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ABSTRACT

While many aspects of high technology may be directly applicable in the vocational agricultural classroom, the primary thrust of high technology into such programs, at least in the short range, will be centered around the microcomputer. Because of its cost and availability, the microcomputer will continue to play an ever increasing role in vocational agricultural programs in such areas as program administration, guidance, computer-managed instruction, and computer-assisted instruction. In addition, the microcomputer will become an increasingly important occupational tool that can be used in courses in word processing, computer literacy, computer programming, and data processing. As it is for educators in other fields, the microcomputer is a valuable resource that can help vocational agricultural teachers improve their teaching. The most important application of the microcomputer in vocational agriculture is, however, in teaching students how they will use microcomputers in their jobs. One such relevant use of microcomputers is in the area of numerical analysis. A large variety of farm management and agricultural business management software packages are already available. The occupational aspects of the microcomputer in secondary level agricultural education are practically limitless. (Appended to this report are a series of transparency masters describing the application of microcomputers in education.) (MN)

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HIGH TECHNOLOGY IN THE VOCATIONAL
AGRICULTURE CLASSROOM

AGRICULTURAL EDUCATION

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HIGH TECHNOLOGY IN THE VOCATIONAL

AGRICULTURE CLASSROOM

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High technology: What is it? What are the potential implications for agricultural education? What are the realistic probabilities?

Defining high technology is within itself a formidable task -- and at best of transitory accuracy. For even as we sit here, some engineer is working on a whole new memory and data handling vehicle which could make the computer, as we know it now, as outmoded and oversized as the rotary calculator. Another engineer is developing totally new applications of robotics. Prosthetic devices which rival the "Six-Milli ilar Man" are in place or in development. Desk top computers are availbable already which can perform more tasks, faster, and more accurately than research university mainframes could just twenty years ago -- and less expensive, better ones are coming out monthly. Communications systems beyond imagination when we were children are in place ... we could go on, and on, and on . . . .

What then is a working definition of "high technology" that has meaning for agricultural education today? I have studied the literature and have found no formal definition upon which there is substantive agreement. In fact, I am reminded of a similar problem of defining career education in the early 1970s. Everyone talked about it. Everyone supported it. But nobody could define it in a comprehensive way.

In much the same way, users' definitions of high technology vary with their perspectives. A computer specialist would think in terms of 16-bit microprocessing chips, or even the 32-bit chips in development now, of voice

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synthesizers, data networking, artificial intelligence and bubble memory. To the soldier, high technology represents laser ranging devices, remotely controlled reconnaisance vehicles wh[illegible] carry television cameras behind enemy lines, and satelite photography so accurate that we can read the headlines of newspapers in Red Square. To the physican it means laser microsurgery, computerized diagnostics and artificial organs (I think of Barney Clark who just passed away, but who lived for 120 days with a mechanical heart.)

On the farm, we find remote controlled systems which allocate specific quantities of feed to specific dairy cows based on their remotely-measured milk production, with the entire process controlled by the farmer's microcomputer. We find remote sensing devices embedded in the soil of various fields which transmit soil moisture levels to the microcomputer at the farmhouse. The computer then responds by directing application of irrigation water to c ly those fields which need it -- the entire process untouched by human hands. We find corrugated drainage pipes being emplaced by a single huge tractor with the depth of the irrigation pipe being controlled automatically by a laser-leveling device.

None of this is "Buck Rogers" in nature, it is very real and in place today. But what does high technology mean in the classroom? The possibilities are limitless, but the realistic probabilities, at least in the short run, are quite down to earth. Let us first look at the possibilities and not limit ourselves to financial realities.

Ford Motor Company has implemented an individualized training system for it's transmission mechanics which combines videodisk technology and microcomputer technology. Most of us are familiar with the videodisk player. It is a relatively inexpensive device, much like a video tape player or a record player. It attaches to a television and plays prerecorded programs. I saw one advertised in Blacksburg recently for $199.95. The movie, The Ten Commandments, cost $29.95 on two videodisks about the size of record albums. The videodisk can also be used to store still frames very much like slides for a slide projector. One disk is capable of storing an amazing 50,000 to 1000,000 slides. The videodisk player can instantly locate any single slide or can instantly go to any part of a moving presentation.

In Ford's training program, the 50,000 slides represent 50,000 views of the parts of the car in all states of assembly and disassembly. The mechanic-in-training is presented with a problem situation on the microcomputer. His response to the situation then determines which of the still frames will appear instantly on the TV screen. Indications are that the mechanics learn skills as well from this training program as they do from hands-on-training for certain types of skills.

The Army Signal Corps here at Fort Gordan, Georgia has experimented with a similar videodisk/microcomputer marriage for radar technician training. The Navy has gone a step further in one if its radar technician training programs and tied a pressure-sensitive screen to the presentation. The technician-in-training is presented with an actual color photo of the piece of equipment on a TV screen and is given a malfunction situation. On the face of the radar set is a panel held on by four screws. By touching the screen at the location of each screw, the trainee literally removes the screws. To accomplish this the computer program is written in such a way that when someone touches the picture screen at the location of the screw, the videodisk player is directed to present the slide of the radar set with that screw removed. Having removed all four screws by touching them, s/he takes off the cover by simply moving his/her finger across the picture of the cover. The computer then directs the videodisk player to show the picture of the radar set with the cover removed. The trainee can then look inside the radar set through the open cover. S/He proceeds to measure voltages across certain connections by simply touching the picture in the same place where s/he would put the voltmeter probes. The next picture shown on the screen is that of the voltmeter with the reading s/he would have gotten had s/he actually measured the voltage across that circuit.

Because of this technique, a very expensive, very large, and highly classified radar system can be left aboard ship where it belongs. The Navy experience has been that learning by this technique has been just as good as from learning with actual equipment with one noteable exception. Initially, technicians who had been trained to test voltages with their fingers had rather lively introductions to the real equipment, an unforseen side effect.

Imagine the possibilities!!! A set of 100,000 slides on technical agriculture, the occupations for which we train, and the FFA could be assembled and placed on a single disk. The first disk could be made for a cost of about $4,000 using existing commercial technology. Each disk thereafter could be made for as little as $15.00. A commercial-grade random-access disk player could be tied through cable and an interface board with the Apple, TRS-80, IBM, or other [illegible] then literally thousands of programs could be written using those same pictures on a single disk. Any combination, any sequence of pictures could be used. The program could address each photograph individually and use it to illustrate any concept. I think 100,000 photographs would probably be enough to do all of these programs. An almost infinite variety of individualized instruction packages for our students could then be written by commercial software producers. In fact, a teacher who is relatively proficient at computer programming could even develop some of his or her own computer-assisted interactive videodisk instructional programs.

What is the realistic probability that this will happen in the next ten to fifteen years? The odds are so great against it that I don't think even Jimmy the Greek could come up with the numbers. First, the videodisk player required to perform this is the laser type and is a commercial-grade random-access disk player. It is very expensive! Second, imagine the magnitude of the task of assembling 100,000 current, accurate, clear slides about anything! Who would do it? Clearly such an undertaking at least in the immediate future must remain in the realm of big business and the military. Let us examine then the more realistic probabilities for agricultural education.

While many aspects of high technology may be directly applicable in the vocational agriculture classroom, realistically the primary thrust of high technology into our programs, in the short run at least, will be centered around the microcomputer because of cost and availability of the equipment. Research has identified the major educational uses for microcomputers (See Appendix 1). In general education, which makes up the largest part of the educational endeavor, those primary uses are identified as:

1. Administrative functions
2. Guidance
3. Computer literacy
4. Computer programming
5. Computer managed instruction
6. Computer assisted instruction
7. Occupational tool

Rather than attempting to exhaustively define each of those categories let us look briefly at some examples of each.

Administrative functions (See Appendix 2) suitable for performance on the microcomputer include maintaining employee records, payroll data, supplies, inventories, student scheduling, student attendance, grades, competency records, and so on. The administrative functions are limited only by the imagination of the administrator.

Guidance functions suitable for the microcomputer include, but certainly are not limited to testing (appitude, interest, etc.), career orientation, and maintenance of student guidance records (See appendix 3).

Computer literacy (See Appendix 4) is a much maligned term and one which stirs strong emotions both positive and negative in the people who use it. Attempting to reach agreement on what is included in computer literacy is an extremely difficult task. For sake of argument let us assume that computer literacy includes some limited programming, the use of preprogrammed software, understanding the impact of computers on our society, and using ideas from the computer world.

Computer programming instruction, as opposed to computer literacy, implies a more detailed application of programming skills (See Appendix 5). The major reasons for teaching programming include preparation for jobs, preparation for further education, the development of a computer-competent citizenry, and an enhancement of students intellectual abilities.

These first four categories are generic in nature and apply to the agriculture teacher no more than to other teachers. In fact one can make the argument, very effectively, that vocational agriculture has no business dealing with computer literacy, with the teaching of computer programming, and only marginally with guidance and administrative functions on the microcomputer. Computer managed instruction on the other hand is a more teacher-specific functional area for which the agriculture teacher has great use (See Appendix 6). Under computer managed instruction (CMI) we generally categorize many somewhat administrative tasks such as typing and storing lesson plans, test-item pools, course outlines, transparencies, handouts, newsletters, student handbooks, mailing lists, and competency records. However, since these are directly related to the instructional program, they are probably best characterized as CMI. The five primary areas under CMI are generally thought to be diagnostics, test scoring, perscription of instruction, instructional recordkeeping and non-instructional recordkeeping (See Appendix 7).

The sixth major category is that of computer assisted instruction (CAI). Since we are in the business of teaching, this is the most interesting of the categories listed thus far. CAI is generally taken to include drill and practice, tutorial instruction, simulations, materials generation, instructional games, problem solv g and demonstration (See Appendix 8). CAI he achers to present instruction and inhance learning. It ranges from simp e drill and practice such as math games to sophisticated total farm management simulations. It is currently the largest single category for the use of microcomputers in all of education (See Appendix 9). In that respect one could argue that CAI is the central thrust of high technology into public education. Most importantly microcomputers have lowered the cost and accelerated the accessibility and therefore the use of not only computer assisted instruction in particular but of individualized instruction more generally. One of the members of our profession, Dr. Forrest Bear in Minnesota, through his Hobar Pubications Company is offering a number of relatively inexpensive CAI packages, specifically designed for agricultural education. I am not advocating them, but simply noting their existance. In addition literally hundreds of teachers, teacher educators, and students in agricultural education around the country are daily developing more and more CAI packages of varying quality (mostly bad).

For anyone who has spent any amount of time working with CAI, the value of the microcomputer as an instructional aid becomes immediately obvious. One student, or a group of students has a direct interaction with an instructional machine which responds to their input. It leads them step-by-step through a concept or problem. In short, it has all of the advantages that individualized instruction advocates have boasted about for so many years. But, it doesn't have all of the shortcomings. The student doesn't have to make decisions at program branches. S/he makes a response, then the computer branches to the appropriate next step.

But, as one spends more time at CAI construction and use, its limitations too become apparent. Essentially, CAI is nothing more than traditional paper-contained programmed instruction presented on a screen. Moreover, there are serious limitations to the illustrations that can be programmed. They amount essentially to line drawings. Photo-quality illustrations are simply not possible using stand-alone CAI. This is a major drawback. In addition, CAI is limited to written material, another serious drawback.

The solution to this problem is on the horizon now. It has been possible for several years now to interface (i.e. connect together) the microcomputer with the video-tape player. This has most of the advantages of viceodisk/ microcomputer combinations I described earlier. It has the added advantage of reasonable cost. For under $1500, we can purchase a videotape player and computer interface board to add to an existing microcomputer to play interactive video/CAI. Anyone with a videotape recorder and camera can produce the tapes.

Finally we have an economical and pedagogically workable means of individualizing instruction. University agricultural education departments can produce interactive video/CAI programs as cheaply as we now write traditional curriculum materials. I foresee a realistic probability that we will move rapidly in this direction in the short term future.

The last and probably most ignored of the seven general categories is that of an occupational tool. Clearly this is the most important use that we in vocational education have for the microcomputer in our programs, yet it receives virtually no attention in the general literature. Why? The answer is obvious. The vast majority of people working on microcomputers and publishing about microcomputers in education are general educators. They simply have no concept of the central role of occupational training within vocational education. The general educator thinks of educational technology in terms of its role in the organization, presentation, and evaluation of teaching.

Clearly agricultural educators have all of the earlier uses for the microcomputer in improving our teaching, yet by far our most important use for the microcomputer is in teaching our students how they will use it in their jobs. Important industry, business, and home uses for the microcomputer include such diverse functions as word processing, data processing, high resolution graphics, sound synthesizers, instrument monitoring and numerical analysis (See Appendix 10).

So where does agricultural education fit into this whole process? Word processing should probably be taught in the same place that typing has been taught all along. Business education has taken this as its responsibility, and I think that is correct. Data processing by the same token should probably be taught in business education, data processing as a generic function that is. High resolution graphics and sound synthesizers are generally computer functions reserved for artists. We probably have little role there except in developing computer assisted instruction.

The use of microcomputers in instrument monitoring is probably an agricultural education function because our students could not receive this instruction anywhere else. Remote sensing devices which were developed initially by the military during the Viet Nam war are now leading to second and third generation remote sensing devices which I described earlier and which are characteristics of specific occupations. Those uses peculiar to agriculture should be taught by agricultural education.

Our really big use for the micro is in the area of numerical analysis. I am speaking here of the myriads of farm management or agricultural business management software packages available today. If we do not teach our students how to use the depreciation schedules and enterprise analysis packages peculiar to the agricultural industry, then who will? Clearly it is the role of the vocational agriculture teacher and county agent to disseminate such technological capabilities to the agricultural community.

I recently visited the soil conservationist in Montgomery County, Virginia. As I left his office I noticed a sign on the way saying National Electronic Marketing Associates. I thought this sounded interesting so I found their office and inquired about [illegible] nature of their company. I found that NEMA had recently opened a nationwide operation that up to this point had been concentrating on the marketing of sheep. It seems that through agreements with a number of sheep producers associations, NEMA has been able to secure large numbers of sheep for sale. Through other agreements with a number of processing plants, the same company has been able to develop a pool of buyers. Once each week, at a predetermined time an electronic auction takes place in which the sheep sellers and buyers are allowed to interact on their computer terminals by means of telephone connections throughout the entire country. The results have been very satisfactory both to buyers and sellers. The microcomputer can be used as a terminal by simply adding a telephone modem and interface board. There is no reason that agriculture teachers should not be able to tie in with NEMA and use their own microcomputers to "sit in" as neutral observers on auctions such as this to teach their students about electronic marketing.

Just as importantly the various farm records management systems available commercially today should be taught to our farm management students. Not only our in-school students but our Young Farmer and adult students also need such instruction. Many of them, probably most of them, will learn this material anyway. It can either be taught in an organized way through agricultural education or it can be passed on from sales people who have specific software or hardware interests. Or, it could be learned through the vary time-consuming method of trial and error.

Combining computer assisted instruction and industry applications, vocational agriculture teachers should be using simulation packages which allow for an analysis of "What if?" questions. What if I add ten steers? What if I produce 50 acres more of corn and 50 acres less of soybeans? What if I add a half-time worker during the months of September, October, November? These farm management simulations allow for extremely efficient use of instructional time. They also allow a type and quality of instruction that simply was not possible prior to the high technology revolution.

It is most important in agricultural education that we not allow ourselves to be bypassed by this revolution. Realistically there are limitations to what we can do and those limitations are primarily financial in nature. Within financial realities we should insure that our students receive the best, most modern instruction possible.

The occupational aspects of the microcomputer are practially limitless. Agricultural business management decision-making tools, records analysis, enterprise analysis, income tax management, estate management, dairy herd improvement records, swine herd improvement records, and as many other occupational implications as you can imagine could be included here. For agribusiness the applications are just as great: payroll management, personnel records, inventory control, accounts receivable and payable, mailing lists, and many more applications come instantly to mind. In fact, the list of functions that can be better performed on the microcomputer than on the record book is growing each day.

It is the unique responsibility of the vocational agriculture teacher to provide this occupational tool to his or her students. Nobody else is going to do it.

It is the unique function of agricultural teacher educators and supervisors to provide the background necessary to carry out these functions to our teachers in-being and in-training. Nobody else is going to do it. If we at this level fall down on this most important task, then ultimately the losers will be the graduates of our vocational agriculture programs. If we go forth with a determination that our teachers will be equipped with these skills and with these abilities then ultimately the winners will be the graduates of our vocational agriculture programs.

At the same time it is essential that we provide the right kind of direction to our teachers. Should it be the role of our teachers to train programmers? I think clearly the answer is no. Should it be the role of our teachers to develop their own instructional materials. I think this is foolish. I think it is counterproductive. I think it is a waste of trained manpower. We train our teachers to organize, present, evaluate, and follow-up on instruction. Computer programming should be left to computer programmers and teaching should be left to teachers. A teacher can spend 50 hours developing a computer program which will run for 10 minutes and teach a relatively simple skill. Unless he or she is an exceptionally good programmer, the package will be of poor quality and of only marginal utility. The same package probably already exists and could be purchased for $25.00. The teacher's time could better be used in coaching judging teams, making SOE visits, preparing lesson plans, and performing all those other functions which we feel are so vital to our programs. That 50 hours could better be used in learning how to use a commercial farm management package so that the teacher could instruct his or her students on the use of that package to solve real-world business problems. That 50 hours could better be used in selecting and evaluating commercially-developed instructional software. Our teachers probably need to know a little programming, but only to the point of computer literacy. It is much more important that they be knowledgeable about available commercial software useful in agriculture.

So let me conclude by getting on my favorite soap box. It is imperative that we recognize and convince our teachers that the microcomputer is a tool that they should use. It is not the vocational agriculture teacher's role to train programmers. It is not the vocational agriculture teacher's role to develop vast amounts of instructional courseware. It is the vocational agriculture teacher le to select, evaluate, and utilize courseware appropriate to agricultural education. It is the vocational agriculture teacher's role to train his or her students in the use of the microcomputer as an occupational tool. Of all the uses that the microcomputer has in education, its function in computer assisted instruction but to an even greater extent, its use as an occupational tool are important to the agriculture teacher.

Here lies the greatest potential use of the products of the high technology revolution in public secondary level agricultural education, at least in the immediate future.

APPENDICES

APPLICATIONS OF MICROS IN EDUCATION

+ADMINISTRATIVE FUNCTIONS

+GUIDANCE

+COMPUTER LITERACY

+COMPUTER PROGRAMMING

+COMPUTER MANAGED INSTRUCTION

+COMPUTER ASSISTED INSTRUCTION

+OCCUPATIONAL TOOL

Appendix 1

ADMINISTRATIVE

+EMPLOYEE RECORDS
+PAYROLL
+SUPPLIES
+INVENTORIES
+STUDENT SCHEDULING
+STUDENT ATTENDANCE
+GRADES
+COMPETENCY RECORDS
+STUDENT RECORDS
+LIBRARY RECORDS
+SUBSTITUTE TEACHER FILES
+SCHOOL CALENDAR
+CLASS SCHEDULE

Appendix 2

GUIDANCE

+TESTING

+CAREER EDUCATION

+STUDENT RECORDS

Appendix 3

COMPUTER LITERACY

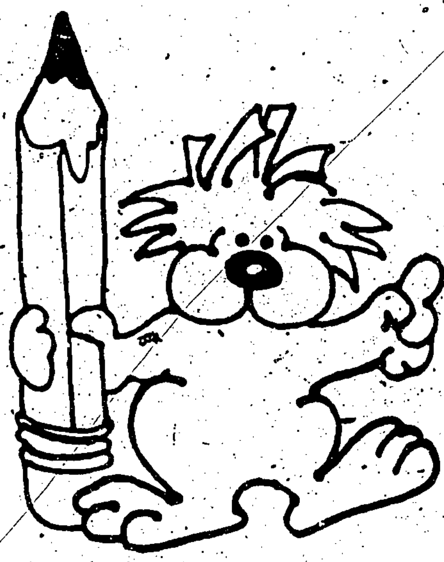
+PROGRAMMING

+USING SOFTWARE

+COMPUTER IMPACT

+USING COMPUTER IDEAS

Appendix 4



COMPUTER PROGRAMMING

+TRAIN FOR JOBS

+PREPARE FOR FURTHER EDUCATION

+PREPARE FOR CITIZENSHIP

+DEVELOP ANALYTICAL ABILITIES

Appendix 5

OTHER TEACHER USES

- TYPE AND STORE LESSON PLANS
- DEVELOP AND STORE TEST ITEMS
- STUDENT ORGANIZATION PROJECTS
- DEVELOP AND STORE COURSE OUTLINES
- DEVELOP AND STORE LESSON PLANS AND TRANSPARENCIES
- DEVELOP AND STORE HANDOUTS
- WRITE AND STORE NEWSLETTERS
- DEVELOP AND STORE MAILINGS
- DEVELOP AND STORE STUDENT HANDBOOKS
- DEVELOP AND STORE COMPETENCY RECORDS

Appendix 6

COMPUTER MANAGED INSTRUCTION (CMI)

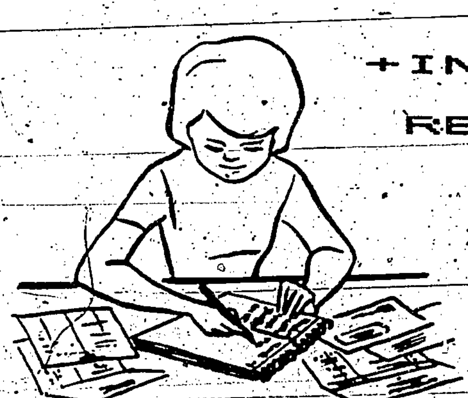
+NON-INSTRUCTIONAL RECORD KEEPING

+DIAGNOSTICS

+TEST SCORING

+INSTRUCTIONAL PRESCRIPTION

+INSTRUCTIONAL RECORD KEEPING



Appendix 7

COMPUTER ASSISTED INSTRUCTION (CAI)

+DRILL AND PRACTICE

+INSTRUCTIONAL GAMES

+PROBLEM SOLVING

+DEMONSTRATION

+TUTORIAL

+SIMULATION

* * * *

Appendix 8

CAI

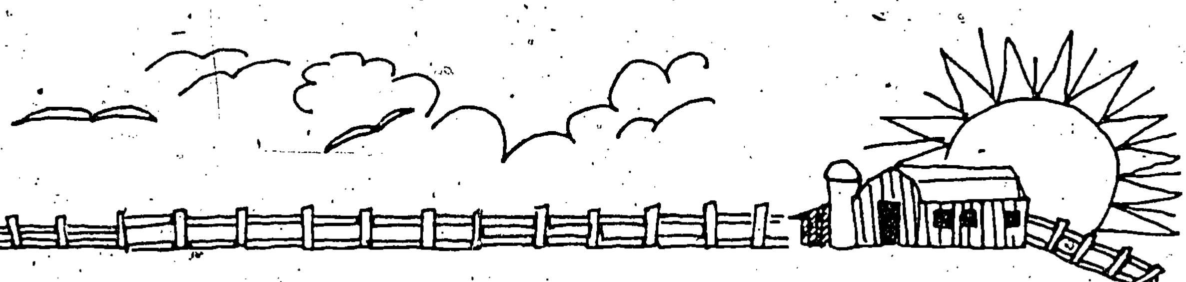
+HELPS TO PRESENT INSTRUCTION AND/OR ENHANCE LEARNING

+MICROS HAVE LOWERED COST AND ACCELERATED THE USE OF CAI

+RANGES FROM SIMPLE DRILLS AND PRACTICE TO SOPHISTICATED TUTORIAL SYSTEMS.

+CURRENTLY LARGEST SINGLE CATEGORY FOR THE USE OF MICROS IN EDUCATION

Appendix 9



OCCUPATIONAL TOOL

+WORD PROCESSING

+DATA PROCESSING

+HIGH RESOLUTION GRAPHICS

+SOUND SYNTHESIZERS

+INSTRUMENT MONITORING

+RECORDS ANALYSIS

+INFORMATION NETWORKING