Data processing

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Using A Microcomputer in the Classroom

by

K.C. Schneeberger, D.D. Osburn and E.S. Reber

We have had a microcomputer in Agricultural Economics at the University of Missouri for three and one-half years. The micro is used for both teaching and research.

Our experiences have been in the area of farm management and finance teaching. The courses we teach are populated with juniors and seniors. We have had assignments on the micro in ag finance two semesters, in farm business analysis two semesters and in farm planning one semester.

We started with five programs written to be as user-oriented as possible so that students could operate them with a minimum of instruction. We now have 10 programs from which students can choose. (See table 1.)

We are fortunate to have a computer support staff of three full-time people in the department. These persons are in the same office as the micro. This was an advantage to us as instructors. As you might expect, the staff had many interruptions during the periods of heaviest microcomputer use. This has frankly been a problem for us. It should be reduced this fall as the College of Agriculture has purchased 12 Apple II micros and established a microcomputer lab in the Agriculture Building. The lab will be open 8 to 5 daily but will be used 16 hours per week when microcomputer classes are being taught in the room. That will leave 29 hours per week for public access.

Our Philosophy

We became convinced in 1977 that microcomputers were a wave of the future. We believed today's student generation would be using micros in their homes,

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Table 1

Programs Available to Students Using the Microcomputer in Farm Management and Agricultural Finance.

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1. Loan Comparisons - a summary of interest and principal payments, period-by-period, for different types of loans

2. Crop Comparisons - the Minnesota CROPEQUAL program

3. Depreciation Tax Options - a comparison of three depreciation options under any marginal tax bracket and useful life specified

4. Linear Programming - an optimization algorithm for either profit maximization or cost minimization for up to a 30 x 30 matrix

5. Investment Evaluation - analyzes the profitability and cash flow consequences of investments

6. Buy vs. Custom - compares the own versus custom operation for any machine specified

7. Auto - calculates the cost of owning and operating an automobile or truck

8. Financial Analysis - summarizes the annual cash flow of a business. Calculates profit and loss, debt servicing capacity, return to management and return on investment

9. Buy vs. Rent - a comparative analysis of buy vs. rent land

10. Tax Management - designed to help farmers make year-end tax management decisions

businesses and for fun. Thus, we decided to provide students the opportunity to address common management and finance problems using the microcomputer.

We had no intention of making the microcomputer the central feature of any course. Our objective was to have students complete two or three assignments that complimented the lecture material being presented. In the process, they would become acquainted with this new technology. Courses which have used the microcomputer have many other exercises and problems that do not require microcomputer use.

The Mechanics of Use

We have tried several ways of using our microcomputer. We have usually made assignments that are graded, but in one case gave optional assignments. When we only had one class of 50 using the micro we operated on a first-come, first-serve basis with 30 minute limits at any one sitting. In the semester that we had two classes (more than 150 students total) vying for use we had to develop a schedule of 20 minute blocks and have signup for individual blocks. We also allowed the students to work in pairs if they wished. However, you will realize there were only 120 time slots per week for use by 70 teams. Thus, with other classwork and part-time jobs, some teams were lucky to get on the computer once during a week.

We actually thought we had prepared for the heavier use by leasing an additional terminal to give us two CRT input units (our CPU and printer were adequate for handling two jobs simultaneously). However, we had some mechanical problems and often had only one CRT input unit operational.

It was probably good that we had the two CRT input units. It could have been frustrating for the students (and us) if we had encountered major downtime due to equipment failure.

What was asked of students?

It is not our objective to teach computing. Nor have we used the micro for most assignments in a semester. Our approach has been to give assignments that most students could complete in two, or at most three, 20 minute blocks. For example, the assignments in the farm business analysis class were:

a) determine the repayment schedules for an intermediate term asset and a long-term asset under at least two different repayment options.

b) compare the profitability of three crops that might compete for the same land, including two price levels for each crop.

c) evaluate the tax consequences of the three major depreciation methods on a major intermediate-term investment decision. Use at least two different marginal tax brackets (one < 20%, one > 40%).

RESULTS

This whole microcomputer area is changing so rapidly we are going to report our findings in two stages. We will first talk about our experience prior to the 1980-81 academic year and then report on our experience this past year. We had not had classes competing for the micro prior to this year.

Student Use of the Micro: Pre 1980-81

The log of student use indicated a nearly continuous stream of students occupying the microcomputer on certain days, especially as the assignment's due date neared. This probably indicates some student procrastination in doing assignments.

Crowding may have caused the class to make less use of the programs than they would have made under less crowded conditions: 43 percent of the class in farm management felt that use of the microcomputer was sufficiently heavy that it

created difficulty in running their assignments. However, only 28 percent of the students in agricultural finance indicated difficulty in completing their assignments. Scheduling student use of the microcomputer would have decreased crowding, but was counter to our objective (at that time) of giving students totally free computer access.

We found that students planning to farm after graduation (a) ran more programs than required, and (b) ran more than the minimum assigned number of programs than students not returning to the farm. This may indicate that students planning to farm were self-motivated to experiment with the newly learned techniques because they could see immediate application to their situations. Several had made some major investments in land and/or machinery. Such students often used the capital budgeting program to determine investment profitability of capital outlays already made. Many students with farming interests indicated they wished they had had access to the micro prior to making some major investment decisions.

Nearly half the students ran out repayment schedules for a new auto or pickup truck, in addition to the assigned problems. Twenty percent used the L.P. routine to estimate the income their parents were getting from farming. Students also tried to determine a profitable plan that would allow them to work into the family farming business. Others looked at the possibility of farming on their own. These students often required substantial help from the course instructor or graduate assistant. Most learned more about enterprise budgets, enterprise competition, and resource constraints than they would ever have learned without the computer experience. However, such a learning experience is not limited to the microcomputer.

Student Use: 1980-81

We have a lot to learn ourselves about making effective use of the microcomputer. For example, we both had assignments on the micro during the same four week period. Use of the micro for teaching purposes was very heavy during that period. However, the micro had been underutilized during the first eight weeks of the semester.

We used different approaches on the computer assignments given in the two classes. In agricultural finance the students were assigned certain problems which were to be run and turned back in. In the farm planning course the students were told they could earn bonus points by doing three optional exercises on the micro. One of the optional exercises was a linear programming problem. An LP had to have at least eight constraints and 12 activities.

There were some major differences in the two classes. The agricultural finance course had a majority of agricultural economics majors, but the farm planning course has only one-third majors. A greater percentage (1/2 or 1/3) of ag finance students had had a computer science course. (See table 2.)

Students tended to do more than the minimum asked. Even in the farm planning course where the assignments were optional, more than half the students did more than was asked. Less than 10 percent reported running many more programs than required. This may have been due to the heavy demand during the key four week period. (Our computing staff did report students came in after the assignments were due and "experimented" with the micro.)

Even though students generally rated the micro "friendly" and easy to use, there were some problems. The three major problems we encountered were:

1. Crowding
2. Inadequate instruction prior to use

Table 2

Responses of 140 Students Using a Microcomputer in Two Farm Management and Agricultural Finance Classes, Fall 1980.

	Ag. Finance	Farm Planning
1. How much computer experience have you had?		
a. A computer science course	51%	30%
b. Used computer in another course	17	19
c. None	32	51
2. Characterize your use of the microcomputer.		
a. Did no run any programs	0%	3%
b. Ran the minimum required	24	37
c. Ran a few more than required	67	52
d. Ran many more than required	9	8
3. Was the computer "friendly"/easy to use?		
a. Very easy	40%	22%
b. Fairly easy	56	74
c. Difficult	3	4
d. Very hard	1	0
4. What problem(s) did you encounter?		
a. Too crowded	17%	46%
b. Insufficient instruction	42	42
c. Instructions confusing	16	17
d. Insufficient time to do assignment	4	15
e. Need attendant to answer questions	48	57
f. No problems	4	0

3. Need someone near the micro to answer questions when problems encountered

Problems 2 and 3 are related. There is always a question of how much time can you take away from the course subject material to spend on teaching mechanics of using a microcomputer. We think we are solving that at Missouri by offering a course in microcomputers. The course was offered for the first time this past semester and three-fourths of the students had either been in the farm planning or ag finance courses. We believe that was a positive evaluation of our efforts.

Student Evaluation: Pre 1980-81

Slightly over half of the class indicated that their perception of what a microcomputer was had changed as a result of their exposure to it in class. Comments on how their perceptions had changed centered around three ideas: (1) before this exposure they had no real conception of what a microcomputer was or what it could do, (2) it was easier to use than expected, or (3) it had greater capabilities than expected. In addition, about 80 percent related they felt the experience would be of value to them in their employment after graduation.

Several students had difficulty believing that questions were being asked and instructions given by "that little box" (the microcomputer). Student feelings of remoteness from the computer, common with batch processing and time sharing, seemed to diminish when they realized the computer they were using was right beside them and they were providing the information for it to process. Also, highly interactive programs and nearly instantaneous feedback seemed to lower student apprehension of microcomputer use. The students could run their problems, then change a number or two and have the alternative answer to their problems in seconds.

Our micro is one floor above the course instructor. It was common for students to come by to show their results as soon as they got some output. We did not keep a count. However, there was evidence of real excitement with the results.

These subjective observations are supported by responses to a question on use of the microcomputer versus the large campus computer. Nearly half the class said that previous to their exposure to the microcomuter they would have chosen to use the main campus computer rather than the microcomputer, if given the same assignments. After their exposure to the microcomputer though, only 4 percent of the class indicated they would rather use the campus computer for their assignments. These results indicated how well students accepted microcomputer use after they had an introduction and limited experience, i.e., had run at least three of the programs.

Student Evaluation: 1980-81

We recognize that an anonymous questionnaire administered near the end of a semester is an imperfect research instrument. Students may mix their feelings toward the computer experience and their feelings about the course in general. We don't believe this was the case this past year as the micro experience got better ratings than our overall course ratings. We believe our course ratings were improved because the micro was used.

Table 3 reports the answers to questions about student perception of the value of the micro in the two courses in which they were enrolled as well as other courses. We believe the overwhelming positive response to the questions on (a) value of the micro as a teaching tool and (b) use of the micro in other courses indicates the micro has a real potential as a classoom aid. We were somewhat disappointed that less than half the students felt their assignments on

Table 3

Student Attitudes Toward Use of a Microcomputer in Agricultural Economics Classes. Fall 1980.

	Ag. Finance	Farm Planning
1. Do you think the micro is a good teaching tool?		
a. Yes	88%	96%
b. No	12	4
2. Did using micro help you understand material presented in class?		
a. Yes	48%	43%
b. No	52	57
3. Do you think other Ag Econ courses should use a micro?		
a. Yes	92%	90%
b. No	8	10
4. Do you feel a micro would be a valuable tool in a farm business?		
a. Yes	98%	98%
b. No	2	2

the micro helped them understand material presented in class. This suggests we have some more work to do as instructors.

LIMITATIONS IN CLASSROOM USE

To this point primarily positive comments have been made regarding microcomputer use. However, there are some potential problems.

1. The micro must be supervised and individualized instructions provided for computer use. Sometimes the student needs help for a minute or less, but someone must be available. We have a small computer and statistical staff who answered many questions in assisting students in implementing their program--even some weekend assistance was provided. Without this kind of assistance and resource, usage would have been curtailed and/or faculty time requirements increased several fold.

2. The types of problems addressed may be limited by available memory. The microcomputer used in this classroom situation could process a 900 element (30 x 30) linear programming matrix, but nothing larger.

3. Security of some microcomputers and their programs may not be adequate for classroom use: students with sufficient knowledge of microcomputer language could tamper with programs available to an entire class.

4. Microcomputers are not supported by campus computing administrations on some campuses. Computer programming for special purposes (operating system changes, etc.) may have to be done within the instructional unit; this requires computer programmers proficient in assembly language programming.

5. Maintenance could be a problem. If not carried out by a responsible, reliable organization, serious downtime problems could result. Losing a microcomputer's services for even two weeks could be a serious blow to a teaching plan--especially if intensive use of the microcomputer was planned.

Another area of concern is the paucity of microcomputer programs available for farm and financial management computer-aided instruction. Because of language incompatabilities, few microcomputers can use the CAI programs already developed for time sharing and batch systems. Rewriting those programs involves considerable expense. Moreover, language incompatability between microcomputers often precludes the transfer of programs from one microcomputer to another. Thus, programming language incompatabilities contribute to the scarcity of financial/management microcomputer programs.

Finally, use of the computer is not a substitute for teacher preparation, nor is it necessarily a saver of faculty time.

SUMMARY

In summary, use of the microcomputer, for whatever reason, appeared to increase motivation among students. Use dramatically increased the number of "teachable moments." Also, a number of other desirable teaching benefits are associated with use: (1) sensitivity analyses of several types were more readily achieved and observed by students as they changed input data, (2) students were able to approximate the real world with greater ease, and (3) students could put theory to a test in the models.

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