The Nuts and Bolts of Designing and Implementing a Videodisc-Based Language Learning Center

The Department of Foreign Languages at the United States Air Force Academy realized as early as 1979 that interactive videodisc (IVD) offered a qualitatively different way of presenting lesson materials to students. The powerful interactions that IVD makes possible between student and subject matter as well as its video and graphics capabilities made the decision to install an IVD Language Learning Center a wise one.

This paper is a blueprint for IVD implementation, addressing four important elements of integration: 1) the presentation environment; 2) the ergonomics of delivery; 3) hardware specifications; and, 4) the authoring environment. This blueprint is flexible in that it allows for the future integration of Compact Disc (CD) technology as a viable tool for foreign language lesson delivery.

Interactive videodisc (IVD) has been heralded by many as an important new technology that will have a significant impact on education (DeBloois, 1984; Schneider & Bennion, 1981; Eastwood, 1979, Howe, 1985; Leveridge, 1979). Although a few educators are still bracing for the impact and feel that it will never come, the Department of Foreign Languages (DFF) at the U.S. Air Force Academy (USAFA) has taken a bold step by replacing its traditional language laboratory with videodisc-based technology.

A great deal of thought went into the decision to install IVD. We examined the capabilities of the more traditional hardware on the one hand and the potential offered by the new technology on the other. We scrutinized the extent to which applications of the technology reflect the tenets of current thinking about second language acquisition. In tallying the results of such scrutiny, the plus column was much larger on the side of IVD than on the side of the traditional language laboratory.

Advantages of Interactive Videodisc

There are advantages to using IVD. IVD offers audio quality that is equal to and often better than that offered by more traditional media. IVD also appeals to the "TV generation" in that it provides the rich extralinguistic context via video that is thought to be so powerful in helping language learners better understand language input. Although immediate feedback and the integration of computer-based testing are also valued advantages, perhaps, the most important advantage of IVD is that it permits and encourages interaction. Nelson, Ward, Desch, and Kaplow (1976) write that "interaction is perhaps the most effective teaching technique possessed by the human teacher." (p. 30).

Educators recognize that a difference exists in the outcome of learning between students who are passive during instruction as opposed to those who are active (Anandam & Kelly, 1981; Mahlios & Bromley, 1984; Schrupp, Bush, & Mueller, 1983; Verano, 1987). "In education it is a maxim that 'involvement precedes interest'" (Abrams & Streit, 1986, p. 92). IVD potentially offers a qualitatively different way of handling lesson

delivery, so that **interaction between student and subject matter becomes paramount.** The great advantage of IVD is that it enables this interaction to be much more intense than it can be in a traditional language laboratory setting.

One of the First of Its Kind in the World

Since the Language Learning Center at USAFA is one of the first of its kind in the world, readers contemplating a similar installation will find the information contained in this article insightful in terms of what is needed for designing and implementing IVD into the process of language instruction.

Concept of Operation

At the USAFA Language Learning Center the most important component is the student. Therefore, we see our primary function as that of providing the most effective language instruction to students in order to motivate them to achieve competence in the target language. Next to the importance of the student, a second important component of the Language Learning Center operation is the conduct of high quality research. The results of this on-going research into the modes of learning made possible and enhanced by IVD technology will guide the Air Force Academy in undertaking wider applications of IVD in the future and provide a database which other institutions can access.

Configuration

The overall configuration of the Language Learning Center is based on extensive experience and research conducted during the past seven years. The underpinning of the Center's configuration is flexibility, allowing both for the delivery of IVD instruction and for research into the interactive learning process.

Physical Layout and Integration. The Language Learning Center at USAFA consists of two 39 x 37 feet rooms equipped with raised computer floors. These floors rest on a 12-inch high metal grid made up of 2 x 2 feet removable panels covered with nonstatic carpet. The panels allow for rapid access to cables and wiring underneath the floor. Filtered alternating current (AC) and dataline connectors are built in via special plugs incorporated into selected panels in the floor.

The two rooms are interconnected by a service area also partially outfitted with a raised computer floor. This service area houses the primary file server containing all programmed lessons for all language courses as well as the network distributors which send the requested lessons to the appropriate student station. Additionally, the service area houses a secondary file server, a Zenith Z-248 AT microcomputer, which contains data evaluation software and authoring programs.

Each room accommodates 32 integrated student stations of 25 square feet per station. The stations, concentrated in groups of four or five, are arranged around a center hexagon which serves as the equipment storage and video distribution center.

The Center's configuration simplifies maintenance and technical supervision, since the videodisc players and the backs of the interactive units—with all of their controls—are accessible through the center hexagon only. Air-conditioned or heated air is filtered via high density microfine glass fiber filters which reduce the amount of damaging dust particles on the equipment.

Student Workstation. Each student station is equipped with a Sony Advanced View interactive videodisc system. The student station is made up of three Pleion metal frame panels with foam insulation and a cloth covering on both sides. The rear panels of the student stations measure 36 x 68 inches. By using 120 degree angle brackets, the panels form a workspace which is not soundproof but restricts the dispersion of sound considerably. The panels are readily available on the market.

The equipment for each module includes the following interactive components: the color monitor, computer, videodisc player, keyboard, mouse, and a lightweight stereo headset connected to the videodisc player, permitting the student to listen to audio in a semi-private environment. The monitor's center is mounted on an ergonomic height of 39 inches and at a distance of 30 inches from the student. The trapezoidal table surface (60 x 26 inches) provides workspace for the student and supports the monitor, keyboard, and mouse. Current generations of "windowing" software require

the use of a mouse. Studies conducted at USAFA as well as by the Strategic Air Command show that use of the mouse as input method is superior to touch screen in many applications.

Completing the ergonomics of the student station is a cloth-covered swivel chair with arm rests, pneumatic lift seat height adjustment, and five-blade base for stability. The chair also has biosynchronized seat pitch, lower back lumbar support, and individually adjustable backrest.

System Specifications

The specifications which follow apply to our system and are provided for information purposes to guide those who may be contemplating a similar venture.

Item: Microcomputer
Description: Sony SMC-3000 with 16-bit (Intel 80286) CPU operating at or above 8 MHZ; with AT compatible bus structure capable of supporting all system requirements; 5 vacant slots for additional components interface cards (for future expansion) after the requirements for the basic system, overlay capability, videodisc controller, and pointing device are met; 640KB volatile user RAM with the following standard ports: Centronics-compatible parallel port, two Serial ports, one RS-232C compatible and software selectable asynchronous port operating at 300-19,200 baud for control of videodisc player and a second nine-pin port for control of a mouse; removable 3.5 inch disk storage subsystem with controller installed with a formatted capacity of 1.44 MB for a double-sided drive with capability to read, write, format a disk compatible with DOS 3.2 operating system; system operates with Seagate ST 225 hard disk drive with controller used as intermediate storage medium; three locations for placing various types of drives (floppy, hard disk, CD-ROM). In the future, to allow student access to multimedia reference materials, Sony System will be equipped with half high CD-ROM drive in third drive slot.

Item: Keyboard
Description: Detachable; supports a minimum of an alphanumeric keyboard; capable of ASCII 128 character subset generation; standard "Qwerty" typewriter style AT keyboard; auto repeat for all printable ASCII characters, cursor controls and backspace functions; 12 user programmable function keys to call up foreign language character sets and control standard repetitious functions; four cursor positioning keys; numeric keypad.

Item: Video subsystem
Description: Display board provides both analog and digital RGB and NTSC composite video signals; subsystem drives a display of 40 and 80 characters with 20 to 25 lines (19 and 24 user and 1 status); generates the ASCII 128 character subset and standard character with minimum matrix resolution of 8 x 8 pixels with true descenders for all lower case characters and special characters; bit-mapped graphics display with each pixel in video memory capable of being directly addressable by CPU and available to video controller; two display screens (one for characters/standard graphics and one for high quality color graphics controllable independently and overlapping each other; screen resolution of 320 x 200, 640 x 200, and 640 x 400 depending on character or graphic screen; capable of displaying from 2 to 256 colors from maximum of 4096 colors depending on character or graphics screen in use.

Item: RGB superimposer
Description: Capable of overlaying characters and full screen analog RGB graphic data from microcomputer over analog video without appreciable flicker; provides separate IBM compatible RGB output.

Item: Videodisc player
Description: Sony LDP-2000 with laser beam reflective, semiconductor laser diode for 12 and 8 inch discs; access time from frame 1 to 54,000 in 1.5 seconds or less; expandable to include still-frame audio capability; expandable to allow computer data read capabilities from videodisc with same reliability as floppy disc; rack mountable, front loading with standard RS-232C computer interface.

Item: CRT Monitor
Description: Sony PVM 1271Q, a 12-inch RGB/NTSC with multi-standard color system; BNC and RCA industry standard jacks capable of processing NTSC signals from videodisc player as well as standard audio inputs and outside sources; jacks can also process digital and analog RGB inputs from computer via DB 25 and/or BNC connector; built in audio amplifier

with speaker and volume control.

Item: Pointing device
Description: Logitech (LG-7) mouse with DB-9 connector and RS-232C configuration.

Authoring Workstation

Each authoring workstation consists of basically the same hardware as a student workstation with the addition of certain options. Each authoring workstation requires a hard disk drive with a minimum of 20 MB. A high speed laser printer with graphics and foreign language font capabilities is accessible from each authoring station. A bit pad/graphics tablet option may be necessary for the authoring station depending upon user applications.

Networking

The Department of Foreign Languages has conducted research that indicates that some form of networking capability is essential if the Language Learning Center is to function properly. Previous experience with delivering lessons to even small numbers of student workstations supports the reality that replication and distribution of floppy disks is cumbersome at best and impossible at worst. No sooner are the necessary copies created for a particular lesson, then changes are needed that necessitate replacement copies. Multiplying this experience with small numbers of students/courses by our maximum load (1,400 students, studying over 20 courses, and working through up to 20 interactive lessons each) points toward the need to deliver lesson materials via some form of networking.

Network of Networks

Although it is not possible in this article to discuss all types of networks and their protocols, a cursory discussion of our internal network is helpful.

Our Language Learning Center is equipped with a Carrier Sense Multiple Access/Collision Detect (CSMA/CD) network, generically referred to as an "Ethernet network" (a trademark of the Xerox Corporation). The "Ethernet network" allows the file server (a central repository of programmed lessons) to transmit one packet of information at a time to the student station. Once the student station has received the

lesson, it can disconnect itself from the host and run the lesson in stand-alone mode, collecting data on a hard disk or a floppy disk for later transmission of student output back to the file server. Obviously, the lessons can also be run in on-line mode, that is, the file server rather than the student station controls the flow of the lesson and initiates data dumps as required.

This network will be capable of interfacing with the academy-wide local area network (LAN) to facilitate teacher access to grades, central word processing, lesson authoring and other software, residing on the USAFA's three mainframe computers.

Network Specifications. As one suggested solution to networking requirements, the File Server is a "3Server3 COMPLETE" incorporating a 70 MB server, a 2 MB Cache buffer and a 60 MB tape backup system including all necessary network software. This server is capable of being upgraded in increments of 70 MB to a total of 910 MB. A 3COM Etherlink+ card with a 256 RAM buffer and a 80186 coprocessor is installed at each student station to facilitate expeditious download of graphics oriented lessons (e.g., a 1.2 MB lesson in 18 seconds). In addition, the network has all connectors and terminators and all cabling necessary to insure its proper operation.

Data Management and Analysis

In order to fulfill one of the functions for which this center was created, namely data collection, we have ordered sophisticated database management software tools and data analysis software to complete the instructional design and delivery loop. These data management tools and other administrative software reside on the secondary file server. We have convenient access to advanced printer capabilities that will provide efficient hard copy reporting of student performance data.

Data and Software Specifications. Student performance data collection is done with "dBase III" or equivalent. To be equivalent, software must be able to create, read, and write dBase III files. "SPSS PC+ or equivalent will be used for the analysis of student performance data. "SPSS ENTRY+" or equivalent will be used for the

manipulation of student information and student performance data as well as interface between dBase III files and SPSS PC+.

Courseware Development

Use of a powerful authoring environment is essential in order to develop the quantity of lessons required to support the activities of the Language Learning Center. Center staff have evaluated several authoring packages in a research effort sponsored by the Air Force Systems Command in support of the Advanced Training System being developed by the Air Training Command. Results of this research project have provided guidelines for the selection of an authoring package.

One of the packages investigated, IconAuthor, promises to significantly increase authoring productivity. This early finding has been borne out; Department of Foreign Languages members are developing lessons in German, Spanish, and Chinese using IconAuthor software.

Language Learning Center staff use this authoring system to create design strategies to guide the development of interactive videodisc-based lessons. The organizing principle of lesson design is partially based on the American Council on the Teaching of Foreign Languages (ACTFL) Proficiency Guidelines. Once the design or structure of a lesson is completed, Center staff help instructors integrate language specific content into the lesson. Instructors are also able to work with Center staff to design special applications.

Software Specifications. The authoring system, IconAuthor, is an icon-based, object-oriented, symbolic authoring system that works within a windowing environment. This system is controllable through keyboard and/or mouse input. IconAuthor has high- and low-level programming capabilities which enable authors to create lessons by building blocks in the high-level environment, or change the function of the blocks under low-level control. "Microsoft Windows" version 1.03 or later is required for authoring and delivery of lessons at workstations. IconAuthor contains the following integrated editors, accessible from any selected environment: 1) a text editor used in the creation and manipulation of standard ASCII text files for

use within lessons being authored; 2) a video editor that contains all the necessary videodisc control functions normally found on the designated player itself; 3) a graphics editor with built-in or third party supported graphics design editor, PC Paint or equivalent; and, 4) a student lesson preview mode available from within the authoring environment without forced exit from the system.

IconAuthor allows the use of designated third party character fonts. The system allows for the creation and recall of complex character fonts. In addition, there are wild card character judging and Boolean operators available.

Miscellaneous Software Tools

Because IconAuthor has an open architecture, it can avail itself of powerful commercial software tools that enhance the authoring process as well as the end product. One of these tools is the "Windows Development Kit" which can be used in the creation of foreign language fonts. The "Microsoft C Compiler" can be used in the creation of extensions to the "Windows" operating environment. Finally, a "Windows Draw" or equivalent graphics editor is useful in creating high quality graphics not possible with the use of the graphics editor contained in the authoring system.

Summary

Several years ago, we cautiously opened the door to IVD technology. We had a vision of IVD's potential, and we set out to make that vision a reality. The planning, development, and construction of our IVD Language Learning Center has finally materialized. For those involved in the designing and implementing processes, there were many long hours of planning and carrying out minute details, peppered with frustrations caused by the limitations of even the most up-to-date technology.

Today, more confident than ever, we are ready to throw open the door to interactive learning and welcome a generation of teachers and students who will use interactive technology in the learning process. Even though much remains to be learned about the limitations and advantages of IVD, our confidence is not shaken; new

technologies on the horizon hold even greater promise for the future of education.

References

Abrams, A., & Streit, L. (1986). Effectiveness of interactive video in teaching basic photography. *T.H.E. Journal, 14*(2), 92-96.

Anadam, K., & Kelly, D. (1981). *Guided exposure to microcomputers: An interactive program.* (ERIC Document Reproduction Service No. ED 205 238).

DeBloois, M. (1984). Designing instructional materials for the humanities: Is there a role for interactive videodisc technology? *Computers and the Humanities, 18,* 189-193.

Eastwood, S.F. (1978-1979). Motivations and deterrents to educational use of "intelligent videodisc" systems. *Journal of Educational Technology Systems, 7*(4), 303-335.

Howe, S.F. (1985). Interactive video: Salt & pepper technology. *Media & Methods, 21*(5), 8-20.

Leveridge, L. (1979-1980). Experience in educational design for interactive videodisc and quadrasync presentations. *Journal of Educational Technology Systems, 8*(3), 221-230.

Mahlios, M.C., & Bromley, K.D. (1984, January). *Student and teacher bidirectional classroom behavior: Effects on classroom interaction, achievement, and attitude.* Paper presented at the annual meeting of the Association of Teacher Educators, New Orleans, LA.

Nelson, G.E., Ward, J.R., Desch, S.H., & Kaplow, R. (1976).Two new strategies for computer-assisted language instruction (CALL). *Foreign Language Annals, 9*(1), 28-37.

Schneider, E.W., & Bennion, J.L. (1981). *Videodiscs.* Englewood Cliffs, NJ: Educational Technology Publications.

Schrupp, D.M., Bush, M.D., & Muller, G. (1983). Klavier im haus—an interactive experiment in foreign language instruction. *CALICO Journal, 1*(2), 17-21.

Verano, M. (1987). *Achievement and retention of Spanish presented via videodisc in linear, segmented and interactive modes.* Unpublished doctoral dissertation, The University of Texas at Austin.

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