Utilization of a Computer-Based Farming Game With Beginning Students in the College of Agriculture

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As the structure of American agriculture has changed dramatically over the last three or four decades, the student population of agricultural colleges has undergone a corresponding shift (Legacy, et. al., 1979). From the time when the non-farm student was relatively unusual in the College of Agriculture, the student body of our colleges has markedly changed so that students with farm backgrounds are now sometimes in the minority. But these non-farm students may be at a disadvantage in programs that assume familiarity with rudimentary concepts and terminology of the agricultural production industry (Anderson and Elkins, 1978; Mayer, 1980). Equally important, both farm and non-farm students need to be exposed early-on in their academic careers to the attitude that the agricultural production sector is a vibrant, rapidly changing institution whose future participants will need considerable expertise and training.

Traditionally, the freshman orientation course in the agricultural college has provided an opportunity for students to be exposed to such concepts. In this paper we report an attempt to utilize computer-based instruction to facilitate accomplishment of these purposes in the introductory course in the College of Agriculture at the University of Illinois. In this paper, we will discuss the development process for this program, its implementation, and student comments on this type of learning tool.

A Pilot Developmental Project

In 1978, a pilot project was initiated to encourage the development of programs which could be used on the University of Illinois PLATO system (Program Logic for Automatic Teaching Operations) in courses of the College of Agriculture (Pelz and Ware, 1978; Wood, 1975). As a part of this pilot effort, an attempt was made to develop a computerized farming game for freshman students in the introductory agriculture course, Agriculture 100. This development had two primary objectives. The first was to familiarize students with the agricultural production system in Illinois. Although this aspect was oriented primarily towards the student with a non-farm background, many students with a farming background were expected to benefit by exposure to the entire range of farming operations in Illinois. As a part of this aspect of the program, the diversity of the agricultural sector of Illinois and basic terminology associated with the farming industry were described.

A second goal of this program was to illustrate the complexity of common decisions faced by Midwest farm operators. This complexity was illustrated in two dimensions. The first of these was that the farm operator has to make decisions without having certain knowledge of their outcome. The second aspect arose from the concern that all students in the agricultural curriculum need to realize that with the expanding scale of the individual farming operation, the magnitude of potential losses and gains associated with decisions increases rapidly. Thus, the concept of cash flow requirements for a farm firm was introduced to illustrate the magnitude of the transactions undertaken by typical farming operations.

In the fall of 1978, efforts were initiated to determine if it was feasible to develop and introduce such a farming game in an introductory course. This project was undertaken with approximately 30 students from the Agriculture 100 course. These students were given access to a very simplistic and rough version of a farming game on the PLATO system.

After trials with that program, the students were asked their reactions to this learning experience. In general, students responded favorably but suggested several improvements. An often-cited comment of these students was that the farming exercise should be simple enough so that students with very little understanding of agriculture would benefit from the exercise. At the same time, however, students with a relatively strong background in commercial agriculture demanded a learning exercise challenging to them. To satisfy the divergent needs of these two groups of students, a farming game with differing levels of complexity was needed. However, the generally favorable comments of the students encouraged more extensive development of the farming game.

The Plato-Based Farming Game

Subsequent to this pilot effort, two lessons were developed, called the novice and the expert versions of the program. In both lessons, an introductory set of material described several of the key aspects of Illinois agriculture. Such factors as size of farms, income levels, the

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state's ranking in the production of certain commodities, and the distribution of those production activities throughout the state were detailed using tables and computer graphics.

The novice version is designed primarily to introduce students to the PLATO farming exercise and to the terminology associated with agriculture at a rather simplistic level. This problem is initiated when the students are said to inherit a 400 acre cash grain farm in central Illinois. The students are required to make a number of decisions with respect to farming that cash grain operation. Prior to initiating any annual operating decisions, they first must choose what size of machinery they need to operate the inherited farm. During each of the five years they "operate" the farm in the farming exercise, several operating decisions must be made. The first is the number of acres to plant in either corn or soybeans. The second decision relates to timing of fertilization. At harvest, the students must choose when to market their crops. In each of these instances, programmed "help" modules are available which describe the complexity of the problem situation and which indicate the impacts of each alternative the student can select.

For example, in the marketing situation the student is faced with the decision of selling grain at harvest or storing it until March. If the grain is stored until March, there is an interest and storage charge. There is also the possibility of adverse price fluctuations resulting in the student receiving a lower price than would have been available at harvest. Conversely, the price could improve considerably between harvest and March. Each year after the student makes a decision as to whether to store or to sell at harvest, the student learns what the March price would have been (whether the student decided to store or not) and an explanation of this price is given. Such factors as export levels, weather events, and crop production in competing nations are listed as causing the price shortfall or increase relative to what had been expected in the fall. As an aid in this process, the student is introduced to the futures market and the opportunity to use the futures market as a source of information is described.

The advanced version of the farming game uses the crop model from the novice game as a point of departure. However, this exercise expands the number of decisions that the student must make. In particular, the student is given the opportunity to purchase additional land in each year of the five year period. The student is informed that land ownership is an attractive option in terms of generating net worth but that interest and principal payments are large relative to potential cash inflows. Also the student is given the option to feed livestock, in this case feeder pigs, to generate additional income. However, if the student chooses to raise livestock, capital investments have to be made to acquire facilities (the size of which the student chooses to be compatible with the livestock decision) and corn must be held back from sale. In this version of the exercise it is quite likely that cash shortfalls can occur, particularly if the student attempts simultaneously to purchase land and invest heavily in livestock facilities. In the framework of this program, the student is initially informed that the provisions of the inheritance require that the net worth of the farming operation must be continually growing or the farm will be forfeited to a third party. Students could repeat the exercise as often as they desire, however.

The program can best be described as a computerized budgeting model with random components for prices and yields. As such the program is rather simplistic in concept but its development in an interactive mode required considerable detail.[1] Development of an operational model was accomplished in less than a year with no one involved devoting full time to the effort. We estimate that model development required the equivalent of five months of professional effort and three months of programmer time.

The Program In A Classroom Setting

In the fall semester of 1979 the novice and advanced versions of the PLATO farming game were made available to students in the Agriculture 100 course interested in participating in them on an extra credit basis. Students received credit for completing the programs but were not required to do so. After approximately six weeks in which to complete the exercises, students were asked to complete an evaluation of the exercises. Seventy-nine students completed evaluations of the farming games. Of those 79 students, 39 indicated they had a farming background whereas the remaining 40 students were equally divided between a small town background and a city background.

A partial listing of the results of this evaluation is presented in Table 1. The students were given the choice of attempting only the novice version, only the advanced version, or both versions of the farming games. Those students with a farming background were more likely to have attempted both the novice and the advanced game than were students with a non-farm background. Almost 62 percent of the students with a farm background attempted both versions, whereas only 30 percent of the students with a non-farm background tried both programs.

These farming games required substantial time of the students to complete the entire five year sequence. For the novice game, the average time for completion was approximately 20 minutes. Students with a farm background were able to complete this game in a slightly shorter time than were students with a non-farm background. The advanced game, on the other hand, required slightly over 30 minutes for completion. Student backgrounds did not affect the time required to complete this

1. Further information on the model is available from the authors upon request.

Table 1. Student Evaluations of the PLATO Farming Games (Fall, 1979)

	Total	Those who live: On a farm	In a small town	In a city
Number of students	79	39	19	21
Attempted novice game only: number	37	10	12	15
(percent)	(47)	(26)	(63)	(71)
Attempted both versions: number	36	24	6	6
(percent)	(46)	(62)	(32)	(29)
Of those attempting both versions, percentage who found the advanced version:				
more enjoyable	61	63	83	33
more educational	89	96	83	33
Average time (minutes) needed to complete the:				
novice version	21	18	26	24
advanced version	32	32	27	33
Percentage who would recommend continued use of:				
novice version	90	91	94	90
advanced version	92	93	100	80
Percentage who feel similar PLATO exercises should be used in other courses	92	92	95	90

exercise. This may indicate that the students with the farm background found the advanced version more challenging and took more time to complete this version. (These data indicate that a minimum of 45 hours on PLATO terminals would have been necessary for these 79 students to complete the farming exercises they undertook.) A major problem hampering more widespread use of the PLATO-based system is lack of adequate numbers of terminals to support campus-wide use. Nearly one-third of these students cited difficulty in gaining access to a PLATO terminal to complete this lesson. (No estimate is available of those students who were unable to complete the lesson because of computer terminals being unavailable.)

It is interesting that the more challenging program was preferred and was regarded as more educational by both the students reared on farms and those with small town backgrounds. Evidently, they enjoyed the additional complexity and opportunity for failure associated with the advanced version. However, those students from a city environment tended to prefer the novice game. Evidently, the additional complexities were less appreciated by students unfamiliar with farming operations. These data indicate that the decision to have two programming opportunities was useful.

Students were asked to indicate whether these computerized farming games should continue to be available as a part of Agriculture 100. Students exhibited a strong preference for continuation of the two exercises. More than 90 percent of the students indicated that they would recommend the continued use of both programs.

In addition to recommending the continued use of these particular exercises, students indicated that the opportunity to work outside class in similar PLATO exercises would be a worthwhile activity. Over 90 percent of the students indicated that they would recommend similar PLATO exercises in other courses. In particular, the students noted that they preferred the interactive design of this particular computer-based instructional system as well as the ability to work independently. The students also indicated a strong preference for working with an applied situation such as was exhibited in these particular farming games.

Summary

A computer-based instructional system was used to present farm production concepts to freshman students in an agricultural college. Student feedback during the developmental and initial implementation phases of this effort was favorable. Development of lessons with differing levels of complexity appeared to be a key step in accommodating the divergent backgrounds of present-day agricultural students.

Although completion of these lessons involved a considerable time commitment by the students, responses of these students encouraged continued use of the lessons. In addition, the students favored the supplemental use of computer-based instruction in other courses.

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