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Integrating Microcomputer Applications Into Undergraduate Quantitative Methods Courses

Daryll E. Ray and Elton Li

Abstract

A quantitative methods course has been developed which bundles together the quantitative methods commonly used in undergraduate agricultural economics courses. Microcomputers are used as computational apparatuses and instructional aids. Students learn to use spreadsheet, business graphics and other general microcomputer application programs while applying the quantitative techniques discussed in class.

For many years computers were in the backrooms and basements of large companies and institutions keeping records, spewing out invoices and other documents, while relatively few people worked directly with computers. Now computer terminals and computers, especially desktop microcomputers, are becoming as common as cash registers and pocket calculators. Most of today's university students will be using computers when they join the work force. Some will use large "company-size" mainframe computers and others will use "department-size" minicomputers, but a large share of them will be using stand-alone or interconnected microcomputers.

The challenge facing educators in general and teachers in agriculture in particular is how to best prepare students to productively use computers, especially microcomputers, in their future occupations (Knapper; Moulton and Colfin). Neither the approach of a quick coverage of microcomputer terminology nor the other extreme of a computer-science-like course which emphasizes programming in BASIC or Pascal seems appropriate for agriculture. This paper describes an approach which combines a quantitative methods course with an introduction to microcomputer application programs.

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Origin of the Quantitative Component

A few years ago, the departmental undergraduate committee of the Department of Agricultural Economics recommended adding a course in quantitative methods. The course was to bundle together quantitative material that overlapped several courses. As it had been, course instructors diverted time from core course material to teach discounting, regression, index number construction, data presentation and other techniques that were also used in other courses but because of a changed mix of students were often covered again. The new quantitative methods course was to be required for all departmental options. Students would be expected to take it early in their college career. The course was put on the books, but a limited staff and no enthusiastic volunteer resulted in the course not being taught for three years.

The Microcomputer Connection

In 1982 a departmental committee was formed to make recommendations concerning the integration of microcomuters into departmental teaching, research and extension activities. One of the committee's numerous recommendations was to use the quantitative methods course to introduce students to microcomputer application programs for performing economic analysis. The committee recommended that the department set up a microcomputer laboratory,

complete with application software, for use in this course and other agricultural economics courses.

At the time, the department owned few microcomputers. Funding the purchase of hardware and software was eased by two special allocations made available to the division and department. The allocation to the division from the university was used to create a division-wide lab containing 16 microcomputer systems (two drives; one printer per 4 machines) and 16 sets of plotting, spreadsheet and word processing software. The departmental allocation, along with regular departmental funds, allowed the purchase of microcomputer systems for half of the faculty. Thus, we were able to schedule the quantitative methods labs in the division laboratory, and faculty had ready access to micros for preparing class materials. Since then, virtually all departmental faculty who requested a microcomputer have received one. The division has also added four micro systems to the lab bringing the total to 20 units.

Course Prerequisites and Organization

The only prerequisite for the quantitative methods course is the usual introductory level agricultural economics course. No computer or microcomputer experience is assumed. The course is credited for three hours and is divided into two hours of lecture and a two-hour lab per week. The lecture portion concentrates on quantitative methods material with limited discussion of microcomputer terminology and application. The labs are designed to provide hands-on experience applying concepts discussed in class with the use of microcomputers. Each student has sole access to a microcomputer during the two-hour lab period. The class size is therefore limited by the product of computers and lab sections. Three lab sections were available for the first year and four sections were taught the second and third years.

Lecture Portion

Objective Topics Covered

The objective of the lecture portion of the course is to provide students with a basic understanding of the major quantitative tools required for the upper-level undergraduate agricultural economic curriculum. The lecture portion begins with a demonstration of the appropriate and inappropriate ways to graphically display and present data (e.g., frequency tables, histograms, line and pie charts, normal curves and probabilities and table construction and labeling).

The second section focuses on descriptive statistics. Topics included are: measures of central tendency, weighted averages, measures of dispersion, normal distributions and association among variables.

The third major section deals with financial concepts, accounting systems and statements, and decision aids. This section represents about a third of the course. Specific topics include: present value, net present value, internal rate of return, amortization, cash-flow, income and balance sheets, break-even analysis and other management decision aids.

Index numbers, are discussed next including material on the general concept, construction of specific types, use of price indices for deflation and how to convert from one base period to another. Regression analysis is covered the last weeks of the semester. The regression concept, calculation methods, R^2, prediction, tests and interpretation of regression statistics are discussed.

Sufficient theoretical background is given to help students understand each quantitative technique but the emphasis is on application. Students are expected to be able to use the concepts of present value, break-even analysis, index numbers and other quantitative techniques in a variety of problem settings.

Mode of Teaching

Microcomputers are used in this class both as an instruction medium and as an instructional aid (Anderson). As an instructional aid, the microcomputer is used to prepare illustrations, outlines, and demonstrations for projection on a large screen T.V. to supplement the lecture and discussions. A microcomputer program called Slide Easy (Li and Ray) is used to make electronic color "slides." These "slides" are actually images on the microcomputer graphics screen which are saved on diskettes and then shown in class in sequence with a "slide show" program. With Slide Easy colors of the background, letters, border and the types and sizes on fonts can be easily changed from one electronic slide to another. These "slides" can be made with minimal effort by the instructor as part of the pre-lecture preparation. The computer and TV combination is also used with spreadsheet, graphics or BASIC programs to explain analysis concepts and to demonstrate available farm decision-aid software.

Laboratory Portion

Objectives

The lab portion of the course has three general objectives. First and most importantly, the lab exercises provide students experience in applying the quantitative methods discussed in lecture and thereby reinforce the material. In this sense, the microcomputer serves primarily as a medium for the primary objective of teaching quantitative methods. Secondly, the students learn the nomenclature of computers; how they organize, store and retrieve information; and other aspects of microcomputer literacy. Finally, the students attain proficiency in using three general types of microcomputer application programs.

The Application Programs

The three types of application programs used in the lab are spreadsheet analysis, word processing and business graphics. Word processing may seem to be an unlikely component of a quantitative methods course but it is an important application of microcomputers. For some of the labs, the students are asked to use the

word processor to compose a report which interprets an economic analysis completed earlier. During and after the course, many students make considerable use of word processing for writing term papers and reports for other classes. The reports often include graphs from the business graphics program and tables constructed with the spreadsheet program.

The lab assignments require students to use each of the three application programs several times throughout the semester. Spreadsheet analysis is used in 10 of the 14 lab assignments, word processing in 4 and graphics in 3 of the labs. Other types of application programs such as statistical packages, data base managers and communication programs are discussed during the semester, but the students receive little or no experience using them.

Assignment Components

Each lab assignment begins by stating the objectives of the lab which relate to both quantitative methods and to learning new aspects of a microcomputer application program. The assignments are handed out two to three days before the lab and typically include two parts. The first part contains short answer questions and problems to be worked by hand or with a calculator. The second part requires use of a microcomputer. The students are requested to complete the first part of the assignment prior to the lab period since the second part is often written as an extension of part one. Part one focuses the student on the quantitative material that is to be mastered, often with illustrative or paired-down data. Part two expands the problem to real-world size, relaxes simplifying assumptions and allows analysis of alternative scenarios or "what ifs." The assignments are due the lecture period before the next week's lab and typically include handwritten material for part I and analysis printouts and a diskette containing saved files for part II.

Summary of Activities

The first lab orients the students to the hardware and disk operating system of the microcomputer system. They learn how to boot the microcomputer system, format diskettes, make copies of files, rename and delete files, run programs from DOS, etc. The second lab involves the construction of frequency tables, histograms and other graphical displays. A relatively easy-to-use business graphics program is introduced and used rather intensively. The next three labs relate to descriptive statistics (central tendency, weighted and moving averages and measures of dispersion) and introduce the students to the use of a spreadsheet program. The next two labs focus on learning a word processor.

The next series of labs on finance, management decision-aids and price index topics (compounding and discounting, amortization, lease vs. buy, cash-flow analysis and bank statements, break-even analysis and index number construction and use) require repeated use of the spreadsheet program (Cochran and Conklin). The spreadsheet program is the most difficult to master of the three application programs. Use of the program throughout the semester provides continual reinforcement of the basic commands and experience with more sophisticated commands. The business graphics and word processor programs are also continually used for information presentation and to report analyses.

In order to teach the mathematical underpinnings of simple linear regression, the spreadsheet program is used for the regression lab. After the students have worked through how to compute regression coefficients, standard errors, predicted values, etc., the regression procedure from a statistical package is demonstrated for multiple linear regression.

Instructional Approach

Tutorials are developed for acquainting the students with the primary features of each application program. The tutorials are not taken from the program manuals, but rather are written to incorporate the week's quantitative methods material as well as to introduce program syntax. The tutorial format is used for two weeks for the spreadsheet and word processing programs and for one week for the business graphics program and the disk operating system. An example of the tutorial format follows:

—(C4+C6+ C8+C10+ C12)/5↓

Enters a formula for calculating the mean of the five values in cells C4, C6, C8, C10 and C12. Use **DELETE** to backspace over errors or if the entry is completely fouled up, keep pressing **DELETE** until everything disappears from the second and third lines of the screen and start over.

Method two will use the **SUM** function (@SUM) to add up the entries. A **FUNCTION, LIKE SUM** (and bunches of others we will encounter later) **MUST BEGIN WITH AN @ SIGN** (press **SHIFT** and "2" key).

The cursor should be over cell C15.

—@SUM(C4. C12)/5↓

Activates the **Sum Function** over the range of cells C4 to C12 and divides the result by the number of observations.

PARENTHESIS ARE REQUIRED FOR ALL FUNCTIONS.

HOPEFULLY, THE SAME VALUE NOW APPEARS IN CELLS C14 AND C15.

Method 3 will use the **AVERAGE** function to compute the mean directly. The cursor should be over C16.

—Carry out Instructions

Use the **@AVERAGE** function to compute the mean. I know you can do it! After making the entry and getting

the correct answer, of course, move the cursor to A17.

We will now draw a line across the bottom using the **REPEATING LABEL** command and take a deep breath. **THE REPLICATE** command. **THE CURSOR SHOULD BE AT A17.**

—/—(RETURN) The "/" kicks **VISICALC** into the **COMMAND** mode; the first "-" tells **VISICALC** which letter to repeat.

We will now use the **REPLICATE** command to copy the repeating label in B17 and C17. This is a very useful and powerful command. Replicating one cell into several rows is a relatively simple use of the command. We will leave the hard stuff for subsequent sessions.

—/R The "/" is to activate the command mode: the "R" is for **REPLICATE.**

The short lines on the left provide a place for the student to make a mark after completing the set of key strokes, then the key strokes are presented and finally, an explanation of the command or key strokes. After one or two weeks of using this tutorial style for an application program, succeeding handouts explain new commands as they are needed to apply the quantitative method that is the focus of the lab. Reference cards or sheets are also handed out which summarize the complete set of commands for each application program. Students are encouraged to read the program documentation manuals to deepen their understanding of the programs and to learn additional operations.

The old adage "if anything can go wrong, it will" seems to be especially true when first being introduced to microcomputer software. Keys are accidently pressed and the program goes off in an unintended direction etc., etc. To help students get back on track, the labs are attended by two or three people who are very familiar with the microcomputer application programs and the quantitative methods that are being applied. So far this set of people has included the primary course instructor and one or two undergraduate or graduate assistants.

The Positives and the Negatives

The positive aspects of the course include:

- Teaching the use of three of the major types of microcomputer programs which have general applicability in a wide range of school and work activities.
- Providing repeated use of application programs over a 14 week period so students retain skills.
- Tailoring computer software tutorials to agriculture by using agricultural data and economic analysis techniques.
- Reducing tedium of completing computationally intensive assignments in a quantitative methods course.
- Sparking student interest in the use of microcomputers on their farms and businesses while using the application programs and analysis techniques learned in the class, in particular, and microcomputer application programs in general.
- Providing a pragmatic, middle-ground approach to the use of microcomputers. The student does not learn a programming language such as **BASIC** nor is the student's microcomputer exposure limited to 'running' a prewritten canned program. The spreadsheet and business graphics programs are general-propose tools for the domain of problems students are likely to encounter later in their academic and professional careers.
- And last but not least, establishing a foundation that can be built upon in other courses in the teaching of economic analysis and in the use of general application and course-specific microcomputer software.

Another positive aspect of developing the tutorials is that they are also being used by college faculty and staff as a means of getting started with microcomputers. Not unexpectedly, there are some negative aspects also:

- Developing the tutorials and laboratory handouts requires considerable time and effort. Each of the four tutorials required between 30 and 40 hours to initially prepare. Even the remaining ten lab assignments took between 20 and 30 hours each to prepare. These latter labs primarily present the economic setting, data to be used, print-outs of partially completed spreadsheet templates, and questions to be answered. They also include explanations of new commands and nuisances (read features) of the application program(s), intermixed with some comments on the quantitative methods being employed at appropriate moments. A diskette file containing data and/or partially completed templates is usually provided also. This frees the student from entering data but increases instructor preparation time. All together there were about 130 pages of lab assignment materials passed out to the students.
- Providing one-on-one help during the four two-hour lab sections draws heavily on departmental resources. The primary course instructor plus one or two assistants are kept busy answering questions and helping students back out of "software" corners.
- Substantial investment in microcomputer hardware and software is required.

Summary and Conclusion

Microcomputers are used as computational apparatuses and instructional aids for a newly developed agricultural economics undergraduate quantitative methods course. Microcomputer training is provided for the students to effectively and realistically implement the quantitative concepts commonly used in undergraduate level agricultural economics courses. The more general objective of computer literacy and productive on-the-job use of microcomputers can be attained as a useful side-product if the proper software and instructional material is used.

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An Assessment of Student Recruitment Activities by Departments of Poultry and/or Animal Sciences

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Introduction

The Joint Council on Food and Agricultural Sciences (1984d) has forecast an impending shortage of highly qualified scientists, managers and technical professionals. The number of highly capable students enrolled in advance degree programs in basic agricultural science disciplines is insufficient to meet these future needs for scientific expertise in agriculture since agriculture must compete with other scientific and technical disciplines for the limited number of high quality students with strong scientific preparation. Moreover, enrollments in Colleges of Agriculture at land grant universities have declined 20% since 1980 (Joint Council on Food and Agricultural Sciences, 1984c). This decline can be attributed to two areas of concern: 1) a decline in the traditional college-age population, and 2) the failure of agriculture to compete with other professions in attracting students.

One result of decline in student enrollment in agriculture combined with a shortage of human resources in agriculture is a renewed interest in student recruitment. Increased emphasis has been placed on attracting academically outstanding students into food and agricultural sciences degree programs. The professional nature of agricultural careers needs to be emphasized in order for prospective students to evaluate agriculture along with other professional disciplines (Joint Council on Food and Agricultural sciences, 1984a). In addition, an increased proportion of the education resources in agriculture needs to be directed to student recruitment activities (Joint Council on Food and Agricultural Sciences, 1984b).

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In view of the increased interest in student recruitment in agriculture, a survey of Departments of Poultry Science and/or Animal Sciences was conducted to determine current recruitment activities in the field of Poultry Science. The objectives of this survey were to access student recruitment activities and to determine the allocation of resources for student recruitment activities at these departments. In addition, present student enrollments and trends in enrollment in poultry programs at the responding departments were determined.

Materials and Methods

A self-administered questionnaire was constructed to evaluate the student recruitment activities of Departments of Poultry Sciences and/or Animal Sciences. The questionnaire, with an explanatory cover letter and return self-addressed envelope, was sent to 61 Departments of Poultry Science and/or Animal Sciences in the United States and Canada (Anonymous, 1984). A 72% response rate was achieved by this survey. The data from the returned questionnaires were summarized and expressed by a percentage of respondents.

Results and Discussion

Eighty-two percent of the respondents indicated that their departments were actively engaged in student recruitment activities. Fifty-two percent of the respondents indicated that undergraduate student recruitment was of the highest priority. Twenty-six percent of the respondents felt that graduate student recruitment was of the highest priority and 22% indicated that they were equal.

The types of recruitment materials utilized are indicated in Table 1. Pamphlets, display boards and slide presentations were the three most popular forms of media. Only 8 respondents used video cassettes. This lack of adaptation of the video media is disturbing in view of the fact that today's college-age audience has been raised as an action oriented, visually stimulated