WORKING TOWARDS A MULTIMEDIA LEARNING ENVIRONMENT: EXPERIENCES IN THE CLASSROOM

Dr. Gayle J. Yaverbaum
Associate Professor
Information Systems
Penn State Harrisburg
777 West Harrisburg Pike
Middletown, PA 17057-4898

ABSTRACT: Multi-media is fast becoming a means by which educators can create a learning environment that is both innovative and creative. This paper discusses the impact of graphical materials and animation in a graduate level course in information resource management. A pilot project is described that illustrates an approach to using such media. The impact is studied by means of survey data collected from students attending the class. The results support the growing number of theorists who have presumed that the impact of multi-media on our educational system will be enormous.

KEYWORDS: Multimedia, Information Systems Education, MBA

INTRODUCTION

Since images and pictorial data are known to play a role in creating a learning environment that strengthens the learning process, the introduction of multimedia into education has made it possible to provide one of the most creative and exciting learning conditions ever.

In the simplest form, multimedia indicates a merging of text and graphics (Harney, Keith, Lasvelle, Ryan, and Stark, 1991). The addition of animation and media, such as video and audio, is perceived to be a more applicable definition by many (Rosen, 1992; Harney, et. al. 1991). Hypermedia and hypertext are terms also associated with multimedia. According to Bland and Liebowitz (forthcoming), hypertext is an interactive approach to presentation that permits navigation among topics, while hypermedia extends the concept to include a variety of media. However one describes the technology, it offers opportunities for learning that were heretofore too costly for widespread use.

This paper first lays a foundation for the introduction of multimedia in education. Next is described a pilot project in which text, graphics, and animation techniques are employed in a graduate course in Management of Information Systems (MIS), the objective of which was to receive feedback, at an early stage, from students.

Project development techniques are then discussed, followed by an analysis of data collected from student participants. The data collection, intended only to be an initial yardstick, should not be taken as in depth research. Finally, observations about multimedia are presented.

MULTIMEDIA IN EDUCATION

Experts are reporting that multimedia instruction promotes learning. Evidence found in Barker and Najah (1985), and Barker and Skipper (1986), supports the premise that perceptions of the environment, memory and recall, and efficiency of communication are far better when multimedia is embedded in learning. Straub and Wetherbe (1989) found hypertext/hypermedia applications to be one of the most promising technologies of the time.

Shim (1992) reviews five specific benefits of hypertext hypermedia/ multimedia. These include: 1) increased learning and reduction of learning transfer time by providing learner-controlled instruction; 2) the presentation of nonlinear access to information; 3) the ability to link information, aiding the discovery of new and relevant information; 4) the promotion of a collaborative work environment; and 5) the ability to present the same information in multiple mediums. Shulman (1992) reports that a United States Department of Defense study found multimedia training roughly 40% more effective than traditional training, with a retention rate 30% greater.

Moore (1990) views advanced multimedia presentations as a means to give control to users of the presentation. For instance, one person may only want to gain an overview of a topic, while another may need more in-depth knowledge. Links, i.e. computer programmed connections between concepts, allow user control over the subject matter. Bland and Liebowitz (forthcoming) support the premise that it is beneficial to learn at one's own pace, and to selectively choose what to learn.

It is natural that forward looking organizations have decided to place resources into multi-media development. The Hewlett-Packard Company multimedia learning library supports customer training (Spitz 1991), and the Library of Congress has unveiled a multimillion-dollar demonstration center for multimedia information and educational technologies (Lunin 1992). Since educational institutions, such as Penn State University, recognize the importance of incorporating technology into the classroom, the University has identified resources to aid and support projects such as the one reported below.

> ***...the introduction of multimedia into education has made it possible to provide one of the most creative and exciting learning conditions ever.***

PROJECT BACKGROUND

A common complaint among students is the often dry nature of the introductory survey course in MIS which presents concepts about information systems, and the management and practices that should be utilized to handle the information system's environment. Faculty are perplexed by student apathy, or simply do not like to present the material. They are in a quandary about how to create an atmosphere in which the information environment becomes alive and realistic, while students, especially those with little or no work experience, find it difficult to imagine technology and its implications.

The introduction of graphical material into an MIS course environment was initiated during the Summer of 1992 at Penn State Harrisburg. Support for two lectures was developed using the TOOLBOOK[1] software environment. Other materials are currently being developed; the long term objective is to have a complete set of multimedia lectures and software to support this MIS course for both the classroom and for students to use in a lab.

The approximately 90 MBA students who complete the introductory MIS course each year are required to have computer literacy prior to admittance to the program, and most are currently holding responsible positions at local businesses.

DEVELOPMENT

TOOLBOOK[1], a software development package which runs under Windows[2], supports the design of graphical applications with hypertext links. A multimedia version includes commands to incorporate video and sound within TOOLBOOK-designed applications. Although current applications are being developed with other media, the situation described below is one in which voice and video were not included. There were several reasons for this limited use of media in the first projects created for the MIS course:

1. The equipment for audio and video presentations was not yet installed.
2. Initially, there would not be widespread availability of laser disc, CD ROM, or audio and video boards. Thus, student versions of the software could only contain texts and graphics.
3. The audio and video effects could be added later, and used in the multimedia classroom being built for the purpose.

TOOLBOOK applications revolve around the concepts of books, pages, and objects. Books represent an entire project, while a page is equivalent to one screen, and objects are text, buttons, or pictures on the page.

The Pennsylvania State University has established a faculty support unit, Computer Based Education Laboratory (CBEL) - Teaching and Learning Technologies, to support and empower faculty in the use of interactive technologies in teaching and learning. Software training and support, and consultation services are provided by CBEL staff.

Initial training for the development of MIS course material and later consultation were obtained from CBEL personnel. This assistance was critical because, although TOOLBOOK provides an excellent support environment, the creative use of colors, arrangement of displays, and design of animation presented challenging issues.

Figure 1 on the following page shows the progression of steps involved in the development of the educational materials.

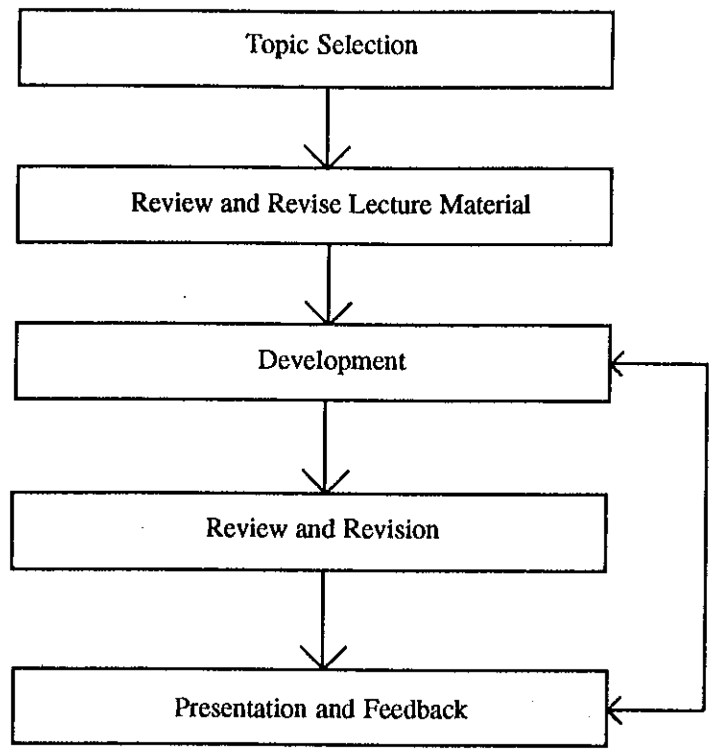
- Topic Selection. The initial topics developed for multimedia were introductions to 1) telecommunications, and 2) expert systems. Both drew upon well-organized notes and, were good candidates for the technology.
- Lecture notes reviewed and categorized. For instance, when presenting the introduction to expert systems, Artificial Intelligence (AI) was introduced. Then expert systems are put forth as one of the subcategories of AI. Some time is spent developing the concept of expert systems and the manner in which they differ from regular programming concepts. Included is a sample "brain-teaser" problem adapted from Turban (1992). The third part of the lecture is an introduction of several expert systems with an explanation of what they accomplish. Finally, an

[1]TOOLBOOK is a registered trademark of Asymetrix Corporation
[2]WINDOWS is a registered trademark of Microsoft Corporation

architecture of the expert system environment is presented.

- Book development within the TOOLBOOK environment. Former overhead materials and class notes were transformed into colorful, easy-to-read text and graphics. Special effects made it possible to link displays in any direction, fade displays, pause, and create animation. Needless to say, this part of the project was the most time-consuming. Later work went somewhat faster because the learning curve was less.
- Review of materials by CBEL staff. This review was one of most beneficial parts of the project. Displays were critiqued for color, text presentation, and design.
- Revision.
- Presentation and student feedback.

Figure 1: DEVELOPMENT STAGES



Prior to the sessions described in this paper, transparencies were used quite extensively to present lecture material. These were effective, but not as forceful as the ensuing TOOLBOOK-produced visual materials. As discussed next, there were limitations and problems imposed by environmental conditions.

Figures 2, 3, and 4 show several pages from the expert systems book. In Figure 2, the first display in the system, topics that can be selected for review or lecture support are shown. The actual screen is produced after a process that creates a fading of the Table of Contents and the appearance of the page. Holding the mouse button down while the mouse is on any of the small, square "buttons" in any one category will result in TOOLBOOK turning to the first page of the category itself. Thus, one is not committed to a specific sequence of notes, nor are students forced to proceed in only one specific manner when reviewing notes.

Figure 3 shows a display that is used to describe an Expert System, CAPER (Alexander, 1988). Note the use of graphics in the screen display. Although the book itself has many more pages, the final example, presented in Figure 4 (see page seven), is one in which interactive learning in the classroom is supported. The aforementioned "brain teaser" exchange problem (Turban, 1992) is shown to the group of students. They are asked to solve the problem by exchanging the places of the contents of the two leftmost squares with the contents of the two rightmost squares. The benefit of the approach is the ability to use the mouse to actually show students what will happen as they propose solutions. The objective of this exercise is to explain the reasoning process captured in a typical expert system. Consequently, students relate to concepts such as "rules of thumb," "process tracing," and so forth.

TESTING

MBA students enrolled in an introductory Management Information Systems (MIS) course at Penn State Harrisburg were used to test the value of the presentation media, with a questionnaire administered immediately after the presentation of each lecture. Two of the lectures presented, utilizing TOOLBOOK produced media, covered the topics of telecommunications and expert systems. Fourteen students attended the telecommunications overview lecture, and 11 were present for the expert systems introduction. IBM Compatible 386SX hardware, TOOLBOOK, and a color data plate were used in the classroom.

Unfortunately, a problem was encountered because the multimedia room, which will be used for future presentations, was under construction and could not be used. Since ideal lighting conditions were not available, the projection environment was much lighter than desired, diminishing effect the clarity of the presentation.

The questionnaire contained six scales, each with five possible rankings. The six attributes measured included: 1) "appropriateness as a learning tool," 2) "makes the material easy to understand relative to the blackboard," 3) "makes the material easy to understand relative to overheads," 4) "clarity of displays," and 5) "perceived retention of material."

Figure 2: INITIAL DISPLAY OF EXPERT SYSTEMS BOOK

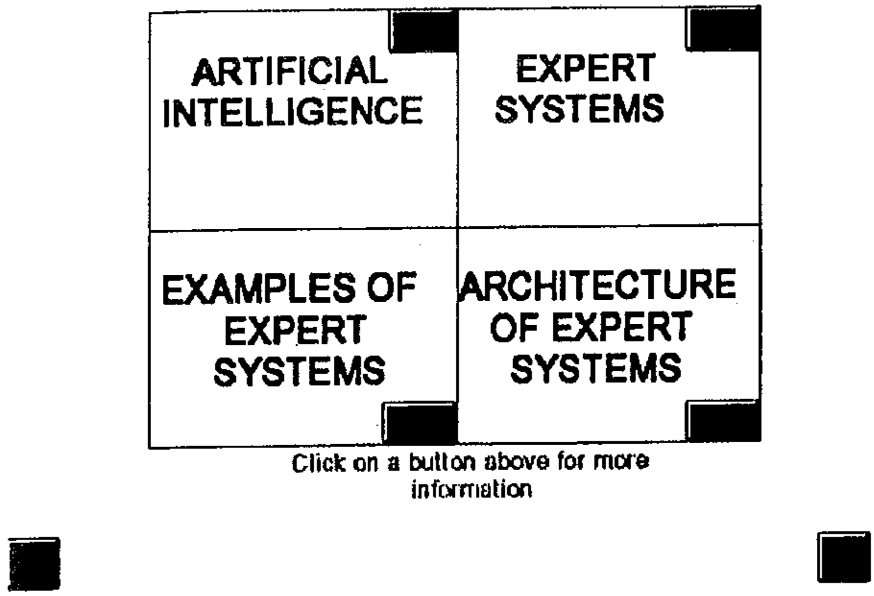
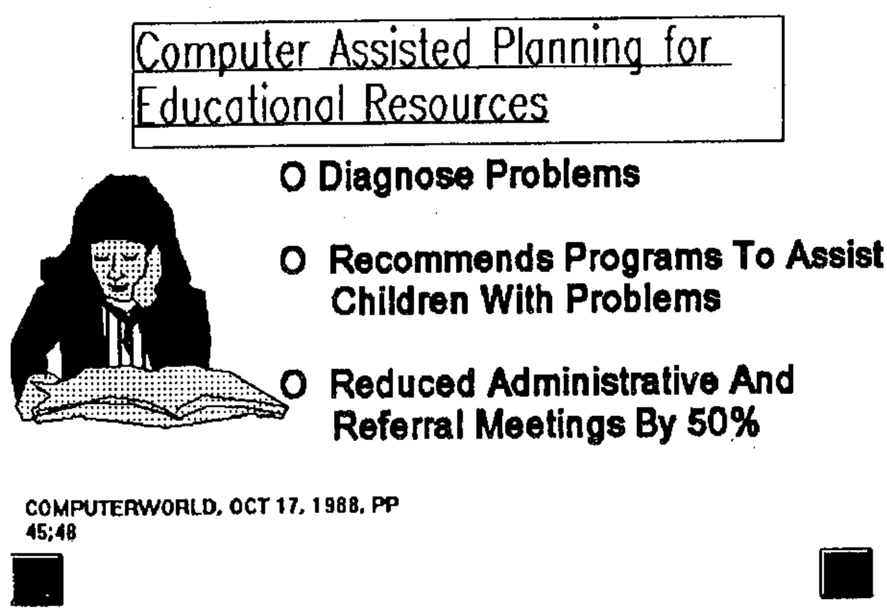


Figure 3: DISPLAY INCORPORATING GRAPHICS



RESULTS

Table 1 (shown on page six) presents the frequencies distributions and percentage of student selecting specific rankings from both lectures. The students believed that the media presentation was appropriate as a tool for learning. Twelve of the fourteen students (82.4%), after the telecommuncations lecture, and eight of the eleven (72.8%), after the expert systems lecture, ranked it very appropriate; i.e. a ranking of either "1" or "2" was selected. Most students preferred the graphical presentations over blackboard-supported presentations. The rankings of "1" and "2" were selected by a clear majority of students, though not as many as the first scale. Fewer students (46.1 % and 45.2%) felt that the material was better than overheads and, indeed, recognized the lack of clarity that was mentioned above.

Increased interest was felt by 53.9% of the students in the telecommunications lecture and 45.5% of the students in the expert systems lecture. This, of course, is difficult to interpret because there is no measure of the base interest in the course material. There were 69.2% and 45.5% of the students respectively who perceived that the support material heightened the retention of information.

DISCUSSION

Students were positive towards the classroom experience and, in only one or two cases were rankings negative. Most students ranked the presentations as being either as desirable as previous presentations or more desirable than previous presentations.

Actual classroom discussion pertaining to multimedia was initiated later in the course. Students openly discussed the limitations imposed by poor lighting conditions, but overall they reported positive feelings. They expressed heightened interest upon realizing that, when references were made to points covered in either of the lectures, they clearly remembered the associated graphic.

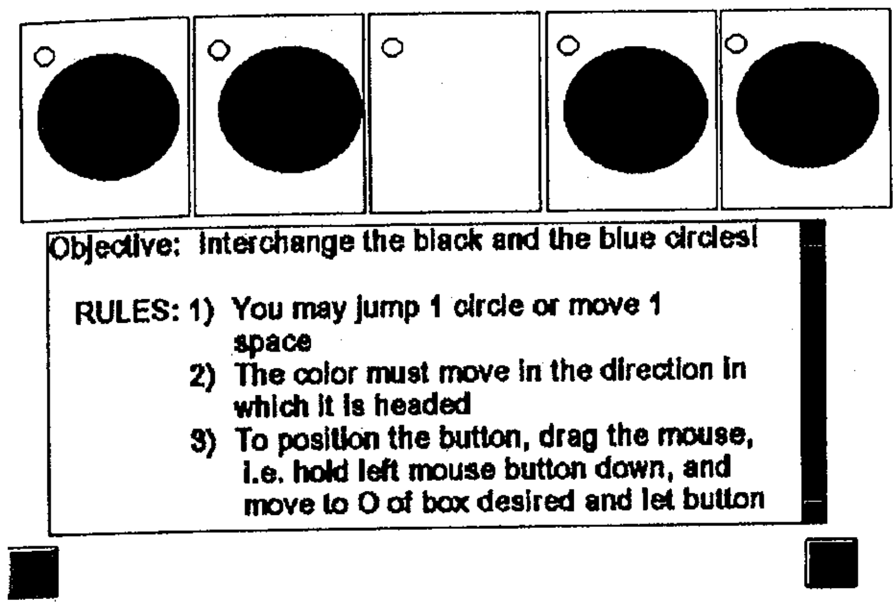
Development is continuing, and plans are underway to adapt multimedia materials to the undergraduate course in MIS and also to a course in expert systems. A multimedia classroom, currently under construction, will improve presentation conditions. Additionally, video and audio are now being included in selected segments. Feedback will be solicited throughout the school year.

Rankings by students have been beneficial as new material is developed, and the books already developed are revised. However, the testing described in this paper is not intended to be rigorous research; merely, it is exploratory in nature, and a yardstick by which we can measure these initial efforts to move forward.

Table 1: RESULTS

	Telecommunications		Expert Systems	
Rank	Frequency	Percent	Frequency	Percent
APPROPRIATENESS AS LEARNING TOOL (1=Very 5=Not Appropriate)				
1	6	46.2	4	36.4
2	6	6.2	44	36.4
3	1	7.7	2	18.2
4	0	0.0	1	9.1
5	0	0.0	0	0.0
RELATIVE TO BLACKBOARD (1=Very Much easier to understand 5=No easier)				
1	3	23.1	-	0.0
2	6	46.2	6	54.5
3	3	23.1	4	36.4
4	0	0.0	0	0.0
5	1	7.7	1	9.1
RELATIVE TO OVERHEADS (1=Very Much easier to understand 5=No easier)				
1	2	15.4	1	9.2
2	4	30.8	4	36.4
3	5	38.5	3	27.3
4	0	0.0	2	18.2
5	2	15.4	1	9.2
CLARITY OF DISPLAYS (1=Very Clear 5=Not particularly clear)				
1	4	30.8	1	9.1
2	2	15.4	4	36.4
3	5	38.5	3	27.3
4	1	7.7	2	18.2
5	1	7.7	1	9.1
INCREASES INTEREST (1=Not at all 5=A lot)				
1	3	23.1	1	9.1
2	2	15.4	1	9.1
3	1	7.7	4	36.4
4	6	46.2	3	27.3
5	1	7.7	2	18.2
INCREASES RETENTION 1=Note at all 5=a lot)				
1	2	15.4	1	9.1
2	1	7.7	1	9.1
3	1	7.7	4	36.4
4	7	53.8	3	27.3
5	2	15.4	2	18.2

Figure 4: DISPLAY SUPPORTING INTERACTIVE LEARNING IN THE CLASSROOM



REFERENCES

1. Alexander, M. "Expert Systems Cut Diagnosis Time," Computerworld, 1988.
2. Barker, P.G. and Skipper, T. "A Practical Introduction to Authoring for Computer Assisted Instruction, Part 7: Graphic Support for CAL," British Journal of Educational Technology, 17:3 (1986), 194-212.
3. Barker, P.G. and Najah, M. "Practical Interfaces to Databases," Journal of Man-Machine Studies, 23 (1985), 4 3-442.
4. Bland, K. and Liebowitz, J. "KARTT: A Multimedia Tool to Help Students Learn Knowledge Acquisition," Journal of End-User Computing, Idea Group Publishing, Winter 1993.
5. Harmon, P. and King, D. Expert Systems, New York: John Wiley and Sons, 1985, adapted in Turban, E., Expert Systems and Applied Artificial Intelligence, Macmillan Publishing Company, 1992.
6. Harney, K., Keith, M., Lavelle, G., Ryan, L., and Stark, D. "The 1750 Video Processor: A Total Multimedia Solution," Communications of the ACM, 34:4 (1991), 65-78.
7. Lunin, Lois "High Tech Information Lab Opens at Library of Congress," Information Today, 9:5 (May 1992), pp. 1, 15-18.
8. Moore, D.J. "Multimedia Presentation Development Using the Audio Visual Connection," IBM Systems Journal, 29:4 (February 1990), pp. 494-508.
9. Rosen, Sheri "Multimedia by Any Other Name," Communication World, 9:3 (February 1992), p. 57.
10. Shim, J.P. "Living Up to the Hype," OR/MS Today, Atlanta: Lionheart Publishing, February 1992.
11. Shulman, R., "Multimedia: A High Tech Solution to the Industry's Training Malaise," Supermarket Business, 47:4 (April 1992), pp. 23-24; 77.
12. Spitz, Carolyn T. "Using CD-ROM to Create Computer-Based Training and Audio," CD-ROM Professional, 4:3 (May 1991), pp. 73-75.
13. Straub, D.W. and J.C. Wetherbe "Information Technologies for the 1990s; an Organizational Impact Perspective," Communications of the ACM, 32:11 (November 1989).

AUTHOR'S BIOGRAPHY

Dr. Yaverbaum is Director of Graduate Studies and an Associate Professor of Information Systems in the School of Business Administration at Penn State Harrisburg. She holds a Ph.D. and an MA in Computer Science from Temple University and has also completed a Masters of Public Administration and a Bachelor of Business degree from the Pennsylvania State University.

Dr. Yaverbaum has published in the areas of end-user satisfaction, requirement analysis, information system education, and information systems management. Most currently, her research interests are in the areas of multimedia and expert systems.

Additionally, Dr. Yaverbaum is an associate editor of the Information Resources Management Journal and has published articles in various professional journals including Information and Management, Expert Systems With Applications, Computer Science Education, Journal of Systems Management, Human Relations, Communications of the ACM, and MIS Quarterly.

STATEMENT OF PEER REVIEW INTEGRITY

All papers published in the Journal of Information Systems Education have undergone rigorous peer review. This includes an initial editor screening and double-blind refereeing by three or more expert referees.

ISSN 1055-3096