Using a Computer Simulation Program For Animal Breeding Instruction

S. M. DeRouen, Jeffrey W. Moss and Donald E. Franke

Abstract

A microcomputer simulation program for beef cattle selection used at the senior level of instruction in animal breeding can be an effective teaching aid of breeding concepts. The program COWGAME, was used in an Animal Breeding and Genetics course at Louisiana State University. This cow-calf selection program allowed students to observe genetic changes as a result of selection practices. Results obtained from a student evaluation of the program and assignment suggest that the program created or increased an interest, understanding, application, and knowledge of breeding principles and practices. Overall student ratings indicate this teaching aid provided a positive learning experience.

Newcomb and Trefz (1987) stress the importance of exposing students to decision-making and evaluation-type learning activities in order to adequately operate at higher levels of cognitive learning. However, teaching animal breeding at a senior level of instruction in animal science has some unique problems. Carlson (1985) noted the largest problem to overcome is the time factor associated with genetic change or progress. To compensate for this limitation, Carlson developed a computerized simulated breeding program for swine limited to one trait, the days required to reach 230 pounds. In this article, results are presented for implementing a similar selection program for beef cattle which allows for multiple trait investigation. Students enrolled in Animal Breeding and Genetics (ANSC 4018) at Louisiana State University in the spring semester of 1988 used a cow-calf simulation program on a microcomputer to observe the outcome of applying principles of genetics to decisions of selection. Using this program not only allowed students to observe genetic change occurring as a result of selection methods practiced but promoted applying concepts learned to real world situations.

The Cow-Calf Simulation Program

The beef cattle selection simulation program, *COWGAME*[1], was written and copyrighted (1970) by R. L. Willham at Iowa State University and adapted for microcomputer use by Larry Burditt and David Buchanan, Oklahoma State University. Each student is assigned an individual "herd" diskette to be used with an IBM-PC (or compatible) microcomputer. One of the main purposes of this program is to show the gains that are possible from genetic progress as a result of selection of traits of economic interest. This simulation program generates data in minutes that would actually take years to collect from progeny produced over several generations.

Traits available for study were weaning weight, postweaning average daily gain and yearling weight. Students selected only one trait for observation since selecting for more than one would reduce the amount of progress for any single trait. Initial herds were

Table 1. Mean Values of Student Attitude Scores Toward a Cow-Calf Simulation Program and Assignment

Statement	Mean[a]	SD
Interest		
This program created an interest of a cow-calf operation.	4.11	.76
This program created an interest of selection methods used in livestock animal breeding.	4.44	.62
Mean and Standard Deviation of Interest Subscale	4.28	.23
Understanding		
Using this program helped me to identify with the genetic progress or change that occurs as a result of selection.	4.28	.75
This program allowed me to see differences in the two selection methods used in the assignment.	4.50	.71
The results obtained from the program were realistic and applied to "real world" situations.	3.28	.67
Mean and Standard Deviation of Understanding Subscale	4.02	.65
Application		
The assignment helped me to apply concepts of selection methods in animal breeding.	4.22	.65
This program helped me in the decision making process involved with livestock selection.	4.17	.71
Mean and Standard Deviation of Application Subscale	4.20	.04
Knowledge		
My knowledge and skills of computer usage were increased.	3.06	1.16
My knowledge and skill of selection principles in animal breeding were increased.	4.28	.46
Mean and Standard Deviation of Knowledge Subscale	3.67	.86
Overall Effectiveness		
Instructions for the simulation program and assignment were clear and properly explained.	4.38	.50
I would recommend this program to other classes for animal breeding and genetic courses.	4.39	.61
Mean and Standard Deviation of Effectiveness Subscale	4.38	.01
Mean and Standard Deviation For All Evaluation Statements	4.10	.48

[a]1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree.

DeRouen is a graduate student and Franke a professor in the Department of Animal Science and Moss is an assistant professor of Agricultural Education at Louisiana State University, Baton Rouge, LA 70803.

unique for each student and consisted of 50 cows, their progeny and five bulls. From the initial herd the students selected 50 females and two to five sires to produce each subsequent generation. Calving rate, sex ratios, and mortality for each generation were randomly determined as a function of the computer program.

Students used two selection methods and produced three generations of data for each method. The first methods involved selecting replacement stock based on actual phenotypic values of the observed trait. In the second method, selection was based on the breeding values of the selected individuals. Breeding value is a measurement of the genetic potential of an animal for the trait of interest.

After completing the computer exercise for each selection method, the students completed a written assignment based on the results obtained from the two selection methods used. The goal of each student was to achieve maximum genetic progress. Overall mean values for the trait being studied were computer calculated for each generation giving an indication of genetic progress made from the proper use of the selection methods. Students showed an interest in this learning activity and competition developed among them when comparing their results.

Student Evaluation

A questionnaire was developed to evaluate the effectiveness of the simulation program and related assignment used in this course. Statements were written to determine if the cow-calf simulation program and assignment created 1) an interest in animal science and selection methods, 2) a better understanding of genetic principles, 3) a condition for application of concepts taught, and 4) an increase in overall knowledge of animal breeding and computer usage.

Students responded on a Likert-type scale (strongly agree to strongly disagree) to eleven evaluative statements concerning the effectiveness of the program and assignment. Student opinions were summarized by assigning the following numerical values for each response category of the Likert-type scale: strongly disagree = 1, disagree = 2, undecided = 3, agree = 4, strongly agree = 5. The evaluation instrument was completed after all students had finished the assignment. Stufflebeam (1987) suggests that students are valid and reliable evaluators of teachers, courses and learning activities.

Results

Eighteen students completed the evaluation instrument. Means values and standard deviations for each of the evaluation statements grouped according to the five major areas investigated as well as the overall rating are presented in Table 1.

Interest. Students agreed (M = 4.28) with statements assessing interest created by use of this program and assignment. A slightly higher score was observed for interest created in selection methods (M = 4.44) than for interest created in a cow-calf operation (M = 4.11). Apparently, this learning activity fulfilled the purpose of having students become interested in selection principles involved with a cow-calf operation.

Understanding. Three statements were used to determine if the program and assignment provided a better understanding of genetic principles and selection methods. The students indicated the cow-calf simulation program helped them to identify genetic progress as a result of selection methods used. The students strongly agreed (M = 4.50) that the program allowed them to see differences among the two selection methods used (phenotypic values vs. breeding values).

Students were undecided that the results generated by this program were related to what is actually happening in the cow-calf industry. A possible explanation for this response is that student perception of realistic results may be altered due to the "unnatural" time factor associated with this program. However, achievement of this accelerated time factor is one of the major objectives of the learning activity.

Application. Two statements were used to investigate if this simulation program helped students to apply concepts of selection procedures. Students agreed (M = 4.20) with the two items pertaining to application. Apparently, this type of learning activity helps students to evaluate and make decisions based on selection criterion.

Knowledge. Two areas of knowledge, computer usage and selection procedures, were examined in the evaluation of the simulation program. "My knowledge and skills of computer usage" was the lowest scored item (M = 3.06) in the study. Executing this computer program appeared to add little if any to the students computer skills. A higher mean value (M = 4.28) was found for increasing knowledge and skills of selection practices, a major objective of the course.

Overall Effectiveness. The overall effectiveness of instruction for this program and assignment was also investigated. Students felt (M = 4.38) they received proper instructions in performing this learning activity. Students were also asked if they would recommend this learning activity to other breeding and genetic classes. The high score (M = 4.39) indicates that this program would be a worthwhile activity to incorporate into the course on a permanent basis. Student comments on the questionnaires supported this fact as well. The overall mean value 4.10 for all eleven evaluation statements suggests that the program and assignment were viewed favorably by the students.

Conclusions

Providing innovative and effective instruction for the teaching of genetic principles and practices in animal breeding is necessary in order to achieve

[1]The program and documentation may be obtained by sending a diskette to Dr. Larry Burditt, Department of Animal Science, Oklahoma State University, Stillwater, OK 74078.

desired student performance. Including a computer simulation selection program can result in more effective instruction as indicated by student evaluation ratings. Student appraisal showed that interest, understanding, application and knowledge of animal breeding were either created or increased as a result of performing this type of learning activity.

References

Carlson, J.P. (1985). "Overcoming Animal Breeding Teaching Problems." *NACTA Journal*, 29(1):71-73.

Newcomb, L. H. and M. K. Trefz (1987). "Toward Teaching at Higher Levels of Cognition." *NACTA Journal*, 31(2):26-30.

Stufflebeam, C. E. (1987). "Validity and Reliability of Student Ratings of Professors." *NACTA Journal*, 31(4):35-37.

TEACH THE TEACHER

A Useful Workshop Model Provides University Faculty For Much Needed Instruction on Electricity in Agriculture

Leon G. Schumacher and H. David Currence

Abstract

Agriculture teachers from across the state expressed a need for electrical education in agriculture. The state Farm Electrification Council (FEC) and the university Agricultural Education Department planned and conducted eight-workshops at eight different locations in the state. Approximately 180 agriculture teachers attended the workshops. Each instructor received both hands-on experiences with electrical wiring and retraining in electrical theory.

Introduction

Although this paper explains how financial and human resources were procured to in-service specific technical subject matter, the model utilized could also be used to facilitate college-level teaching which helps solve other rural problems. The cooperative efforts of state wide organizations, university faculty, and high school teachers can provide the monetary and human resources needed to address both current and future rural issues.

Electricity use in agriculture has continually increased during recent years. According to McFate and Linhardt (1985), the use of electricity will continue to increase. With the large and varied agricultural electricity use, the service sector of the electrical power industry has become quite busy - in some cases understaffed. According to McClarney (1987), the number of "small community electricians" has declined. In short, a real need exists for electrical instruction in rural America. Agriculture teachers within the state have sensed this need and responded by requesting in-service instruction in electricity. A panel of 13 agriculture teachers meet each year to identify areas in which they need additional education. Based on their recommendations, the state Land Grant University, together with the state Farm Electrification Council (FEC), have planned and conducted off campus electricity instruction for agriculture teachers.

Schumacher is an assistant professor in Agricultural Engineering/Agricultural Education and Currence is an associate professor in Agricultural Engineering, Agricultural Engineering Bldg., University of Missouri, Columbia, Missouri 65211.

The University and the state FEC have supported instruction in agricultural electricity for many years. Their decision to provide instruction in electricity was initiated at the grass roots level. High school agriculture departments are grouped into 13 geographical areas. Each area selects one delegate to represent them on the state in-service committee. The in-service committee meets bi-annually to determine the in-service needs of the agriculture teachers. Three times during the past twenty years, the agriculture in-service committee has recommended that in-service efforts focus on electricity.

As early as the 1960's, the state FEC recognized the importance of electricity education. Electricity was rapidly becoming the workhorse of modern agriculture. The state FEC organized an education committee to determine how they could best educate citizens about the use of electricity. According to John McClarney (1987), the committee decided to assist the agriculture teachers in providing electricity education to their students. After discussing their concerns with the university agricultural education/engineering faculty, the state FEC education committee decided to provide money for electricity education and teaching aids for the instructors. The instructors in turn would assist them in accomplishing their goal by teaching electricity to their students.

Developing a Meaningful Program

Developing a meaningful program would not be successful without the support and financial commitment of several groups within the state. The University faculty and administration, the industrial farm electrification council, the state department of elementary and secondary education, and the high school teachers cooperated in the planning and delivery of this program.

The University has employed a faculty member for in-service education. Part of his assignment has been to teach electricity to agriculture teachers both on and off campus. Part of the success of this in-service course was attributed to the fact that the in-service course professor who coordinated the instruction also taught