control. *Journal of Personality and Social Psychology* 31:101.

Krohne, H.W. and L. Laux. 1982. *Achievement, Stress and Anxiety.* Hemisphere Publ. Corp., N.Y. p. 152.

Lefcourt, H. 1966. Internal versus external control of reinforcement: A review. *Psychological Bulletin* 65:206.

Lorenz, K. 1981. *Foundations of Ethology.* Springer-Verlag, N.Y. p. 333-335.

Wang, M.C. and W.J. Weisstein. 1980. "Teacher Expectations and Student Learning" In: *Achievement Motivation.* L.J. Fjans (Ed.) Plenum Press, N.Y.

Editor's Note

A countervailing viewpoint was expressed by one of the reviewer's of "Microcomputer Instruction in Agriculture — A Cooperative Approach." It is presented here to enhance the dialogue.

"In summary, this article raises some important issues but chooses only to look at the positive side of each issue. Frankly I was stunned with the expenditures of faculty and student resources for a semester course. Certainly there is value being generated from these exercises. We in the Colleges of Agriculture need to be making decisions, however, based on the net benefits not simply the fact that there are gross benefits being generated. Frankly, I personally am somewhat disappointed that articles still are written from the advocacy viewpoint rather than in an evaluation mode assessing the costs and benefits of using this innovation."

Microcomputer Instruction In Agriculture A Report of a Cooperative Approach

R.M. Foster and C.E. Walker

Institutions of higher education across the country have recently been faced with the problem of providing undergraduate instruction in the use of microcomputers in agriculture.

Such problems with emerging technology surfaced in the Institute of Agriculture and Natural Resources (IANR) at the University of Nebraska-Lincoln (UNL) in the spring of 1981. Although the University of Nebraska had long been recognized as one of the pioneers in the application of computers to agriculture, primarily through the AGNET system for delivering information to time share subscribers, very little effort had been made in applying new developments in microcomputer technology. The rapidly increasing pace by which computer technology was affecting the agricultural industry made it obvious that UNL must adopt the latest microcomputer technology to prepare students to enter the highly computerized agricultural industry.

The institute of Agriculture and Natural Resources consists of three principal components: the College of Agriculture, the Agricultural Extension Service, and the Agricultural Experiment Station. Although many staff and graduate students in the Experiment Station were using microcomputers for research, there had been relatively little application within the College of Agriculture for teaching, or within the Agricultural Extension Service for serving Nebraska clientele.

This led to the astute observation by one faculty member that, regarding the state of affairs for the use of microcomputers at UNL, there was good news and bad news. The good news was that UNL was no farther behind than other similar institutions, and in fact, was ahead of many. The bad news was that we were all behind the elementary and secondary schools.

The implication was obvious. Even though students were enrolling with increasingly greater computer awareness, IANR had remained essentially unchanged in computer sophistication for nearly a decade. While some individual departments and faculty were using specific microcomputer applications, IANR had no overall coordination or long range plan for the incorporation of microcomputers into the educational programs of the institute as a whole.

The IANR Model

The Dean of the College of Agriculture appointed an ad hoc committee of concerned faculty members to determine the options available.

One point became obvious very quickly. The college could not allow each department the luxury of developing their own, unique microcomputer applications course. Such a fragmented approach to providing microcomputer instruction would only lead to "turf building" and duplication of efforts. The solution had to lie in a uniform offering which had direct appeal to the broad spectrum of academic departments within the College of Agriculture. The first alternative was to take advantage of existing computer courses offered by the University's Computer Science Department. It became evident that none were particularly appropriate for agricultural students, nor was there room in existing courses for the additional four to five hundred IANR students per year.

The second alternative was to have the Computer Science Department offer a course tailored to the needs of agricultural students. While receptive to the concept, Computer Science officials indicated they had no microcomputers; had no space to teach that many additional students; and had no instructor with the

Foster is associate professor in the Department of Agricultural Education and Walker is associate professor in the Department of Food Science & Technology at the University of Nebraska, Lincoln 68583-0919

interest or qualifications to teach the course. Computer Science did, however, strongly support the need for such a course within the College of Agriculture.

It was decided to solicit the college-wide support of individual faculty and academic departments to develop a course specifically targeted for the microcomputer needs of agriculture students; a course to be taught in, by and for the College of Agriculture. The Dean of the College and the Vice-Chancellor of the Institute pledged both personal and financial support to initiate and maintain such a course.

The target audience was to consist of sophomores in the College of Agriculture, representing approximately 400 students per year. The course would require a substantial investment in hardware, space, and personnel. The tentative objectives of the course would be:

1. To increase computer awareness and literacy.
2. To provide instruction in the use of the AGNET system.
3. To teach students how to program in BASIC or a similar computer language.
4. To develop an appreciation for good programming, so students might more intelligently purchase and use commercial programs.
5. To introduce students to selected commercial software programs applicable to business and agriculture.

One of the most significant features of the UNL program was the cooperative approach used to involve faculty representatives from academic departments — designated as "departmental counselors" — to interact with students taking the course and to serve on a college-wide coordinating committee. Not necessarily experts in microcomputers, these discipline specialists would be available to help students apply microcomputer technology to their respective fields of study and to provide future direction to the course itself.

An overall coordinator was selected to organize and provide primary instruction for the course. The course content was based on the experiences of the coordinator who had taught a similar course as a special problems topic for faculty and graduate students. Ag 271 — An Introduction To Computer Applications in Agriculture — was officially offered in Fall, 1982.

Specific Course Objectives: The official course objectives were as follows: Upon completion of Ag 271, students should be able to: a) Outline the historical impact of computers in agriculture. b) Log onto AGNET and use it as a tool in various courses in the College of Agriculture. c) Describe the differences between the time-share and stand-alone computer systems. d) Explain the value of computers for information analysis, storage and retrieval, and for computer-assisted instruction. e) Identify and evaluate commercial software useful for agriculture. f) Write simple computer programs in BASIC (or a similar language) on a computer.

Departmental Counselors: Since the course was indeed a cooperative effort, all academic departments in the College of Agriculture identified one or more individuals to serve as class counselors. The departmental counselors not only provided suggestions for appropriate classroom examples and laboratory assignments but also assisted students enrolled in the course.

These counselors met regularly each semester as a coordinating committee to evaluate the status of Ag 271 and provide directions to the instructor. Course policies and procedures, as well as appropriate hardward and software usage were discussed at length, making Ag 271 a truly cooperative effort within the college.

Since each student's term project had to relate to his/her specific major, advice and approval of the departmental counselor was essential. The counselors evaluated the projects from the view of the discipline and forwarded the evaluation to the coordinator for consideration in grading.

Instructional Strategy: Classes were designed to be held three times per week. The Monday class covered general computer awareness topics, history and application of computers in the business world, guest lecturers from the Agribusiness sector, instruction in the use of AGNET, and several lectures and laboratory assignments on the use of specific applications programs.

The Wednesday class was primarily concerned with programming in BASIC. While the specific programming examples used were in Applesoft, the proprietary BASIC used in Apple II series computers, emphasis was upon good programming practices and upon those statements which are generally applicable to "Microsoft BASIC," used in essentially all presently available micro-based personal computers. Students were given the option of using other brands of equipment which might be available to them.

Students were introduced to programming from the very beginning and completed approximately 13 programming assignments. Programming commands were presented in class, illustrated in syntax and carefully explained. Students were given a syllabus containing reference material, summaries of instructions for the equipment, and specific examples for all BASIC commands. Several illustrative programs were included. Weekly assignments were designed to build programming skills gradually but systematically and logically. By the time the student had successfully completed the course, he/she was reasonably competent in the BASIC language.

During the Friday class, the instructor, teaching assistant and one or more of the graders answered

general questions, expanded on pertinent topics or provided students with individual assistance.

The course was graded on a "total points" basis. The points assigned in the course were divided equally, with 1/4 from the weekly laboratory assignments, 1/4 from examinations, 1/4 from miscellaneous assignments, and 1/4 from a term project.

Students obtained a substantial amount of hands-on experience during the semester. They self-scheduled their time into either of the similar microcomputer laboratories. This provided an opportunity for students to access computers from eight o'clock in the morning until one o'clock the next morning. Weekend hours were slightly more restricted. For students registered in the course, there were approximately 9 machine hours/week/student available. To eliminate wasting time in the laboratory, students were instructed to develop hand-written versions of their programs before they entered them into the computer.

Equipment and Facilities: The microcomputer laboratory had to be readily accessible to large numbers of students, yet provide a secure area with adequate supervision. Miller Hall, the traditional home of the AGNET system, was chosen as the site of the initial laboratory and equipped with 8 Apple II Plus microcomputer systems. The laboratory room was constantly supervised and staffed by graduate students with computer expertise.

Each workstation contained an Apple II Plus computer with monitor, disk drive, and an Epson MX-80 printer connected through a Grappler Plus parallel interface card. A few stations also included a second disk drive, a 16-K RAM card, a Microsoft Z-80 Softcard, and a DC-Hayes Micromodem II. The computer drive(s) and monitor were encased in a steel security cabinet. To date, there have been no problems with security of the equipment and it has not been misused or misplaced by students.

A priority system was established to ensure students enrolled in the class had first choice for computer access. The demand was so great that a second laboratory was established in C. Y. Thompson Library for the 1983-84 academic year. Ten Apple IIe and two IBM-PC microcomputers were installed in the library laboratory. Since the library was open 17 hours per day, additional supervision and assistance was added.

The Apple Computer was chosen as the primary system for use in the laboratories and for instructional purposes. This brand uses a straight forward, BASIC language that is easily understandable and easily adaptable to other microcomputer systems. The availability of maintenance and service to the immediate area was also a consideration, even to the extent of purchasing the machines locally rather than direct from the manufacturer.

Over 500 students were enrolled in the course during the first two years, and scores of others have used the microcomputer laboratories. To date, there have not been any significant mechanical problems with the computers, disk drives, or monitors. The laboratory equipment has been both reliable and durable.

Laboratory microcomputers are replaced after two years of use. This allows capital expenditures to be allocated evenly on an annual basis (one half replaced each year), and to maintain the latest computer technology in the laboratories. Software needs are evaluated annually as well.

The Term Project: Perhaps the most important component of the evaluation strategy was the term project. This exercise allowed the students to express creativity and programming knowledge by writing a software program to address a problem area that might be encountered in his/her "discipline." The program has to be useful and not just a programming exercise.

To ensure applicability to an agricultural discipline, a faculty advisor or "counselor" in the student's academic department must have endorsed the program concept as being beneficial. The counselor must also have monitored completeness and accuracy, and indicated the extent to which the program met its initial objectives and was usable within the profession.

The term project provided an additional benefit which addressed the concern for readily available computer programs in agriculture. Students completing their term projects agreed to place their programs in the public domain for use by faculty, other students, or others interested in the programs. To assure quality programs were made available, only the best 20 to 25 percent were maintained on permanent file.

Anticipated Outcomes: When the need for such a course first surfaced, many concerns were voiced. After three semesters of offering Ag 271, several benefits have been realized.

Benefits to students:

1. A systematic, organized approach to learning microcomputer programming was made available.
2. Cooperative working arrangements were established between faculty and students within each academic department.
3. Students were allowed to address current programming problems and contribute to finding solutions within their own fields of study.
4. Students gained valuable computer skills to use throughout their academic careers and in their chosen professions.
5. Students were introduced to word processing, data management, electronic spreadsheets, telephone communications, and other microcomputer utility programs

that should prove beneficial throughout their lives.

Benefits to IANR:

1. The faculty developed an increased awareness of microcomputer technology and its role in agriculture and education.
2. The course increased the usage of microcomputers at all levels within the institute.
3. The course prompted further investigation and application in the use of microcomputer assisted instruction (CAI).
4. A source of technical, agribusiness-oriented programs that may be adaptable to instruction, research or extension was made available.
5. A cooperative effort was made across all departments within IANR to develop computer awareness and skills.
6. The IANR computer advisory committee broadened its scope to include a wide variety of agricultural computing problems.

Benefits to the Departments:

1. Faculty involvement with microcomputer applications in both educational and agricultural areas was enhanced.
2. A means to purchase microcomputers on a cost-share basis for use within departments was made available since staff members were involved with assisting students enrolled in the computer course.
3. A means to secure microcomputer programs needed within departments was developed.

The greatest benefits are yet to come. In a coordinated effort, IANR faculty will plan the future role of Ag 271 and make necessary adjustments in the objectives and content to meet the ever-changing needs of agriculture and IANR.

Future Considerations: Initially Ag 271 was regarded as a "stop gap" measure for those students not receiving computer instruction in Nebraska secondary schools.

A similar course will most likely be needed with periodic modifications as technology changes. The initial course may need to be divided into a basic, remedial offering to address students entering UNL with no computer skills, and then into a higher level programming course with more sophistication and difficulty. A higher level course would allow greater exposure to a variety of microcomputer systems and allow greater application of commercial software for agriculture.

The Institute of Agriculture and Natural Resources at the University of Nebraska believes this method of providing microcomputer instruction to undergraduate students has been very effective. In three semesters, approximately 350 students have completed the course and exhibit excellent programming and user skills. An additional 150 are enrolled for spring '84, and about 50 faculty have also participated in the course.

One of the underlying reasons for this success is the cooperative approach allowing participation of faculty from each of the technical departments in providing assistance and supervision of Ag 271 students. These efforts have made this course a truly college-wide effort in which students and faculty alike can take pride.

This is a model for microcomputer education which is easily adaptable to other educational disciplines and/or institutions. The keys are cooperative planning and involvement to address not only student needs, but also the comprehensive microcomputing needs of a particular educational setting.

CASE REPORT

Toxicity Terminology And Dilution Factors Taught by Simple Formulae

S. Warwick Fisher

Modern Agriculture has become an increasingly technical field in which an instructor is inevitably pressed to explain terms or processes which are themselves sophisticated and technical. Two such problematical areas are expressions of toxicity, such as LD_{50}, LC_{99}, KD_{50} etc., and the means of diluting concentrated solutions. Both concepts are of relevance to agricultural education whether the student wishes to pursue basic experiments in a laboratory or apply the principles to tank mixtures in a field setting. The teaching of these ideas, however, is fraught with much confusion as a result of the multiplicity of seemingly interchangeable terms as well as the lack of standardized methodologies for carrying out related procedures. The confusion can be eliminated if the instructor reduces expressions of toxicity and the calculation of dilution factors to derivatives of simple formulae.

Toxicity Expressions

In the case of the first principle, namely expressions of toxicity, we find that the term LD_{50} is most frequently used as a measure of toxicity. Here the amount of compound (mg) needed to kill 50 percent of individuals in a test population (individual weight given in kg) is calculated by exposing groups of organisms to graduated doses of the toxicant; the mortality of each group is scored subsequently. In this type of experiment, the experimental variable is the dosage of

Fisher is a member of the Department of Entomology, Ohio State University, Columbus, OH 43210.