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## Introduction

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 University curriculum. He states:

> "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,** and by partnering with industry to understand quickly and clearly marketplace needs, provide practical experiences for students, and gain access to the latest breaking technologies for the academic community." (NASULGC NEWSLINE)

Greater integration of information science and technology studies and discipline-based programs is the key idea in this testimony and captures the essence of this paper. The goal of this project is to facilitate the development of computer applications throughout the curriculum in agricultural economics. This goal was pursued by the development of modules that promote the integration of computer applications into the curriculum. It is not easy to integrate across disciplinary lines and there are substantial challenges in keeping up with the rapidly changing information technology

skills that are valuable in agribusiness. However, the benefits to students and their employers upon graduation are enormous.

Technology leverages abilities. That is, economic and business abilities are magnified by technology, particularly the use of computers for problem solving, data analysis, and communication. Professionals can do more than they realize, and can be more efficient and productive with the use of technology if they are taught its power and potential. Current spreadsheets now have the capability to solve quickly and efficiently many types of problems that were taught in computer science and operations research programs many years ago. The problem for years was that students who knew about these techniques were not able to use them unless they ended up working in companies with large research departments and mainframe computers or in research universities. Those capabilities are now available to anyone with a reasonably recent spreadsheet and personal computer.

Computer application courses often cover a variety of topics. The focus of each topic is the use of an application to simplify what was done before by hand or to make possible what was not before. Typically, most subjects related to computer use are covered in these application courses. The end result is an eclectic assortment of topics that prevent the course from flowing coherently. A possible solution is to teach the computer applications where they are most relevant within the curriculum. That is, teach each topic covered in the traditional computer applications classes within the course to which that particular topic relates. For example, spreadsheet methods used to find present value would be taught in a finance course. In the same way, techniques to graph moving averages and interpret their changes would be included in an agricultural

marketing course. This approach to computer applications would allow students to better understand the subject matter and the problem-solving abilities of the applications.

The ultimate goal is to help students learn, but integration does not come without challenges. Schurle (1992) expanded on impediments to teaching courses involving computer applications. As student backgrounds become more diverse, computer applications are more difficult to teach. For the students who have extensive training in the area (computers in general, or the specific application), coverage of the application may be too elementary to hold their attention. On the contrary, if students have had very little background training, the application may be beyond their grasp and more frustration than learning results. Also, integration of computer applications into the curriculum would require more time in course preparation. Besides the developing and organizing the new material, homework assignments must be thoroughly thought out. The volume of student questions also increases, as do student visits to offices. Along with preparation of the course comes the need to continually update material based on technological innovations. This requires faculty to adjust assignments and to renew computer skills. Due to these limitations, integration of computer applications into courses has been and will continue to be slow in coming.

The agribusiness industry desires the integration of technical and business skills. Schneider and Litzenberg (1989) surveyed over 500 agribusiness managers regarding skills of current and future agribusiness managers. The respondents were asked to rank the importance of certain items on a 1 to 5 scale (1 equaled not important and 5 equaled important). Both information technology and the integration of technical and business

skills ranked 3.3 or higher on the scale. These concepts are facilitated through the work that will be discussed in this paper.

As industry identified skills needed by managers, it is important that educational institutions respond in an appropriate manner. Erven (1992) categorized curriculum as one of six major issues in undergraduate agricultural economics education. Some of the decisions included in the heading of "curriculum" are small business versus large business management, the inclusion or exclusion of the most recent data processing, electronic communication, and management information system courses. Along with curriculum, he argued that undergraduate paradigms, faculty ability and interest, demand for agricultural economics majors, demand for agricultural economics courses by non-majors, and support resources for teaching were also major issues. Erven asserted that these issues should be addressed as the profession develops strategic plans in education. In addition, he dismissed 10 minor issues in the development of strategic plans. Curriculum is paramount in this paper which discusses instructional modules developed to aid in the integration of computer applications into traditional agricultural economics courses.

While continual development of curriculum is essential, the current foundation of agricultural economics' programs is desirable. Farris (1992) identified agricultural economics' applied, problem-solving emphasis as a unique characteristic of the discipline that has proved advantageous to graduates. However, he also stated that modernizing courses with this type of orientation will be a major challenge. Certainly, incorporating computer skills into this applied, problem-solving discipline should be of primary importance to facilitate modernization. The modules discussed in this paper offer a

relatively simple approach to teach computer skills where they are most relevant in the curriculum.

One option in modernizing these courses is the use of technology as a teaching tool. While many times new technologies are used for the purpose of experimenting with the most recent fad, Schurle and Cromer (1995) caution that technologies should be used for instruction only if they will enhance and expand current capabilities. They also stress that the ultimate objective of education is "to produce active problem solvers and lifelong learners" and this should be kept in mind as a curriculum is being developed.

As curriculum is changing, so are students. Weldon et al. (1999) cites the increasing diversity among student backgrounds as a factor to consider in program planning. Increasing diversity exacerbates the problem of integrating computer skills throughout the curriculum. The approach presented helps to lessen this problem. Modules enable students to learn any basic techniques required before certain skills are taught in the classroom. This helps to level the playing field for students and teachers alike.

The evolving nature of both the agribusiness industry and the information age necessitates programs that are quick to embrace the new approaches made possible by technological advances. Lucas (1998) 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."

One type of new technology enables a "movie" to be produced on a personal computer. This technology captures any movement on the computer screen while

recording an audio narration. Brown (2001) discusses some of the teaching possibilities that lie untapped in this screen-capture technology. He notes that the programs are inexpensive and easy to learn. They also offer students the ability to watch the instructions/application numerous times to enhance understanding/learning. This type of technology was used in this project.

**Background**

For years a major void existed in the textbooks and materials used to teach computer applications. Many books and aids were available for learning the most basic spreadsheet operations. This type of material is illustrated by the "Dummies" series of books and videos produced for training purposes, which illustrate very basic spreadsheet operations. More advanced books did an excellent job of illustrating more advanced spreadsheet operations. What was largely lacking was emphasis on the information of value to decision-making and the ways these techniques can be used effectively and efficiently for agribusiness and agricultural economic applications. Many operations research books also are available that stress the mathematical properties of problems and the math involved in the algorithms used to solve problems of interest. Also lacking were books covering the large middle ground emphasizing efficient use of spreadsheets to generate information of value for decision-making purposes. Some books are attempting to fill this void. One by Ragsdale titled Spreadsheet Modeling and Decision Analysis, A Practical Introduction to Management Science, third edition, and others of a similar nature are helping to fill in the niche for applications of an operations research nature.

However, there are still many applications that are not covered and the generation of information for decision making is not emphasized to the extent that would be valuable.

Two years ago computer applications in agribusiness at Kansas State University were taught in two courses, an orientation course and a sophomore/junior level computer applications course. For reasons discussed previously, it would be preferable to teach applications throughout the curriculum where the applications are most relevant. Because integration of computer use throughout the curriculum proved to be slower than originally anticipated, a grant was obtained to facilitate this process. One of the objectives of the Higher Education Challenge Grant was to develop computer application materials relevant for many courses throughout the agribusiness and agricultural economics programs. Modules have been developed to help students master the techniques. The modules have both audio and video components that play like a movie on the computer monitor. They are accessed from the local network in the department computer lab and from CDs that students buy for their own computers. Use of a web site to distribute the modules is also being evaluated. At some point in the near future, these modules will be made available for instructors at other institutions.

**Module Development Methods**

The first step in producing the modules was deciding upon the topics to be covered. After determining what material the current module will cover, the author starts the recording program. The modules were recorded in a program that keeps track of both movements on the computer screen and (audio) narration. The particular program used was HyperCam. It allows the user to select the area of the desired screen capture. It also

has a "start paused" button (see Figure 1) that enables the producer to arrange the computer screen in the desired manner before the program will record it. HyperCam's "hotkeys" enable the user to start, pause, and stop recording by pressing a specific key (see Figure 2). These keys proved indispensable as the program recorded every movement and sound unless it was paused. When the computer and the producer were ready to begin the lesson, the "pause" key was pressed to end the pause and actually begin recording. The producer then began speaking and demonstrating the application on the computer. If it was necessary to change the screen dramatically (i.e. start a different program), Hypercam was paused, the screen was set up, Hypercam was unpaused, and the lesson continued. When the application was completed, the "end record" button was pushed, and the file was created.

The program generates an AVI (Audio-Video Interleaved) movie file. In the creation process, the file is compressed (pixels are taken out of the pictures). This reduces the visual clarity of the file, but helps to keep it at a manageable size. The average size of a fifteen-minute file is 65,000KB. Different HyperCam settings allow a smaller file of the same length to be produced, but the result is reduced audio or video quality. HyperCam allows the user to define the exact screen area captured in the movie along with various screen settings. For these modules, a frame compression quality of 75% was used with a recording and playback rate of 2 frames per second (see Figure 3). After the modules were recorded, they can be stored on a server or burned onto a CD for distribution to students.

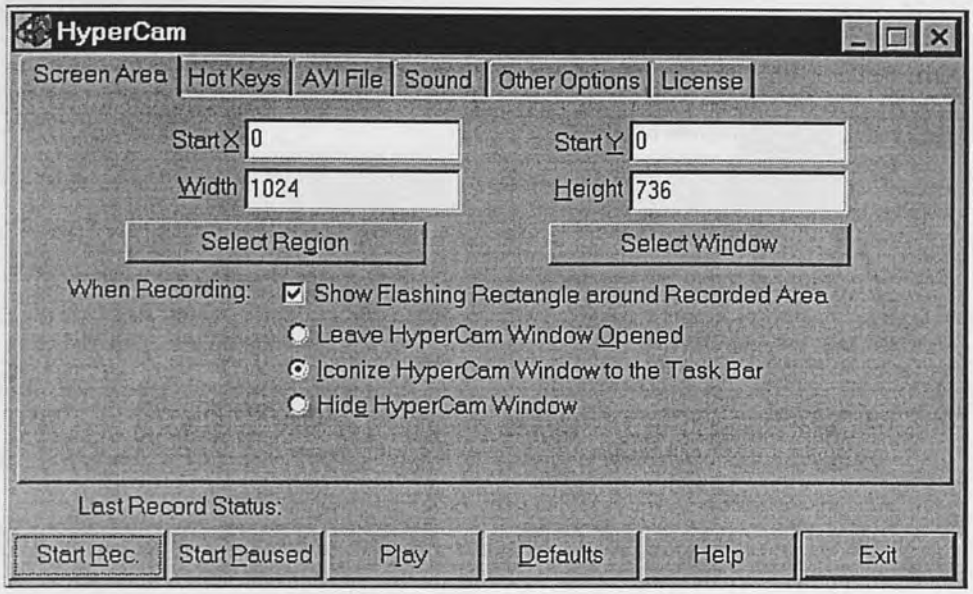


Figure 1

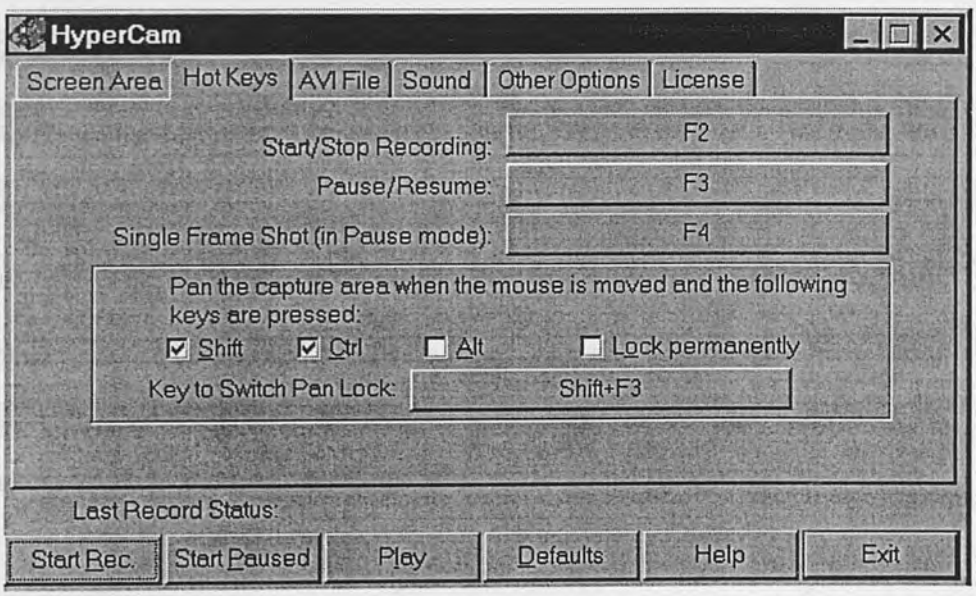


Figure 2

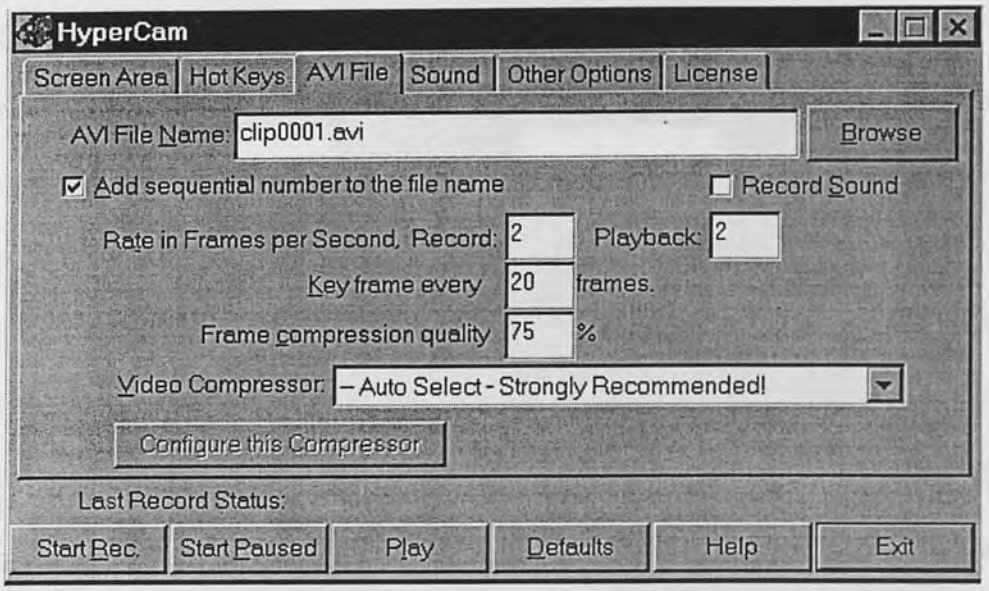


Figure 3

To aid in the process of distribution, the creators originally intended to make the modules available on a website. While HyperCam worked well in recording and playing back information, the files it created were too large to download in a reasonable amount of time. Therefore, streaming technology was investigated to make the modules more suitable for the web. Streaming transfers data in a way that enables it to be processed as a steady and 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 abilities. Different types of streaming servers are available. They include Windows Media, QuickTime, and Real servers. The particular server where the modules were stored was a Windows Media server. One requirement for streaming from this type of server is that the modules be ASF (Advanced Streaming Format) files. In order to change the files from AVI to ASF,

they were compressed again using MediaCleaner Pro. This reduces quality again with many variables for file size and modem speed. Different programs can be used to change files to an ASF format depending upon the server from which the file will be streamed. After the files were in ASF format, they were placed on the server. An ASX file is also necessary to tell the computer to stream rather than just download the file. This type of file points the computer to the correct address to find the specified ASF file. Streaming options and possibilities for making modules available will continue to evolve as technology and software enhancements are developed.

Other options to make the modules available were also explored. One of these was to distribute the CDs containing the modules in AVI format. This would eliminate concerns about connection speed on the Internet for streaming and downloading. While this is a viable option, one must order the CD-ROM and wait for shipping in order to view the modules. A presence on the Internet is also conducive to greater visibility. Another distribution alternative is simply offering a downloadable form of the modules on the website (with no option to stream). As mentioned earlier, this was the authors' original intent, but due to the large file size, downloading would be extremely time-consuming. This method is also subject to "hiccups" in the video or audio if the viewer's computer is older or the connection speed is slow.

Alternative methods of module production also exist. The modules could be recorded at a multimedia facility in a form that would play on a television screen. Then, a scan converter could be used to change the image so it is suitable for a computer screen. This method does not compress the file by a measurable amount, but access to proper recording facilities is needed. Another technique is to produce the modules and put them

onto a CD-ROM with a Terapin machine. In this method, modules would be recorded in a multimedia facility and a scan converter would be used to change the format of the modules into that which is usable by a Terapin machine. The machine would produce a MPEG-4 movie on a CD-ROM. MPEG-4 movies can be played on Windows Media players, which are installed on most PC's. While this may produce a slightly higher quality file, the equipment needed for this technique is much more expensive. In addition to possible cost limitations, the current distribution difficulty would still exist. Both of these methods will be explored further in the future.

**Module Topics**

Topics covered by the modules ranged from various spreadsheet applications to basic tasks in FrontPage. The applications addressed follow:

| **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 | Change the results of a formula depending on whether the reference is relative or absolute |
| Charts | Provide visual representations of data in order to aid in understanding |
| Database Operations | Summarize 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 |

**Experiences with Module Use**

Twenty-two modules were developed during the first year of exploring the use of modules for computer training. These modules were used extensively in the computer applications course in the department. While viewed favorably by students, they were not general enough to be valuable as a reference in teaching certain technologies across many applications. In other words, they were very problem-specific, which limited their applicability to a wide range of courses.

After this experience, 13 additional modules were developed. They were designed to be more general with emphasis on the wide range of uses to which techniques could be applied. These modules have been made available to students in the computer orientation course as well as other courses.

Several faculty members at Kansas State University have used the modules to teach applications within their classes; however, some faculty have developed their own modules using the same techniques. One faculty member built modules that covered applications of solver in an intermediate microeconomics course. He built modules so that his own voice would be in the module because he felt students would respond more favorably to him and 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. Still another faculty member used modules providing instruction on Microsoft FrontPage to supplement materials in a logistics class.

In the previous examples the modules were used in undergraduate coursework, but the same material was also used in graduate courses. In particular, some of the materials have been used as reference materials for students in two courses of the Masters

of Agribusiness program. This program is offered as a distance course at Kansas State University and accepts students who have been in the workforce for two or more years. The vast majority of the program is taught by distance methods, so the materials developed in this form are already easily adapted to a distance program.

In addition to using the modules to teach students, some faculty also want to use the modules to learn the applications themselves. One faculty member, an extension specialist, plans to use the modules to learn spreadsheet techniques that would be useful in his area. A second faculty member also plans to use the modules to enhance his spreadsheet skills.

**Conclusions**

As noted by Spanier, integrating computer applications into curriculum where they are most relevant is important for the academic community. This approach allows for both better understanding of the technology and increased ability to apply what is learned to real-world problems. Furthermore, industry desires graduates to have a greater integration of technical and business skills. Despite these opportunities, technology must be used as a means to an end (student comprehension) rather than an end in itself.

While these concepts are evolving along with technology, students are also changing. Agricultural economics student backgrounds are increasingly diverse. This adds to the complexity of teaching due to large gaps in ability levels among students. That is, students who have much experience with computers are alongside those who have extremely limited experience. This, along with technology's rapidly changing

nature, requires agricultural economics programs to be adaptable to new technologies and techniques in teaching.

For these reasons, modules were developed to help train students in various computer applications. These modules have been used both to increase students' understanding of basic applications and to facilitate the integration of technology into the curriculum. While this material has been advantageous to the agricultural economics department at Kansas State University, it will outlive its usefulness quickly if it cannot be disseminated efficiently to other institutions and departments. Several options to make the modules more widely available are being investigated.

The approach of using "modules" to facilitate the integration of computer applications throughout the agribusiness curriculum has met with some success and some challenges. The use of general modules intended for a broad range of applications has met some success because of the widespread possibilities for their use. Development of specialized modules oriented toward a specific problem in a specific course has also been an approach with merit in some cases.

In either case, development of modules is quite easy and the potential number of applications is enormous. The end benefit of incorporating computer techniques throughout the curriculum is that students will become highly capable in using computer technology to generate information of value for decision-making. These skills will prove extremely beneficial to the students and agribusinesses that employ them.

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