An active learning project for forage courses

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ABSTRACT

Active student involvement and learning are positively correlated. Active learning projects require decision-making and thus actively involve students in the learning process. The large time commitment normally required of instructors and the time needed for creating, developing, and implementing active learning projects often results in active learning projects being ignored for more traditional teaching methods. This article presents a successfully implemented active learning project and results of a survey to assess the success of the project. Eighty-six to 92% of survey respondents found the experience to be educational and to require application of knowledge from the current course; 88% recommended it be continued as a part of future courses.

The ability of students to critically analyze and synthesize information into problem-solving ideas is one objective of higher education (Haning, 1983). Often, traditional classroom instruction results in students acquiring specific information but does not facilitate critical analysis or integration of the information into potential solutions for real-life problems (Schweitzer, 1986). This situation is frequently solved by involving students in supervised internship programs. These programs allow students to solve problems in a specific area of knowledge but often do not allow for extended decision-making opportunities in crop management systems (Schweitzer, 1986). Classroom projects that stimulate student involvement, critical analysis, and synthesis of ideas are therefore beneficial to the student’s educational experience.

Active learning projects that stimulate analysis and thought have been incorporated successfully into the classroom learning experience (Buhr and Knauf, 1984; Carpenter, 1979; Schweitzer, 1986). Individual and group projects that employ the use of realistic problems and situations stimulate improved student understanding and higher-level thought concepts and are generally regarded by students as valuable learning experiences (Howe and Durr, 1982; Engle, 1979). Student projects tend to arouse student interest by encouraging them to take responsibility for obtaining information and creating ideas (Schaefer and Kauffman, 1975). However, improper matching of the student’s ability with project difficulty can result in either apathy or anxiety. The objective of this article is to present an active learning project that has been used successfully in upper-level forage courses over a 5-yr period at two universities.

MATERIALS AND METHODS

Cooperative forage producers are identified through personal contacts or county extension agents. Producers and situations representative of a relatively large production area are selected. The selected producers serve as the information and data sources for the development of the active learning projects. Producer involvement is minimal following the initial information collecting phase in project development; however, producer cooperation

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tools in making the project more real for the students.

Forage production information is obtained from the producer during an informal on-farm meeting. A local county extension agent also attends the initial meeting because of familiarity with the producer and the forage production system. Unfortunately, student participation in this meeting is not possible because it is conducted 2 to 3 months before the class begins. Minimal information required from the producer is the following:

A. Producer:
  1. Name
  2. Address
  3. Experience in forage production (years)

B. Farm:
  1. Type [dairy, beef (Bos taurus), sheep (Ovis aries), etc.]
  2. Land area in forages (land area for each species)
  3. Forage species normally produced and others that have been produced
  4. Typical harvesting schedule
  5. Normal harvesting method and system (silage, hay, pasture, etc.)
  6. Actual and desired yield and quality of forages produced
  7. Current forage fertilization schedule and amounts
  8. Equipment available for forage establishment and harvest
  9. Storage facilities for forage [silo (type and size), barn (approximate storage capacity)]

C. Immediate forage production plans or goals and current production aspects that the producer is unsatisfied with the following:
   1. Does producer want to establish a new forage stand?
      a. What are the field size, fertility, and production limitations?
      b. How will this forage fit into the producer's production system?
   2. Does the producer want to improve yield and/or quality of existing forage?
   3. Does the producer want to improve forage persistence?

Other beneficial information includes forage production costs and past forage production problems. Unfortunately, producers often do not know their actual cost or are unwilling to provide this information; therefore, average cost and hay value information is often used in the class project. If a recent soil test and forage quality analyses are unavailable, then soil and forage samples are collected and analyzed to obtain the information for the project and as a service to the cooperating producer. An attempt is made to learn as much about the producer and the farming operation as possible during the meeting. Slides or photographs are taken of the farm, forage production fields, and area in which the producer wants to establish forages. Slides and pictures are beneficial tools in making the project more real for the students.

A production plan that addresses the producer's problem is prepared cooperatively by the county agent, producer, and myself. The county agent makes follow-up visits to monitor implementation of the new forage production plan. Records of what was advised and what was actually completed are maintained and used in discussion when the students have completed the active learning project.

Active learning projects have been developed dealing with pasture improvement for beef and sheep grazing, annual forage crops, irrigated pastures, and alfalfa (Medicago sativa L.) production systems. The current active learning projects are used in a semester course that meets weekly for two 2-h periods, which are used for both lecture and laboratory. Similar projects have been used in the laboratory sections of a course in which the lecture and laboratory were separate. During the fifth (quarter system) or eighth (semester system) wk of the course, individual students select the project they prefer to complete from two or three options.

Involving students in the active learning project and making them feel it is a real-life problem is necessary to provide a bridge from the classroom to the farm situation. This is accomplished by supplying the students with some but not all necessary information about the producer's problem, forage needs, and forage production experiences and asking them to develop a solution to the producer's problem. Students are encouraged to work cooperatively in determining what additional information is needed and possible problem solutions; however, each student is required to submit a paper presenting his or her advice for the producer. The project normally accounts for 20% of the student's grade. Groups of students working on the same project are encouraged to schedule informal sessions when questions will be answered or sources suggested that can provide the additional information students believe is necessary for completing the project. In addition, 5 min are allocated at the beginning of each class period for student questions about the project or the farmers production system. Requiring the students to formulate questions and ask or search for the answers is an essential, active part of the learning project. It also allows the instructor to monitor student progress on the project. Students periodically work on the projects until the final week of the course, when the projects are due.

After collecting the projects, the class discusses the similarities and differences between the advice formulated by the county agent, producer, myself, and that proposed by students. The discussions provide an opportunity for student analysis and acceptance or rejection of other advice and also exposes students to active learning projects that other students completed.

Student evaluation of the active learning project was completed by adding supplemental questions (Table 1) to the University's course evaluation form. Evaluations were made at the end of the course. Student response to all questions except one was limited to: strongly agree, agree, neutral, disagree, or strongly disagree. A response was considered affirmative if either agree or strongly
Table 1. Student response to use of an active learning project in forage courses.

<table>
<thead>
<tr>
<th>Respondents, no.</th>
<th>Affirmative response, %</th>
<th>Evaluation question</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>86</td>
<td>Was the knowledge gained from the comprehensive project worth the time and effort needed to complete it?</td>
</tr>
<tr>
<td>77</td>
<td>88</td>
<td>Should the comprehensive project be used again in this course?</td>
</tr>
<tr>
<td>13</td>
<td>92</td>
<td>Was the comprehensive project beneficial in applying the knowledge gained in this course?</td>
</tr>
<tr>
<td>13</td>
<td>38</td>
<td>Was the difficulty of the comprehensive project greater than what you initially felt prepared to manage?</td>
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</tbody>
</table>

agree were selected. Each student was also asked to suggest changes that could be made to improve the comprehensive problem.

Example Project

Comprehensive Forage Problem

Plant Science 308

Dairy Farm

John Johnson contacted his county extension agent (Jim James) and asked for advice to improve forage production on his farm. Jim contacted me for assistance and I am in turn asking you to assist in providing this farmer with the advice he needs.

The Problem. John is unhappy with both the yield and quality of the forages produced on his 130-ha dairy farm in Franklin County. The cost of soybean [Glycine max (L.) Merr.] meal (alternate protein source for the milk cows) is rising and John would like to cut that cost by improving his forage production system. He currently plans to remove a 20-ha alfalfa field from forage production in the spring and establish forages on a 18.8-ha field that was in oat (Avena sativa L.) last year. John feels that this is a good time to initiate changes that will make his forage system more productive. He wants advice on what forage to plant in the new field, management of that forage, and potential management changes that will improve the yield and quality of the 42.4 ha of alfalfa that will remain in production.

The Situation. The current forage management system produces about 1.12 English tons/ha of forage annually. The best forage quality analysis from last year’s crop was CP = 17%, ADF = 37%, and IVDDM = 54%. The existing stands are from 2 to 4 yr old and few weeds have invaded. Two years ago John applied 450 kg/ha of K, but last year no fertilizer was applied. John’s normal harvest schedule is as follows: first cut is put into silos (two, 6 by 18 m) in early June, second and third cuttings are harvested as hay at 50% bloom and stored in his dairy barn. No hay is harvested after 1 September, because John has read that there is a potential for stand reduction when harvesting after that date.

The new field to be used for forage production was soil-tested last fall with the following results; pH = 5.9, available nutrients of K = 321.3 kg/ha, P = 25 kg/ha, S = 71.4 kg/ha, and B = 2.9 kg/ha. The field is predominantly a sandy loam soil and lies in a flat (<2% slope), well-drained area. The Franklin County soil survey shows few limitations for crop production. This field is not fenced and John does not want to install a fence; therefore grazing the forage should not be considered as an option.

John assured the county agent that between he and his neighbors there is sufficient equipment and facilities to plant, harvest, and store almost any forage that we might suggest.

Things to Consider.

A. What should John do to improve existing stand yield and quality?
B. What should be done with the new 18.8-ha field?
   1. What soil fertility adjustments are needed prior to seeding and during the seeding year?
   2. What species and which variety or cultivar of that species should he plant and how will that species fit into his system?
   3. Which method of establishment, seeding date, and seeding rate should be used?
   4. Describe the seeding year management of the new crop: harvest method and schedule, weed control, and irrigation.
   5. Explain management practices after the seeding year: harvest method and schedule, weed control, and soil fertility.
   6. What cost will be involved in establishment and management of this forage and what are the potential returns on this investment?
C. John would appreciate other suggestions that would help him produce a high-quality forage for his dairy herd.

Notice. There is no incorrect advice for this project, (although some advice may be better than others) if you can logically explain why you advised as you did. Justify your advice!!!

RESULTS AND DISCUSSION

Students have responded positively to the use of this active learning project in forage courses (Table 1). Seventy-seven students responded to the original evaluation questions. During 1988, the survey was modified to include two new inquires; therefore, only 13 students have had an opportunity to respond to the last two questions (Table 1). Eighty-eight percent of those students thought the project should be continued. Eighty-six percent believed that the time and effort required to complete the project was worth the knowledge they gained. Of the 13 students, 12 (92%) felt that the project was beneficial in applying the knowledge obtained in the course, and 5 (38%) initially felt that the project was too difficult for their ability. The difficulty/ability question was included to verify that the project’s difficulty matched the student’s ability.

A final question asked of all students who have completed the project was, “What can be changed in the comprehensive problem which would make it better?” Each
year the project has been modified as a result of these responses. For example, one response after the initial use of the active learning project suggested that more information be provided regarding the producer’s experience with different forage crops. Another response suggested that the producer actually come and discuss the problem with the class. This has not been done; however, it certainly has potential and would be a beneficial addition in making the project a real-life situation.

Class time devoted to questions and discussion increases substantially several weeks before the project is due. Occasionally these discussions consume substantial portions of the class period and discretion of time allotted for these discussions must be made. The class discussions arising from this project, however, are excellent means for identifying subject areas that are unclear to the students. These discussions also stimulate student interest in the project.

The development and use of an active learning project such as the one described in this article requires course schedule flexibility to accommodate impromptu discussions. Instructors who follow an extremely rigid schedule or do not feel comfortable with student discussion may find this type of project inappropriate. Obtaining the full potential of this project requires some schedule flexibility and instructor-student discussion.

Use of this active learning project also necessitates careful matching of project difficulty and student ability. This is presently accomplished by varying the amount of background information provided to the students at the onset of the project. Classes that contain a high percent of honor students are required to solicit more information to complete the project than classes with fewer honor students. Unfortunately, this aspect of the project must be determined individually for each class. Timing the initial presentation of the project is also important. Students express high anxiety when the project is presented during the initial weeks of the course because they feel the project is too difficult. Although some anxiety may motivate students, this initial anxiety probably occurred because insufficient basic forage information had been provided at that early point in the course. Fewer students expressed anxiety over the project when it was presented during the middle of the course. Presenting the project later in the course allowed more time for the students to obtain basic forage information during the first half of the course, but still provided sufficient time for students to complete the project.

This active learning project increased student involvement in their learning process and provided an opportunity for students to critically analyze information and to integrate that information into solutions for real-life problems. The active learning project presented in this article has been used successfully and appears to increase student excitement and interest in forage crops.

REFERENCES


