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Computer Use in Educational Presentation Systems

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A Abstract Presented to the Faculty of the Graduate School of Lindenwood College in Partial Fulfillment of the Requirements for the Master of Science

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Abstract

Computer based Interactive MultiMedia has many uses in creating educational presentations. Apple's HyperCard has unlimited applications for use in Interactive Video presentations. Basic Interactive Video terminology and the five levels of Interactive Video Programs are defined. The process of producing an Interactive Videodisc, as well as the necessary production equipment is described. Interactive computer programs have an exciting future of use and expansion in the many and varied aspects of education.

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Table of Contents

Chapter One

Over all use of Computers in "Interactive Multimedia"

Ever since the first computer operator turned from his terminal and yelled to a co-worker "Come here and look at this!" the computer display has been a presentation medium.

But the computer hasn't always been a very good presentation tool. For one thing the typical computer monitor is far too small for viewing by more than a handful of people at one time.

Besides that, even in today's increasingly computer knowledgeable society, most presenters are at least a bit uncomfortable with trying to speak and show a computer program at the same time.

Over the years, developments in hardware and software have made computers more useful in creating presentations. This chapter will look at how the computer is being used in presentations. Today's presentations can be created faster than ever before. Now presentations can be livelier, more adaptable and responsive to viewers than ever before.

As little as five years ago, most computer users had to be content with fairly crude graphics software, perhaps even printing the resulting charts on overhead transparency film using a pen plotter. (Lockwood, p. 6).

Today, graphics software packages are much more sophisticated and easy to use. Now available output options include laser printers, high resolution color printers and moderately priced desktop film recorders for slide making. Even videotape presentations can be created using hardware and software products that are now becoming available.

In wide practice is the use of the computer to create presentations which can then be displayed with conventional pieces of equipment like overhead or slide projectors or distributed on videotape. These solutions often make for ideal presentation. Use of personal computers can result in faster production time, lower costs and increased flexibility and creative controls over the finished product (Lockwood, p. 7-8).

But there are other times when the presenter would like to have the ability to tell the audience to "Come look at this" and let them look over his shoulder as he puts the computer through the program.

Slide making is still more popular than electronic presentations, most likely because of its fifty year history. Since it has been used so long, many presenters are very comfortable with slides. But now we have all these wonderful computer graphics software programs and presenters would love to be able to use those beautiful graphics without the awkward process of transferring the images to film.

A variety of products are helping to make such direct-from-the-computer-to-presentation possible. The products include both display hardware such as Liquid Crystal Display (LCD) projection panels and CRT based video projection equipment, data storage devices and many other varieties of computer hardware to control and interconnect these devices too (Gibson, p.21-22).

The word interactive in the title of this chapter refers to making the computer part of the presentation, allowing the presentation to be more dynamic and more flexible, and ultimately more responsive to the needs of a particular audience.

The presentation no longer has to be inflexible or carved in stone, but can be changed at will to match the needs of the audience/situation. Both sequencing, but also content can be changed. At that point of the presentation, it becomes nearly impossible to see the fine line between creation and display of presentations.

This capability represents a major breakthrough in presentation technology. In the past when an audio-visual department created original drawings or typeset charts and photographed them to make slides, which later were shown by the presenter with the aid of an audio-visual technician, the gap between creation and display was very wide. As personal computers and desktop film recorders made it possible for the presenter to create slides a lot easier, the gap between creation and display began to narrow.

More recently, (LCD) devices used on overheads, larger video monitors and video/data projectors have brought the creation and display functions even closer together. Both creation and displaying can be part of the same presentation process (Lockwood, p. 8-9).

The other half of this chapter's title "multi-media" refers to combining a variety of (formerly separate) media, with computer assistance.

Some of this combining is happening naturally as audio and video move from analog to digital formats, in which sound or visual information is stored as what amounts to computer code. On the audio side for example analog phonograph records are quickly being replaced by digital compact discs. Currently, broadcasting television standards are analog, but television production is responding to the new technology moving towards digital formats (Wilson, p.32-33).

The new advanced television standards, like high definition television (HDTV), may eventually make television distribution digital as well. Being digital, these media are easily controlled, edited, and modified by computer or computer controlled equipment.

Many of the new media are based on the compact disc technology, which permits the combination of audio, visual and computer data on a single medium. Compact Disk Interactive (CD-I), Digital Video Interaction (DVI) and even newer CD-ROM/XA are a group of related technologies that use laser compact discs to store all types of information. All are still under development.

With the appropriate interface hardware, even analog media, like standard videotape or disc players, can be controlled by computers and the information stored in them can be merged with computer generated text, graphics and sound. There's a growing industry engaged in the production of interactive videodisc, and several companies have looked into the benefits of using videotape and other media in combination with computers. As a result, a wealth of possibilities exist for creating interactive multimedia and new forms may ultimately emerge (Wilson, p.32-33).

Now that we have a background that suggests the scope of the current technological capabilities, let us consider the questions of how these showy products apply to the real presentation world. My favorite example because of its simplicity is interactive training. Studies show that students learn more when they are actively involved rather than just passively observing. Personal computers have made it possible to create interactive training systems at a low price. The users of interactive training systems find that the results are well worth the small investment.

One of the benefits of multimedia training is the ability to simulate real life situations and events. Interactive multimedia simulation not only shares knowledge, but it instills confidence in the user. A trainee can make mistakes, learn from them, and avoid making an error in a real setting or on an expensive piece of equipment. Interactive multimedia is both a good learning tool and a good learning experience; it builds confidence that the trainee takes with him to the job. Although the development cost is high, these types of programs are now paying for themselves through decreased downtime and training costs in almost all settings. Studies show that training time to learn is decreased and the retention of the information learned is increased by 80 percent over traditional learning methods (Harris, p. 45-47).

Use of interactive presentations can also stimulate the creative process. Ames Cornish of Apple computer says that "People have to go through this in stages. The first is understanding the benefits of doing a presentation from the computer...Just showing slides can bore everybody to death." With Apple's interactive authoring software, Hypercard, you can preset from a larger set of information then just information appropriate to your audience. And, as

Cornish observes "A lot of people are going a step further, doing meetings and using the computer to organize and analyze," (Cornish, p. 15). These electronic meetings employ the computer, usually with some kind of outlining software, to help groups of people organize their thoughts and develop ideas on the fly. While the concept is still in its beginning stage, it represents a significant area for growth of computer-based presentations. Meetings can be interactive using a computer hooked up to an LCD on an overhead projector. The main benefit here is so that information can be changed right at the meeting and printed out or saved. This is very useful for planning sessions. Ideas can be thrown into the meeting, reworked and restructured on the computer and then formalized (Lockwood, p.10).

In the business community it is well known that one useful sales technique is to draw the customer into the sales process by getting him or her asking questions. The main objective here is to get the customer to focus on the presentation by becoming involved in the presentation. One example is the video machines that provide product information in stores and shopping malls. The maker of Touche Interactive Screen programs estimates that 50,000 such systems will be in use by

1990. User studies have shown that shoppers who use the information disks are likely to spend more money and buy more items than those who bypass the systems. Such disks (called kiosks) have been used to sell varied types of products such as blue jeans, audio recordings and home improvements.

Competitive Solutions, Inc., of Virginia, has recently announced an interactive system called Expert ReaListor that enables a real estate agent to sit clients down in front of a computer monitor, then evaluate their needs/wants and qualifications, with computer assistance. Clients can see room by room through any thousands of homes using words, color photographs, maps, floor plans and audio descriptions, all captured, stored and accessed through a desktop computer (Harris, p. 47).

Computer based presentations lend themselves well to product information handouts. Software companies in particular have been quick to take advantage of demo disks. An interesting note is that software companies giving out demo disks encourage users to copy the demo disks to give to friends. This strategy actually helps to spread advertising at no cost to the software companies. At the same time these companies discourage users from copying their real software programs.

Besides software companies, other companies are finding interactive computer disks a worthwhile media for publicizing their products. For example, auto companies like BMW are using them as a way to distribute information on their new cars to upscale computer-owning consumers.

In the training profession, IBM's Storyboard software has long been popular with developers of interactive disks and other training type programs. The software program was originally created for in-house use at IBM. It has gone through some revisions and is now available to outside companies. Recently, it has taken a backseat to other, more sophisticated, presentation software used on the Macintosh. These programs use the ability to combine computer graphics and text with animation, still video, music and voice duplication (Wilson, p. 34).

Other companies using these types of interactive programs include Ford, Quaker Oats, GTE and the U. S. government. IBM is the world's largest user of interactive video having developed over 200 courses for internal use.

IBM has entered a cooperative venture with Intel Corporation to develop Digital Video Interactive (DVI), a multimedia storage system based on compact disc technology (Lockwood, p. 11).

St. Louis University's School of Medicine recently was selected as a site to evaluate the use of interactive video disk technology for the National Board of Medical Examiners. The medical center library uses a CD-ROM based technology to store journal entries for recall. CD-ROM is being used because it can store large amounts of information on small disks.

An alternative system to standard presentations is the use of General Parametrics' VideoShow. It is a fast, easy method of using a system that can either make slides or be hooked up to a television monitor to show graphics. The frames can be called up at random, so information can be displayed in any order and then stored into memory for play back.

In this chapter I've shown how the definition of Multimedia has changed through the years, from graphics and slide-based programs to computer produced slides and video to interactive multimedia. The common trend in all this remains the intelligent use of available technologies, alone or in combination, to produce the best possible presentations for teaching, selling or training information.

Chapter Two

Computer Based Learning Using Apple HyperCard: Videodisc Authoring System

The advent of any microcomputer software brings with it the problem of describing the program meaningfully to the uninitiated. There are many interactive videodisc authoring systems: in this chapter one example system, the Apple Computer HyperCard program, is explored.

Software reviewers struggled for metaphors to explain Lotus 1-2-3, the popular microcomputer spreadsheet program. Descriptions such as "sort of like a wordprocessor for numbers" sounded intriguing but failed to communicate the program's real nature. Essentially Hypercard lets you organize information much the way you do in your mind-by association and context. HyperCard lets the user explore large amounts of information at exceptional speeds, or quickly zero in on exactly what the user needs. Pages of a HyperCard file are linked and cross referenced, so users can learn at their own pace.

In spite of the near unanimous praise, HyperCard, a program for Apple Macintosh microcomputers, has suffered similarly in reviews because it does not easily fit into established microcomputer software categories. HyperCard is part graphics program and part database with a built-in programming language. Author Bill Atkinson describes HyperCard as "a software-construction kit, to let non-programmers put together interactive information" (Silverstone 1988). HyperCard allows users who have little or no previous experience with traditional computer programming languages to integrate text, audio and video material, including computer graphics and animation into educational and training applications that take full advantage of the Macintosh's easy-to-use graphic interface feature.

The HyperText concept underlies HyperCard applications (Yankelovich et al. 1988). In HyperText applications, users browse through a system designed to link and cross-reference text. HyperCard adds to these elements with graphics and audiovisual information. The non-linear, interactive format can respond to the user's requests for more information on a subject. For example, for further information on a word or graphic, the user points at the area on the screen and clicks the mouse button. The program then branches to another screen, plays a video sequence, calls up new text from disk or CD-ROM, or in some other way brings a new set of related information to the user. Thus, users can explore the program heuristically, pacing themselves and taking advantage of the computer's ability to organize, correlate, store and retrieve information (Silverstone 1988).

HyperCard files employ the metaphor of a stack of index cards. HyperCard files, or stacks, are collections of cards containing screen buttons, text fields, paint graphics and other familiar components of the standard Macintosh user interface (Goodman 1987). While not a substitute for database management software, HyperCard shares some structural features with conventional database programs. Text is stored in fields. Fields are arranged on cards, which are comparable to record in a conventional database. Cards can be searched and sorted rapidly. The program also incorporates a full range of paint graphics tools and a powerful English-like programming language, HyperTalk.

The card is the fundamental unit within HyperCard stacks. When displayed, a card in a HyperCard stack occupies the full screen of a Macintosh plus or SE (342 by 512 pixels). On a Macintosh II the card occupies about half of a twelve or thirteen inch monitor. Regardless of screen size, only one card is visible at a time. Users browse through the HyperCard applications by moving among cards, much like flipping through a stack of index cards. Cards are composed of two independent layers, a transparent foreground layer containing graphics, buttons and text fields unique to a particular card, and a background layer of graphics, buttons and text fields that may be shared by many cards (Apple Computer 1985).

The HyperTalk language interpreter within HyperCard is a simple Object Oriented Language (OOL). Most conventional programming languages require the creation of a long master instruction list (Goodman 1987). However, HyperTalk is object oriented, tied to the various components, buttons, text fields, cards, and backgrounds that make up a HyperCard stack. Short pieces of HyperCard code attach to objects in a stack and do not execute until a specific event occurs, such as a user clicking the mouse while resting on a screen button to initiate action, e.g. one click on the mouse button could replace many lines of computer code in a conventional database. By choosing options from pull-down menus familiar to users of the other Macintosh programs, a user can create, move, resize, and visually restyle all basic HyperCard objects (Yankelovich 1988).

Familiarity with the object oriented structure of the language enables the user to write programs, or script. Scripting, the HyperCard mode of speech for programming HyperTalk, resembles a very forgiving, English-like implementation of BASIC. HyperTalk contains an array of basic programming constructs for repeat loops, if-then-else and true-false logic operators, mathematical functions and operators, and text-handling routines. HyperTalk also allows direct control over the visual properties of all HyperCard objects and painting tools (Goodman 1987).

HyperTalk's handling of variables is particularly convenient, since local temporary variables may be created and used "on-the-fly" without prior declaration. Text may be imported from text-only (American Standard for Computer Information Interchange, ASCII format) documents, conventional tab or comma-delimited database and spreadsheet files. The user can program HyperCard to accept and reformat other types of text files, can design custom "Function" subroutines (icons) to move around the file, and can create extensive sound and visual effects.

HyperCard allows the user to create five classes of objects: buttons, text fields, cards, card backgrounds and stacks. The user creates objects by choosing the appropriate command from pull-down menus, such as "new button" or "new field." After creating a button or text field, the user can move the field around the screen and resize it by "picking it up" and moving or stretching in MacDraw, an object oriented drawing program (Apple Computer 1985). By double-clicking, the user can build up a dialog box for choosing names, visual styles, text styles, icons and other options appropriate to that class of objects.

The user accesses HyperTalk scripts by opening a script editing window from the dialog box, which is attached to every object that HyperCard creates. If the user encounters problems executing a script, HyperCard automatically offers the user an option to edit the defective script.

On the screen a button animation can appear. This button is used to control the animation of a series of screens. When the user holds the mouse button down while the cursor lies within the "Animation" button, a short repeat loop cycles continually until the user releases the mouse button. This could illustrate an animated sequence of drawings, showing for example, a door opening and closing. What the viewer sees is a series of frames at a rapid speed that creates the illusion of motion.

In addition to the programming possibilities offered by HyperTalk's standard 250-word command vocabulary, HyperCard's native capabilities may be extended and customized through the addition of special-purpose segments of Pascal or C-Language Code. Such customizing allows the HyperTalk language to control virtually any device connected by a serial interface, including a videodisc player, a CD-ROM drive, and other audiovisual and computer equipment (Williams 1987). Hence, it becomes interactive, responding to the unique inputs of each user in each session.

The Apple Programmer and Development Association (APDA) offers a number of ready-to-use resource extensions to HyperTalk of particular interest to audiovisual application developers. The APDA video resource adds thirty-three English-like HyperTalk videodisc commands to HyperCard, allowing it to control five popular models of interactive videodisc players: the Sony 1500, the Pioneer LV-P4200 and LDO-V6000A, the Hitachi 9550 and the Panasonic TQ2024f (Laffey 1988).

Most videodisc player manufacturers now offer cables with the appropriate connectors and hand-shaking protocols for connecting Macintosh computers to player serial ports. The SendSerial resource, also from APDA, enables HyperCard to send strings of hexadecimal or mnemonic codes directly to the videodisc player, bypassing the generic videodisc commands available through the video resources and allowing full access to all features that a particular videodisc player offers. The APDA offers these extensions to HyperCard within stacks that contain full, understandable instructions for installation and that require no particular expertise in computer programming.

Many resources have entered the public domain, such as ShareWare, which is obtainable from most Macintosh users' groups and national forums such as CompuServe bulletin boards. These resources allow HyperCard stack authors to incorporate digitized audio sequences, color graphics and other capabilities not native to the standard version of HyperCard. Users can copy these capabilities from one HyperCard stack to another in a simple cut and paste operation using the Apple resource editor ResEdit, available from the APDA and most Macintosh users' groups (ADPA 1987). After installing the resource into a HyperCard stack, the user operates the resources with simple English-like commands such as Video-Play, Video-Stop, or Video-Slow.

Fully developed HyperCard stacks may look and act much like stand-alone application programs based on a programming language (ADPA 1987). HyperCard stacks can be opened and run only under the control of the HyperCard program. This dependence on the presence of HyperCard is a relatively minor drawback since Apple now includes the program with every new Macintosh sold and sells HyperCard at the cost of packaging and is distributing it through Apple University Consortium arrangements.

HyperCard includes a full set of painting tools similar to those found in MacPaint (Apple Computer 1984), SuperPaint (Silicon Beach 1986) and other Macintosh paint graphic programs. The user can import graphics from most Macintosh graphics programs into HyperCard applications via the clipboard and scrapbook or directly from MacPaint-formatted documents. The user chooses paint tools and fill patterns from unique tool palettes by "tearing them off" the menu bar and moving them about as independent windows on the screen. As with typical Macintosh paint programs, HyperCard graphics are limited to the seventy-two dots-per-inch resolution of the Macintosh display screen (Laffey 1988). HyperCard does not currently support color graphics, although, a similar new product called SuperCard will support color graphics.

A typical card within a HyperCard stack may contain illustrative graphics, text fields containing explanatory notes, and a variety of screen buttons. The student user can click on any of these buttons to initiate action from the program. The "Animation" buttons causes the program to animate the drawing, illustrating movements. For example, reference button can allow the user to refer to another card extensively labeled with relevant landmarks. Simple animations, coupled with video sequences, can introduce the student to the main focus of the class or assignment.

To produce short computer graphic animation sequences, the user attaches a HyperTalk program script to a button. The program then rapidly flips through a series of cards each containing a drawing of one step in the cycle. Each of the graphics comprising the sequence has its own card. When the users clicks the "Animation" button, the nine cards cycle rapidly onto the computer screen in a reasonably convincing animation of the scene. Note that all other graphics on the screen remain identical from card to card within the animation sequence, creating the illusion that all of the action occurs on a single card screen (ADPA 1987).

HyperCard's primary virtue lies in its ability to easily link associated graphics, text, and videodisc sequences into an integrated connection of information. A dissolve is one of the seventeen visual effects built into HyperCard. A dissolve would work as follows: the student moves the screen cursor over the illustration and holds the mouse button down, the on-screen illustration then melts away to, as one possibility perhaps, an internal view. When the student releases the mouse button, the program dissolves back to the original external type view. This dissolving allows the student to easily associate the two illustrations.

Enabling the user to create multiple levels of depth and complexity by linking illustrations in HyperCard stacks is a central strength of the program. Cards can branch directly to more than a dozen of other cards, containing related graphics and animations, literature references, menu options and program-help information. The card also can link different video sequences from a videodisc. If the creator designs a standardized background graphic that is shared by all the cards in the application, this makes the process of switching from card to card largely transparent to the student user. Icons are standardized at the bottom of the screen allowing the users to page between the previous and next cards, obtain general help type messages, print the current screen, go to the main course menu, or exit the program directly from any card (Williams 1987).

Running HyperCard requires minimum hardware of one Megabyte of Random Access Memory (RAM), a hard disk drive, and a Macintosh operating system version 3.2 or greater. HyperCard and application files can be run from systems equipped with two 800 K floppy drives: however, from my point of view, HyperCard then performs sluggishly due to the large size of the program and application stacks. Complex HyperCard stacks, dense with graphics and screen objects, tend to be quite large, averaging about 10 K per card.

Currently HyperCard based interactive videodisc (IVD) applications cannot be set up on a single touch-screen monitor due to lack of appropriate video display monitors and video overlay hardware compatible with the Macintosh. Such equipment is now available for the Macintosh II, but in most situations the added cost of using the Macintosh II as a host for an interactive videodisc workstation can be prohibitive. So, Hyper-Card generated IVD will probably remain double-monitor configurations (computer screen and a separate video monitor) in the near future. While two monitor IVD workstations do not suit some applications, the low cost of a Macintosh based workstation (about $3500, at University prices, including player and monitor) makes it an attractive alternative to the more expensive touch-screen systems (Sliverstone 1988).

Apple's HyperCard is just one of a number of programs entering the market to implement interactive hypertext concepts in microcomputer educational applications, but no program has yet made all of the capabilities of a fully realized hypertext system accessible to audio-visual developers. While HyperCard allows educational software authors easy access to the Macintosh interface "look and feel," it does lack critical features a true hypertext system would require. In HyperCard, buttons are tied to their locations on the screen, so scrolling text fields cannot be used as reliable branching points for cross-referencing and annotating as a true hypertext environment would allow.

The ease with which HyperCard allows the graphic look and feel of IVD programs to be redesigned may make it an ideal tool for creating "dummy" test programs for complex projects which are highly dependent on an intuitive, easy to use, user interface. A creator could design and test a reasonably functional model of the proposed interface design in HyperCard before programming it in more efficient, but less flexible compiled languages such as BASIC programming language (Williams 1987).

Admittedly, the low resolution of the paint graphics in HyperCard and the lack of access to color, do hamper illustrations. But animations that might take weeks to accomplish on advanced computer graphics systems can be created in more modest form and made available to student users simply by scanning them from pencil sketches and placing the graphics into a HyperCard stack. Most educational personnel are quick to see the virtues of simplicity, low cost and quick turnaround time.

Chapter Three

Interactive Computer Based Learning: Terminology and the Five levels of Interactive Programs

With the advent of interactive computer based learning comes a language all its own. A high-tech alphabet soup, interactive-video terms have baffled many with their unfamiliarity and their definition variations. This chapter will attempt to set the record straight and explain the different phrases that are coming about with the innovative technology.

From the research I completed, this is the first time that interactive video terms, with definitions, have been compiled, making this chapter a unique, but useful document.

Authoring: Refers to the preproduction phase of an interactive video or videodisc program, or to the preparation of an original computer program to run the interactive video or videodisc. Nonprogrammers often use an "authoring language or "authoring system."

Authoring Language: A high-level computer program, often based on a computer-programming language like Basic, which facilitates authoring by reducing the number of instructions involved and translating these into language resembling everyday English. Authoring languages still require programming skills. An example is Course Design Language (CDL), which is programmed using a limited vocabulary of English words.

Authoring System: To further facilitate the authoring process, a front-end program is added to the authoring language, which makes it easier to use by nonprogrammers. CDS/Genesis is a menu-driven authoring system that works like a word processor and produces CDL code. CDL and CDS/Genesis are designed and sold by the Interactive Technologies Corporation, San Diego, California.

The Books: Known by the color of their jackets, these are the Phillips/Sony books of technical standards, released to developers who are licensed to use the technology. The Redbook covers Compact Disc (CD) Audio technology; the Greenbook, CD-Interactive; and the Yellowbook, CD-Read Only Memory (ROM).

CAV: Constant Angular Velocity. Each frame of the videodisc program occupies one track (revolution) of the videodisc. Freeze frame, slow motion, and frame accurate access are possible in CAV. Program time is 30 minutes per side on a 12-inch disc, 14 minutes on an eight-inch disc. Almost all interactive uses are in CAV.

CD-G: Compact Disc Plus Graphics. Warner New Media Inc.'s recent offering, a compact disc with extended graphics capabilities. CD-G discs can be played on regular CD players, but, to see the graphics, you need a player with a graphics-reading chip and a video out port to hook up to your TV. The new JVC-developed players can be seen playing pop and classic music at retail chains like Musicland. The graphics include lyrics, liner notes, and pictures.

CD-I: Compact Disc Interactive. To be released this year by Phillips. The disc has 650 megabytes of storage and is designed to carry digitized, still images like computer-graphics--which are low (one-tenth of the 525-line NTSC image, American Standard) resolution, as well as text and audio. A slow-speed animation can be simulated with wipes, dissolves, overlays, and scrolling. The user will interact with a CD-I player (which has a microprocessor) using a mouse. CD-I will function as a subset of LaserVision.

CD-ROM: Compact Disc-Read Only Memory. Uses the same media format as a CD audio disc, with computer storage applications. CD-ROM can store up to 550 megabytes of data (the complete Encyclopedia Britannica, with room to spare) on one disc, along with other mixed media. Used as an adjunct to small computers.

CD-ROM-XA: Compact Disc-Read Only Memory-Extended Architecture. Sony developed CD-ROM-XA as a bridge from CD-ROM to CD-I, and to provide some level of standardization for using audio and video on a CD-ROM platter. Still in development, CD-ROM-XA will support audio (defining fidelity and speech quality sound) and some CD-I-like motion video (but not full screen or full resolution). Intended for industrial use, XA will be playable on Personal Computers that have audio chips and VGA boards added on.

CLV: Constant Linear Velocity (extended play). More than one frame of the video program is recorded per disc revolution. Freeze frame, slow motion, and frame-accurate random access are not possible. Program time is 60 minutes per side on a 12-inch disc, 20 minutes on an eight-inch disc. It is used for movies, with consumer applications.

CVD: Compact Video Disc. A 4.75 inch disc that carries a band of LaserVision-compatible analog video (six minutes). It can deliver interactive/mixed-media applications, but it needs a special player that can read both bands. Used for music video and point of purchase displays. A company called SOCS Research in Los Gatos, California uses CVD to define proprietary SOCS technology that puts 18,000 still frames (in CAV) or 16 minutes of continuous, full-frame, TV-quality video (CLV) on a CD-sized disc. CVD also encodes two-channel CD-quality audio and data. Slow motion, still frames, searches, and reverse play are possible.

In development is a consumer CVD player that will also play CD audio discs and will have an expansion port for use with personal computer interactive mode, as well as a portable CVD player for music videos, movie shorts or instructional material that can be connected to a television or stereo. Sometimes these devices are referred to as CDV.

DVI: Digital Video Interactive. Invented by the David Sarnoff Research Center (formerly RCA Laboratories, Princeton, New Jersey), in 1983 and first demonstrated in 1987, it's now proprietary to Intel. Using advanced compression techniques, DVI gives the CD-ROM disc the ability to store and interactively process 72 minutes of full-motion, full-frame, low-resolution (256 by 240 pixels, just below the VHS video format) video. It works with and displays any kind of audiovisual material, including motion video, still, audio, graphics, text, and computer data. DVI boards can be added to a Level III interactive system with an IBM personal computer or a compatible system. Used in a variety of markets, DVI will reach the consumer level late in 1989.

EGA: In IBM personal computer display devices, there are different types of boards that determine the quality of the image on the screen. The earliest boards were Color Graphics Adapters (CGA). Then came Enhanced Graphics Adapter (EGA) soon to be followed by Video Graphics Array (VGA). Each standard includes the one(s) below it.

Encoding: A 12-inch laser disc can hold up to 54,000 frames of information. Each of these frames has its own frame number embedded in the disc (like edge numbers in film). Encoding is a process that electronically assigns a precise frame number to each video frame (on CAV discs) as the videodisc master is made from the edit master.

Interactive Video: Any motion picture (videotape, compact disc, optical disc, or hard disc) or program in which the user determines the program sequence by remote control, joystick, keyboard, mouse, or voice control. Most interactive programs consist of a video program and a computer program running in tandem under the control of the user. The basic levels of interactive hardware (or delivery systems) are defined by the Nebraska Video Design/Production Group in Lincoln, Nebraska.

Laser Disc or Videodisc: These terms are often used interchangeably to refer to an optical storage medium read by a laser beam that follows the LaserVision (the trade name for the Optical Disc format promoted by Phillips, Pioneer, 3M, Sony, Hitachi, and others) standard for NTSC (American standard) video and audio. Laser discs have been a standard for interactive programming since 1978. Eight-inch and 12-inch sizes are available, in either single or double sided. Discs can be recorded to play in CAV or CLV.

Level 0: Represents Domestic Standard videodisc players that have no potential for interactivity; it hooks up to a TV like a VCR. A Level 0 player can play any level videodisc, but no interactivity with the program on the disc is possible.

Level I: A Level I videodisc player has certain basic features: remote control, "search" facility, freeze frame, forward and reverse motion, replay and dual-channel audio features. By entering the numerical addresses manually, the user can go to precoded chapter starting points or picture stops. It can be hooked up to a TV. Most Level I applications are consumer-oriented feature films, instructional, and educational programs.

Level II: Like videotape, LaserVision videodiscs have two audio channels. These channels can be used to store digital data such as a computer program. A Level II player contains a microprocessor that reads a computer program encoded in the second audio channel of the videodisc. It offers all the features of Level I, plus on-board programmable memory, improved access time, multiple choice, branching facility, and score-keeping. It is operated with a hand-held remote control.

Level III: Control of the videodisc player resides in an external microprocessor or a personal computer. The computer program that runs the videodisc player resides on a floppy disc instead of on the laser disc itself. Level III offers the greatest versatility of any configuration. The user can interact through a touch screen, light pen, mouse, keyboard, or voice control. A typical Level III delivery system consists of a Zenith high-resolution RGB touchscreen monitor, a Zenith microcomputer with 640K RAM, 20-megabyte hard disc with 8MHz clock speed, a keyboard, and a Pioneer 6010 high efficiency, industrial grade, laserdisc player.

Level IV: An informal level of interactivity; 3M has defined it as "applications requiring standard video plus data encoded in the video field." The data encoded in the video area could be still frame digital audio (which permits as much as 10 seconds of audio for 1/30th of a second of still frame), or digital data to run the program. This data is then downloaded into the computer or computer network, eliminating the need for floppy discs.

Magneto-Optics: To record digitized audio and video signals on an MO disc, a magnetic head on a player generates a magnetic field, where all the dipoles are polarized one way--all positive or negative.

A laser beam then selectively heats certain spots on the surface of the disc and changes the direction of specific dipoles, which results in a binary code, or digital information, that can be read by the laser.

Asaca has developed the ADS-300, a compact still-store recorder, editor, and player that uses magneto-optical discs. The double sided discs come in similar cartridge form and can store up to 1,600 frames (650 Megabytes) of digitized color still image data. Up to seven external dual disc drive units can be supplemented to the ADS-300 main frame for a maximum on-line data bank of 11,200 frames. The portability of the ADS-300 allows for easy data distribution between video libraries, production and news studios and outside relay vehicles and master control rooms. In development are two digital videodisc recorders (the Asaca ADR-5000 and 5500) that use rewritable magneto-optic discs. The 12-inch unremovable discs can store 10 minutes of motion picture video and sound (two channels) or 18,000 still frames (additional disc drives can bring it up to 100 minutes or 180,000 frames).

Premastering: The stage in the production of a videodisc when the master tape is checked and prepared for transfer onto the master disc, from which all subsequent discs will be pressed.

WORM: Write Once, Read Many. Refers to any blank optical disc on which the user can record data once, and access (or read) many times, but can never erase. Storage capabilities vary with the size of the disc.

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Chapter Four

Interactive Videodisc

With all of its exceptional promise, interactive video has been a slow starter. While it has been developing fitfully for over 10 years, interactive, in the late 1980s, has made a less than spectacular splash in the marketplace. The question remains: will things soon change?

Videodisc is the veteran survivor of interactive video developed by Philips, under the name Laservision. Videodisc is an optical technology that stores images and sounds in analog form and more recently digital audio (on some consumer discs and players). Not surprising, it was Defense Advanced Research Projects Agency (DARPA) which in 1978 helped give interactive a push and more visibility by funding the MIT production of the Aspen project, described as "surrogate travel," while the Army also began to spend funds on interactive training discs. RCA announced its ill-fated SelectaVision, or Capacitance Electronic Disc (CED), in 1981, a linear and noninteractive format using a stylus. The company plunged $170 million over 15 years into development and marketing of the format which eventually lost out to VHS video cassette recorders in the home market (Iuppa p.10). Manufacturers of the other interactive and disc playback schemes envisioned interactive disc as a tool for training in the military and business sectors. Nevertheless, out of the flurry of dollars spent came a standard developed for both NTSC (American standard) and PAL (European standard) of video.

With a slow but steady growth forecast, interactive analog videodisc has an industrial market base of 160,000 players. The consumer market is waiting to be tapped with 400,000 players in the U.S.A. (Harris p.18). Thus far, though, products are mostly old movies; and precious little is interactive.

It is the next wave of technical advancement in interactive that may well be stalling broader acceptance of standard videodisc interactive, Compact Disc-Interactive (CD-I) and Digital Video Interactive (DVI) with their increased capabilities that obsolesce their progenitors. The growth of these videodiscs is being retarded by all the talk about CD-I and DVI. With competition on the horizon for the videodisc, potential producers and buyers are hesitating, to wait and see what develops (Price p.38).

Two developments have pushed the videodisc along: the combination player, which plays standard twelve and eight inch analog videodiscs, as well as Compact Disc audio and Compact Disc video, has increased awareness of the optical technology, specifically in the business sector; and, second, IBM's introduction in 1986 of InfoWindow, a multimedia development and presentation system. Recently, competitor Sony has made its View System compatible with the InfoWindow development and presentation system.

There are 1,000 off-the-shelf generic courseware titles for business training, which will run on Info-Window and the new compatible View System, as well as over 100 other on earlier View Systems (Harris p.20).

Equipment cost is generally minimal. But Info-Window or View System, as a development platform also doubles as a display, which can be a problem because neither IBM nor Sony has yet produced a cheaper presentation system. The InfoWindow system includes an IBM monitor with touch-sensitive screen, microcomputer and control program, and an optional non-IBM videodisc player. The price is about $10,000, less if the buyer already has a microcomputer and applicable software

(Iuppa p.20). A producer will need hardware and software to configure the system, including an Enhanced Graphics Adapter (EGA) card and graphics software. Depending on the purpose and design, a producer may opt to use an authoring system, an application program to input data and run the interactivity instead of writing a customized program, which demands a higher-level programmer, but yields a more complex design. An authoring system prices from a few hundred dollars into the thousands.

Fifty-four thousand still images, or thirty minutes of moving imagery, on an analog disc is a lot of information to fill, along with two audio tracks, which can be used separately or as stereo. Add to that graphical and text overlays, created and stored on a hard disc for repurposing or multipurposing a disc. Some producers minimize or eliminate the videodisc's role in storing full-motion video because they find interactive graphics on hard disc (as offered by CD-I and DVI) more effective for their purpose than the use of full-motion video on videodisc (Perlmutter p.12).

One producer, Jeffery Silverstein, CEO of New York-based Fusion Media, says as much as forty percent of the cost of preparing a videodisc may go into design and programming (Iuppa p. 14). Before broaching manufacturing costs of the disc, a check disc must be made from a 1-inch videotape master for technical and design verification at about $200 per side. At one major facility, 3M, a master costs $1,800 per side with a ten day turnaround. Replication runs at $18 for one side for less than a hundred copies. Costs do drop with an increased volume of copies. A videodisc producer may, though it's rare, complete a program for a little as $35,000; more likely, the project will run $125,000 or more.

The standard post-oriented teleproduction facility does not require massive rearmament for videodisc production as long as there's a Sony BVH-2500 (1-inch single frame capable videotape recorder) on premises. It is with the digital formats of CD-I and DVI that the facility owner stands on the sidelines of a whole new ballgame. The clincher is that live-action digital video images demand a formidable amount of computer storage space, more than data, graphics, or sound (Bond p.14).

CD-I is a by-product of CD-Audio, a consumer success story that came to market in 1982. CD-Audio drove the creation, in 1985, of CD-ROM in the business sector with a storage capacity of 650 megabytes, which in turn inspired DVI development, first introduced in 1987. Developed by Philips in conjunction with Sony, CD-I was announced three years ago; another announcement is forthcoming from Philips that full-fledged full-motion interactive video will be available by 1991. The scheduled rollout for units in the business/professional sector is now first quarter 1990, and late 1990 or early 1991 for the consumer-which is the heart of Philips's venture. The consumer players are to be priced under $1,000. and array of software will be available at that time (Iuppa p.12). With 650 megabytes, CD-I can handle data from a variety of sources: for instance, two hours of high stereo sound; or 16 hours of AM radio quality video still frames; or up to 150,000 pages worth of text and graphics; or, most likely, some combination of the above. Because of the nature of digital data, the actual length and time of the resulting audio and visual property depend on the elements and complexity of the design.

CD-I is set up as a world standard, with Sony and Philips cooperating in order to avoid a battle comparable to that between VHS and Beta for video tape format like battle. Using CD-Audio technical specifications to ensure maximum compatibility, a CD-I player is a stand alone unit that can be plugged into any television set and will adapt to its video signal. With a universal standard as its master key, CD-I has another advantage: A CD-I machine will handle CD-Audio; and many CD-Audio players, with a separate decoder, will connect to a TV and display CD-I, which primes the format for the market.

Assuming that traditional video equipment is in place, the cost to a facility of CD-I setups (audio, video, and simulator workstations) is at least $80,000 if the components are purchased as a package, according to the estimates of Vango Video, a Minneapolis based CD-I equipment manufacturer. However, Laura Buddine, president of Tiger Media Concepts, a production company in Downey, California, who began early on to explore CD-I, estimates expenditures at more like $250,000. "There is a tendency to develop for the technology," she says, "rather than for the user" (Perlmutter p.20).

A postproduction video house has two alternatives: purchase of a CD-I workstation at the beginning of a client relationship with a "service bureau;" in the latter situation, a producer brings raw audio and visual materials with flowcharts and other specifications on how the work is to be organized interactively.

Sounds and images are digitized, and at the simulator (a form of authoring system) they are assembled with the complex coding and processing that, at this stage, CD-I requires. A 1/2 inch tape is produced and from that a Programmable Disc System (PDS) is produced or the tape is sent off for mastering and replication.

While CD-I has garnered mixed reviews within the interactive community, an anticipated announcement of full motion video capabilities along with the entry of Matsushita into the manufacture of CD-I equipment could go far to alter the skepticism (Anderson p.34).

DVI, on the other hand is met with more enthusiasm. Developed by David Sarnoff Research Center, DVI was designed around CD-ROM. The technology was sold to Intel, and IBM subsequently announced its support of the medium and a joint development with Intel.

Described as interactive multimedia on a PC platform, DVI tackles the full range of audiovisual material: motion video, still, audio, graphics, text, and computer data. To produce DVI programming, a producer will generate video, sound, and other images, then scan and enter stills and audio into a computer, using

Intel's Pro750 Application Development Platform (ADP). At this point the information becomes a series of digitized files that can be manipulated interactively. Compression of full motion video is pricey at $250 per minute. In digital format, an Edit Level Video is conceived, analogous to a work print, with high-quality compression of stills and audio. But the analog full motion sequences must be sent off with time code to a compression service. They also become digitized files which are put into place with the digitized graphics, stills, and audio files on the Pro750 ADP, and a Presentation Level Video (PLV) results. From this, a disc is mastered and replication is standard, the same as that for all other optical digital 4.75 inch formats (CD-Audio, CD-ROM, CD-I); the master is $1,400 and replication $2.00 per disc with a ten day turnaround time. Paula Zimmerman, manager of marketing communications at Intel's Princeton, New Jersey, operation, estimates that DVI's production costs range from $25,000 to $250,000 plus, depending on applications. A DVI full motion, full screen resolution is "perceived" as VHS quality. The resolution quality is much higher for a still frame videodisc.

The Pro750 is a 386-based PC, with boards and software, including a variety of graphics capabilities necessary for DVI application development. At $21,500, the Pro750 begins shipping in late 1989. With prices expected to be substantially less, end users equipment for the business market will be available in the first half of 1990; for the consumer in 1991. Chips for the manufacture of end user equipment will be ready in 1990. Commercial software titles are expected to hit the shelves at the beginning of 1990, while consumer software is slated to appear in late 1991 or early 1992 (Prince p. 38).

What will happen to the interactive video marketplace? In spite of recent statements about the professional market, CD-I looks more like the consumer product because of price point (a stand alone playback unit for the consumer market is available for under $1,000). American Interactive Media, a Philips /Polygram company, has opened three U.S. studios to co-produce CD-I discs, with well known book and record publishers, who will then market them. Meanwhile, DVI fits well into a corporate production environment because of its role as a multimedia desktop platform (Lee p.18).

Digital formats, DVI and CD-I, provide the greatest flexibility in production of stills and full motion, graphics, and text; but analog videodisc still presents a higher resolution and a more powerful image. No matter what the delivery format, interactive video is here to stay; we've only seen the first few frames.

Producing an Interactive Program

How does a producer prepare an interactive disc of, say, a history lesson? First, he/she consults with experts in the field and decides on when and where to use motion, stills, graphics, and text. A script is written, including strategies for interactivity; in this case, there is an assumption that the user will access the program through a touch screen with menus, icons, objects in photographs, or some combination of same.

A flowchart graphs how the information will be accessed through branching or other means. The designer must also consider how a disc can be repurposed or multipurposed through graphics and textural overlays stored on the computer's hard disc. For instance, dates can be updated, special packages inserted, areas on maps isolated and enlarged through graphics, and text stored on hard disc. The script may be put into storyboard, then the production process continues with video production, sound recording, the creation of graphics. The process of putting stills on tape is slow and costly, with lab time per slide at three or four minutes for color timing where hundreds or even thousands of still images may be used.

The edit occurs with careful attention to where images are to be placed on the disc in relation to frequency of access, and speed of frequency of access, and speed of retrieval time. Each frame is given a number. From the edited video tape, a 1 inch video tape premaster is produced, following strict disc formats dictated by the mastering facility. Then a check disc is struck; it is used to verify that all is correct, including branching. If errors have been made, the producer must return to the one inch video tape master to reedit. The corrected tape is mastered and replicated. Then the program, planned out in earlier stages, is developed. To drive the interactivity, an authoring system is used, an application analogous to a word processor. But, for more flexibility and options, with a program such as HyperCard, a producer can write a program customized to the project at hand and connect disc segments and frame numbers to the machine instructions within the computer's program.

This chapter has shown that videodisc started as medium to play entertainment type movies. Interactive videodisc then came about with the support of military projects. Now, interactive videodiscs have emerged from the movie videodiscs to educational interactive computer based programs. As equipment pricing decreases for production, manufacturing and viewing systems, more educational programs will surely be produced in the future.

Chapter Five

Interactive Video's Future in Education

Marshall McLuhan used to remark, "Gutenberg made everybody a reader. Xerox made everybody a publisher." Personal computers are making everybody an author. E-Mail, word-processing programs that make revising as easy as thinking, and laser printers collapse the whole writing-publishing-distributing process into one event controlled entirely by the individual. If, as alleged, the only real freedom of the press is to own one, the fullest realization of the First Amendment is being accomplished by technology, not politics.

Based on the history of past technology, in the near future the cost of the equipment to create full interactive video programs will decrease significantly. This will make the interactive hardware available to a larger base of educators. To this end, national and international educational associations devote a large portion of their conferences to computer assisted instructional presentations. Some associations even have special conferences on the subject. Many of these programs are devoted to computer assisted instructional presentations using interactive video.

At the recent American Association of Medical Colleges' (AAMC) annual conference in Washington, D. C., a student representative stood up in a seminar on computer based learning and stated that schools, colleges, universities need to take a hard look at the budgets given to computer labs available for student use. The student stated that pupils are becoming more computer literate in high school than ever before. The student added that as students plan to continue their education, they look for educational institutions that provide a strong availability to computers. This is one indicator that educators need to move on the situation at hand; and, part of the response should include interactive videodiscs.

Institutions are waking up to the fact that computer availability is a growing concern. To add to the computer usage, many educators are devising programs that use interactive's capabilities to add to the student's knowledge. For the last three years Dr. Hurley Myers and Dr. J. Kevin Dorsey from Southern Illinois University at Carbondale have had medical students using interactive computer programs to facilitate learning. The program is easy to use and was developed to create patient simulation modules that were designed to improve the clinical reasoning skills of preclinical medical students. The computer interfaces with video to deliver patient simulations through video. It delivers the patient records on the computer for the students to study. From this information the student can ask medical questions which the patient answers through video and then can order tests for the patient. All data questions asked and tests ordered are stored in the student's computer disk record so the professors can see how the individual student addresses the medical problem. The software system provides for tracking of all student choices, scores the student on the exercise and provides an accounting of patient costs for all tests ordered by the student in the simulation. The software provides the flexibility for the professor to look at every piece of data entered (in order) by students, allowing individual professor-student counselling.

These educators are on the cutting edge of the interactive explosion. The explosion will happen as individuals learn to devise their own software and integrate video for teaching use.

In a keynote address at a computer education conference, Michael J. Ackerman, Ph.D., Chief of Educational Technology at the National Library of Medicine, noted that "throughout history, as new communications media were developed, they were adopted by educators in a continuing effort to enhance the learning environment. The current 'new' media are the microcomputer and the videodisc. Educated microcomputers controlling videodisc players are being used to provide patient management and laboratory simulations as well as instant access to picture libraries, with each library containing several thousand pictures and associated text."

Ackerman added, "Will the educated computer find a place as a learning enhancement tool within the educational community? Or is it just a passing fad? It is too soon to tell! A large enough body of courseware is yet to be written. New display technologies are being tried and most important, the educational benefits remain to be clearly demonstrated." These questions where posed by the very person who heads the area responsible for applying interactive technology to medical education. His statements show that the future of interactive video is still unknown. But development of interactive programs are still moving forward.

To that end, a review of where we have come from is appropriate. All is vanity, said the preacher, and there is nothing new under the sun. Well, maybe there wasn't in the time of King Solomon; but the author of Ecclesiastes was pondering the human condition, not man's evolution as a toolmaker and healer. In these high-tech days of the second millennium A.D., something new whizzes by practically every minute. In just the past dozen years the personal computer has transformed offices; video cassette recorders and compact discs have revolutionized home entertainment; and biotechnology has conferred genetically engineered vaccines and a host of other benefits on mankind. The next ten years will bring the world to the year 2000. Many further wonders are lurking in the labs today that will be commonplace when the new century begins (Bylinsky 1988).

Apple computer took a look at the future in a videotape called "The Knowledge Navigator". The video program showed a professor verbally interacting with his notebook size computer. The notebook has a screen on the top right hand side of the notebook where a human like figure answers for the computer. The professor was able to have the computer act as assistant by dialing phone numbers and getting the other party on the line. The computer was also able to use a telephone type modem to contact library databases and obtain articles for the professor to review. Along with text came full color animation and graphics. The professor was able to save and send the lecture outline and the animated teaching graphics to the lecture hall. This Apple Computer program is a true vision of the future combining an interactive talking computer with advanced telecommunications.

With interactivity we will soon have capabilities no human ever had. Back when our forefathers were young, they used to take horse drawn carriages to the railroad station. There were no automobiles, no telephones, no movies. No airplane had ever flown. There was no television, no atomic bomb no man on the moon. But today we have flown in jets and seen all those other technologies emerge.

With all that has happened already, and with an appreciation of the significant impact the dawning of the computer age has already had, why wouldn't we think that the next ten years will lead to a technological, as well as a chronological, new millennium? What could possibly top all that has gone before? The answer is that now, in contrast with earlier decades of invention, mankind stands at the dawn of the Age of Insight--a new era of understanding how things work and how to make them work better. In both electronics and education, these two principles create new products; the immediate future holds not just the compilation of more and more data but also some startling new visions of interactive usefulness.

In product development, emerging computer technologies will enable researchers to create designs of products and test for strengths and weaknesses without ever building expensive prototypes. In medical fields, the computer's interactive capabilities to respond to voice commands and to improve body scanning techniques, will aid both diagnostic and surgical accuracy. Generally, we can anticipate the new Age of Insight offering views of the workings of the human body never before attainable. Computers will decipher the interactions of the body's own healing substances and the underlying causes of disease, allowing researchers to develop novel drugs and methods of treatment.

In education, the new technology, though intially expenisive could in the long run save money and improve services:

Its impact in this field, as in others, could be quite profound. The cost of education per year for each pupil increased from $1,000 in 1952 to $3,800 in 1986. The rise is not due to inflation, because the study used constant 1986 dollars (Bowsher 1988). Educational interactive video programs do require a initial investment to develop and produce. But, once produced, they can be duplicated inexpensively. If mass duplicated and used in schools, interactive videodisc could combat the increasing cost of education by inexpensively augmenting teacher services.

An analysis of student to teacher ratios suggests why there is a need for instructional aids in the classroom. The plain fact is that pupil to teacher ratios have been falling throughout this century. Back in 1900 there were 37 pupils per teacher in public schools, 27 in 1955 and in 1986 there were 18 (Bowsher 1988). The book, <u>Educating America</u>, claims that education researchers have been unable to produce any consistent evidence that low pupil-teacher ratios do improve student performance. Nationally, well-developed interactive programs could educate students in a uniform style. Using interactive video programs, which are far more dynamic than any "programmed learning" packages now being used, students can learn what they are most interested in, at their own pace. True interactive learning promises to reduce boredom, so often noted as a educational problem.

Economist Eric A. Manushek, of the University of Rochester, concluded that the experience since 1960 is unmistakable: "Expenditures are unrelated to school performance, as schools are currently operated" (Bowsher 1988). The U. S. education system is not providing an adequate return on the dollars being spent to educate the nation's youth. Interactive videodisc education programs offer a viable way to add quality and improve that return rate in terms of better educated persons.

U.S. Education is essentially a socialized business, the American equivalent of the Soviet Union's collective farms (Bowsher 1988). In keeping with this style, standardized educational interactive video programs could be developed for national use. Interactive programs can keep the educational process standardized for the entire nation. The cost associated with program production will be lower on a per student basis as the number of students learning from a videodisc increases. There are intangible as well as far-reaching tangible rewards to be reaped from and by a better educated citizenry. The new technologies offer reasons for optimism about improving the beleaguered big-city public schools. Interactive video build on acculturation that begins in American living rooms interacting, albeit more passively, with the family television.

So far, the national educational reform movement has tried to improve the system without making changes in the classroom. In the 1990s, if there is to be a breakthrough in education, the process of education -- of what happens in the classroom -- must be restructured. Educational interactive video programs can change the process of education by making the class room environment interactive, not souly dependant on teachers. Interactive video programs can augment the teaching process and increase the level of interest among students and educators.

Similarly, interactive videos can exert a profound impact on corporate training programs. Most people have no idea that employee education is a $40 billion dollar plus industry in the United States. Millions of employees attend school for a few days or weeks each year during their thirty to forty year career (Russell 1989). The cost of employee education has been rising and many executives are becoming concerned not only about the cost, but also about the quality of education. Industry is starting to develop interactive training programs for employees as away to reduce training costs.

The lessons learned within the employee education (interactive computer based programs) could become the model for restructuring the process of education in the public schools and other educational systems. It is encouraging to note that one of the national education goals recently articulated by President Bush is to guarantee "the supply of qualified teachers and up-to-date technology".

In conclusion, it is likely that this emerging national attitude expressed by President Bush will provide a springboard to accelerate the introduction of interactive computer based programs in to learning. Ackerman noted, "the future is uncertain, but development of new interactive programs continues."

Throughout this paper we have explored a number of issues. First, interactive multi-media technology was described. The speed of producing computer generated presentations for educational use is faster than ever before. New technology has also made it less expensive to produce such presentation.

Second, Apple Computer's videodisc authoring system software HyperCard offering a simple-to-use and low cost solution to developing interactive presentation systems was described. The low cost of Apple's HyperCard program is a leader in bring affordable and easy to operate authoring systems to education.

In the first compilation of its kind, Interactive videodisc terminology and the five levels of interactive programs have been defined.

Although no one can predict the future and be 100 percent accurate, it is clear that interactive computer based programs can be used in education to help keep cost down and provide uniform, interactive learning that will improve education efforts and that its potential for making significant contributions in business, medicine, and other fields is quite high. From what we have seen so far, the technology used to produce interactive video programs is becoming less expensive; the future is secure for continued interactive video development. More and more programs are being produced for both school and employee education.

As long as the government and industry continue to spend the dollars needed to develop new equipment and programs, the future of interactive technology will be a shining star for the education of our country.

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