

# Microcomputer-Based Networks For Teaching Agricultural Marketing

Michael A. Hudson, Raymond M. Leuthold, and Steven T. Sonka

## Abstract

*An exploratory project relating to the uses of microcomputer-based networks for teaching agricultural marketing is described. Applications to teach information retrieval, risk management using futures and options, and price discovery are discussed to illustrate the potential of networks for teaching. Issues related to the evaluation of the effectiveness of computer-based learning are considered in the context of these applications and suggestions offered. Based on the experiences reported, suggestions for other uses of microcomputer-based networks are offered.*

Computer use has a relatively long history in agricultural economics education. Until recently, however, the computer was primarily used in classrooms and laboratories to process large quantities of data (Wiggins and Trede). Recent technological advances, economic availability of hardware, and increasing sophistication of software have greatly expanded the potential uses of the computer as a classroom tool (Sonka, Hudson, and Leuthold). As a result, microcomputers have become commonplace in agricultural education. In fact, casual observation suggests most Colleges of Agriculture are currently teaching (or have available) at least one microcomputer course to provide students with a base level of computer literacy. Microcomputers are also being introduced into subject matter courses, particularly those related to marketing, farm management, and financial analysis.

The development of sophisticated microcomputer-based networks also has recently expanded instructional possibilities in agricultural economics. A particularly intriguing opportunity offered by network systems is the potential for simultaneous interaction among several students in a controlled setting. Students can share information through the network system and experiment with information management techniques similar to those they will employ in future careers.

The purpose of this paper is to briefly describe an exploratory project on the uses of microcomputer-based networks. Specific attention will focus on teaching applications in agricultural marketing. The three-year project, entitled "A Pilot Investigation of the Uses of Microcomputer-Based Networks for Business Management and Marketing Simulation in

Hudson is an associate professor in the Bruce F. Falling, Sr. chair of Personal Enterprise, Cornell University, while Leuthold and Sonka are professors, respectively, Department of Agricultural Economics, University of Illinois at Urbana-Champaign. The support of the IBM Corporation through project EXCEL, the College of Agriculture, and the Department of Agricultural Economics is gratefully acknowledged.

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## Computers As Teaching Tools

A number of factors affect the learning process. Some students are able to grasp concepts clearly through lecture and subsequent study, while others require a more active approach to the learning process and prefer concepts presented in a practical and usable manner. As a result, educators are faced with the challenge of developing an effective mix of educational approaches to reach their students (Fulkrod). Recent evidence suggests that students in Colleges of Agriculture may "have a greater need to learn in an environment where teaching material being presented is practical and usable for the present, and that they may have less need or desire for theory of future implications of the subject matter" (Barrett, Sorenson, and Hartung, p. 53).

Thus, there is a need for agricultural economics educators to integrate the presentation of theory into practical and usable contexts. One approach used with some success has been the development of computer-based simulation exercises (for example, Babb and Eisengruber; Dahlgran). Historically, such simulations have been mainframe-based and often required that the student make decisions based on information provided by the instructor. The student responses then were entered into a computer for processing, often by a third party. The results were returned at a later date.

Such simulations have become a valuable part of the learning process and often constitute a major portion of some courses. This type of mainframe interaction, however, does little to acquaint the study with the workings of the computer. As a result, the student fails to develop the perception of the computer as a tool in the decision process. A major factor is the time lag between decision and feedback which seriously limits the effectiveness of the simulation, the student's ability to relate the outcome to the decision process and grasp the desired conceptual materials.

The development of interactive simulations which use either standalone-microcomputers or network systems offers several advantages over the mainframe based simulation, including efficiency, immediate feedback, convenience, and a more active mode of learning (DiAntonio, Hudson, and Toensmeyer). Networked systems also offer increased instructor control, improved flexibility in terms of access and set-

up, and increased computer literacy through student interaction with the computer. Such systems also open new simulation opportunities. For example, conducting a trading simulation on a mainframe computer would be quite costly and would suffer from significant limitations, including a lack of immediate instructor control and limited student interaction. The same simulation, however, can be readily conducted on a self-contained network system at a low operating cost, allowing the instructor to illustrate numerous concepts in a short period. Additionally, the technology of the network allows students to review additional information during the simulation process.

In summary, computer simulations can be valuable tools in teaching agricultural economics concepts. The technology for networking microcomputers to develop interactive simulations offers the potential to introduce new and more effective teaching tools. A description of one approach to the use of networks in teaching marketing concepts follows.

### Teaching Marketing Concepts

Price discovery and risk transfer are two important concepts of decision making in agricultural marketing. Traditional approaches to teaching these concepts include lecture and discussion, case studies, observation of trading in local markets, classroom simulations of trading, and paper trading exercises to simulate risk transfer decision making. Students interested in practical and usable educational experiences, however, may have difficulty in associating such classroom activities with practical business settings.

The development of an interactive trading simulation offers the potential for students to personally experience the price discovery process. In addition, the microcomputer-based network allows the instructor to control the flow and types of information available to the student, the mix of traders, and the types of quality of goods sold. These parameters can readily be changed to provide students with exposure to several different types of processes in a short period of time.

Students often have difficulty grasping the risk management concept and its implementation. An understanding of the basics of futures and options markets can be achieved through classroom lectures and discussions, supplemented with case study type homework problems. Many students, however, find the *ex post* nature of the problems unrealistic. Simulation exercises where the student participates in the decision process increases comprehension and understanding of the material. The active form of learning is generally perceived as more interesting than numerical exercises and may foster repetition of the process for further comprehension and understanding.

Finally, the student is able to observe several actual years of data to examine the impacts of changing market conditions and information on the decision

process. The network environment also allows the introduction of information uncertainties into the process. Thus, there is the potential for the exercise to become an integrative learning experience.

### The Microcomputer Network

The network system employed in the applications described here consists of two IBM-PC/XT remotes (two disk drive, mathcoprocessors, 640K, enhanced graphics adapters and monitors), one 30MG external hard disk for data storage, one high speed page printer, one dot matrix color printer, and two 8-pen color plotters. The IBM-PC Local Area Network (LAN) program links the machines. Applications are programmed in one or more of the following languages: MicroSoft C, Windows for Data, DBASE-III, IBM Professional Fortran, and Borland Turbo Pascal.

The network has been used in a variety of courses, focusing on the development of teaching applications in agricultural marketing, including: (1) a module on information retrieval; (2) exercises on using futures and options; and (3) a livestock trading simulation.'

The information retrieval exercise simulates the use of microcomputer networks as communications devices. This simple exercise requires students to utilize one of the remote machines to access and modify an item of information from the server — similar to gathering and analyzing data from a marketing service. In completing the exercise students learn how to use a microcomputer to gather and analyze information and then send it on to someone else via the network. Thus students see the network as a tool to enhance productivity through the gathering, processing, and distribution of information.

The futures and options exercises provides students with a tool to learn about risk management decisions in the context of realistic problem situations (see Leuthold). Students are given the basic data and required to utilize the network system to generate solutions to classic hedging problems. The network system tracks their performance and the students are allowed to replicate the exercise until achieving a satisfactory level of performance. Consequently, repetition is encouraged and students are able to focus on learning the material, with the grade being a secondary issue.'

The livestock trading simulation teaches the concept of price discovery. Following an introductory lecture on conceptual materials, students participate in a series of controlled auctions designed to illustrate the impacts of differential information, market power, and various mixes of traders on the competitive bidding processes. Following the use of the simulation, price paths are plotted and results examined in class.' As a result, students develop a better understanding of how the price discovery process is affected by information and composition of traders in the market, consequently, students are better able to grasp the impacts of less competitive trading situations covered later in the course.

These experiences allow us to offer a number of observations. First, students find such exercises valuable as supplements to traditional instructional methods. Performance and understanding both appear to increase with their use. Students comment positively on course evaluations — perceiving the network activities as relevant and beneficial to the learning process. Also student responses to subjective test questions show a higher level of thought and reasoning resulting from using these exercises. Lastly, in subsequent courses students exhibit a greater degree of computer literacy and an increased awareness of the computer as a tool for problem solving.

Despite these positive impacts, microcomputer networks have a negative side. First, the costs of installation, development, and maintenance are high. Significant faculty time is required to facilitate the development and testing of useful applications. Also, the network can become a source of frustration for students with alternative access to microcomputers for whom the network is an inconvenience. Student response to the network appears to vary by application. For example, in the information retrieval exercise students perceive the network as necessary to teach the concept and react positively. In other applications, where the network is used primarily to facilitate communication and feedback, the access obstacles may override the benefits. Finally, the network system suffers a similar problem to mainframes in being slower than standalone microcomputers, a problem which worsens during peak usage periods.

### Evaluating Educational Effectiveness

Evaluation of the educational effectiveness of network applications presents a number of challenges and requires input from a variety of sources. Major issues to be considered include: 1) realism of applications; 2) impacts on student learning; and 3) benefits and costs of the system. Project staff, university colleagues, technical specialists, and students have provided the basis for evaluation of the project.

The realism of the applications must be addressed from two perspectives. First, it is important that the exercises are presented in the proper context relative to the concepts being taught. Second, the applications should provide a realistic application of the microcomputer in problem solving or decision making. Student input in this area is important but limited by their *a priori* knowledge of the material. Thus colleagues, technical specialists and project staff must provide major input. Our experiences suggest that the best way to evaluate realism is through extensive review during the developmental phase. While developing the livestock marketing simulation, for example, project staff actively consulted with colleagues and industry representatives to create a realistic trading environment. Computer specialists also were consulted at this stage to enhance the use of equipment to achieve realism. Students became in-

involved in testing the simulation and suggesting modifications.

Perhaps the most important and challenging dimension of the evaluation process is determining the impact on student learning. While it is useful to divide students into groups to assess performance after using the network, this may not always be physically possible. Additionally, if the network system is truly effective as a teaching tool, separation of students into groups which do and do not use the system will result in differential performance between student groups. From the valuation standpoint, performance differences across groups provide evidence of effectiveness. The educator, however, may have difficulty in justifying not taking advantage of available tools in teaching all students.

Our approach to this issue has been experimental. For the information retrieval exercise, students were divided into groups which did and did not use the network and performance compared. The futures and options exercises were required for all students in the course (as they had been in the past) and the network used primarily to track performance. Students using the livestock trading simulation were divided into groups which used the simulation at different points in the course. This latter approach afforded each student the benefits of learning via the simulation, while still allowing for comparison of test scores in a before and after context. In addition, technical specialists and professionals have been used to review these applications and their feedback has been incorporated.

The final issue of evaluation relates to the benefits and costs of the network system. Project staff and instructors using the applications provide the best perspective here. Our assessment to date suggests that the long-run benefits of such systems are significant, but the short-run costs can be high. Both programmers and faculty tend to grossly underestimate the time involved to develop, test, evaluate, and implement new applications. In addition, equipment limitations are often an obstacle to turning an idea into a usable and realistic program.

### Concluding Remarks

The use of microcomputer-based networks for teaching in agricultural economics offers considerable potential. As technology continues to evolve, the potential uses of microcomputer-based networks will continue to expand. Additional work is needed to explore several other uses of such systems, including 1) the use of microcomputer networks in course administration, 2) network based simulations for teaching business management, and 3) the use of networked systems to integrate computer literacy into disciplinary courses.

Ongoing evaluation is critical to the successful use of network systems such as the one described here. As new applications are developed and incorporated into curricula, it may be necessary to re-examine the role of the microcomputer in instruction. In particular, the

tendency to use an application simply because it required a great deal of time and effort to develop needs to be avoided; only those applications which enhance the learning process should survive in the curriculum.

Finally, the experiences reported herein should offer encouragement regarding the potential of microcomputer networks in agricultural economics education. The difficult-evaluation of immediate and long term benefits to both students faculty vs. initial and recurring costs must be done with each system's data. System benefits and costs will vary. It should be noted that an ongoing commitment to hardware and software maintenance is a necessary condition if such a system is to be effective, as is an active program of evaluation.

### Endnotes

<sup>1</sup> A number of other possible applications of the network exist. The three reported herein have been tested in the classroom and are currently in use. Other applications currently being developed include: 1) a hedging simulation for grain and livestock operations which allows the student to simulated hedging during production and feeding period in the context of specific costs, goals, and objectives; 2) a livestock feeding and marketing simulation; 3) a question and answer program for review of basic concepts in a game format; and 4) retrieval and analysis of actual marketing data which changes on a daily or periodic basis.

<sup>2</sup> It is not necessary to use the network system for these types of exercises, nor does it enhance the student's ability to repeat the exercise. The benefit of the network system lies in providing a monitoring mechanism for the instructor which enhances communication between students and the instructor, while tracking performance in an effective (although unforgiving) manner. Using a network system for such exercises does create a disadvantage for students who have access to microcomputers in their residences and are forced schedule lab time to complete assignments.

<sup>3</sup> The livestock trading simulation also offers a number of interesting research applications related to experimental markets, such as evaluating the impacts of differential market information on competitive bidding processes or investigation of the impacts of alternative forms of auctions (e.g., single-sided versus double-sided) on price discovery. Further discussion is omitted to allow a focus on the teaching applications of the network. See Roberts, Adam, and Hudson for an example.

<sup>4</sup> Although benefits are difficult to measure, our experience to date suggests the network system can improve learning and comprehension. For example, students exposed to the information retrieval exercise scored an average of ten points higher on examination questions related to networking than their fellow students who were given only a lecture on the subject. This limited evidence suggests the network system offers the potential to enhance student learning, although further and more vigorously generated evidence is needed to verify these impacts.

<sup>5</sup> The hardware system and initial programming for the applications described here required an investment of over \$250,000 (at retail prices). Maintenance programming support, continued faculty time, and operating expenses can easily add another \$30,000 per year to the costs of using such a network.

<sup>6</sup> Recent technological advances allow the addition of hardware enhancements to increase the speed of the network. The system described here was recently augmented with such equipment, including additional workstations and new high capacity multi-tasking servers. To date the updated network has been tested on a limited basis with positive results.

<sup>7</sup> The test scores related to the price discovery concept indicated that students using the trading simulation understood the concept better than their peers who had not used the simulation. These

scores, however, were not counted in grading to avoid penalizing or rewarding either of the student groups while assessing the impacts of the simulation on learning.

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Gerry L. Posler  
Book Review Editor  
Kansas State University  
Manhattan, KS 66502

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Robert E. Taylor and Ralph Bogart. *Scientific Farm Animal Production - An Introduction to Animal Science*. Macmillan Publishing Company, 1988. 618 pp. Hardback \$43.00.

This third edition is one of the good introductory texts for the teaching of animal science. Most chapters are clearly written and the reader has little difficulty in reaching a full understanding of the material with one reading. Perhaps of greatest importance is the approach to animal science which those with little practical experience in the field should find both exciting and easy to understand.

The authors were confronted with the problem that has plagued previous authors in this field: should the subject matter in an introductory course be discussed from a) a life cycle biological principles approach, b) a species approach, or c) a combination of the