TEACHING WITH THE MICROCOMPUTER: ADOPTION OF A NEW TECHNOLOGY

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INTRODUCTION

In an earlier paper, Litzenberg reviewed many of the issues associated with computer use in the agricultural economics classroom. His work also included a survey of land grant university work, inventorying hardware resources and computer-related course offerings. His paper offers valuable overviews of current issues and some suggested directions. The perspectives on the educational use of a microcomputer offered here are from a slightly different vantage point. The experiences are those of an extension worker, working primarily with adults.

Reviewed first are some powerful forces that are dictating change in microcomputer use in education. One force is the mass marketing of sophisticated hardware and software that is increasingly cost effective. Another force is the inevitable search for ways to make humans more productive. After reviewing these forces affecting the extent and speed of adoption, some final observations are offered about issues educators face in setting priorities in microcomputer-aided teaching.

COMPUTER CAPABILITIES AVAILABLE TO THE GENERAL PUBLIC

Though those in education have often been isolated from many outside influences, the coming of inexpensive, widely distributed microcomputers is forcing major reexaminations of both the content and delivery systems of public and private education.

In a prophetic book Nelson described a "home computer revolution" during which grassroots users of microcomputers gain access to computing resources. A wide population of intelligent, ingenious people find that they can program these computers to enhance their productivity, in some cases designing more effective analytical tools, in other cases causing the computer to do mundane, tedious tasks. In effect, the local users substitute their abilities and priorities for the traditional mainframe computer program designers who tended to have neither the background, the inclination, nor the motivation to work on the important problems facing the general public. Nelson's computer revolution projected a reorientation of work, with new focus on computing needs and special attention to making computer use easy, flexible, and effective. He notes:

> Little computers, with easy-to-use programs, are cropping up all over. And many of the people working on these systems have a real commitment to the opposite idea: that computers should be easy to understand and easy to use.
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> The impact of these developments on the business world is going to be formidable, profound and revolutionary. Easy systems for accounting, typing and filing, scheduling and personal databasing, will appear quickly. First to grab will be the innovative small businesses; but then larger firms will come too.
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> The structure of the computer world evolved not from real considerations but from marketing tricks. Big companies and batch processing, once necessary, became a way of locking out minicomputer manufacturers and interactive systems. But it will become plain for all to see: most usage of computers is best done on interactive minis, and should have been all along. Large data bases need large disks, not large computers.
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> Presently, armies of programmers are employed doing complicated things that someone thinks are wanted. But when the smoke clears a great deal of this is going to turn out to have been make-work: ad hoc, ungeneralized and unstructured programming elaborately interfaced to horrid operating systems. The general problem is not *more* programs but *better* programs. Particular and temporary programs will be replaced by general and simple. I believe that in the future we will find that a few simple programs will do most of what's wanted in business. And a new generation of businessmen will see that computers can be easy and accessible. (pp. 193–94)

The above forecasts, published in 1977, six years after the first computer on a chip, have proven to be much more accurate than most would have expected. Currently, a new computing industry is not only designing and redesigning equipment, but developing the logical architecture needed for important applications, with special emphasis on minimizing the effort required in using the computer.

At first, computer software could be separated into programs that focused on the logic of (a) creating, storing, retrieving and revising text, (b) sorting text and numbers, (c) monitoring and controlling certain processes, (d) calculating and recalculating, and (e) communicating text and data base information. Increasingly, good computer software combines sev-

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eral of these functions. Nelson's simple, general software is beginning to appear.

THE DRIVE FOR GREATER PRODUCTIVITY

A primary force in the move toward greater computer use is the competitive nature of modern life with its never-ending search for greater productivity. Many of the following insights on computer applications in office automation (Kiely) have implications for the teaching industry.

> The need for office automation in the business office is the subject of countless business publications, management seminars and media messages. The need is summed up in one word: productivity and the solution is straightforward: technology. The definition of office automation is also simple: the application of computer technology to the office to solve the problem of "too many people, doing too little, for too much."
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> A manager and his secretary of the 1930's could move back into today's business office and be comfortable and productive very quickly. The typewriter can be plugged into an electrical outlet and the telephone may have some extra buttons, but the methods of performing work have not changed very much.
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> The costs attributable to that office have risen astronomically without a comparable rise in the productivity of either individual.

The current economic crisis has caused people, for the first time in years, to reevaluate educational priorities. College graduates who cannot find jobs wonder if they might have better spent their time studying something else. Universities are being asked to choose between program areas when there is not enough money to pay for all the traditional programs. Though the immediate focus in the word-processing application of microcomputer technology has been on increasing the productivity of secretaries, the real objective is to increase the effectivenes of the more expensive professionals for whom the secretaries work. Educational applications of microcomputers show promise for increasing the productivity of both teachers and students.

New technology offers some serious options for education. In some cases the options are threatening because they substitute technology for the traditional teacher with blackboard, chalk, and books. There are now applications, both within and outside education, that enable computers, rather than people, to do certain tasks more quickly, more accurately, and at less cost. People are concerned about what the humans who performed those tasks are going to do when computer-assisted systems are implemented.

It is to be expected that special interest groups try to preserve their self-interests. In many cases, that involves maintaining the status quo. Any current discussion about technology has to anticipate the changes in peoples' lives and incomes brought about by that technology. Discussions concerning new technological possibilities must be evaluated in terms of whether the discussant has an open mind, or whether perceived selfish interests are the motivating factors.

EDUCATION AT A CROSSROADS

In Litzenberg's survey of 48 agricultural economics departments, "a surprising response showed that only 15 of the agricultural economics departments responding had a written plan to adopt computer technology." However, there was a great deal of computer-assisted teaching activity. Following are some issues that bear upon choices that must be made as educators, particularly those who work with college and adult students, adjust their efforts to reflect the role microcomputers play in teaching.

1. Though experience with microcomputer use is brief, users recognize that equipment and software has enormous potential to enhance man's ability to manage text, calculations, and data bases. Teaching efforts, whether with adults or younger students, that overlook the chance to help students effectively use this new technology will soon lose credibility with the students. Both farmers and students now seem to believe that they will not continue to be competitive without a better understanding of computer use.

2. Educators sense a general interest in computers but most have very little understanding of current applications, equipment trends, issues in software development, or possible future applications. Within the campus environment, older faculty dictate direction and influence the choice of successors. Many older faculty members feel uncomfortable about microcomputer use, and many untenured faculty members are still being advised to stay away from computer involvement. Computers are still viewed as toys, and people are continually warned to view the computer as the means, not the end. However, microcomputers now offer very effective means to achieve certain educational ends. A primary need is to bring many of the decision-makers in education up-to-date. The general public may be better informed on many of the issues than those in education. There is some danger that public education may overlook too long the most significant development in education history. Private sector education options may fill the void.

3. Students need to develop certain skills in computer use. Many land grant universities are involved in microcomputer-aided instruction, even though it is not clear where this involvement will lead. College of Agriculture students at Clemson have access to courses in the college's microcomputer lab. Extension workers are gaining access to computers in the local offices in a project supported by the Kellogg Foundation to explore the use of microcomputers with extension clientele. Through both activities, students (adult and undergraduate) are learning:

   a) hardware characteristics and operating procedures
   b) software design and evaluation
   c) new management skills

4. Teachers and students need to improve their skills in outlining the logical steps to analyze problems and perform other computer-assisted tasks such as in equipment control applications. Education in the past has concentrated on teaching students how to perform certain calculations and follow certain logical steps. The new tasks are to prescribe the logic for electronic execution. Computers can now handle the jobs of calculation, storage, sorting, retrieval, and display. Most persons are not well trained or comfortable in prescribing analytical rules. Generally, it is much easier to learn a programming language than develop the well-chosen steps needed to analyze a problem, particularly when minimizing computer-user effort is a priority. These skills are needed; those who do not care to emphasize computers can teach these skills apart from computer mechanics.

5. Many of the great debates about microcomputer use center around what a person needs to know to use a computer. It is an issue in education because computers store and execute logic—logic that was formerly stored in the mind rather than on a disk or a chip. It is thus becoming possible for computer users to take certain logic as given and let the computer execute that logic. This possibility allows, with good programming, certain unskilled workers to do some skilled jobs such as accounting, tax preparation, least-cost feed mixing, and so on. Though teachers may object that users must know all the theory about what is going on and the cautions needed in interpreting results, the push is toward developing software that extends user capabilities. There are opportunities in computer programming to build tests and safeguards into programs so that quality control is achieved. The ability of VisiCalc, an electronic accounting sheet, to display cell definitions is an interesting way to document program logic. Certainly other software developers will find still other means of building user confidence and instruction into programs. Spacemen flying to the moon, largely under computer control, led to a new confidence in man's ability to work out difficult logic executed by computers. That logic was not necessarily understood by the pilots.

There are more mundane issues such as whether a farmer should use a least-cost ration formulation without understanding matrix inversion. Some would like to say no, but the trend is otherwise. The move is toward transferring most mathematical calculation from humans to computers. Let someone with the proper skills and training work out the details. Let the masses use the result. If the results are accurate, this is a new kind of educational efficiency, where program design allows computer users to skip the tedious steps and move on to decision-making.

There currently is a great deal of public disenchantment about education. The education industry has been too comfortable with the products that teaching interests are prepared to supply. Standardized test scores, often offered as measures of educational achievement, are better indicators of job security for certain teaching professionals than measures of education. Too often students spend so much of their time concentrating on isolated facts, figures, and procedures that they never learn how to use what they have been taught. The students have not been taught to hear and to see. They have certain skills, but they are not educated people.

Microcomputers bring a revolutionary new force to education. Given its short history, the equipment is impressive. In a competitive environment, software designers are developing programs that allow the computers to be cost effective for many applications. Productivity requirements result in a search for quality, not quantity. There is a need for a few well-trained students to continue the search for better hardware and software design. However, there is also the greater need for masses of students to make use of the electronic capabilities currently available.

It is not clear that traditional education industry will accept or will be able to afford the new microcomputer technology. However, videotape, videodisc, and computer programs have an easy mobility, making it possible to share the best in lectures and outstanding computer programming. Private industry may have become an increasingly competitive force in public education.

Computers have allowed spacemen to get off the earth into space. Microcomputers offer students an ability to move to a higher plane in educational experiences. The hope is that once freed from reinventing the mechanics of certain repetitive tasks, the students will have more time to read a good story, listen to some music, grow a tomato, cook a good meal, and catch a glimpse of the excitement of some creative act.

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