Using Computer Technology to Enhance Agricultural Economics Teaching

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Abstract

Computers are becoming an affordable and effective tool for assisting with classroom instruction. This paper describes experiences utilizing a hypermedia presentation system for a farm management course. Some advantages as well as drawbacks and issues associated with using microcomputer-controlled hypermedia in the classroom are presented. Hopefully, readers will find some assistance in planning the design and implementation of such techniques for their own classes.

Keywords: hypertext, microcomputers, multimedia, teaching

Microcomputer use has become an increasingly important aspect of the undergraduate agricultural economics curriculum. In contrast to instructing undergraduates in the use and application of the technology, microcomputers can also be used to facilitate and enhance the presentation of the subject matter as well. The availability of affordable personal computers capable of displaying multiple forms of digitized media (text, graphics, animation, photographs, sound, and full-motion video) makes it possible to use this technology to present a greater variety of information to students in the classroom and laboratory (Bergland). The greatest potential for computers in education will be unleashed when they are used to enhance learning on topics unrelated to computer programming (Ambron, Jensen et al.). Recent developments in computer projection display technologies, and the availability of user-friendly authoring software make it possible for the non-programmers to create sophisticated, interactive multimedia lecture aids and laboratory applications (Ambron, Bergland, Berk and Devlin). This technology allows flexibility in curriculum presentation, assists with curriculum organization and structure, allows multiple representations of learning concepts, and can facilitate stimulating and creative presentations of information and discussion.

The 'Hype' in Hypermedia

Crucial to the successful use of computers for developing learning applications is an understanding by the teach of how to use hypertext in the creation of computer-controlled hyperdocuments. Hypertext is the creation of specific blocks of information (usually one computer screen) that are linked, cross-referenced, and accessible in different ways by the reader. Hypermedia is the linking of multiple media sources (e.g. text, graphics, pictures, sound, video) to create interactive tools for presentation and even self-guided tutorials and exercises. These 'hyperdocuments' are the key to accessing and teaching the rapidly increasing volumes of information and ideas that can now be stored in digital forms.

The use of computer-enhanced teaching and learning has been implemented in Agricultural Economics 260, Principles of Farm Management since the fall of 1992. Planning and curriculum development for courses was initiated in the spring of 1991 using a computerized classroom display system as the primary lecture aid. This system consists of a single microcomputer attached to a projection system that displays the computer output

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on a large screen at the front of the classroom that can be viewed by the students.

History

I first experimented with using videotaped presentations to provide instruction when I could not be in the classroom for several weeks. The extension office had a series of videos and text from the *Business Management in Agriculture* series that seemed appropriate to an introductory farm management class. Class evaluations of the videos were conducted and the response was less than favorable. I am reminded of the anecdotal evidence that viewers rate a videotape with two professional actors highest, then a tape of a professional actor and an agricultural economist, and the lowest ratings correspond to two agricultural economists. It would appear that viewer satisfaction is negatively correlated with the number of agricultural economists. The ultimate conclusion from this experience is that "talking heads" are not a satisfactory teaching tool.

My classroom presentation uses microcomputers running Microsoft Windows™. All students in the College of Agriculture take an introductory course on personal computers and are reasonably familiar with this interface. Asymetrix Toolbook™ authoring software was used to create most of the hypermedia material for classroom lecture support. Inclusion of diagrams, graphs, illustrations, photographs, and animations is relatively easy. However, skills in drawing, data presentation, interface design (typefaces, layout, use of color), photography, audio, and learning to write "hyper-linked" documents are also required to some degree. Recently introduced software provides assistance in many of these areas, but considerable training time will be required for someone new to using computers for developing presentations.

Advantages

From the student and instructor perspective, a hyperdocument offers many advantages over traditional teaching techniques as well as problems (DeFelice and Monson). The ability to show concepts in more ways opens new avenues for teaching. This technology allows flexibility in curriculum design, assists with curriculum organization and structure, allows multiple representations of learning concepts, and can facilitate stimulating and creative presentations of information and discussion. Computer-controlled multimedia usually allows depiction of the concepts, processes, and data in more realistic ways than do traditional chalkboard or overhead transparency presentation.

Graphics more stimulating

Presentation of graphics provides an additional emphasis to the material under discussion. The use of graphics becomes particularly important as fewer students have a traditional agricultural background. A picture of a field, crop, animal, or farm implement helps the students understand and focus on the topic. Such pictures can be found in farm magazines and quickly scanned for ready access.

As an example, a still image inside a milking parlor is used to develop the concept of an enterprise budget and its components. Pointing at items such as the building, equipment, machinery, and livestock investment let the students categorize fixed cost components. The feed, a worker (for labor), a light (for utilities) help to identify variable costs. While the milk is readily observed as income, pointing at the door illustrates the additional income from the sale of dairy calves, and cull heifers and cows.

Forces more organization and creativity

One advantage of using a hyperdocument in classroom presentations is that the instructor must be prepared beforehand. By using this technology, I became much more aware of what I intended to accomplish in the classroom because I needed to develop the presentation to support that objective. I must confess that much of the organization was serendipitous. The links across topics became apparent after the fact, and were now easy to incorporate in the presentation.

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linked" documents are also required to some degree. Recently introduced software provides assistance in may of these areas, but considerable training time will be required for someone new to using computers for developing presentations.

Can encourage interaction

A computer-assisted presentation is especially useful in stimulating the "what if?" questions from the students. A computation or graph is instantly evaluated depending upon student input. The presentation is customized in response to a student's suggestion.

The hyperdocument also encourages interaction in a more subtle way. The instructor is no longer committed to a presentation in a particular order or sequence. Topics can be readily accessed for review, further discussion, or related to other topics. The increased ability to respond to questions will encourage the instructor's interactivity as well.

Given the time and effort involved in developing a computer-assisted presentation, and the speed at which material can be presented, a natural tendency may be to present too much material during the class period. Providing access to the presentations and a corresponding set of notes or text frees the student to focus on and participate in discussion. I provide the guideline that if I felt a topic or point was important enough to put on the screen, it is important that the students understand. The ultimate sign of classroom interaction is when the screen blanker comes on, even with a five minute delay.

Easy to update and change

Many of the points that apply to encouraging interaction are also relevant to the ease of updating and modifying a presentation. Perhaps the key point to be made in this section is that a hyperdocument is never finished. New material is always available, and refinements of existing sections are always needed. The class lecture should not be considered "in the can". Even without significant changes, with all the interaction and potential links in a hyperdocument, it is unlikely that an instructor will present the same material in the same manner from semester to semester.

Fun

If the instructor doesn't enjoy working with a computer and software, then a computer-assisted presentation technique is not likely to be successful. However, developing a hyperdocument for classroom presentation can be viewed as a challenging and rewarding experience. If the instructor is enthusiastic about the presentation, it is not surprising that the students can also be motivated and enthusiastic about the presentation as well. Just using multimedia as an attention-getter has a purpose in keeping the students' attention.

Don't be afraid to experiment. Some techniques don't work. One of my biggest failures involved using the computer to randomly select students for a question over the assigned material for the day. The cost of a wrong answer did not affect the student's grade, but did subject the student to embarrassment in front of the entire class. Student response was extremely negative. The computer became an instrument of torture and fear, not fun.

Other considerations

Integrating computer resources in research and extension with computer-assisted teaching is quite easy. Research data, spreadsheet models, graphics, text and software skills from other projects are easily incorporated into class materials. The computer is a marvelous tool for storing, retrieving, creating, and transmitting information. Larger volumes of information must be organized and accessed than in the past, with less office and technical assistance. The computer is the best way to synthesize and transmit this information into the classroom.

Student access to presentations

By definition, a hyperdocument draws information from a variety of sources. A textbook alone can not contain the interactive tools, images, and sounds presented in class. It is essential that students have access to the relevant portions of each class presentation in order to learn the material and study for exams. In choosing an authoring software package, the ability to produce and distribute run-time versions will permit student access. The instructor does not have to worry about multiple

software licenses. The students can utilize the interactive aspects of the presentation, provide their own examples, and verify understanding of the concepts.

A network assists in providing student access. The task is made easier by avoiding problems with handling and copying files to diskette. Ideally, homework and exercises can be submitted, graded, and returned electronically. This reduces the volume of paperwork.

Consistency in techniques

A natural tendency in using authoring software is to utilize as many special effects, transitions, and other "bells and whistles" as possible. This is a sure way to spot a novice hyperdocument author. Experienced multimedia authors will develop a feel for what works well. If the students do have access to the presentations, then they can quickly learn how to use the material provided that symbols, buttons, and data fields are easily recognized. I use colored data entry fields to alert students to numbers that they can change in contrast to numbers that are the result of calculations or a formula. By observing the presentation in the classroom, they quickly learn how to turn the page, bring up a definition, or display a video clip.

Anticipate questions, interaction

Anticipation of questions and topics where students need interactive reinforcement is difficult without some prior experience in teaching the material. Many traditional homework problems and exercises can be readily modified and incorporated into the presentation. Experience indicates that students quickly realize that their input will shape the nature of the presentation if they can provide input. And they are much less hesitant to ask questions if the instructor is obviously prepared to deal with them.

Can't compete with entertainment

The production techniques and values in the entertainment industry are extremely difficult for a classroom instructor to match. Don't be disappointed if your own animations or video fail to produce much reaction. Perhaps the hardest aspect

of multimedia is to not use it where it is not needed. Too much video, animation, or graphics will overwhelm the students. Ultimately, both the instructor and students are distracted from learning objectives. My experience indicates that fifteen seconds of video is enough in a fifty minute lecture. Like any tool of technology, multimedia computing can be as easily abused as used.

Effectiveness

The ultimate question regarding computer-assisted classroom presentations is the effectiveness of the technique. The technology and instructor time needed to provide computer-assisted presentations in the classroom are not cheap. Yet, objective measures of teaching effectiveness are extremely difficult to construct. Few have the number of students or the time to establish control groups and compare traditional versus computer-assisted teaching techniques. There are some personal observations that I would share regarding teaching effectiveness.

Rating and teaching evaluations

The flippant response is that by showing a cartoon, an instructor's ratings have to go up. In a more practical sense, I argue that an enthusiastic instructor has to be more effective. The above points regarding interaction with students, fun, creativity, flexibility, and organization should all contribute to a more effective instructor.

Self-directed learning reinforces class material

The simple act of pointing at an object or word to bring up an explanation or definition or entering a number in order to compute an answer is an amazingly powerful learning tool. Students "discover" something by their own actions. In addition to progressing at their own speed, interactive programs give the students' a sense of control in the learning process.

More advanced topics

One of the difficulties in measuring effectiveness is that a computer in the classroom permits a different presentation than without the technology. More advanced topics and difficult

concepts can be covered. In my case, a traditional whole-farm plan and analysis can be completed in one or two lecture periods rather than requiring the entire semester to formulate and develop. Cash flow planning, depreciation, present value, and investment analysis are more readily addressed when computations are instantaneous. The constraints imposed to simplify a problem for presentation are relaxed. Students have access to more sophisticated tools that can be used in the classroom to address the problems.

Can save time

A hyperdocument can, after initial development efforts, save time in several ways. Linkages to previously covered material used earlier in the course provide easy access and can be readily incorporated into the current topic. Changes in material do not require reproducing new overheads or copying handouts.

Provides immediate or quick feedback

A near-instantaneous response to student questions has already been discussed with respect to the advantages of a computer-based presentation for interaction. Another contribution that this technique can provide is by providing immediate feedback on an individual basis for quizzes and exams. Quizzes and exercises can be readily developed into an auto-tutorial framework. Student response can be monitored and linked back to the appropriate portion of the presentation, either confirming or correcting student input. An added advantage of such an approach is the time savings in grading and recording scores.

Emphasis on concepts over programming

Many of the calculations required of my students could be readily completed using a spreadsheet template. However, the typical spreadsheet tends to distract the students as they see formulae and cell references in addition to numbers. This also requires a sufficient number of copies of the spreadsheet available, and sometimes developing templates for each spreadsheet software package. Instead, I have developed exercises with the authoring software that can be freely distributed, just like the presentation.. Students need recognize

only that one color indicates data they can input, and the other is the result of underlying calculations. A good authoring package can also check the relevance or validity of data supplied by the students. This encourages students to explore the impact of changes in key variables, such as the interest rate in land valuation and the cost of equipment in machinery selection.

Administration concerns

Administrative support is crucial to the success of adopting computer-based presentations in the classroom. If an instructor plans to develop a course using this technology, be sure that the administration is aware of and committed to the project. If the project is successful, you will find that administration is too supportive, in that the requests for presentations to special groups may be more numerous than you care to meet.

Cost

The cost of equipment, including an active matrix LCD display, high output overhead, and fast multimedia computer continues to decline. Software packages are available at various prices. The simple screen show presentation packages are probably the easiest way to get started. Authoring software that enables interactivity can be substantial more. An adequate setup can probably be purchased for under $10,000 today. In addition, be prepared for continued updates of equipment and software. Probably the least-used but most effective money should be spent on training and support personnel. Undergraduates can quickly learn to digitize images and video. The instructor can focus on course content, while someone else worries about hardware configurations and compatibility.

Physical and "virtual" structure in classrooms

Most classrooms were not designed for multimedia presentations. Lighting, equipment security, and classroom scheduling are potential problems. Hardware and software standards are very controversial. Several hardware and operating system standards may need to be supported. Class size considerations and political boundaries in classroom ownership complicate classroom scheduling. The diversity of available software is

also extensive and some courses will be best served by relatively unique software. Copyright consideration will need to be enforced on the loading of software onto classroom computers. Coordination is needed among the instructors who share a classroom computer to ensure software and hardware configurations are compatible.

Faculty time

It is impossible to overestimate the startup time required to develop multimedia course materials. Time required was three to four times higher than that spent on normal course curriculum development using traditional hand written or word processed lecture notes. However, the instructors had to evaluate and purchase hardware and software, and install and maintain the equipment. Also, time was required to learn how to use the software and write 'hypertext' documents. Presumably, most faculty will only need to learn how to use the development software and become familiar with the hardware components required for multimedia that are already installed.

Faculty have the support and encouragement of their administration to adopt computer technology in the classroom. Faculty need the assurances that resources will be available for use in a classroom and that they will be rewarded for the time, enthusiasm, and commitment to teaching required for this work. Support programs for faculty training, shore sabbaticals, etc. in this new area of hypertext development and multimedia would increase the acceptance and adoption of computers for teaching.

For all intents, a multimedia hyperdocument for classroom presentation is like authoring a textbook. Unfortunately, most publishers are not prepared to switch from hardcover to compact disc. This makes the development of such a course difficult to evaluate when compared to more traditional measures. The same forethought involved in committing to authoring a textbook should be made when considering developing a multimedia course.

Conclusions

The teacher is still the most important 'medium' in a multi-media classroom. Microcomputer technology should be used to enhance, not replace the instructor. The computer as a multimedia integrator is required to assemble and present the rapidly growing quantity and diversity of information that needs to be accessible in the classroom. As students are provided with access to the information superhighway, such techniques help the instructor serve as a highway patrolman rather than roadkill.

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