, evaluations, and guidelines for student conduct (McMahon, 2000). By helping to create and evaluate their learning experience students are practicing the two highest categories of cognitive learning, *i.e.*, creating and evaluating (Newcomb and Trefz, 1987).

Setting class goals and objectives

Goals and objectives come from asking students what they expect from the class, what they feel they need to learn, and what their professional interests are. Compiling student profile forms completed at the beginning of the term generally results in five to six most frequently mentioned expectations and needs. These become the goals and objectives. Invariably in the author's experience, the goals and objectives the class sets match closely those of the instructor. Although students in upper level, major/minor classes usually have little difficulty in describing what they expect and need from a course, students in lower level, required general education classes might need some help. Reminding these students that even though it is a required course, they are taking it because it will help them to succeed in their careers usually motivates them to describe their expectations and needs.

Determining and delivering course content

Perhaps the most beneficial aspect of student-centered learning occurs when students must help determine and research the content needed to satisfy specific objectives of the course. Similarly great benefit is derived from their active involvement in presenting the results of their research to their peers through presentations or other forms of dissemination. Such direct responsibility for guiding their own learning and answering their own queries gives students the sense that they are learning what they feel they need to learn from the class in ways that best accommodate their learning preference. The question arises regarding how students know what they need to learn. They do not know entirely, but with proper guidance from an instructor they can make decisions based on their experiences and knowledge of the careers they have chosen as to what information, relevant to the course, they are lacking.

Course level determines how much input students have, with lower level classes having the least. The teacher does not entirely relinquish determining or disseminating course content. Teachers provide at minimum the foundation information in all courses. For lower level courses, student involvement on topic selection may be no more than explaining to students how the topics already on the syllabus correlate with what they have set as goals and objects. Pursuit and presentation of information may be limited to individual or team effort for written reports. Because student involvement in upper level classes is generally greater, additional techniques such as the use of affinity diagrams can be used to provide students with the necessary structure for selecting (Langford, 1996a,b; McMahon, 2000).

In return for the right to determine the subject matter, students assume responsibility for gathering and presenting the information on those subjects to their peers in the class. Such involvement and responsibility can be a powerful learning activity. Having students responsible for presenting some of the course content is also necessary because teachers may not have the time to prepare adequately for all of the topics chosen.

Presenting information on selected topics is often accomplished by team effort. Teams encourage cooperative learning and are a very effective method for SCL (Johnson and Johnson, 1989; Langford, 1996a). Teams are chosen by having each student indicate which of the already selected topics holds personal interest. The class then decides who is on each team. The end result is that requested and relevant topics are covered by students most interested in those topics. Complaints from students who feel that their favorite topic was neglected nearly disappear.

Although students enjoy determining what they will learn, they may balk at accepting their responsibilities for locating, compiling, analyzing, and synthesizing the subject matter, especially as a part of a team. It may be necessary to help students understand that by being responsible for gathering and disseminating information they are learning the skills necessary to succeed on the job. The skills that employers are seeking go beyond the memorizing facts about their discipline (Anon, 1998; Newcomb and Trefz, 1987; Rebecca Sexton, Department of Human Resources, Ball Horticultural Co., personal communication 1998). Employers are most interested in students with team, decision-making, and communication skills for middle management positions with potential for employee advancement. It is helpful to remind students that when they start a job that pays well and has advancement potential, they will not know everything required for that job and will know even less for the next position on the promotion ladder. To succeed, they will have to know how to obtain and use new information.

Working on topics of their choosing gives a sense of relevance that is very useful in keeping students focused and engaged in their own learning. The presenters take their assignments very seriously and the presentations are excellent. In the course evaluations students report that they realize they are no longer working for just a grade, but that their pride and their credibility with their peers are at stake. The students work diligently to find the most current and factual information. They learn how to process information that is contradictory or of questionable accuracy by evaluating the source and finding experts to consult. They pride themselves on finding innovative and creative ways to present the information. Skills such as information gathering, critical thinking, decision-making, and effectively communicating are developed. Student comments at the end of the class have included:

“There is more pressure to do a good job because my friends are depending on me.” “It was hard deciding what information to believe, but I know I will have to do that in my job so thank you for teaching me how to do it.” “I no longer feel that I have to know everything because I feel that I can learn anything.”

Student-centered learning, even in lower level courses, requires students to synthesize information or draw on personal experiences to make decisions. In the process students learn to utilize knowledge they have acquired over their lifetimes from many sources. Barr and Tagg (1995) point out that in the instruction paradigm the solution to get students to learn how to integrate information is solved by creating a course that teaches how to integrate information. An additional course creates additional costs for the institution and the student. In the learning paradigm there is little or no increase in costs because the development of integrative thinking is a part of an existing course.

Evaluating learning

Allowing students to define the evaluation criteria, set the weights of each criteria, and determine who gives them some control over how they are evaluated. They also assume some responsibility for assessing their learning. For students to be able at the start of the term to decide what the criteria and weights should be, the teacher has to clearly explain how much effort the student should expect to expend for each component of the class. Later in the term, modifications can be made with the involvement and approval of the class. When students are involved in evaluation decisions, complaints at the end of the term having to do with fairness are reduced and are replaced comments such as “thank you for considering me to be intelligent enough to help decide how I should be evaluated.”

When setting evaluation criteria, students find it easy to assign weights to tests, reports, and other assignments. They find it harder to decide who evaluates each criteria (McMahon, 2000). However, students state that they want to have a part in the assessment process. They know that on the job they will be responsible for evaluating the employees whom they supervise. They especially want to have a voice in the evaluation of their own presentations and those of their peers. Most often the students have decided that within a team, team members evaluate each other and the overall team is evaluated by their peers and the instructor.

Individual effort has been the most difficult criteria for every class to handle. Students want to include such things as attendance, participation, and effort. After much debate, each class has handled the problem by deciding to have the student evaluate his or her own effort by describing the effort put into the class and what learning occurred as the

result of that effort. The evaluation is done in the form of a letter written or emailed to the instructor persuading him or her to give the amount of credit asked for in regard to effort. The letters are almost always eloquent, thoughtful, honest, and can be very entertaining. The teacher can agree or disagree and modify the amount of credit requested with explanation of the modification made available to the student. As an aside, the author has not noted any attempts of deceit on the part of any student.

Testing might seem to go against the idea of student-centered learning. This need not be true. If the tests are valid, *i.e.* they measure what the class has agreed is important, then tests not only give useful assessment, information and feedback, but are also another potential source of learning. There are ways that allow students to feel involved and that tests are a fair evaluation tool. One technique is to allow them to write questions they would like to see on the test and/or ask for their thoughts on what they feel were the important points made during the period that the test covers. The questions and thoughts must be shared with the class. The teacher then chooses which questions are used in the examination. The teacher may reserve the right to also ask some questions that have not been discussed in the class, but the class must know before the test that these non-pre-viewed questions may appear. Seeing their own words or the words of their peers as part of the test gives students a sense of control and involvement.

Although students are involved in the evaluation process, it is important to remember that it is the teacher who approves and submits the grades. Students need to know this. If a grade appears to be inaccurate the teacher has the right to make an adjustment. An explanation of any grade adjustment should be available to students upon request. So far inaccurate evaluation has not been a problem. By using groups of students to evaluate other students and averaging the results, any bias including that of the instructor, appears to be removed.

Another technique for using the test as a teaching tool is giving a second chance exam. A second chance exam appears as the last page of the exam. It is a single page, front and back, with all the test questions sized to fit on that page. The student takes that page when the exam is finished and has until a certain time, usually the end of the next day, to correct or amend any answers that s/he feels were incorrectly or inadequately answered. To correct an answer, students can consult any source of information except the instructor, teaching assistants, or a guest lecturer who may have given the information during the class. When returned, the sheet is attached to the original. The original is graded and then the corrected answers are graded. Whatever the new answer is worth is averaged with the original answer. This gives an incentive for learning by allowing the student to potentially recover half of the points lost.

Although the second chance exam increases grading time for the instructor, the comments from students justify the effort. Many students indicate that they are less anxious when taking the test. They feel that by being less anxious, they perform better on the original exam. Overwhelmingly they felt they really learned from the exercise. They note that not only did they have to study to do well on the test originally, they had to think about each answer as they took the test. Finally, they had to discern if their answer was correct or incorrect and correct the answer if necessary. Reinforcement is important for any kind of learning.

In addition to graded tests, giving a pre-test allows students to see their progress. A pre-test is given the first or second day of class before lectures or other forms of information dissemination begins. The test consists of four or five short answer questions regarding the main points that the students should learn in the class. The tests are collected, the answers read but not graded, and the tests kept by the teacher. The students see the tests again at the time of the final exam when they are passed out along with the exam. Students realize what they have learned as a result of being in the class. Students report that they enjoy seeing their progress presented in such a manner.

Code of conduct

Traditionally, the final section in a syllabus, usually labeled Academic Misconduct Statement, describes how academic misconduct will be handled. Often this section is required. However, misconduct has a very negative connotation. In SCL classes a code of conduct replaces the academic misconduct statement with a positive expectation and governs everyone in the classroom, not just students. The code of conduct includes the required guidelines for academic misconduct, but it stresses respect, tolerance, and good will. Students read the code, offer suggestions for improvement, and vote to approve.

Class Structure

Class structure may have to be altered to accommodate the principles of SCL. When a class ends after 45 to 55 minutes, there is little time for discussions or other interactive methods. Time is lost at the beginning of each class as students settle in, announcements are made, and other administrative activities take place. The author has compensated for this with her senior level courses where SCL is used extensively by changing the format from four one-hour lecture sessions and one two-hour lab or discussion period to two three-hour sessions per week. The longer format allows the class to move smoothly from one teaching method to another. The extended format also allows 20 to 30 minutes at the end of one of the weekly sessions for teams to get together. By enrolling in the

class, all students have made the commitment to the full class period and should be available to meet with their teammates.

Advantages and Disadvantages of Student-Centered Learning as Noted to Date by the Author

Advantages

Student-centered learning has advantages for both students and teachers. Students develop learning and other skills and gain meaningful knowledge that will help them throughout life. The relationship between rights and responsibilities is learned. Students discover that learning is interesting and fun. Several have written in their course evaluations that they learned more because they were involved and had fun being involved.

Teachers have less traditional work to do, especially in the upper level classes during the latter portion of the academic term. Students are more attentive and willing to participate in the class. Complaints about irrelevance and unfairness decrease. Reports and papers generated by students increase a teacher's collection of useful information. Teacher evaluations do not decline and usually improve (Tables 1 and 2) especially in upper level courses and with some SCL experience on the teacher's part. Teaching is interesting and fun.

Disadvantages

One disadvantage is that there are students who do not relate well to student-centered learning in spite of a teacher's best efforts. This is most prevalent at the lower levels but can occur in upper level classes. Judging from course evaluations, this is about 15 percent of the lower level and less than 5 percent of the upper level. However, because there are many different teaching styles encountered at a university, these students have the opportunity to learn in alternate ways in many other classes.

Another disadvantage is that the students have to work in teams. They complain about being on teams, but most often the complaints are accompanied by acknowledgments that they understand that they are preparing for the 'real world'. They appreciate real world experiences even when they do not like them. Also students find it difficult to work in teams because they have not been taught team skills. Most teachers in agriculture and natural resources are not trained to teach team skills. Fortunately there are many programs, articles, and books which can help instructors become better teachers of team skills (Arrien, 1996; Davis, 1993; Johnson and Johnson, 1989).

Table 1. Student evaluations for 1997 before Student Center Learning (SCL) was incorporated and 1998 after SCL had been incorporated into an introductory crop science course. The instructor first taught the course in 1997. Enrollment was 59 in 1997 and 90 in 1998. Scale is 1 to 5 with 1 being lowest and 5 being highest. Numbers are the average score for each category.

Criteria	Evaluation	
	1997	1998
Instructor well organized	x 3.8	x 4.3
Intellectually stimulating	3.8	4.0
Instructor interested in teaching	4.5	4.6
Encouraged independent thinking	4.2	4.2
Learned greatly from instructor	3.8	4.1
Overall rating	4.1	4.2

Table 2. Student evaluations for 1996 before Student Center Learning (SCL) was incorporated and 1997 and 1998 after SCL had been incorporated into a senior level floriculture production course. Enrollment was 15 in 1996, 14 in 1997 and 12 in 1998. The instructor first taught the course in 1995. Scale is 1 to 5 with 1 being lowest and 5 being highest. Numbers are the average score for each category.

Criteria	Evaluation		
	1996	1997	1998
Instructor well organized	4.3	4.6	4.8
Intellectually stimulating	3.3	4.7	4.8
Instructor interested in teaching	4.3	4.9	5.0
Encouraged independent thinking	4.0	5.0	4.9
Learned greatly from instructor	4.3	4.9	5.0
Overall rating	3.8	4.9	5.0

Disadvantages to teachers include an increase in work. The work is often of a non-traditional nature. Teaching students how to work in teams, how to make decisions, and how to become critical thinkers adds to the responsibilities of the teacher. There is a fear that students will see the instructor as being less organized because of the more open style of class format. In the case of the author, student evaluations regarding organization have improved with the use of SCL (Tables 1 and 2). Student written evaluations do state that initially some students regard the class as being disorganized but at the end of the term they understand that there is organization, but of a type they have not experienced before. The students also admit that they understand that the type of organization they experience in SCL resembles the kind they will encounter in the 'real world' where daily and long term agendas are constantly modified to fit changing conditions.

Do It, Just Do It

It is not necessary to convert a course entirely to student-centered learning in one term. The process can be incremental. Trying one or two techniques at first can help the teacher learn to share control and governance of a class at a comfortable pace while gaining confidence in the effectiveness of SCL. In many cases, teachers are already using one or more SCL techniques to encourage learning. Taking the process one step further and incorporating SCL methods throughout the course would not be difficult.

Only a few of the many methods, techniques, and tools available to assist in developing a student-centered

classroom and assessing the quality of student learning in that classroom have been presented here. Many others are available (Arrien, 1993; Johnson and Johnson, 1989; Langford, 1996a,b). Teachers in agriculture and natural resources should be willing and encouraged to learn and try as many of these techniques as possible.

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