Report

of

Spring 1994 Sabbatical

Multimedia in Education

One Faculty Member's Experience

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Original statement of purpose:

The purpose of this sabbatical is twofold. The first purpose is to determine the applicability of multimedia presentations to various teaching and learning situations. I will perform an extensive literature review on the use of multimedia in education. I will contact multimedia experts concerning the development of multimedia presentations. The second major purpose of the sabbatical is to develop at least one multimedia package that can be used to teach respiratory care.

Sabbatical Summary:

"May you live in interesting times" is an ancient Chinese curse. These are very interesting times for multimedia and its application to teaching and learning. The times are interesting because of the rapid pace of improvement in the systems that can produce multimedia educational packages. The capabilities of software, hardware, and multimedia peripheral devices is rapidly increasing while the cost of each of these components of multimedia is rapidly decreasing. Currently, the learning curve for multimedia is quite steep. Fortunately improvements in authoring systems and multimedia hardware are making this technology less and less cumbersome.

Review of the literature:

You will find an annotated bibliography attached to this report that reviews a number of articles and books that I read during my sabbatical and feel will be useful to the college in planning multimedia strategies. The bibliography is divided into the following categories: 1. applicability of multimedia to teaching and learning, 2. design tips, 3. software for multimedia, and 4. multimedia hardware. I will try to summarize my findings in each of these areas.

Applicability of multimedia to teaching and learning:

Common uses for multimedia instruction include tutorials, educational data bases, learning nodes, simulation, and educational games. Sweeters (1994) uses Gagne's "events of instruction" as a model to describe how each of these applications functions as an effective learning system.

yourself - The first amendment, and 4. Isaac Asimov's the ultimate robot. See Brown (1993) for information on contacting the vendors for these multimedia programs.

It is almost always less expensive to purchase and adapt commercially available software than to develop in-house software. In general studies programs, science, math, and others there is a large variety of multimedia applications available for presentations. Very specific content areas such as respiratory therapy, do not have as much commercially prepared multimedia software available.

Multimedia Kiosks have been developed for museums, business, music and video stores, and even as electronic milk cartons for the National Center for Missing and Exploited Children. A multimedia Kiosk could be designed for KVCC to provide students with information on registration, financial aid, courses and programs, navigating around the college, or a variety of other college services. For more information on the uses of multimedia, see detailed annotation of Sweeter's article in the bibliography.

Does multimedia make a difference?:

Simpson (1994) describes the neurophysiology of learning and associates it with multimedia. He reports on a study by Fletcher that showed a 0.5 standard deviation increase in achievement with interactive videodiscs as compared to less interactive strategies. Another research study showed a 35% improvement on a mean mid-term score in a pharmacokinetics course when interactive instruction was used (Feldmean and Shoenwald in Simpson 1994). This research indicates that multimedia can be an effective teaching and learning strategy when developed as a learning system.

Design tips:

Articles by Meilach (1993) and Pearson (1994) highlight practical applications of color. Contrast is an important aspect of designing computer screens. An example of contrast is using cool colors, such as blue, for the background and hot colors, such as red or orange, for graphics. This type of contrast scheme highlights the graphics for the user. Using drop shadows behind letters gives the letters a 3-D appearance which emphasizes introductions, key points, or closings. Color can be used for organization, with each section having a different color scheme. The main menu in a package may act as a key to identify the color scheme of each section.

Color should be tested on a variety of different computers and presentation devices. Finding colors that work well on a variety of devices is sometimes difficult. Computer screens, overhead projection
panels, and video projectors may all display the intended color differently. Subtle changes in color from the monitor to the projection systems can often be controlled by color adjustments on the projection devices.

Changing color is generally a better method for emphasis and organization than changing type size or font. Changes in type distract the reader from the total message while color changes tend to change the emphasis of the message. Color blindness is also a consideration when working with color. The most frequent color difficulty is differentiation between red and green by white males, so these colors should not be placed next to one another in a presentation. According to The Bureau of Advertising and 3M Meeting Management Institute (in Pearson 1994) proper use of color can significantly improve the effectiveness of almost any presentation.

Avoiding Muddymedia:

Nick Arnett, the system operator, for the CompuServe Multimedia forum, coined the term Muddymedia. Muddymedia applications feature buttons that link to nowhere, cryptic help systems or no help at all, and media elements that confuse rather than clarify information. John Murdock (in Rosenberg) developed an application called "The Lurker's guide to bad design". This humorous application points out some obvious design flaws commonly made by novice multimedia developers. The following are the key points to bad multimedia design:

1. Rediculously garish windows and loud colors are a must.
2. Make sure that button sizes are not consistent.
3. Why use two buttons when you can have 30?
4. Make sure that all the screens in your application look different. Consistency is for the unimaginative.
5. Assume that user's machines are just like yours. Feel free to use a variety of fonts. Why worry whether users have the same fonts on their machines?
6. Do not let users in on the secret of how to use your application. Use cryptic labels for your buttons and fields, better yet, do not use labels.
7. Make sure that you leave out what everyone else forgets-menus! A sure sign of a novice application is a wealth of buttons, without a single menu.

As a novice multimedia person, I hate to admit how many of these design flaws I have made. Many screens, buttons, and other components of my application have been redesigned several times to avoid the above problems.
Multimedia Software:

There are two general categories of multimedia development software that are useful in education. The first category consists of multimedia graphic presentation packages. These packages are usually presenter-controlled, and are generally used to develop linear presentations. Software such as Microsoft’s Powerpoint, Lotus Freelance Graphics, Harvard Graphics, and Aldus Persuasion fall into the category of presentation software. Powerpoint is available for both the Macintosh and IBM compatible platforms at the college. These presentation packages generally meet the requirements for multimedia, but are not necessarily interactive. A good instructional designer can make the presentation interactive just as a good designer can make a slide show interactive. These multimedia presentations are often better than slide shows because they can incorporate high quality graphics, sound, and video and attend to more senses than a non-multimedia presentation.

The second, more powerful, type of multimedia development software for education is designed for authoring interactive, stand-alone multimedia packages. This type of software is often categorized as authoring software and is used to make learner-controlled presentations. These stand-alone packages could be used in a computer lab, LRC, or other KVCC laboratory.

The best authoring packages include the ability to create branches either through the use of built-in logic or variables. These systems can track and score user responses, and then branch to different portions of the application based on the responses. The design of these packages requires much more time, design expertise, and reliance on the content expert. The author has to anticipate student responses and prepare branches in the software to meet the needs of a variety of learners and learning styles.

Most of these systems allow access to an underlying scripting language, or at least the ability to go beyond a set number of standard functions, providing some degree of customization. They provide the ability to incorporate graphics, animation, digital audio, and both analog and digital video. Most authoring packages can be used to develop anything from simple linear presentations to true hypermedia presentations which access a variety of files, graphics, or data bases.

There are at least 40 multimedia programs available for either presentation or interactive multimedia authoring (Burger 1994). A recent review by Fritz rated interactive multimedia authoring software for both the MacIntosh and IBM-PC compatible platforms. The following MacIntosh software packages were reviewed: HyperCard Development Kit, Macromedia Director, Aldus SuperCard, and Authorware Professional. Of these, the most highly rated is Authorware Professional. It is icon based, flexible, allows tracking and scoring responses, and provides branching based on these responses. Authorware is the only product with built-in
cross platform support for IBM-PC compatibles with Windows. It is also the most expensive, with a retail price of nearly $5,000.00. KVCC can upgrade its current Authorware Academic to Authorware Professional for about $1000.00. Authorware does have some licensing restrictions on run-time products, but in a recent conversation with Authorware, the sales representative told me that an educational institution can sell products through its bookstore without paying run-time fees to Authorware. A clear understanding of run-time licensing fees and restrictions is a necessity if the college chooses to purchase Authorware or any other multimedia authoring system that has run-time licensing restrictions.

Fritz also reviewed IBM-PC compatible authoring software packages, including AuthorWare Professional for Windows, Asymetrix Multimedia Toolbook, IconAuthor, Multimedia GRASP, and Tempra Media Author. The two highest rated packages were AuthorWare Professional for Windows and IconAuthor. These programs retail for about $5000.00 each. The best all-around value for entry level multimedia on IBM PC-compatible systems is Asymetrix Toolbook ($595.00 retail - substantially less with an education discount). HSC interactive which is a scaled down version of IconAuthor is reasonably priced at $495.00 but lacks some of the features of ToolBook. The Cardiorespiratory Care Program, Computer Informations Systems Program, and the computer lab have purchased or ordered the Asymetrix ToolBook program.

Another area of software that is very useful when preparing multimedia presentations is clip media. Clips of sound, graphics, photos, and video are available on CD. There is a large variety of royalty-free media commercially available on CD. (See Glas and Clip Graphic Gallery notes in bibliography).

Software Executive Summary:

Recommendations for multimedia authoring software:

Authorware Professional upgrade for MacIntosh: I recommend that run-time licensing be clarified in writing. Cost of upgrade is approximately $1000.00.

Asymetrix Toolbook 3.0 for IBM compatible PC's: I recommend that we consider upgrading any existing Multimedia Toolbook 1.53 versions to Multimedia Toolbook 3.0.

Video for Windows: This can be included as Windows software option when purchasing most IBM-PC computers.

Presentation Software: The college has Microsoft Powerpoint, for both MacIntosh and IBM-PC. I believe some faculty in the computer information systems program are also using Lotus FreeLance Graphics. I
recommend that the college continue to support this software. The instructional development council should also offer mini-workshops on developing presentations with this software.

The teaching learning center is purchasing an Intel Smart Video Recorder video capture device which includes Asymetrix Compel and video for windows software packages.

Graphics manipulation and editing software from Corel (Draw and Photoshop) and Adobe (Illustrator) that the college currently owns should be upgraded and licensed for MacIntosh and IBM-PC compatible multimedia development platforms.

Faculty interested in multimedia graphics should be encouraged to purchase CD clip art for their content area.

**Hardware:**

The college already has much of the hardware required for developing multimedia. I feel multimedia should be supported on both the MacIntosh and IBM PC-Compatible Platforms.

The key to multimedia computer hardware is avoiding data flow bottlenecks. Data bottlenecks occur at several points when trying to use multimedia for video, animation, or high quality computer graphics. The processor determines the maximum data flow rate. Bottlenecks occur in the computer's expansion bus, device slots for external devices, the computer's data bus, and the graphics card for the monitor. Maintaining data flow subscribes to the weakest link theory, data will flow only as fast as the weakest (slowest) link in the computer will allow it to flow.

The most difficult multimedia task is processing, compressing, decompressing, and displaying high quality, full motion (30 frame/second), digitized video. The MacIntosh Quadra 660AV model has the capability to process, capture, and compress video. For other MacIntosh models, including the Power MacIntosh, the purchase of a video capture board would be necessary to capture video. A high speed (486 66HZ ) processor, or high speed pentium processor can handle the tasks of processing digitized video in the IBM-PC compatible platform. A video capture board is also a necessary add-on for compression and decompression of video in IBM-PC compatible systems.

Currently there are two types of compression/decompression systems for digitized data. One type is designed for Apple’s Quick Time Movies and Microsoft’s Video for Windows. The initial approach I believe we should use for video capture is a board that uses hardware for compression but software for decompression. This type of video capture system will allow the video to be captured and placed in a file. Because only software is
required for decompression, files can be played back on machines that
don't have video capture boards. In the MacIntosh environment, these
would be played back as Quick Time Movies. In the IBM-PC compatible
environment, Quick Time Movies can be played back as video for windows.

Radius makes several video capture systems for the MacIntosh for less
than $1000.00. Video capture is a standard feature of MacIntosh's
Quadra 660 AV series. A MacIntosh Power PC should be released in the
near future with built-in video capture for Quick Time Movies. For the
IBM-PC, several video capture boards are available, but the best value
board, according to Brown (1993), is the Intel Smart Video Recorder at
about $500.00 (retail - education pricing may be less). The Smart Video
Recorder is also bundled with software such as Microsoft's Video For
Windows, presentation packages, and image editing packages.

The second type of video compression/decompression system requires
hardware for both compression and decompression. This type of system
produces VHS or better quality video images. It is used for compressing
video on CD-ROM and other distribution media. A hardware based
compression/decompression system has been developed by the Motion
Pictures Expert Group (MPEG). MPEG is considered the industry standard
and will be used by cable television and telephone companies for
compressing video. It is currently being used in CD-movies that play on
CD-interactive game devices by Philip's and Motorolla. MPEG
compression in October of 1993, cost $20,000 to $40,000 for the
compression/decompression board. It was originally very time
consuming, requiring 400 minutes of compression time for each minute of
video. MPEG compression/decompression systems are now able to perform
real time compression "on the fly" (one minute to compress one minute of
video). They are rapidly decreasing in price, but still may not be cost
effective for applications that are not going to be widely distributed.
Although MPEG compression/decompression hardware is probably not
feasible at this time, any video captured with the software decompression
systems should be archived and indexed, so that it can be easily
recaptured on a MPEG system when this equipment becomes affordable.

Trying to transfer the data from high quality video at a rate of 30MB per
second through the computer's bus to and from the compression board and
then to the monitor can create other bottlenecks. High end MacIntosh
systems (The Quadra and the Power PC) have buses and graphic display
cards capable of displaying video. With IBM-PC compatible models, a
graphics accelerator card is necessary to refresh the monitor at a rate
that will allow video to be displayed. Many multimedia IBM-PC's include
graphic accelerator cards, but it is important to check the specification of
these cards, as generally 2MB of video RAM or Dynamic RAM is necessary
for displaying video. If a graphics accelerator card is not supplied with
the PC or if the supplied card is not adequate, an accelerator card should
be purchased. This component of multimedia hardware has one of the
highest benefit to cost ratios. The improvement in graphic display is well
worth the cost of investment. A recent article by Miastkowski (1993), reviewed several graphics accelerator cards for the IBM-PC compatible platform. The Diamond Stealth 24 was rated as the best value, and it retails for about $250.00.

On the IBM-PC compatible platform it is important to pay attention to the types of expansion buses on the machine. A recent article by Lauriston (1993) reviews the expansion bus requirements for video based multimedia programs. The data transfer rate of the standard expansion bus (ISA bus) on an IBM compatible PC is less than 5MB/second which would only allow you to display video at 5 frames/second. To be able to move video through the computer an upgrade in the computer's expansion bus is necessary. Most multimedia IBM-PC compatibles have an upgrade expansion bus, but it is important that you determine whether your computer's expansion bus is adequate. An enhanced industry standard architecture (EISA) bus was developed to transfer data at faster rates for IBM clone machines.

The Video Electronic Standards Association (VESA) is a committee of videoboard manufacturers which has developed the VESA local bus (VLB). To display high quality video (30 frames/second) on a 20 inch screen the required data transfer rate is at least 30MB/second. A VESA local bus which transfers 126MB per second is essential for serious multimedia production on 486 PC's, and is found on many multimedia quality IBM compatible computers.

Finally the newest bus feature on the block is the Intel Peripheral Component Interconnect (PCI) specification bus for Pentium based machines. PCI transfers data at 252MB per second, which is double the transfer rate of the VESA local bus. At the time this article was published (August 1993) Lauriston recommended a 486 processor with a combination of VLB and EISA expansion buses.

Finally once video is captured it may have to be loaded from one machine to another. For either IBM compatible or MacIntosh computers, a Syquest drive is probably the best way to transfer large files between machines. A large, portable hard drive is another reasonable option.

Executive summary for Hardware

MacIntosh Development Platform:

The MacIntosh's Quadra 660av has built-in video capture, CD-ROM, and other multimedia tools. MacIntosh boasts that its AV multimedia units are supposed to be ready to go right out of the box. This machine has a relatively slow processor, but has built-in accelerators for processing multimedia functions. The slow processor may limit the ability to upgrade the Quadra 660av. The Power MacIntosh line has recently been introduced. This line has the capability to run both MacIntosh programs
and programs designed for Microsoft DOS and Windows. Most likely the Power MacIntosh line will soon have some of the same built-in multimedia features as the Quadra AV line. I recommend that the college look at purchasing a Power MacIntosh for multimedia, and add any multimedia devices such as hardware compression-software decompression videocapture boards, CD-ROM, and large hard drives as required. The AV monitors with built in Speakers should be considered the monitor of choice for the MacIntosh multimedia platform.

**IBM PC - Compatible Platform:**

I recommend the following be considered essential parts of an IBM-PC based multimedia development platform.

**Processor:** At least a 486 66MHZ processor or a high speed Pentium processor.

**Computer expansion bus:** For 486 based machines, a hybrid bus that includes Video Electronic Standards Association (VESA) local bus architecture, enhanced industry standard architecture (EISA), and industry standard architecture (ISA) bus slots is recommended. If a pentium based processor is used the PCI, expansion bus is recommended.

**Graphics Accelerator:** A 2MB local bus graphics accelerator for displaying video images with video RAM (VRAM) or Dynamic RAM (DRAM) is necessary for multimedia. The Diamond Stealth 24 card was rated as the best value (at $250) in a review of several graphic accelerator cards (Lauriston 1993).

**Hard drive:** Holsinger (1993) recommends at least a 1GB hard drive with a fast access time.

**A multispeed CD-ROM:** At least a double speed is necessary for playing images from a Kodak photo CD. The higher the speed the more efficient the image processing.

**Sound Card:** Creative Labs Soundblaster Awe 32 or similar Soundblaster compatible card.

**Speakers:** Self-powered speakers are available at prices from $49.95 to over $400.00. Ironically, the development platform can function with lower quality speakers because only the author needs to hear the sound. A microphone/earphone set would be ideal for listening to sound and recording voice overs for sound.

**Monitor:** A non-interlaced SVGA monitor with no greater a 0.28 pitch and at least a 14" diagonal screen.
A complete multimedia development system for IBM-Compatibles, as described above, could be purchased for between $3000.00 and $3500.00. It will also be important to assure that this hardware is completely compatible with current hardware in the computer lab and at other campus locations.

Presentation Platforms

**MacIntosh Presentation Platform:** The presentation platform on the Macintosh side would not need video capture capabilities, but should include CD-ROM and sound capabilities such as those found on the Quadra AV series. Again, these features should soon be available on the Power Macintosh. Generally, with Macintosh products, it is best to buy their Apple in Academe packages. It is important that Apple's Quick Time Movie software be included in the operating system that is purchased with the machine. Again the AV monitor system with built-in speakers should also be considered for the Macintosh presentation platform. A complete Macintosh presentation package could be purchased for less than $3000.00.

**IBM-PC compatible Presentation platform:** The presentation platform should include the same processor, expansion bus configuration, graphics accelerator card, monitor, and multispeed CD-ROM as the development platform. A video capture card would not be necessary and a smaller hard drive could be used. Also, the less expensive creative labs Sound Blaster 16 or a similar sound blaster compatible card is adequate. Better quality self-powered speakers for presenting to a larger room may be necessary. A complete IBM-compatible presentation package could be purchased for less than $3000.00.

**Laserdisc player:** A laserdisc player for incorporating interactive video segments in multimedia presentations is also an essential part of multimedia hardware. The computer center currently has these devices on the IBM-Ultimedia system. Chemistry and nursing also have dedicated multimedia systems that incorporate videodisc lessons. One or two of these laserdisc players may need to be purchased. They could be available for the presentation and development platforms on a check-out basis. A variety of laserdisc players with serial port interfaces are available for less than $1500.00.

**Projection Panels for both Platforms:** Overhead LCD Projection panels or LCD projectors and cabling may be needed for both platforms. We currently have these available through media services. As the demand for computer projection increases I would recommend purchase of new panels for these machines. There is a wide range of projection panels, but a quality projection panel with built-in speakers can generally be
purchased for between $5,000.00 and $6000.00. A quality LCD projector (stand alone device - no overhead needed) with audio support and built in speakers can be purchased for about $6500.00 to $7500.00.

**Man-Power**

It is time to work smarter not harder. A full-time multimedia specialist who could work with our content expert faculty to develop multimedia would be a valuable asset to the college. I recommend that the college consider developing this type of position. This person would need to have the experience and ability to work with faculty to develop multimedia presentations and stand-alone interactive multimedia packages. A person with these qualifications could probably be hired on about the same pay structure as full-time faculty.

**Meetings with area multimedia experts.**

This is an area that I wish I had devoted more time to during my sabbatical. I did spend a lot of time working with Ken Gillette at Borgess's Lawrence Education Center. Ken is an expert in video production and computer graphics. He videotaped and edited some sleep lab segments that are included in my physician assisted procedures package.

I had several informal discussions with Charlie MacDonald from Kalamazoo Valley Intermediate School District about my project. Charlie is in charge of much of KVISD's instructional technology efforts. Charlie taught physical education at KVCC while he was getting his Master's degree in education technology at Grand Valley State University. Charlie and I attended an AuthorWare seminar in May of 1992 which was the stimulus for my sabbatical proposal.

Charlie suggested I contact Esther Javits, Ed.D at Grand Valley State University. Esther is a professor in the education technology program. During a meeting with Esther she described how they are using multimedia at Grand Valley and the requirements of their education technology program. Creating a partnership with graduate students in instructional technology at GVSU may be a possibility. These students need to develop instructional packages and sometimes need a content area.
My multimedia project:

Prior to my sabbatical, most of my experience with computers was on the MacIntosh platform. I was a true "point and click" man, and my IBM-PC compatible experience was minimal. I barely knew the difference between a C prompt and a B prompt. When I proposed my sabbatical in the Fall of 1992, I anticipated developing multimedia on the MacIntosh platform using AuthorWare Academic. I switched to the IBM-PC platform because the computer center's Multimedia Toolbook was readily available on its IBM Ultimedia platform. The AuthorWare academic that the college owns does not support some of the high end multimedia functions that AuthorWare Professional now has. I feel using an IBM compatible PC platform dramatically increased my learning curve, but also dramatically increased my learning. I can now easily navigate many of the features of DOS and Windows that I had only brief exposure to before my sabbatical.

I planned to develop an integrated stand-alone multimedia package on all of the physician assisted procedures tested by the National Board for Respiratory Care. These procedures include bronchoscopy, thoracentesis, transtracheal aspiration, tracheostomy, stress testing, transtracheal oxygen catheter placement, sleep studies, cardioversion, and intubation. I chose physician assisted procedures because they were topics that had not been well covered in the Cardiorespiratory Care Program. Our NBRC scores in this content area were acceptable but not as high as the program normally scores in other content areas.

Tracheostomy, thoracentesis, transtracheal aspiration and transtracheal oxygen catheter are not performed on a regularly scheduled basis in our clinical affiliates. These skills are nearly impossible to plan into the students' clinical experience. If they occur while students are in a clinical affiliate every attempt is made to expose students to these skills. There are not enough of these skills available to have each of our students participate in a clinical experience. My goal with these skills was to develop a multimedia program that could be used to simulate clinical experience.

Cardioversion is a very frequently performed procedure, but is almost always an emergency procedure. Although this procedure is not readily scheduled into a clinical experience, nearly every student sees cardioversion performed during cardiopulmonary resuscitation attempts. Cardioversion or defibrillation during an arrest takes only a few seconds. A student who may be assisting with airway management or performing chest compressions may not be able to observe and learn about cardioversion in this setting. The goals of multimedia for cardioversion were to act as a pre-clinical preparation, to review what the student may have seen during an arrest, and to act as a simulation for clinical experience.
Bronchoscopy, sleep study, and intubation rotations are built into the clinical component of the respiratory therapy program. My goal for multimedia with these skills was to develop a pre-clinical experience to prepare students for their clinical rotations.

Running before you can walk leads to a lot of stumbling. One of my first stumbling blocks was that the content for this project was too broad for a one-semester sabbatical. I had to narrow the content of my project by working on it in modules. The most efficient use of my time and readily available resources was to begin developing the modules for bronchoscopy and sleep studies.

One of the challenges in developing multimedia for these skills is obtaining the media necessary for multimedia. I was able to observe the key components of assisting with bronchoscopy procedures at both Bronson and Borgess. Dr. Schoell at Bronson allowed the bronchoscopy staff to videotape down the the bronchoscope during a procedure. He provided me with the tape from this procedure for use in the bronchoscopy module. I had access to a commercially prepared videotape on bronchoscopy from the Department of Veteran's Affairs. The two tapes provided excellent resource media for the bronchoscopy module.

I met with Tom Wittenburg from Borgess's Sleep Disorders Center. Tom agreed to be videotaped doing a lecture on sleep disorders and sleep study equipment. A therapist at Borgess agreed to act as a patient while Tom connected the various electrodes and sensors necessary to perform a sleep study. Ken Gillete from the media services department edited these tapes and collected some still video segments of the graphs from a sleep study. These video segments will be incorporated in the sleep study portion of the physician assisted procedures package.

At this time the introduction and overall navigation structure for my physician assisted procedures is complete. The bronchoscopy component is nearly complete and includes the ability to interact and choose video segments. The sleep study component is about 50% complete, and also has video segments available. The other components are in skeletal form. I need to collect more video segments and scan more graphic images to complete these sections.

I presented the completed sections of my sabbatical project at faculty seminar days in August 1994. I am continuing to develop this program by dedicating some time each week to the program.

What I learned:

The greatest learning occurs when we are able to learn from our mistakes. Ray Hedricksmaj told me when I started my sabbatical that I was probably trying to run before I learned to walk. My greatest challenge was integrating my content expertise and my knowledge of education and
training theory, with capabilities of the multimedia authoring software and hardware.

I often designed an interaction or a computer screen then read about a better color scheme, a better way to program a button and would redo the interaction. A big challenge was incorporating video into my multimedia package. The IBM Ultimedia platform that the college currently owns allows video to be incorporated into presentation from either a videodisc player or a videocassette recorder. The videodisc player that is part of the IBM Ultimedia system is easily controlled by the computer. The college owns a few medically related videodiscs, but only a few video segments from these discs were applicable to my content areas. I needed the ability to control a video cassette recorder to incorporate the video segments on bronchoscopy and sleep study into my project. I researched the market for a videocassette recorder that could be controlled by a computer. I also had to find software that would be compatible with the computer hardware, Asymetrix ToolBook software and the videocassette recorder. A Panasonic AG 5700 industrial quality S-VHS player and a Media Control Interface (MCI) driver from Lenel Systems met my requirements and was purchased. Don Spencer and I worked many hours learning the programming required to make these components easily interact. All of these challenges consumed time from developing the actual modules.

My goal continues to be the development of a stand-alone package that will provide students with "clinical like" exposure to these physician assisted procedures. The advantage of a stand-alone package is that the student could use it prior to a clinical experience, review it during a clinical rotation and again after assisting will a clinical skill.

I am going to learn to crawl, then walk, then run with some of these procedures. Crawling may just be collecting high quality graphics and other resources that can be integrated into the program. Walking may be developing a linear, presenter-controlled multimedia lecture for the topic and delivering it a few times. Finally I can then package the program into a stand-alone multimedia system.
Conclusion

The Future of Multimedia and Education Technology at KVCC:

The technology for distance education is just around the corner. In the near future KVCC will be competing with a number of academic and training institutions who will want to bring learning packages to the living rooms of our community. Presentations in this arena must have a very professional appearance to compete in this expanding market place. Developing a position for a multimedia instructional specialist is a prudent step in preparing for the campus without walls.

We may need to seek grants and other sources of revenue to support the development of multimedia and distance education at KVCC. One creative source of revenue may be the sale of any educational software that is produced. Any revenue above KVCC's cost could be shared by the content expert faculty and the multimedia specialist. A revenue sharing system may allow us to get an experienced multimedia developer and distance learning expert at a reasonable salary and be an added stimulus for faculty participation as content experts.

The expansion in education technology might create a need for a KVCC multimedia arts program. Courses from computer science, graphic arts, business, elementary education, education psychology, communication, and general studies could be programed to develop a graduate that will meet the multimedia programming needs of our community. A team of students could, as part of a collaborative course project, be required to develop a small multimedia package for a client. The client could be selected from a number of enterprises in the community or the client could even be KVCC faculty members.

KVCC will need the ability to produce broadcast quality video for multimedia presentations. We may need to create a partnership with a firm such as Lawrence Productions, or another video production company with experience in broadcasting and education. One of the local television stations, public television, or even cable access could be another area for partnerships. It is not unusual to see public service announcements that are sponsored by a commercial entity. Ferris State University advertisements are sponsored by the the Big Rapids Holiday Inn and other enterprises in their locality. An automotive distance education program could be sponsored by a local auto parts distributor, or a biology multimedia program could be sponsored by a pharmaceutical company. Would Dean Witter sponsor a distance learning program in personal finance? Would Biggs-Gilmore sponsor a marketing course?

Maybe hiring a multimedia specialist, creating partnerships, and developing a multimedia arts program is premature. I do know that we at least need to begin thinking hard in the direction of professional quality media production and educational technology. Soon the University of
Illinois, Stanford, Northwestern, or even Jackson Community College will be knocking on cable boxes and ringing telephones in our community with their education products. KVCC needs to be prepared to be a competitive leader in this arena.

There is only one way to predict the future and that is to create it. We need to create a future for KVCC in education technology that meets the needs of our community, our state, our nation, and our world. One of the most exciting advantages of multimedia and the distance education that goes along with it, is that it not only allows us to go to distant destinations, but it also allows distant destinations with their diversity to come to us. Our future in multimedia, like the futures we've created to get to this point in time, must be one of excellence with a single-mindedness to meeting the educational needs of our community. Excellence doesn't come from technology. Excellence comes from the people who know how to use the technology. An investment in the latest and greatest multimedia-distance learning system will not buy you nearly the quality outcome as an investment in excellent humans who can get quality out of a system, which by the day after tomorrow, will no longer be the latest and greatest.
Annotated Bibliography

Applicability of multimedia:


Overviews a multitude of award winning multimedia programs from the March 1993 Intermedia Conference. Five of the award winning titles are of interest to medical education: 1) ADAM (Animated Dissection of Anatomy for Medicine), 2) Myocardial and Perfusion Imaging Atlas, 3) Tough choices: Ethics, The Elderly, and Life-Sustaining Technologies, 4) Dynamics of Human Anatomy, and 5) Mayo Family Health Disc. Several other interesting award winners with applications in higher education include: 1) Caduceus Physics Hypercard Stack, 2) The Bill of Rights, 3) Express yourself - The first amendment, and 4) ISAAC Asimov's the ultimate robot. Information for contacting the producers of the award winners is provided.


Reviews research literature from both neuroscience and communication, and relates this literature to interactive multimedia. The article reviews research on three forms of memory, including sensory memory, short term memory, and long term memory. Two variations of long term memory, relative memory and declarative memory, are described. The article not only reviews research on neurophysiologic effects of memory, it applies this research to learning and multimedia.

Simpson summarizes a meta-analysis study by Fletcher. The analysis included 47 experiments comparing interactive multimedia instruction with conventional instruction. Fletcher's study revealed a 0.5 standard deviation increase in achievement with interactive video disk technology, compared with less interactive approaches. This study also showed that the more interactive attributes employed by a medium, the more learning was enhanced. Another study by Feldmean and Shoenwald was also reviewed. This research showed a 35% improvement on a mean mid-term score in pharmacokinetics course when interactive instruction was used.
Simpson, M. S. (1994). Neurophysiological Considerations Related to Interactive Multimedia. continued

Simpson believes that "interactive technology combines different symbolic representations into a new form of symbolic language" ..."that might through its interactive nature more closely match the way the mind works."


Describes the various uses of multimedia kiosks in several different public and private enterprises.


This article describes common uses of multimedia based learning programs. Common uses include tutorials, educational data bases, learning nodes, simulations, and educational games. The author uses Gagne's "events of instruction as a model to describe how each of these applications function as a learning system."
Design tips:


The author gives several tips on using color in presentations. She presents tips on contrast, using drop shadows behind letters, using color for emphasis and organizing, suggesting topics with color. Her last and most valuable tip may be to test color on a variety of different computers and presentation devices.


Although the purpose of this article is to describe methods of making overhead transparencies more effective, many of the topics discussed apply to designing screens for presentations. The author gives tips on honing the message, designing the screen for different types of presentations (formal vs informal, serious vs light, etc), using type, and the use of color. The information on the use of color makes this article worth reviewing.

"According to the 3M Meeting Management Institute and the Bureau of Advertising, color visuals:

sell (products and ideas) more effectively by 50 to 85%.
accelerate learning, retention and recall by 55 to 78 percent
increase comprehension by up to 73%
increase the willingness to read by up to 80%
increase motivation and participation by up to 80%
reduce error count from 55 to 35%"
Multimedia software:


This article outlines the features to look for when purchasing multimedia authoring and presentation programs. ScriptX, which is new a cross platform scripting language for multimedia, is briefly described. This language, which will play through a Kaleida Media Player, is designed to make it easier to develop multimedia that is functional on the MacIntosh and IBM-PC compatible programs. Apple and IBM are both bundling Kaleida media players with desktop machines.

A table listing over 40 multimedia authoring packages includes, the production and delivery platform, other features of the program and a brief set of comments on each program. The suggested retail price and phone number for each vendor is also provided.


The subject, format, price, and vendor information for over 20 clip graphic packages available on CD-ROM are presented in table format.


The author compares the following MacIntosh based authoring software packages: HyperCard Development Kit, Macromedia Director, Aldus SuperCard, and Authorware Professional. He also reviews IBM-PC compatible authoring software packages. These include Asymetrix Multimedia Toolbook, IconAuthor Multimedia GRASP, and Tempra Media Author.


This article provides a set of questions to ask when considering the purchase of multimedia authoring programs.


This article lists royalty free visual clip media that is available from over 30 different vendors on CD-ROM. The subject of the clip media, the file format, price per disk, and phone number for contacting the vendor are provided.

The authors describe a framework for evaluating automated instruction. They feel that the three main levels which need to be considered when evaluating automated instruction are: the products, the users, and the context in which the user interacts with the product.


This review covers nearly a dozen presentation programs that also have some authoring capabilities. The features of each program are rated on a 5 point scale. The price of the programs range from $99.00 to $499.00.


Discusses the features and applications of video for windows in multimedia presentations.
Hardware:


This article compares 14 different video capture boards, ranging in price from $299.00 to $1295.00. The most highly recommended board was the Intel Smart Video Recorder.


Compression technology using the Motion Picture Expert Group (MPEG) standard is allowing up to 74 minutes of video on a CD. Adaptors are being made for Philips, and JVC Compact Disc Interactive (CD-I) game machines that will allow the playing of digital Movies on CD-I.


Briefly describes how compression/decompression algorithms (Codecs) work.


Compares the two main types of video compression systems. One type is hardware compression with software decompression, the other type requires hardware for both compression and decompression.


Provides major considerations when shopping for digital storage devices including access time, data throughput, and storage capacity. He also describes cost effective methods for moving large files from computer to computer with portable storage devices.


Describe requirements for expansion buses for multimedia computer systems.

Describes the MPEG compression/decompression (CODEC), it is the only internationally recognized code for digital video. Over 53 million cable TV subscribers are slated to switch over to digital boxes fitted with MPEG decoders. AT & T is also developing MPEG decoding systems.


Article delineates data storage requirements for various multimedia forms. It also provides an in depth description of each of the storage devices. The article describes the differences in capability between constant linear velocity (CLV) and constant angular velocity (CAV) laser discs. The article also describes advantages and disadvantages of various magnetic storage systems such as hard drives, floppy diskettes, magnetic tapes, digital audio tapes, removable magnetic cartridges, and video tapes.


This article compares five different graphic accelerator cards and a shows picture of each card. There is a photo anatomy of a typical accelerator card. The cards were rated on a 5 point scale.


Describes the use of images from videodisc and videotape in multimedia production. The best applications for videodiscs are presentations that are non-linear, and require access to a small amount of video. The permanent nature of the videodisc makes it a good choice when the subject matter is not likely to change. Videodisc is excellent for drill and practice application.

Videotape is best suited for linear presentation and in applications where video shares the stage with computer graphics and digitized audio. Videotape is the application of choice when there is a limited budget, and where the content of the presentation is subject to change. The VCR's allow the author to incorporate commercially prepared videotapes in a multimedia presentation. Videotape gives the author the ability to test the video sequences that may be eventually mastered into a videodisc-based multimedia presentation.

Discusses the use of CD-Recordable (CD-R) technology. There are still some bugs in the technology but it is getting cheaper and better. It allows authors of multimedia programs with a small audience, to afford publication of their product on CD. It also allows testing of a CD planned for wide distribution, prior to investing in a master. CD recording devices will soon drop to less than $1500.00. The price for a CD-R disc is generally $20.00 to $40.00 per disk.


Compares Orchid's Videola video board with Smart Video Recorder, and Videologic's Captivator. It is interesting both the Smart Video Recorder and the Captivator were highly rated by Brown (1993), Wodaski feels that the videola board out shines both of these products. The prices of the Orchid's videola board is $399.00.


Introduces two videocapture cards: VideoLogics's 928 movie and Vidiola from Orchid technology. The VideoLogic has plans for expandability for the 928 movie. No test drive or ratings. Just an introductory article.


Introduces a new audio video interleave (AVI) videocapture compression card from ATI technologies. This card provides display of live video source at any screen size. It also allows one-step capture and compression. No test drive or ratings. Just an introductory article.
Texts:


This text is a guide to creating multimedia applications with Apple Computer's hypercard system. Many of the concepts presented apply to any multimedia application. These include hypermedia and visual literacy, interactive images for education, cognitive load and hypermedia, and designing for the exploratory learner. The final chapter in the text presents a vision for the continuing development of multimedia.


The title for this book is absolutely on target. It is a bible for multimedia. The book begins with two chapters which review physics as it applies to computers and multimedia. The next chapter reviews electricity and wiring connections. The second part of the book contains three in depth chapters on computers including computer technology, computers for multimedia (platforms), and using computers. Part IV includes chapters on audio technology, audio tools and audio production. Part V covers video and includes chapters on video technology, video tools, and video production. The final section of the book is dedicated to integrating each media and covers chapters on optical technologies, media integration tools, and producing multimedia.

This text is excellent for providing detailed explanations of any component of multimedia, and the science behind the component.


This book is divided into four parts. Part one, introducing windows multimedia, has chapters covering multimedia, using multimedia windows at work, and making multimedia work with your hardware. Part two, multimedia in the business environment, has chapters on using multimedia in the corporate environment, multimedia from the end user's perspective, and multimedia from the developer's perspective. Part three, the most valuable part of the book, has chapters on planning multimedia, avoiding 'muddymedia' and managing different types of media. The last portion of the book covers authoring multimedia and the future of multimedia. The book also provides a sample Toolbook application which allows you to view a fictitious annual report in multimedia format. The disk is
used in conjunction with the chapter on authoring multimedia as a training tool.

This book does a good job of describing the requirements for producing in-house multimedia, or developing a multimedia consulting service. The book is well designed and illustrated. Complex issues in multimedia are explained in lay-terms. The glossary could be expanded, but terms are defined at the time they are encountered in the book.


This text explains what hardware and software is needed to run multimedia programs, and what components are needed to develop interactive multimedia programs. An evaluation edition of Multimedia Toolbook is included with the text and the author walks the user through the development of a multimedia program from using text to adding animation and sound. Glossaries for new terms are provided at the end of each chapter.