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INTEGRATING MULTIMEDIA TOPICS IN GRAPHICS COURSES

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ABSTRACT: This paper specifies an approach to include multimedia topics in computer graphics courses in MIS programs. It identifies multimedia topics that need to be covered such as compression technology, system architecture, and the development of multimedia applications. It suggests a sequence of projects that introduce one media for each project, and culminates in a multimedia presentation. The paper also identifies the configuration of multimedia equipment required to support the course. Student perceptions and feedback are also discussed.

KEYWORDS: Presentation Graphics, Hypertext, Multimedia

INTRODUCTION

Personal computers have undergone a transformation from simple text and numeric processing tools to being able to handle graphic drawings, images, audio and motion video. Audio, video, and photo realistic images are now available in digital format to be manipulated, controlled and displayed by the end-user and application developers (1). The addition of these datatypes enables people to be more effective in their tasks and makes computers fun, enjoyable and less intimidating to use.

Pictures often describe physical objects more effectively than text usually can. Text conveys information about abstract objects, properties, and relationships more effectively than pictures can (2). Students can enhance their communication effectiveness by combining both these mediums, along with audio and video in presentations.

Though outlines and storyboards are useful in graphics-based presentations; they are central to the successful use of developing multimedia presentations and applications (3). In addition, students must not only be skilled in the conventions of coherent presentations using one medium, but they now need to be skilled in using multiple mediums. They need to be able to understand how to coordinate the different mediums, decide when and where it is appropriate to use the different mediums and learn to provide links from one medium to another (2).

Furthermore, advances in digital multimedia are being affected by every aspect of computer science; from object oriented programming, human-computer interfaces, databases, to networks (1). Therefore, it is essential for the student to understand this important new topic and use it effectively and efficiently.

The addition of (graphic drawings, images, audio and motion video) enables people to be more effective in their tasks and makes computers fun, enjoyable and less intimidating to use.

The author has taught a graphics course offered at the junior level and taken mostly by business students majoring or minoring in information systems. He has incorporated multimedia in the course, and this paper discusses the course structure and results of incorporating these topics into the course.

The next section describes the graphics course that includes the multimedia topics. Section 3 categorizes the knowledge units in multimedia. Section 4 discusses some sample multimedia projects that can be used to reinforce the topics in this course. Section 5 specifies the laboratory hardware support needed for these courses. It concludes by discussing student feedback.

COURSE DESCRIPTION

The draft DPMA 90 model curriculum (4) gives a broad definition of the graphics course as concepts, techniques, and technology used in computer graphics, including image processing and pattern recognition. The topics recommended cover such diverse issues as needs, applications for graphics in business, principles behind software graphic packages, composition of text and graphics, user interfaces, etc.

Topics that cover digitizing processes by which data are converted to graphic images and video imaging and the processing of video data are also included. However, usually multimedia is not part of the course curriculum.

Lee, Yen and Tang (5) report that there is no consensus on how to teach graphics within the business curriculum and state that the business student would be

better served with presentation graphics and place less emphasis on the programming aspects of the course. Dorsey (6) seems to suggest the same and itemizes eight concepts as critical to the business student:

- Elements of business graphics hardware systems
- Types of graphics software
- Rules of thumb for choosing graph types and creating graphs
- Graphics software proficiency
- How graphics tools are used and choices for end users
- Research findings on the use of computer graphics
- Design principles for computer graphics
- Process of creating computer graphics

For the courses that are oriented toward presentation graphics and communication skills; multimedia is the next step in a logical progression of the use of technology to enhance communication. It complements the expressive capabilities of the speaker by bringing in animation, full motion video, and stereo sound, besides text and graphics. A description of a course oriented toward presentation graphics that includes multimedia topics follows.

Graphics Course Content

The course is divided into five major areas: Introduction, Presentation Graphics, Hypertext, Multimedia, Graphics and Decision making. The introductory area contains the description of hardware, software, tools that are available and choices for the user. The presentation graphics area contains elements of graphics design, appropriate use of charts, graphical integrity, and graphical presentation techniques. Projects using presentation software and drawing software are assigned at this time in the course.

The hypertext area contains the description and definition of hypertext, components and architecture of hypertext, business applications of hypertext, authoring and developing hypertext applications. Projects that require the development of hypertext applications/ presentations are assigned. This is followed by multimedia and hypermedia. Multimedia topics are discussed in detail in the next section.

The course ends with decision making and graphics. The implication of graphics for decision making and the design of decision support systems are discussed. Graphical user interfaces, graphical and multimedia information systems are also covered.

MULTIMEDIA TOPICS

Topics in this section are categorized under the scheme used in DPMA's model curriculum (4). Every effort has been made to provide references wherever possible.

Computer Concepts

1. What is multimedia (7)?
2. Hardware and software needed to create and deliver multimedia applications. This includes topics such as CD-ROM, music instrument digital interface (MIDI), videodiscs and software topics such as hypertext and other authoring tools (8).
3. Differentiate between analog and digital multimedia (1).
4. Conceptual architecture models for a multimedia machine (9,10).

Organizational Concepts

1. Impacts on industry, such as advertising, engineering, medicine and education (11).
2. Identify uses of multimedia mail, multimedia conferencing, and collaborative computing within the organization.

Information Technology

1. Compression technology: This includes the following:
   - The need for compression; differences between lossless and lossy compression.
   - Lossless compression techniques for text such as Huffman encoding, and Runlength encoding.
   - Compression techniques for audio, such as pulse code modulation (PCM), and differential PCM (DPCM).
   - Compression techniques for images and the joint photographics expert group standard (12).
   - Compression techniques for motion video and the motion picture experts group standard (13).
   - Compression techniques for transmission and the PCX64 standard (14).
2. Digital video interactive (DVI) (8), CD-I technology (15).
3. Networking technology for multimedia (1,16).
4. Hypermedia (17).

Systems Theory and Development

1. Multimedia development life cycle approaches (1).
2. Video production and multimedia (18,19).
3. Multimedia development tool sets (20,21,22).

PROJECTS

The projects are assigned to reinforce the instruction of concepts in the class. They should have clear objectives and complement class lectures. Reisman (23) provides the following four goals for multimedia projects:

1. Gain disc manufacturing experience.
2. Work with multimedia application development software.
3. Work with existing audio visual materials to develop a new multimedia application.
4. Develop new audio visual materials for a new multimedia application.

It is the author's opinion that the above goals are laudable, but cannot be met in a graphics course unless the entire course is on multimedia. In addition, students relate to information that they can immediately put to use, so the emphasis should be on the communication of ideas using multimedia. Therefore, the projects developed concentrate on the third goal. A sequence of five projects capped with a group project is envisaged. Each of the first four projects deals with a single and different medium. The fifth project integrates the first four projects. The projects that can be assigned in increasing orders of difficulty are the following:

Project 1: Scanning in a picture. An example would be to require the student to scan in their photograph and incorporate it in a presentation. The objective of this exercise is to help the student learn how to create and manipulate bitmap data. A second objective of this exercise is to show the need for compression and the use of compression and decompression software.

Project 2: Incorporating simple animation using a presentation software package. The project would require the student to draw an organization chart, with an arrow moving from one chart element to another in a timed manner. This is used to simulate the movement of a pointer as the speaker is speaking. The objective here is to show how presentation software can be used for animation, and to show the importance of sequencing and timing in many multimedia applications.

Project 3: Incorporating sound in a presentation. This project requires adding audio to liven up the presentation, by introducing the presentation with a theme song. This is possible with authoring tools that allow the ability to clip audio from a CD-ROM and add it to the presentation. The objective here is to show how CD-audio discs are organized, how analog data can be accessed and controlled through the computer.

Another example would be to annotate a text with voice. This can be done by digitizing the students' voice using audio capture software. The objective here is to show the difference between digital and analog audio data, and the different mechanisms used to access and present the data.

A lab equipped with multimedia machines is crucial to the successful teaching of the proposed graphics course.

Project 4: Incorporating video in a presentation. Similar to audio, the aim of this project is to show how to incorporate video into presentations. The project requires the student to bring in some video frames from the laserdisc collections that are available at the university. The objective here is to acquaint the students with the use of frame numbers, data organization in a videodisc, access and control of a videodisc player through the computer; creation of video windows and display of full motion video on the computer screen.

If the authoring software allows transferring data from a video cassette player, an easy project would be to have the student bring in a video frame of him/her making a presentation from a video tape. This has not been tried by the author as access to authoring software that controls video cassettes is not available.

Project 5: Integrating the various media. The previous projects had the aim of introducing the student to individual media in the various projects. The objective of this project is to help integrate the various media into a single presentation. The project has the requirement that when the arrow points to the student's name on the organization chart, it will display their picture, and the student's voice will be heard on the speakers. The video of the student will be shown when the student clicks a button on the screen.

Group Project: Multimedia presentation. Project 5 integrated the elements in a linear sense. A key feature of multimedia is the element of nonsequential access (7). Multimedia authoring tools provide integration and nonsequential access. They allow dynamic linking of on-screen elements such as video, audio, animation, text or graphics to additional information. This requirement forces the students to think carefully about user interfaces, organization, and the structure of the material.

A typical project may be the development of a multimedia presentation on Dr. King or other contemporary person. The project module can include the text of his speech annotated with multimedia features, such that, at the press of a button, the user can hear, or view Dr. King's speech. This project makes an ideal group project. The group structure has the benefit of requiring students to: a) work as part of a team and b) gain experience in using both written and oral communication (24). Table 1 provides a summary of the projects and key activities.

LABORATORY FACILITIES

A lab equipped with multimedia machines is crucial to the successful teaching of the proposed graphics course. Instructional labs with hands-on training for the students is desirable. Early faculty-student interactions help ease the students' anxiety and allows the students to make progress on the projects through initial guidance and feedback. The labs should also be staffed by knowledgeable persons who can help the students working on the projects.

Multimedia programming occurs in three stages (7):

1. Creating the multimedia delivery system.
2. Creating the content to be delivered by the multimedia delivery system (information authoring).
3. Structuring the content by creating the links and paths through the content (information structuring).

Systems that support each of these stages of multimedia programming are useful. A delivery system is required to support stage one so that the students can present their material to an audience. The delivery machine will meet the capabilities of the information structuring machine,

Table 1: PROJECT SUMMARY

Project	Goal	Key Activity
1.	Gain experience with still images	Transfer a Scanned image
2.	Animation and sequencing	Animate simple charts such as bar charts, organization charts
3.	Work with audio	Annotate a chart with audio data; create new audio
4.	Work with video	Include a clip with video from a laser disc; create new video footage
5.	Integration of multiple media	Integrate the above projects into a single project; create new script, program the application
6.	Develop nonsequential interactive applications	Group project; use authoring tools with multimedia to create script, program the application

along with a three beam overhead projector so that the students can present the group projects to an audience. Stage two (information authoring) requires systems that let the user digitize, capture the information from the various devices and store in a hard disk. Stage three (information structuring) requires systems that include authoring software which can access the information captured and created in stage two. They must allow playback of the information captured in stage two.

Two information authoring systems along with 6 information structuring systems are recommended for every classroom lab (21). In addition, a classroom equipped with a delivery system is required. Pea (21) describes the equipment needed for a Macintosh based lab. The equipment recommended for the IBM environment is listed in Table 2 on the following page.

Structuring software helps create the links and paths through the information content. The types of software that are needed on each machine include:

1. DOS, Windows 3.0 with multimedia extensions, as the operating system software,
2. Toolbook for authoring and structuring the information.
3. Alternately OS/2 and AVC can be used as the operating system and authoring language respectively.

An IBM PS/2 Model 57SLC with 6 MB RAM and 160 MB hard disk drive, M-Audio adapter and M-Motion Video adapter, along with the video disc player and the structuring software would suffice for the structuring systems. These recommendations do not include DVI software and action media boards that are just coming to the market from IBM and other vendors that support multimedia on the PC. These are not yet mature markets; however the future is likely to include more DVI hardware and software.

CONCLUSION

PCs today can create, store, and manipulate multimedia data. Easy to use authoring software enable even end users to use multimedia data effectively in business presentations. Unless used correctly, these types of data may actually impede communication. Therefore, there is a need to teach business students proper techniques to create, manipulate and incorporate multimedia data in their presentations. This paper has described a method by which it can be integrated into an existing graphics course. It also described projects that can be assigned to the students to complete.

Introducing multimedia in MIS classes is a time consuming and involved process. Developing the lab facilities and other resources involve substantial investments in funding and in faculty time. It should be emphasized that the commitment of the school and the university toward multimedia is essential. The author is very grateful to the support given by the administration in developing this course. They have supported this work with a summer grant, and have provided funding and adequate lab support.

Our lab still does not have the ideal eight computers called for in this paper, but has two information authoring system and one delivery system in a room suitable for presentation. Fortunately, projects 1 and 2 did not require these multimedia machines and could be done by students in the regular labs which were equipped with 386 machines and presentation and hypertext software. Projects 3,4,5 were accomplished as group projects with students in groups of three. With a class size of around 40, and the hours the labs were open, it was possible for the projects to be completed. Very explicit instructions on completing the projects helped reduce the waiting time for the students at the lab. A demo of the project was initially shown so that the students were aware of what was expected.

The students were very pleased at the opportunity to work with multimedia and showed creativity by including material in the presentation beyond that required in the projects. They had suggestions such as capturing and digitizing their own voice to include in the projects. Another suggestion involved using a camcorder to capture their image, and its inclusion in the project. They also saw applications of what they had learned. A student working at a bicycle repair shop suggested an application to answer customer queries on various types of repairs. An application with a video of the various techniques, along with a list of items necessary to complete the repair, could be programmed and used in the bicycle shop.

Every aspect of the course was not as rosy. The students disliked some of the technical aspects of the course such as compression techniques. The author had assigned some parts of the multimedia topics as papers to be written and presented in class by the students. Students suggested that the papers were not a worthwhile effort

as they did not learn as much from these students presentations. Some students also complained of excessive work. The consensus of the students was that multimedia was an exciting technology that had important applications in their future career areas.

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Table 2: IBM RECOMMENDED EQUIPMENT

1. IBM PS/2 model M57SLC with 10MB RAM, 320MB hard disk, an internal CD-ROM drive, an enhanced system speaker, M-audio capture and playback adapter. The M-Audio adapter is used to provide digital recording and playback of high quality.
2. The M-Motion Video Adapter/A to deliver full motion video. This card can display motion video fed from video camera, video disc player or VCR in a full screen or resizable window. It also allows still images to be captured and stored within the PS/2.
3. Video Capture Adapter/A. This allows the system to capture still images from various sources such as a VCR, video camera, or laserdisc and store it on a disk.
4. The PS/2 3.5" rewritable optical storage device. This can store up to 127 MB of data and can be used to either transfer information between the various machines, or distribute data to students.
5. IBM multimedia clipmakers. This makes it simple to select audio and video from CD's and videodiscs. It uses Toolbook as the authoring system for windows based development.
6. Audio Visual Connection (AVC): The authoring language used for information structuring in the OS/2 environment.
7. VideoDisc player such as the Pioneer LD-V8000 or Pioneer LD-V2200.
8. Optional powered speakers and large screen monitor.

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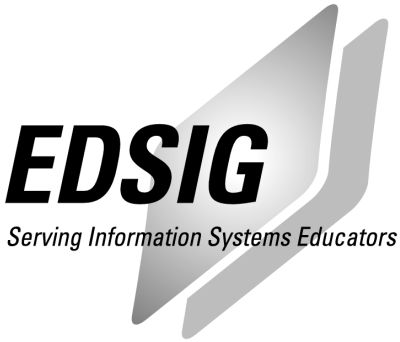

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