Using Computer-Generated Modules to Integrate Computer Applications throughout a Curriculum

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Abstract

Instructors in several disciplines have developed modules to help train students in various computer applications. These modules increase students' understanding of basic applications and facilitate the integration of technology into the curriculum. Developing modules is quite easy, and the number of potential applications is enormous. The end benefit of incorporating modules into the curriculum is that students become more capable in using computer technology to generate information of value for decision making. Modules can be especially useful for teaching agribusiness students computer skills in accounting, finance, marketing, database management, and other agriculture-related activities.

Introduction

Technology leverages abilities. That is, technology, particularly the use of computers for problem solving, data analysis, and communication, magnifies the user's economic and business skills. If students and professionals are taught the power and potential of technology, they can use technology to become more efficient and productive. For example, problems taught many years ago in computer science and operations research programs can now be solved quickly and efficiently by using spreadsheets. For years, students who learned data analysis techniques such as regression and net present value analyses could use them only if they worked at research universities or in companies with large research departments and mainframe computers. Now, data analysis techniques can be used by anyone with a personal computer and a reasonably recent spreadsheet program.

The purpose of this paper is to discuss how one recent computer technology–screen-capture technology–was used to develop teaching modules that enhanced students' classroom experience in learning about computer applications used in agribusiness and the agricultural industry.

Bekkum and Miller (1994) conducted a survey of colleges of agriculture in the National Association of State Universities and Land-Grant Colleges that indicates the direction in which agricultural education is heading. They concluded from the survey that computing will become more integrated into courses throughout the curriculum. The computer will become more of a teaching/learning tool for instructors and students to use in analyzing and solving problems. Furthermore, at the Information Technology Association of America's 1998 national convention, Graham Spanier, president of Pennsylvania State University, testified to the need for continual integration of computer skills into the university curriculum. He stated, "In short, what institutions of higher education must do is balance near-term information technology skill needs with long-term competencies in communication, management, and other disciplines. I believe we will accomplish this best through greater integration of information science and technology studies and discipline-based programs" (Spanier, 1998, p.4).

Farris (1992) notes that while continual development of curriculum is essential, the current foundation of an applied, problem-solving emphasis in agricultural economics programs is desirable. Problem-solving through the use of economics principles is a unique characteristic of the discipline that has proved advantageous to graduates. Farris recognizes that incorporating computer skills into this applied, problem-solving discipline is of primary importance in facilitating modernization. However, giving agricultural economics courses a heavy computer orientation can be a major challenge.

One way to modernize agricultural courses is to use technology as a teaching tool. However, because new technologies are often used to experiment with the most recent teaching fad, Schurle and Cromer (1995) caution that new technology should be used for instruction only if it enhances and expands students' and teachers' current capabilities. Schurle and Cromer also stress that the ultimate objective of education is to produce active problem solvers and lifelong learners and that this should be kept in mind as a curriculum is being developed.

The evolving nature of both the agribusiness industry and the information age necessitates that educational programs quickly embrace new approaches made possible by technological advances. As Lucas (1998, p. 22) asserts, "In the Darwinian shakeout, the organizations that survive will be those adaptable and nimble enough to continue to meet the needs of their students even as technologies change. Dinosaurs probably won't make it."

Computer application courses traditionally cover a variety of topics, each of which focuses on the use of

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an application to simplify what was previously done by hand or to make possible what was previously not possible. Typically, these application courses use any subject matter that makes effective use of computer technology. The end result of this approach is an eclectic assortment of content that prevents the course from having a clear focus.

Computer applications should be taught when they are relevant to a particular curriculumthat is, lessons in computer applications should be included within the course to which the application most closely relates. For example, spreadsheet methods used to find present value should be taught in a finance course. Similarly, techniques to graph moving averages and interpret their changes should be included in agricultural marketing courses. This approach to teaching computer applications allows students to better understand both the subject matter and the problem-solving capabilities of the applications.

While the ultimate goal of computer applications courses is to help students learn, integrating the lessons into the curriculum does not come without challenges. Schurle (1992) explains some of the difficulties inherent in teaching courses involving computer applications. He notes that integrating computer applications into the curriculum requires more time for course preparation. In addition to developing and organizing the new material, the instructor must carefully rework homework assignments in great detail since computers are not very forgiving when even small details are wrong. The number of students' questions also increases, as do student visits to instructors' offices. There is also a need to continually update material whenever technological innovations occur. Instructors must adjust assignments and upgrade their own computer skills as computer software and business solutions change. These challenges almost guarantee that integrating instruction on computer applications into discipline-specific courses will continue to be slow.

Furthermore, because student backgrounds are now more diverse, computer applications have become more difficult to teach. Because students with different backgrounds have a wider range of exposure to computer applications, it is difficult for instructors to know and meet the needs of individual students. For example, students entering a program with a high level of computer training soon become disinterested if the computer requirements are not sufficiently challenging. On the other hand, students with little computer training are often overwhelmed if instruction begins at a level beyond their experience. Weldon et al. (1999) have identified the increasing diversity in student backgrounds as a factor that must be considered in program planning.

Some instructors have found hope in attacking these problems by employing a computer technology that enables them to produce a movie on a personal computer. This "movie" technology captures any movement on the computer screen and allows it to be accompanied by an audio narration. Brown (2001) discusses some of the untapped teaching possibilities inherent in this screen-capture technology. He also notes that the programs are inexpensive and easy to learn. The resulting movies offer students the opportunity to repeatedly view and listen to the instructions or process, which enhances their understanding and learning.

Instructional modules using screen-captures or movies enable students to learn basic techniques before specific skills are taught in the classroom. These computer-based tutorials level the playing field for students who need basic instruction and relieve teachers of the need to spend valuable class time in teaching students basic skills before moving on to specialized skills.

Pompelli and Hobbs (2002) found that students view computer-based tutorials favorably within a course. They assert that instructors usually use computer-based teaching tools for three purposes: (1) to improve upon the methods by which the material is taught, (2) to supplement the ideas presented in the class, and (3) to enable students to grasp the concepts more easily. However, instructors must recognize that the design of the program and the attitudes of the students toward computer-based learning affect the potential benefits of computer-based tutorials.

Kappes and Schmidt (2002) assessed the effectiveness of using QuickTime® movies to teach students with different learning styles. They found that differences in learning styles were not a significant factor in the effectiveness of the movies as a teaching tool. Overall, students found the tutorials to be beneficial as a supplement to the lectures. One reason these types of movies are useful in teaching is that students are more likely to fix them in their long-term memory when they see them as images than when they receive them verbally (Kappes and Schmidt, 2002).

Dahlgran (2003) has discussed the differences between traditional teaching materials and multimedia materials. The nature of multimedia materials can make them more effective than traditional classroom teaching materials. For example, a movie can illustrate a sequence of events more effectively than a series of static drawings. Dahlgran asserts that instructors should develop multimedia materials that enhance concepts normally presented in a traditional format rather than simply use technology to distribute traditional materials more widely.

There is a large void in the availability of multimedia materials compared to the availability of textbooks and other traditional instructional formats. For example, many books and teaching aids have been produced for learning basic spreadsheet operations. The "Dummies" series of books and videos produced for training purposes illustrate this point. Other books do an excellent job of illustrating

how computer software such as Microsoft® Excel can be used as a business tool to solve complicated statistical, financial, and operations research applications. However, there is a severe lack of effective techniques and multimedia instructional materials for teaching students how to generate valuable information for decision making in fields such as agribusiness and agricultural economics. The instructional modules discussed in the remainder of this paper offer a relatively simple approach to teaching computer skills where they are most relevant in the curriculum.

Developing the Modules

Developing training modules that teach students to use computer applications in curriculum-specific situations is relatively simple. The first step is to decide on the topics to be covered. The author of the modules must then develop spreadsheets that can be used to illustrate the chosen topics. When the spreadsheets have been constructed, the author begins making the "movie," or capturing the process of using the spreadsheet on a computer. A microphone attached to the computer can be used to record verbal explanations while the technique is illustrated on the computer. Thus, the resulting module consists of both the screen capture of the process taking place on the computer screen and an audio component.

One way modules can be produced is by using HyperCam®, a program that records both the movements on the computer screen and the narration. The file is saved in an AVI (Audio-Video Interleaved) movie format. The file can be compressed; that is, pixels can be taken out of the pictures while the module is being created. Compression reduces the visual clarity but produces a smaller file, making it easier to store and distribute the movie. HyperCam® also has a pause option that allows the person recording the movie to stop, reorganize the screen elements, and then resume recording again with no disruption in the flow of the movie. Other features in HyperCam® allow the user to define the exact screen area captured in the movie and control various screen settings. After the modules are recorded, they can be stored on a server or burned to CDs for distribution to students.

While HyperCam® works well in recording and playing back information, the files it creates are very large (e.g., HyperCam® files require approximately one megabit of storage per minute of movie depending on settings). AVI files are difficult to download in a reasonable amount of time from a website unless the user has access to a high-speed Internet connection. However, a technology called "streaming" can be used to make the modules more suitable for delivery on the web. Streaming transfers data in a way that enables the data to be processed as a steady, continuous stream. This allows the beginning portions of the data to be displayed before the entire file has been transmitted. For files to stream correctly, the server on which they are stored must have streaming capabilities. Different types of streaming software are available, including Microsoft® Windows Media, Apple® QuickTime, and Real® RealOne media players. One requirement for streaming is that the modules be in a file format called Microsoft® Advanced Streaming Format (ASF). Different software programs can be used to convert files to this format. An ASF Streaming Redirector (ASX) file, a Microsoft® Windows container file, is also necessary to instruct the computer to stream rather than just download the file and to direct the computer to the correct address to find the specified ASF file. Streaming options and other techniques for producing instructional modules will certainly evolve as technology and software enhancements are developed.

Experiences with Using the Modules

Modules can be used for many different purposes. For example, they can teach general techniques, such as showing students how to construct a two-way table in Microsoft® Excel. More complex techniques can also be developed, such as how to use Microsoft® Excel to set up a net present value problem to assist farmers in deciding whether they should hire a custom harvester or purchase a combine to harvest their wheat crops.

The authors developed 17 modules applicable in agribusiness to teach various techniques, as well as to help students learn to produce their own spreadsheets. The modules were used in the computer applications course in the Department of Agricultural Economics at Kansas State University. Because many modules were quite problem-specific, they were most useful in narrow situations rather than being helpful in teaching general techniques across many applications in a wide range of courses. However, we did develop a few general modules that demonstrated how to set up spreadsheets for the use of specific techniques but not on specific class assignments. These modules had broader appeal and wider applications.

Students had access to the modules through the local network in the department computer lab and from a CD that they could use on their personal computers. The CD distribution of the modules worked well because they could be bundled with related classroom lectures that were also recorded using HyperCam®.

Of the 52 students enrolled in the computer applications course, 19 indicated that they used the modules. (Comments were collected in a survey students completed at the end of the course.) Of the 19 students who used the modules, 16 indicated that they were helpful. Generally, the students using the modules fit into two groups: (1) those who used the modules as a review prior to completing an assignment and (2) those who used the modules as a reference when they experienced difficulty complet-

ing an assignment. When asked how the modules could be improved, most students responded that more tools on material not covered in class should be added. They also suggested adding more examples that were similar to the assignments. The three students who did not find the modules useful thought they were confusing. All three indicated that more detailed, step-by-step explanations of how to do the assignments would have been helpful.

We did not conduct a formal evaluation of student users of the modules compared to nonusers; therefore, we were not able to assess the impact of the modules on student performance and learning. The use of the modules in this class did not lend itself to this sort of evaluation. Specifically, the students were asked to use the modules as an optional learning technique. Consequently, some students used them while others did not. Furthermore, we produced 17 modules for the course, or one module for each class assignment. Some students used every module while others referred only to selected modules when they were experiencing difficulty. Therefore, we were unable to collect and assess complete data on student use of the modules and the students' academic performance associated with their use.

The modules covered topics ranging from spreadsheet applications to basic tasks in Microsoft® FrontPage. Table 1 identifies the applications and provides short summaries of each module. (The modules are available on CD to readers of the article by contacting the authors). Most of these applications were applied to agribusiness or agricultural economics problems. These modules demonstrated the usefulness of specific techniques for generating information of value for a decision maker in an agribusiness or agricultural economics setting.

However, the modules with a more general orientation have many potential uses. Similar modules have also been used extensively in two distance education courses in the Master of Agribusiness program at Kansas State University. The instructor used modules in a computer decision tools course to instruct students on using spreadsheets and in an optimization techniques course to instruct students in programming linear, integer, and nonlinear problems. The vast majority of the graduate agribusiness program is taught by distance methods, so the modular materials are ideal for use in this instructional setting. Modules have also been supplied to farm managers enrolled in the Management, Analysis, and Strategic Thinking (MAST) extension program and to faculty in the Department of Agricultural Economics and other departments in the College of Agriculture.

Five faculty members at Kansas State University have used the modules to teach applications within their classes; other faculty members have developed their own modules using techniques similar to ours. One faculty member built modules that covered applications of Microsoft® Solver for use in an intermediate microeconomics course. In his modules, he used his own voice for narration because he felt that students would respond more favorably to his voice and would appreciate the fact that he had tailored the module very specifically to the course. Another faculty member used previously developed modules on regression in an agricultural marketing course.

Table 1. Module Summary

Module Title	Purpose
One-Way Table	Substitutes many different values for one input into a formula in order to compare the different results each value produces
Two-Way Table	Substitutes a combination of values for two different inputs into a formula in order to compare the different results each combination produces
Cell Addresses	Changes the results of a formula depending on whether the reference is relative or absolute
Charts	Provides visual representations of data in order to aid in understanding
Database Operations	Summarizes records and data into useful form, often from extremely large data sources
Operation Order	Allows formulas in spreadsheets to be calculated in a uniform manner based on the mathematical functions used
Pivot Table	Groups, summarizes, and rearranges data
Printing Spreadsheets	Provides a visually pleasing format on paper
Professional-Looking Spreadsheets	Provides information in a visually pleasing and easy-to-read format
Scenario Manager	Generates information of value in decision making by automatically substituting a combination of values for several data items and reports results for each scenario
Spreadsheet Integrity	Provides more information from spreadsheets by enabling spreadsheet results to change as inputs change
Introducing Regression	Generates information of value in decision making by summarizing data and illustrating relationships using an equation
Solver	Generates information of value in decision making by substituting values into an equation to find the maximum, minimum, or a target result
FrontPage Introduction	Allows the creation of web pages in a NWYSIWYG (near what you see is what you get) environment
FrontPage Basic Tasks	Demonstrates the fundamental tasks in using FrontPage
FrontPage Pictures and Backgrounds	Makes the website easier to look at and more user friendly
FrontPage Site Design Guidelines	Explains underlying principles in creating websites that attract and keep visitors

Still another faculty member used modules providing instruction on Microsoft® FrontPage to supplement materials in a logistics class. The modules were also used in a graduate-level econometrics course to instruct students in the basics of using SAS® and GAMS®.

Faculty members who used the modules provided the authors with written comments on the applications and the limitations of the teaching tools. Godfrey's (2002) comments summarize the observations of the faculty. The faculty members thought that the modules were not an effective substitute for an instructor who initially explains and demonstrates the principles illustrated in the modules. Instead, the modules provided an excellent method for repeatedly explaining and demonstrating concepts and principles. Their greatest impact, however, occurred when they were used to imitate the principles of computer applications. In providing the opportunity for students to see the same techniques repeated several times, the modules conserve valuable classroom time and circumvent the difficult problem of maintaining student interest during repetition intended for a limited number of students. The modules allow students to review the material in a nonthreatening environment until they feel comfortable doing the task (Godfrey 2002).

Conclusions

As Spanier (1998) notes, it is important for the academic community to integrate computer applications into the curriculum where they are most relevant. Integrating computer applications into course content allows students to better understand the technology and increases their ability to apply what they learn to real-world situations. Furthermore, industry desires graduates who demonstrate better integration of their technical and business skills.

Just as technology is changing rapidly, so are students. The background of agricultural economics students is increasingly diverse. Differing computer experience among students adds to the complexity of teaching classes where different ability levels exist. Students who have extensive computer experience learn alongside those who have extremely limited experience. Rapid technological changes require instructors in fields such as agricultural economics to adapt to new technologies and develop new teaching techniques.

Instructional modules can provide a key solution to these challenges. They can help train students in various computer applications and facilitate the integration of computer technology into the curriculum where repetition is an important element of learning. Integrating both general and specialized modules into the agribusiness curriculum has met with some success.

The development of modules is quite easy and the potential number of applications is enormous. The greatest benefit of incorporating computer applications techniques throughout the curriculum is that students will become more capable in using computer technology to generate information valuable in decision making. These skills will prove extremely beneficial to students and the agribusinesses that employ them.

Literature Cited

Bekkum, V.A. and W.W. Miller. 1994. Computer proficiency for undergraduate students in agriculture. NACTA Jour. 38(2):43-46.

Brown, D.G. 2001. Screen-capture: The underutilized teaching tool. Syllabus 14(10):29.

Dahlgran, R.A. 2003. Internet usage in agricultural economics instruction. NACTA Jour. 47(1):8-12.

Farris, P.L. 1992. Issues in undergraduate agricultural economics education: Comments. In Proc. of the American Agric. Economics Association Teaching Workshop 7-9 Aug. 152-153.

Godfrey, E.B. 2002. Personal correspondence on the evaluation of modules for use in an agribusiness curriculum.

Kappes, S.M. and S.J. Schmidt. 2002. Effectiveness of using QuickTime movies in an introductory food science and human nutrition course as affected by learning styles. NACTA Jour. 46(1):68-78.

Lucas, R. 1998. An ecology of distance learning. Syllabus 11(10):14-16, 22.

Pompelli, G. and T. Hobbs. 2002. Student responses to the initial use of a computer-based tutorial in an introductory agricultural economics course. NACTA Jour. 39(1):33-36.

Schurle, B. 1992. Meeting the challenges of teaching computer applications courses. In Proc. of the American Agric. Economics Association Teaching Workshop 7-9 Aug. 113-116.

Schurle, B. and Cromer. 1995. Technological advances in agricultural economics curricula. Jour. of Agric. and Applied Economics, 27(1):86-94.

Spanier, G. 1998. Industry, government, and higher education leaders address critical shortages in information technology professions. NASULGC Newsline 7(2):4.

Weldon, R.N., B. Covington, B.F. Long, L.J. Connor. 1999. Who will our students be? A futuristic view. Rev. of Agric. Economics. 21(2):527-541.