COMPUTER APPLICATIONS IN VOCATIONAL AGRICULTURE

Ken Kajihara

The major mission of vo-ag education is to prepare individuals for the agricultural workforce

The major mission of vocational agricultural education is to prepare individuals with entry-level skills for the agricultural workforce. These skills should include proven ones as well as those reflecting technological change.

The approach used by many secondary vocational agriculture programs to develop entry-level skills is based upon a "hands on" production system. Students sign business agreements with the school's Future Farmers of America chapter to enter the world of entrepreneurship. The FFA chapter then leases land and equipment to the students for vegetable, ornamental plant, crop, or livestock production. Students are also charged for fertilizer, pesticides, water, and other related supplies. These costs are eventually deducted from the sales income of the students.

This system has traditionally worked well at Kapa'a High School on Kaua'i, Leilehua and Kahuku on O'ahu, Lahainaluna and Baldwin on Maui, and at the Honoka'a, Konawaena and Kohala high schools on the Big Island. In an attempt to further develop this system it was decided that alterations could be applied to compensate for limitations in land-lab area and traditional management practices. A cooperative planning effort by then agriculture curriculum specialist Thomas Hatakeyama of the Hawai'i State Department of Education and agriculture teachers Theodore Kawamura and Ken Kajihara led to the decision that the microcomputer could be a key to program improvement.

A successful application for a federal vocational education grant resulted in the establishment of a computer lab at Waimea High School on Kaua'i with an initial purchase of two Apple IIe single-drive systems and an Epson FX-80 printer. Parent- and student-generated funds were used to supplement these machines with five, resource-sharing Commodore 64 computers. Resource-sharing allows up to eight computers to access information from a single-disk drive.

Curriculum Applications

Project participant Dr. Curtis Ho of the University of Hawai'i at Manoa College of Education's Department of Communications and Technology developed the following instructional objectives. Efforts were made to couch them in the larger computer literacy plan that was designed by computer education specialist Evelyn Horiuchi of the Hawai'i State Department of Education.

Students are able to: (1) identify and understand the basic functions of the microcomputer systems, (2) identify the functions of software documentation, (3) load and run software: collect, enter, save, and print data, (4) identify uses for the microcomputer to vary and improve cropping systems, (5) identify uses for standard scientific investigative techniques in the planning and implementation of agricultural production, (6) use word processing software to write business correspondence and personalized sales receipts, (7) identify uses for recordkeeping software, (8) state the uses of the microcomputer as a controller of farm devices, (9) indicate an appreciation for the educational, career, and economic impact of microcomputers on their lives, and (10) indicate a positive attitude toward computers on a computer-attitude questionnaire.

Prerequisites to actual production applications of the computer include computer literacy training and skill development in basic recordkeeping. While programming with high-level languages is not a project objective, students are introduced to BASIC. They practice simple programs which perform the math operations they first learned to do by hand, as well as programs that show the cause-and-effect relationships between such variables as numbers of plants and crop income. Operations of this nature lay the foundation for the use of spreadsheets

planned for the latter part of the school year.

When the project was in its infancy, it was determined that major software purchases would be made on programs of the caliber of proven business applications tools. With this in mind, spreadsheets and word processing programs that seemed to be tailored for home or educational use were purchased. The quality and availability of software written for the vocational area has since improved dramatically.

Remote Farm Management

A focus was also made in the area of backyard, hi-tech product development because many computer applications cannot be purchased as packaged units. By consolidating ideas from industry with the needs of rural-area farms, a unit with the capability of remote farm management was developed by programmer Tom Kajihara. It features a control system which allows the activation and deactivation of solenoids, motors, and lights via telephone. This system will also monitor the opened or closed condition of switched windows and doors and "call" up to seven telephone numbers upon unauthorized entry.

Interfacing the Computer to Real World Tools

A Commodore 64 computer is connected by a modem to an ordinary telephone jack. A modem converts computer output to a kind of signal that can be sent over telephone lines for conversion by another modem at the receiving end. This computer is kept at the farm or school and runs 24 hours a day under continuous fan cooling. It is called the "base terminal."

An identical unit kept at the operator's home is called the "remote terminal." Both the base and remote terminals are independent computer systems and can transmit and receive commands entered through their keyboards.

On command from the remote terminal, the base terminal controls farm devices through a switching unit called a relay. The farm devices would include electromagnetic water valves (solenoids), fan or pump motors, and lights. The relay can also route incoming signals such as those generated by a burglar alarm switch or a soil water saturation sensor to the computer. Possibilities are almost endless because this system will process and act on almost any kind of electrical signal.

A commuting agriculture teacher or farmer can call the base location and get a status check on demand. An active rather than passive system, the base will call the remote if any predetermined condition occurs. For example, one could call a farm on Maui from O'ahu to see if the irrigation system was operable. Direct intervention could be made if more irrigation was needed. Furthermore, if a farm warehouse was entered through a switched door, a call could be completed to the farmer on O'ahu within 15 seconds of the entry.

Instrument Control

The instrument control segment of the farm management package has proven to be a time-saving feature. A user at the base terminal interacts with a menu-driven program to actually schedule the operation of farm devices. For demonstration purposes, a direct override mode allows a manual toggling of farm devices using function keys as switches.

The instrument control mode is like an enhanced version of the remote control mode because "events" are programmed or planned to occur. Through a cursor selection system, events are entered on a master calendar at the discretion of the user. An event might be the activation of a sprinkler system in a greenhouse or the deactivation of a burglar alarm system during the hours that school is in session.

Devices can be scheduled by the clock or upon demand under sensor control. For example, a sprinkler can be turned on every day at 6 p.m. (by the clock) or only when soil moisture probes indicate low soil water levels (demand). With appropriate sensors, this system will respond with corrective measures when greenhouse temperatures fall below a danger level by turning on a heating system and calling the operator's home with notification of the condition with an audio code or a voice-synthesized message. A unit called the Home Atmospheric Weather Station (HAWS) provides additional information by monitoring temperature, humidity, and atmospheric pressure. Photocells, temperature-sensing resistors (thermistors), and infrared security monitors are other examples of input devices.

Telecommunications

Early designs of the farm control system included a communications utility which eased the accessing of bulletin boards and data bases like the Ag Ed Network directly off the main menu. We have since found that the proliferation of fine public domain systems like the FIDO Network and the Bill Information Telecommunication System (BITS) developed by Hawai'i State Representative Galen Inouye has made independent linking preferable.

Using the Lahainaluna and Waimea high school agriculture computer labs as remote test sites, an intra-state vocational education computer network became operational in the summer of 1986. Students use electronic mail to correspond and exchange information on their Supervised Occupational Experience Programs (SOEP) to better understand the technology and to improve their farm projects.

Curriculum Concerns

This writer agrees with those who feel that the hi-tech revolution will create a need for recurrent education interpersed in the evolving world of work. Such a scenario validates the stressing of problemsolving, analytical reasoning, reading, and writing to provide a foundation for learning and more cycles of relearning.

A cross-curricular approach to teaching these skills will find wide acceptance by agriculture teachers, many of whom have traditionally practiced the reinforcement of basic skills in their instruction.

Another important area of interest relates to special needs and disadvantaged students who have traditionally been vigorously mainstreamed into vocational education. The project promises to provide these individuals with a unique opportunity for year-long access to computers in practical learning situations.

Other students will find that this kind of vocational program can provide sound foundations for college courses of study, as well as preparation for trade schools and the world of work.

Conclusion

The Waimea Project has a tested curriculum and a computer lab with a 3:1 student to computer ratio. Students are able to conduct farm projects by using the computer as a management and instrument control tool. They are able to apply word processing and spreadsheet software as part of their SOEPs.

It is hoped that this exploration into computer applications in vocational agriculture education will continue to yield information that will improve our curriculum. It has already demonstrated impressive results in time and water savings in vegetable crop production that can be translated to the business world of production agriculture.

More information will be shared as the project evolves and grows through on-site experiences and the incorporation of ideas generated by other practitioners. To this end, the Hawai'i Educational Dissemination Diffusion System and numerous user groups already provide well-structured routes of information exchange.

Cost effective, the microcomputer is an appropriate agricultural technology that must take its place beside the traditional tools. The DOE's guide — *Computers in Instruction* — helps by delineating procurement procedures for using computers as tools of industry. These steps must be followed and local efforts continued to infuse this technology into all vocational areas.

Ken Kajihara is former Vocational Agriculture Teacher at Waimea High School on the island of Kaua'i. In that position, Ken developed an extensive computer network in the field of horticulture. He is presently the Hawai'i State Department of Education Vocational Agriculture Specialist.

Students in Maui Community College's agriculture education classes participate in activities such as **(top left)** preparing ornamental potted plants for marketing, **(bottom left)** creating fields of dryland *taro* using a drip irrigation system, and **(above)** practicing grafting procedures on potted citrus plants. *Photos courtesy of Ernest Rezents, Maui Community College.*