COURSE PROPOSAL

Providing Computer Literacy

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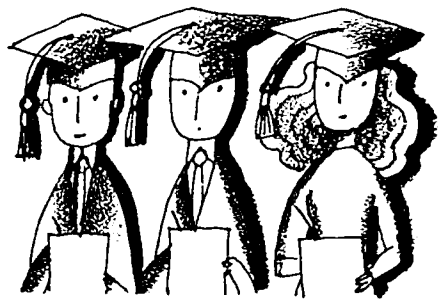

Abstract

The interest in computer literacy in colleges of agriculture has paralleled the development of microcomputer technology. This highly accessible, relatively low cost technology seems to be particularly appropriate to the needs of typical agricultural businesses. Full appreciation of this technology, however, requires a basic understanding of the functions, abilities, and limitations of hardware and software and an ability to conceptualize problems for computer solution. These understandings and abilities are considered to be important characteristics of computer literate individuals. Their attainment should be the primary objective of a college level computer literacy course.

The purpose of this paper is to present some of the issues important to the provision of computer literacy to students of agriculture. The first section below will describe the characteristics of the computer literate student, both in general and in the context of the college of agriculture. The next section will discuss the issue of who should teach computer literacy to students of agriculture. This question may require only a short run solution as secondary schools will likely impart basic literacy skills in the near future. The section following will suggest and discuss the content of a computer literacy course directed at students in the college of agriculture. These three issues are closely related. Clearly, the desired characteristics of computer literate students will largely determine the content of a computer literacy course. Somewhat less clear is the relationship between the characteristics of computer literate students, course content, and the question of who should teach the course. The relationship, however, again hinges on the desired characteristics of the computer literate student.

The Computer Literate Student

The concept of computer literacy has resisted a single, concise definition. Most educators would agree that, in general, computer literacy can be defined as the quality of having an understanding of computers and a basic ability to use them. Several authors have supplied a more detailed description of the computer literate individual emerging from a secondary school or college curriculum (Huntington, Innskeep, Johnson). These writers seem to agree on the following characteristics:

(1) An understanding, in a nontechnical sense, of how a computer works and how its component parts are related.
(2) An understanding of the capabilities and the limitations of computers.
(3) An appreciation for computer applications to a subject matter area.
(4) An ability, at an introductory level, to conceptualize problems for computer solution.
(5) An ability to represent problems in the syntax of a computer language.
(6) An understanding of the societal impact of computers.

Just as verbal literacy usually connotes the ability to read and write but not necessarily with fluency or creativity, computer literacy suggests a mastery of very basic computer skills.

Writers on the subject have made a distinction between literacy and fluency (Masat, p. 17), and literacy and competency (Turner). In both cases, the latter quality implies a deeper understanding of computers and better developed ability to employ computers in problem solving. The computer literate individual would not be expected to know computer architecture or how to configure hardware, although he or she should know the functions of each major class of hardware. The computer literate individual would not be expected to have the ability to write any but the simplest algorithms although he should understand what an algorithm is and its importance to data processing. Computer literacy does not imply the ability to design and code efficient, general purpose programs, although it should imply an understanding of when such standard procedures as looping or branching are appropriate.

In the context of graduates of colleges of agriculture, computer literacy should mean:

(1) The ability to identify and understand the functions of the hardware components of a computer system.
(2) An understanding of the impact, both current and expected, of computer technology on agriculture.
(3) The ability to conceptualize a computer solution to typical agricultural problems such as farm record keeping, feed ration analysis, and budgeting.
(4) The ability to write simple computer programs that contain read and write commands and branching and looping procedures.

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(5) An understanding of how data can be stored and accessed from secondary storage devices.
(6) Knowledge of important general purpose software; namely, electronic spreadsheets and database managers.

This list is virtually identical to the one presented previously although it speaks in more specific terms. The concept of computer literacy does not change as it is shifted from the university at large to the college of agriculture. What does change, however, is the context in which literacy is achieved. Just as the concept of computer literacy has several meanings, so the question of who should teach it has several sides.

Teaching Computer Literacy

The question to be addressed in this section is whether individual colleges in general and the college of agriculture in specific should administer their own computer literacy course or whether the computer science department should administer a standard, university-wide course. In practical terms, many computer science departments throughout the country would be hard-pressed, because of instructor and equipment shortages, to teach computer literacy to the entire university. Assuming, however, that the computer science department was able to offer a university-wide computer literacy course, would such a course be preferable to separate college offerings? In the March 1 issue of *The Chronicle of Higher Education*, Dr. Bruce W. Weide, a professor of computer science at the Ohio State University, is quoted as saying that "There are good academic reasons why computer science ought to be taught by computer scientists. There is some theory about computing, some intellectual content to the science." Dr. Russel V. Skavaril, a professor of genetics at Ohio State defends his department's computer literacy course, saying that "we want to focus on the unique application of the computer to biology (Turner, p. 1)." These statements are probably quite representative of the views of those on both sides of the debate. On the one side, computer scientists stress the separate and cohesive theory that underlies computers and computing and the depth of knowledge required to teach this theory. On the other side, educators in other disciplines stress the application of the computer to the problems in their disciplines. The more closely computer literacy is identified with computer science, the greater the comparative advantage of the computer scientist teaching it. On the other hand, the more closely literacy is identified with application of accessible computer technology to subject matter problems, the stronger the case of those in the subject matter areas that they should teach literacy.

The degree of interest in computer literacy among non-computer scientists, including those in the college of agriculture, has paralleled the development in the computer industry of the small, low-cost, but highly sophisticated microcomputer. These computers appear to be particularly applicable to the data processing needs of small to medium sized businesses of which farms, ranches, and other agribusinesses are so highly representative. They can be used very effectively in tasks such as budgeting, record keeping, and database management. Furthermore, there will probably be increased use of computers in process control functions such as the monitoring of feed consumption and milk production. It is this focus on a specific type of computer technology and the knowledge necessary to access that technology that appears to have prompted many colleges of agriculture to enter the business of computer literacy. The same can probably be said of other colleges and departments as well.

It is perhaps on this point that the college of agriculture can justify its computer literacy course. The course is not designed to train computer scientists but to instruct future farm managers, for example, or agronomists, animal scientists, or horticulturalists in how to use the computer as a tool in their profession. While some "theory" is part of a computer literacy course, it is not computer theory per se but theory that derives from logic and mathematics. Likewise, computer languages, especially the high-level languages likely to be taught in a literacy course, are not, at an introductory level the province solely of computer scientists.

Ultimately, the question of who should teach the computer literacy course may not be as important as the question of what to include in the course. That question depends, as has been stated before, on the desired characteristics of the computer literate student. The section below will propose the content for a computer literacy course for students in the college of agriculture.

The Content of the Computer Literacy Course

The course content suggested here simply mirrors the description of the computer literate individual given previously. This individual will not be prepared to enter the computer industry but should be prepared to work in an environment where computers are used as tools. Students in the college of agriculture may require some special preparation. Unlike many of their colleagues who enter industry or government, many of these students will be called upon not only to gain proficiency in the use of computers but to make decisions about investing in computer hardware or software. It is imperative, therefore, that they have a sence of the appropriateness of computer technology to their particular situation.

A general principle that should be kept in mind when implementing a computer literacy course is that the course should attempt to strike a balance between the general and the specific. A course oriented too much to a particular skill (i.e., the use of electronic spreadsheets) risks obsolescence. One that is too general, that does not allow the student to use a computer to solve a problem of interest to him or her, will likely have little practical value. This principle should be adhered to both in selecting topics for inclusion in the course and in designing the treatment of any particular topic. Computer literacy courses, in general, often include the following topics (Masat, p. 16). These topics, it will be seen, compare quite closely with the desired characteristics of the computer literate student listed above.

(1) Computer organization, including microcomputers.
(2) Procedures and algorithms for processing information.
(3) A history of computing.
(4) A hands-on experience.
(5) Capabilities and limitations of computers.
(6) Present and future uses of computers.
(7) A perception of the societal impact of computers.
(8) The potential threat of computer abuse.

Each of the items in the list above, with some modification, appear to be appropriate for a computer literacy course in the college of agriculture. Skipping items 2 and 4 for the moment, items 1 and 3, computer organization and computer history, respectively, form the basis for an introduction to the technology of computers. Items 5 and 6, capabilities and limitations and present and future uses, respectively, provide an opportunity to discuss applications to agriculture. Item 7, the perception of societal impact and item 8, the potential threat of computer abuse would offer the opportunity to present some of the broader issues involved in the computerization of agriculture such as the potential impact of computerization on farm size and structure. Items 2 and 4, which constitute the "hard" part of computer literacy, require a more extended discussion.

Items 2 and 4 taken together could be covered in a couple of class sessions or they could constitute a good one-half or more of the course. Students could be told about algorithms and shown a few examples or they could be required to write them. Similarly, a hands-on experience could mean anything from a few hours in front of a computer to a rigorous study of the fundamentals of a computer language. There are several reasons for designing a course content that tends toward the latter end of the scale in both cases. The ability to write algorithms to solve simple problems and to do elementary programming in a language such as BASIC or Pascal is consistent with the characteristics of the computer literate student. Students who succeed at designing the logic and programming the solution to a problem will likely find themselves more comfortable with computers and better able to appreciate their strengths and limitations. In the process of designing, writing, entering, and running programs, students will become more familiar with the operating system of a computer, a familiarity that will benefit even those who never write another program after they leave the course. While writing computer programs, students gain experience in logical thinking and precise expression, experience which yields benefits even beyond computer literacy. On a more specific note, program design and writing experience will give students valuable insights into the work of software developers with whom they may consult in the future. In addition, some available software may require modifications that those with programming experience can easily make.

The course outline which follows incorporates the topics listed on page nine above along with the emphasis noted in the preceding paragraph. It was written with a five credit hour, quarter system course in mind. Such a course would meet for 50 minute lectures three times a week and for a two hour lab session once a week. Over a ten week quarter, students and instructor would meet for thirty lecture hours and twenty lab hours. Also, the course assumes the availability of computers, either micros or a main-frame, for hands-on experience.

The course consists of five major sections, the largest being an approximately four week treatment of BASIC. Other features of the course include a four-lecture discussion of general purpose computer software including a lab problem utilizing an electronic spreadsheet. The full outline is as follows:

Section I. Introduction to Computer Technology (3 lectures)

Lecture 1. Computers and information systems. A general discussion of the use and role of computers and computer technology in modern society.

Lecture 2. An historical perspective. An overview of the development of computers. The critical distinctions between succeeding generations of computers.

Lecture 3. The computerization of agriculture. A discussion of current and future applications of computer technology to agriculture.

Section II. Computer Technology (3 lectures)

Lecture 4. Computer hardware. A brief discussion of the major components of computer hardware, the processor, data storage devices, and input/output devices.

Lecture 5. Computer software. A description of the major categories of software: system, language, and general purpose.

Lecture 6. Data management. A review of the principles of data storage, retrieval, and manipulation.

Section III. Information Systems (4 lectures)

Lecture 7. An overview of the information systems and the system "life cycle." The basic elements of MIS and a definition of the system "life cycle."

Lecture 8. Analysis of information systems. Determining the objective of an information system and evaluating the economic feasibility of such a system.

Lecture 9. Design of information systems. Reviewing the elements of system design, and data base selection.

Lecture 10. Programming and the information system. A review of the general principles guiding program development.

Section IV. Programming in BASIC (13 lectures)

Lecture 11. Introduction. The structure of the BASIC language. Program statements and line numbers. Using the REM statement for internal documentation.

Lecture 12. Data input and output. Using the READ, DATA, and PRINT statements.

Lecture 13. Formatting techniques. Formatting with the PRINT USING statement.

Lecture 14. Arithmetic operations. The hierarchy of arithmetic operations. Using the LET statement to do computations.

Lecture 15. Interactive programming. Data entry via the INPUT statement. Prompting the user for input.

Lectures 16 and 17. Unconditional and conditional branching and procedures. Coding the program logic with the GO TO and IF-THEN statements.

Lecture 18. Looping procedures. Using the FOR-NEXT statements to repeat operations.

Lecture 19. Subroutines. Modular program design. The GOSUB, ON GOSUB, and RETURN statements.

Lectures 20 and 21. Array and matrix operations. Creating and utilizing multidimensional arrays.

Lectures 22 and 23. Data files, creation and handling. Reasons for using data files. Opening, closing, and writing to data files. Sorting, merging, appending, and editing data files.

Section V. General Purpose Applications Software
(4 lectures)

Lectures 24 and 25. Electronic spreadsheets. A general description of the use and operation of electronic spreadsheets.

Lectures 26 and 27. Database managers. A general description of the use and operation of data base management software.

Each section of the course contributes something to the attainment of computer literacy and the characteristics listed on pages three and four. Those characteristics, in abbreviated form, are listed in the left-hand column below. The section or sections of the course addressing that characteristic appear in the right-hand column.

Desired Characteristic	Relevant Course Section
1) Understanding the functions of hardware	I and II
2) Impact of computers on agriculture	All sections
3) Conceptualizing problems for computer solution	III, IV and V
4) Writing simple computer programs	III
5) Data storage and access	II, III, IV and V
6) General purpose software	III and V

The lab topics are designed to do more than just complement the lectures. In a course such as this, the labs are crucial to the students' success. The labs should offer the opportunity to design, code, and execute programs. They should also offer them the opportunity to see, first-hand, the components of a computer system, be it micro or main-frame. The suggested lab topics are listed below, by week.

Week	Topic
1	An introduction to microcomputers
2	An introduction to computer operating systems
3	Program design problem; program flowcharting
4	BASIC problem; input and output
5	BASIC problem; branching and looping
6	BASIC problem; arrays
7	BASIC problem; creating data files
8	Electronic spreadsheet problem
9	Database manager problem

It may be desirable to base all of the labs on a single problem situation, that of a farm, for example, or a small business. If the problem situation is clear and straight-forward, students will be better able to relate to it and will not need additional instruction to understand it.

Nothing has been said up to this point about when in a student's curriculum he or she should take this course. It is probably best that a student complete the course before the end of his sophomore year. Most students should be adequately prepared to take this course early in their college career since it is a course with no college-level prerequisites. It is also advantageous for students to be able to use their literacy skills while still in college. Having achieved literacy relatively early in their college careers, they can make even more applied use of the computer in upper-level courses.

Conclusions

As computer literacy increasingly comes to be provided in secondary schools, the need for such a program in the college of agriculture will diminish. There may, however, be a remedial role for a course in computer literacy for some years just as remedial courses in mathematics and English are commonplace today. But, even more importantly, since literacy is not an end in itself, even if the college of agriculture does not teach computer literacy it still should feel an obligation to incorporate computer technology into its subject matter courses in order to enhance and strengthen the literacy of students in agriculture.

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