Interactive Videodisc and the Teaching-Learning Process

Edward C. Beardslee, Geoffrey L. Davis

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Edward C. Beardslee is professor of mathematics and computer science at Millersville University of Pennsylvania. He earned his B.S. from Elizabethtown College, his M.S. from the University of Kentucky, and his Ph.D. from Pennsylvania State University. He has taught at several universities and has served as consultant to Hewlett-Packard Co., Cincinnati Public Schools, Research for Better Schools, Inc., and Ferranti Educational Systems. He is the author or co-author of several books, articles, curricula, microcomputer courseware, manuals, and interactive videodisc materials.

Geoffrey L. Davis is director of marketing with Ferranti Educational Systems, Inc., where he is responsible for all domestic and international education and training markets. Additional responsibilities include strategic planning and new product development. A former English teacher and department chairman, he also has been an adjunct in teacher education at Millersville University of Pennsylvania, where he earned both his bachelor's and master's degrees.
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by
Edward C. Beardslee
and
Geoffrey L. Davis
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Introduction

Throughout this century we have seen a parade of technological innovations, each of which has been touted to be the salvation of education. With the advent of the computer and optical disc, a new technological tool is available, which could have a profound impact on the way we approach learning. That tool is the interactive videodisc (IVD), which evolved during the mid-1970s and into the 1980s. Like the movie projector in the 1950s and the microcomputer in the 1970s and 1980s, the exciting potential of IVD for education has aroused the interest of many educators. However, like other technologies, IVD will not reach its potential unless we pay meticulous attention to the research-based pedagogical techniques needed for its effective application.

The purposes of this fastback are 1) to describe IVD technology and how IVD materials are developed, 2) to show how the effective application of IVD must follow the principles of the teaching-learning process, and 3) to discuss trends involving IVD in education.
Facilitating Learning in the Age of Information

We've inherited a woefully limited set of expectations of what schools can accomplish and what children can learn.

— William R. Graham

With the advent of the Information Age has come a growing need for a well-educated population with skills appropriate for an increasingly technological society. Corporations in this country are spending billions on education and training to upgrade the knowledge and skills of their employees. Many of their educational programs involve some level of technology, with interactive videodisc playing an ever-increasing role in their education and training programs.

Technology can provide the means to facilitate both traditional and non-traditional methods of educating and training. Lecturing remains the most widely used method of traditional instruction. Today this traditional method is supported by a variety of resources, such as textbooks, workbooks, manuals, slides, filmstrips, films, videotapes, television, and computers. However, all of these have inherent weaknesses.

The effectiveness of lecturing depends on the experience and expertise of the instructor. The information explosion makes it difficult to keep up with new knowledge. Print materials require high literacy skills. They vary in quality and require constant mediation by the instructor if they are to be effective. With the various visual media,
there is limited interaction, placing the learner in a passive role. Traditional computer-based instruction is one-dimensional, may lack consistent quality, and demands a certain degree of computer literacy.

Today, IVD technology can overcome the inherent weaknesses of traditional instructional modes. With IVD, all the different media and delivery options are possible in one, comprehensive package. It is capable of combining lectures, slides, films, video, audio, and computer-based instruction with such off-line components as workbooks and manuals. It wraps all of these into one, easy-to-use format that is easily controlled by the learner with little or no computer skills. After initial orientation, the user soon becomes oblivious to the technology. IVD provides the vehicle for effectively presenting most instructional components, while at the same time simulating traditional learning environments. Finally, it provides a stimulating learning environment with access to physical models not typically available in traditional settings.

IVD is the marriage of proven instructional methodologies to innovative technologies. It employs user-controllable features of the personal computer, videodisc player, and high resolution monitor, which empowers learners in a variety of instructional settings. Learning via IVD has been shown to increase retention, significantly decrease learning time, and virtually guarantee mastery learning. Vadas (1986) reports that an IBM study showed a 30% to 50% increase in learning gain scores and a 300% increase in the number of students reaching mastery level.

IVD harnesses the power of the computer with the vast storage capacity of the optical disc, which can be accessed by a variety of input devices. It is flexible enough to incorporate emerging technologies, such as Compact Disc-Read Only Memory (CD-ROM), Digital Video Interactive (DVI), Compact Disc Interactive (CDI), and Artificial Intelligence (AI) without making initial hardware investments obsolete. IVD has the potential of meeting the education and training needs of this country over the next several years.
Interactive Videodisc: Definitions and Components

Technology is not about tools. It deals with how man works.
— Peter Drucker

All emerging technologies spawn new jargon, and interactive videodisc technology is no exception. Therefore, before discussing IVD and its use in education, let us become familiar with several key terms needed to understand IVD technology.

A videotape is a rigid circular platter that can store still or moving visual images, audio sounds, and digital data. Discs are available in various diameters, but the 12-inch disc is currently the most widely used. The 12-inch videodisc comes in two formats: CLV and CAV. The CLV (Continuous Linear Velocity) discs have 60 minutes of video per side and are used for non-interactive programs such as motion pictures. CAV (Continuous Angular Velocity) discs are used in interactive programs. Although only 30 minutes of video can be stored on a side, individual frames can be accessed and still pictures shown. In this format, up to 54,000 video frames can be stored on each side. In addition, each side has two, 30-minute audio tracks that can be used for stereophonic sound, for students at different levels of ability, or for different languages. A laser is used to transfer the video and audio onto the disc by etching micropits in the surface. Although a videodisc resembles a phonograph record, it is virtually indestruc-
tible and never degrades in visual quality because the micropits, which the laser reader interprets, are protected by a layer of plastic.

A videodisc player resembles an enclosed record player. When the disc is inserted, it revolves and a laser reads and interprets the micropits and transfers the pictures and sounds to a TV-type monitor or receiver. Depending on the type of player used, it can randomly access or retrieve any video or audio segment in less than 3.5 seconds.

Interactive Videodisc (IVD) is the term used to refer to any system involving a videodisc, a videodisc player, and a video receiver. IVD instructional systems are classified according to levels of interactivity. The levels of interactivity are determined by the hardware used and the manner in which the user interacts with the system.

At IVD Level 0, there is no user interaction with the system. Videodiscs are simply replayed linearly from beginning to end as in watching a motion picture. At IVD Level 1, interactivity is limited to rapid retrieval of a single frame and commands to move forward or backward, slow or fast. There is no internal programming or computer control. At IVD Level 2 the programming that controls the disc replay is recorded on the audio track of the videodisc itself. The disc-stored commands are executed by a microprocessor built into the player. There is no programming or computer control external to the videodisc.

IVD Level 3 is the most popular and has the highest level of interactivity. It is what most users expect when referring to IVD. The controlling program is on an external computer. At this level, there are usually three or more hardware components: a videodisc player, a TV-type monitor, and a computer. User interaction can involve video and audio from the videodisc and computer-generated text and graphics.

Depending on the system, a user responds via a keyboard, a mouse (which moves an on-screen pointer), or a touch-sensitive screen. Also, depending on the system, one or two monitors can be used to overlay text, graphics, and video. If two monitors are used, one screen displays
videodisc images and the other screen displays computer-generated text and graphics. In a one-monitor system, both computer-generated text and graphics and videodisc images appear on the same screen.

A workstation for IVD consists of a user response device (keyboard, mouse, or touch-sensitive screen), a computer, earphones, a videodisc player, and one or more monitors that display videodisc and computer-based material.

*The IVD workstation includes a computer and monitor and a videodisc player with videodiscs*

Courseware is the material that makes up the IVD program. In a Level 3 IVD system, the courseware consists of videodiscs, computer software (stored on some magnetic medium to drive the computer,
such as floppy or hard disks, hard cards, or CD-ROM), and related manuals or guides.

Other terms used in discussing IVD come from the computer lexicon and are no doubt familiar to most readers. These include computer-assisted instruction (CAI), computer-managed training (CBT), software, feedback, tutorials, and self-paced instruction, to name a few.
Development of Interactive Videodisc

There are two things that have to happen before an idea catches on. The idea should be good and it should fit with the temper of the age. If it does not, even a good idea may well be passed by.

— Jawaharlal Nehru

The development of IVD has been a natural extension of the computer technology revolution. From the ability to randomly access text-based material via a computer has evolved the ability to randomly access video images (still and motion) and audio segments. Concurrent with the development of IVD technology has been the applications of IVD to industrial training and education.

The history of videodiscs is mainly the story of different companies developing and trying to market their own technology. Driving their efforts was a vision of a huge potential market for these products. The prospect that millions of color TV owners would pay for movies and other home entertainment software was uppermost in the minds of corporate executives in charge of developing videodisc technology. In 1978 the first videodisc players were introduced to the U.S. market. The PR-7820 was introduced for the industrial market by MCA-Discovision. The Philips-designed laservision system was introduced to the consumer market by Magnavox.

The trade and popular press immediately proclaimed that videodisc had “arrived” and predicted huge sales over the next several years.
As often happens when new technology is announced, the press releases were, at best, premature. The market labored along for a few years but did not attract a large audience. In industry, one of the major obstacles was price. Software development could easily run into millions of dollars for one program, and this for a technology that at the time only promised to be better quality than existing videotape and film technologies.

In the consumer market, videodisc had to compete with the emerging market for 1/2-inch consumer videotape machines (VCR). Matsushita introduced consumer videocassette machines to the American market in 1975, followed by Sony in 1976. Several million had been installed by the end of the 1970s, and sales continued to flourish throughout the 1980s. Although videodisc technology had better visual resolution, videotape machines could record material off the air and were more popular.

By 1978, the beginnings of a U.S. industrial market for videodisc were taking place at the same time as the consumer market. General Motors was the first large customer of the Discovision PR-7820, the first industrial player. GM purchased machines to use for training its dealer network. This system was an IVD Level 2 system. One of the powerful IVD Level 3 systems developed by DEC in the early 1980s, the Interactive Video Information System (IVIS), was no longer available by the late 1980s. Thus in the first decade of IVD, several major vendors failed in their efforts to make an impact on the consumer market.

By the late 1980s, the temper of the times had changed; and there were indications of unparalleled growth of IVD within the industry. Two of the major systems competing for the IVD market in the late 1980s were IBM with its InfoWindow System and Sony with its Sony View System. Apple also was providing videodisc capability with its hardware. IBM entered the IVD market with its InfoWindow system in the summer of 1987. Its first catalogue had about 50 applications. Two years later its catalogue listed more than 600 applications avail-
able for off-the-shelf purchase. It appears that InfoWindow has become the industry standard, with most competitors providing InfoWindow-compatible hardware and software.

The use of IVD is occurring in a variety of settings. In 1988 a government official estimated U.S. government IVD hardware potential to be $1 billion, with courseware potential significantly exceeding that figure. The U.S. military has become a large user of IVD in both technical and general skills training programs. Other users include Ford, General Motors, Chrysler, Bethlehem Steel, most major universities, many U.S. government agencies, the U.S. Postal Service, major airlines, major computer manufacturers, and several major service industries. They are currently using IVD applications for everything from remediation to skills updating to advanced level certification. Videodisc production increased 20% from 1985 to 1988, with 3M producing 15 master discs and 4,000 replicas per day. Pioneer, Philips-DuPont, and Sony are other major producers of videodiscs in the U.S.

Other parts of the world are embracing IVD technology as well. According to a Coopers and Lybrand Associates report, Europe is "a good five years behind in this technology, but the needs of the workplace and the demands of the competitive environment are forcing a flurry of activity." A National Center for IVD has been established in London. N.V. Philips, a pioneer in optical technology, is having an impact in other parts of Europe. IVD systems are an increasing presence within the Middle East. China has indicated a strong interest in the technology because of its ability to provide more instruction to its enormous population using only a small cadre of teachers. In Africa, entire nations are being educated and trained using IVD technology.

Although the effectiveness of IVD as an instructional mode is well documented, it has not yet won a significant place in the U.S. education market. By the mid-1980s, only several thousand videodisc players were being used in U.S. educational institutions. However, with
increased availability of generic courseware and reliable and less expensive hardware, it is projected that use will increase by as much as 400% by 1995.

There are many reasons for the reluctance of U.S. education institutions to embrace IVD. First, they did not feel they could abandon their existing investment in libraries of 16mm films and videotapes. Second, the sizable initial investment needed to acquire new hardware and libraries of generic IVD courseware was difficult to justify in a period of fiscal retrenchment. Third, many educators had become skeptical about still another "miracle" technology that was long on promises, short on results, as well as being very expensive.

By the late 1980s, the scene was changing. The costs of hardware had decreased significantly. More of both generic and custom courseware was becoming available. "Hypertext" programs, which allow users to customize existing videodiscs and use the technology for different presentation modes, began to appear. Both courseware developers and educators began to see far greater opportunities for using IVD. There was a growing awareness of the potential of IVD for both at-risk and gifted students.

Currently, innovative IVD programs can be found in community colleges and universities. Secondary schools and vocational/technical schools are using IVD for both basic skills and advanced programs. Even correctional institutions are using IVD as part of their minimum competency programs for inmates eligible for parole.

Another positive development is the production of more generic courseware. Until the late 1980s, most IVD courseware was custom designed for a particular institution or business. Now many IVD vendors have turned from strictly custom business to a mixture of custom and generic or off-the-shelf programs, which are finding a place in the school market.
Developing Interactive Videodisc Courseware

As the years pass, analysis will reduce one job after another to its essentials, program it and turn it over to a box of electronics.

— Gregory Benford and David Book

The traditional instructional delivery system consists of a textbook and a teacher. IVD incorporates all the components of a textbook and many of the tasks of a teacher, but the expertise needed to produce IVD courseware is more complex than traditional instructional delivery systems.

There are at least five disciplines involved in the development of quality IVD courseware. The subject matter expert determines the courseware content. Instructional designers analyze learner populations, determine objectives and outcomes, and organize the content and learning tasks. Video producers generate video footage as prescribed by the subject matter expert and instructional designers. The software designers (computer systems analysts and programmers) are involved in the process from the outset to ensure that the courseware is feasible for the hardware being used. Likewise, systems engineers are involved to select, procure, and install the hardware needed to run the courseware. With the involvement of these many processes and attendant personnel, the production of quality IVD courseware is both a costly and time-consuming process.
The subject matter expert's involvement in the development of IVD courseware comes at the beginning of the process. This person identifies the content to be covered and then prepares the content for the other disciplines to implement on IVD. This person must write the content in an interactive mode, that is, the material should be written as if the writer were working one-on-one with the learner.

The instructional designer plays a critical role in the development of IVD courseware. This person must be well-versed in the design and format of instructional materials and must have a firm grasp of learning theory, instructional strategies, sequencing theory, and testing and evaluation. The instructional designer establishes the structure of the course and the structure of the individual lesson, thus ensuring program continuity. This involves translating the content to a storyboard (a form used in the developmental process to hold content, design, video, graphics, and programming information) to be used by software designers and video producers. The instructional designer then reviews the final product to ensure that the courseware includes all the elements of the designer's original plan.

Video producers are responsible for pre-production, production, and post-production of video and audio material that will be put on the videodisc. Pre-production involves writing scripts, storyboarding, researching footage, preparing graphics, and scheduling facilities. Production includes shooting the video, recording audio, and producing computer animation. Post-production consists of editing, providing effects, generating characters, and preparing the videodisc master tape. The master tape then is sent to a videodisc manufacturer for mass production.

Software and graphics designers perform the bulk of their work after the content is written and story-boarded. The computer program to deliver the content must mirror the storyboards prepared by the instructional designer. Any graphics and artwork must also be verified prior to final programming. Software personnel also must work closely with the systems engineer at the outset to see that appropriate
Technicians duplicate videotapes by engraving micropits with a laser on plastic-coated aluminum discs.

hardware is available to handle the courseware. Much courseware is not transportable from one hardware system to another. Therefore, great care must be taken in selecting the hardware for the IVD workstation, based on the needs of the user.

Producing quality IVD courseware is a team effort involving experts working with sophisticated technical equipment and materials for a substantial period of time. Hence, the process of developing custom courseware is extremely expensive. Depending on the application, professional quality video alone can cost between $1,000 and $3,000 per finished minute. Thus, if a one-hour lesson includes 10 minutes of video, $10,000 to $30,000 is needed to complete only the video portion. Quality custom courseware can cost in excess of $100,000 per user hour to produce. Another critical cost factor is the time consumed in the development of a quality IVD. Most tasks in the development process are sequential and require the completion
of one task before moving on to the next. The process usually cannot be accelerated without sacrificing quality. It is estimated that as much as 2,500 work hours are needed to produce one user hour. This is in excess of sixty 40-hour work weeks. To recoup these costs, IVD producers must create generic courseware that can be mass marketed.

**The Interactive Videodisc Lesson**

The same care that goes into the development of IVD courseware must be maintained for each individual IVD lesson. Each lesson in a particular IVD course should adhere to a fixed format, which incorporates as many instructional strategies as needed to maximize learning (that is, presenting objectives, optional pretests, motivators, short-step teaching sequences, applications, posttests, retention tests, etc.).

IVD provides the potential for each lesson to be presented in a consistent format, yet in an exciting and stimulating way. In a traditional lesson, a teacher may devote an hour or less to prepare a one-hour lesson. For an IVD program, subject matter experts may devote 40 or more hours in preparing one hour of instruction. The resulting instruction is accurate, efficient, and highly motivating. For example, the opening segments that present objectives might use video sequences that show applications of the objectives in an interesting way.

After presenting the lesson objectives, the prerequisite skills are presented giving the student an idea of what they should be prepared to study and practice. Then, an optional pretest provides the opportunity to bypass the lesson if students feel that they already know the material. By making the pretest optional, students may take it if they choose. Otherwise they would proceed with the instruction.

Immediately after these opening segments, video can be used to motivate the concept development or tutorial part of the lesson. This motivation video can take the form of Ausubel's "advanced organizers," which prepare students for the tasks to be learned. During the tutorial or concept/skill development segment of the lesson, the in-
teractive capabilities of IVD are used to the fullest. The video, audio, and computer combine to present instruction and monitor student involvement. Students should be actively involved (responding every 20 to 25 seconds or less). Feedback in the form of positive reinforcement or correction is given. Instruction is presented in short, incremental steps, with the student demonstrating understanding at each step. Both guided and independent practice provide for mastery. Frequent use of summaries helps to ensure concept closure. Throughout the tutorial, applications or real-life settings can be presented through video to make the instruction more meaningful and useful.

A posttest usually follows the tutorial and student practice. This posttest should be formatted similar to the optional pretest. If a student fails the posttest, a reteaching sequence can be included to provide immediate remediation. This reteaching can then be followed by another version of the posttest.

One more component that can be included in an IVD lesson is a review or retention segment. This could be a short review or short quiz requiring students to recall skills or concepts previously mastered. This is one technique to teach for retention. Another lesson component that can be included is an optional recreational activity or interesting historical vignette. This can be used as a lesson "reward."

A quality IVD lesson includes all of the components discussed above, each of which is well grounded in learning theory. Most classroom teachers have neither the time nor the expertise to prepare and then deliver each lesson in this fashion. Even if they could, student learning would vary depending on individual teaching styles, learning styles, and learning rates. Which brings us to the issue of individual differences in student learning.

**How Interactive Videodisc Can Deal with Individual Differences**

In most academic subjects and at any grade level, teachers can expect students to come to a lesson with different levels of knowledge
and skills. For example, in teaching a grammar lesson to a class of 30 fifth-graders, some will know, as a result of previous learning and experience, much more than others about the subject. Some students do not need to learn everything the teacher plans to cover in the lesson. Other students may not be ready to study anything the teacher is planning to cover.

An IVD course can deal with these individual differences by means of a prerequisite test. A prerequisite test is used to determine if a student is ready to study the material in an IVD course. If a student fails the test, then appropriate remediation can take place using a simpler IVD course or by direct teaching.

Another way of individualizing learning with IVD is using placement tests. A placement test can be used to determine where a student should start a course. If students demonstrate knowledge of two-thirds of the content on a placement test, then repeating this content would not be the most efficient use of their time. Moreover, since a quality IVD course is carefully sequenced, some content and skills in the course are prerequisites for learning other content and skills. By using placement tests that follow the course sequence, the teacher can determine which students need to take the entire course and which need to take only part of the course. With the data retrieval capabilities of IVD, a teacher can immediately determine the level on which a student is functioning and counsel the student accordingly.

In addition to being carefully sequenced, well-designed IVD courses can be organized into major topic areas or strands. This provides another avenue for individualization. Rather than studying five or six sequential lessons on one topic strand, students can move to another strand to pursue lessons they find interesting. This provides for variety and allows students to skip lessons they have already mastered.
Applications of Interactive Videodisc

He that will not apply new remedies must expect new evils, for time is the greatest innovator.

— Francis Bacon

Educators and trainers throughout the world are concerned because the traditional methods of transferring knowledge and teaching skills are not keeping pace with the needs of today. They are now turning to technology, not as the answer, but as a tool to help meet these needs.

Historically, no technology (except perhaps the printing press and the chalkboard) has dominated the teaching-learning process. Although the overhead projector, movie projector, and microcomputer have found a place in education, none of these revolutionized the teaching-learning environment. Nor should IVD, at its current stage of development, be expected to revolutionize the teaching-learning process. IVD is no panacea for all of education’s shortcomings. However, there are specific applications where IVD is being used effectively today; and its potential is certainly promising.

In particular, IVD has been successful in remedial education with students who have failed one or more times in a traditional setting. IVD also has the capability of presenting simulations of historical events or processes that are expensive or dangerous to carry out in real life. In addition, applications are possible in such areas as teacher training.
Remedial students often have a negative attitude and are uncooperative. They have not been successful in a traditional learning setting, yet many of these "problem learners" have sophisticated visual learning skills. With IVD, these students can move at their own pace and achieve success in small increments. IVD empowers them to take control of their own learning.

Several IVD remedial programs have produced successes where traditional instruction has failed. In particular, a remedial reading program, Principles of Alphabet Learning System (PALS) by John Henry Martin and IBM, and a remedial mathematics program, Interactive Mathematics by Ferranti Educational Systems, have been successful with remedial students. Users of these programs have stated that their attitudes toward the subjects have become more positive, that the IVD environment was motivating and stimulating, and that they would prefer to study other subjects using IVD. Likewise, instructors supervising these programs have been enthusiastic with the results.

In addition to remedial education, IVD applications involving simulations have been well received. Industry and the U.S. Military have used IVD simulations since the late 1970s for training purposes. Learning to operate an expensive piece of machinery or a dangerous piece of military apparatus can be safely simulated using IVD. Video allows the user to see and "manipulate" the equipment in ways approaching the actual environment. Thus when it comes time to operate the equipment, there are no surprises.

Some of the notable IVD applications of simulations are in the fields of physical, biological, and health sciences. Experiments in the physical sciences can be performed without the expense of equipment and supplies. Chemistry experiments involving reactions of different compounds can be simulated without danger to the user or the laboratory. Experiments using expensive elements such as gold or platinum also can be simulated. An IVD simulation of a nuclear reactor, which requires the user to go through the steps to prevent a meltdown of the uranium core, can provide on-site training that approximates reality.
Other notable IVD simulations are available in the health care field. A program to train medical personnel in emergency room techniques has been highly successful. Since turnover of emergency room personnel is high because of its stressful nature, IVD can provide an efficient and cost-effective way to prepare new personnel to replace those who leave. Emergency medical technicians now take IVD simulations with them in their ambulances to refer to when faced with emergency situations requiring special procedures. IVD simulations can provide training for all kinds of situations that would be virtually impossible (or ill advised) to conduct in the laboratory or on the job.

Another potential area for using IVD is in teacher training. With video footage of actual classrooms, prospective teachers can see model teacher behavior and student responses to various teaching strategies. In this way they can “experience” teacher behaviors that heretofore they could only read or discuss in class.

With increasing demands being placed on education and the increasing diversity of the student population, IVD provides a way to address many complex educational tasks for which conventional approaches have not worked. In summing up, IVD provides an instructional system that offers the following benefits:

- Consistency of instruction
- Subject mastery
- Self-paced learning
- Reduced training time
- Increased instructor productivity
- Round-the-clock instruction available
- Vicarious visual experiences
- Dual language capability
- Equipment and task simulations

Taken as a whole, this list of benefits is impressive; but in the long run, IVD will need to demonstrate a significant advantage over traditional teaching methods if it is to receive widespread adoption.
The Interactive Videodisc Instructional Setting

*What computers are good at and what people are good at tend to be different.*

— Thomas Sheridan

The instructional setting of an IVD workstation could be a classroom, a laboratory, a media center (library), or, as in some colleges and universities, a dormitory room. In the not too distant future, IVD workstations also will be available in the home. But whatever the setting, the use of an IVD workstation calls for a different approach to instruction.

In a traditional teacher-centered classroom, the instructor can use IVD Levels 1 and 2 in much the same way as a film projector or videocassette recorder. However, to tap the interactive potential of IVD Level 3 requires a workstation dedicated to a single user or a small group. Ideally, there should be one workstation for each student. This allows students to work at their own pace and to enter a course or lesson at their individual skill level. It is entirely feasible that a class of 30 students could be doing 30 different lessons simultaneously, with all completing their lessons in different amounts of time.

In this setting the instructor becomes a learning facilitator rather than a disseminator of information. This change in role can be threatening to teachers who are used to having complete control of
the learning process. However, in this new role as learning facilitators, teachers can help to maximize each student's potential. They can closely monitor each student's progress and work individually with those who are having difficulty. With the recordkeeping capabilities of the computer component of the system, teachers can spend much of their time focusing on learning tasks, rather than managing students and grading their work. They also can encourage more capable students to proceed at their own pace without teacher supervision. In short, both teachers and students can concentrate on learning.

The IVD classroom or laboratory should have an administrator who is responsible for coordinating the operation of the lab, including student scheduling, staffing, and equipment maintenance and repair. In or adjacent to the IVD classroom, there should be an IVD administrative workstation that includes a printer, student records, and materials for processing and monitoring students.

At the present time, three different models are possible for scheduling students into IVD programs: 1) a traditional class model, 2) a science lab model, and 3) a walk-in variable model.

In the traditional class model at the precollege level, a student might be assigned to an IVD workstation for one hour per day for a marking period of 12 weeks. At the college level, a student might be assigned to a workstation for one hour of instruction three days a week. Of course, scheduling will be determined by the number of IVD workstations available. After a short orientation, students can be assigned to workstations and begin work as soon as they arrive for class. When their assigned time has elapsed (45 to 50 minutes), the student must sign off to allow students in the next class to use the workstation. This calls for the IVD courseware to have a "bookmark" feature, which allows students to sign off and then return to the exit point the next time they are scheduled for the workstation.

The science lab scheduling model is a modification of the traditional class model. Science labs are often scheduled in two- or three-hour blocks to allow time to complete experiments. Similarly, as students
get involved in personalized IVD instruction, they often find they want to work for more than the typical class hour. Also, because the IVD course may include drill and practice, tutorial, and testing components, a student would need more time to complete all the components. With a traditional one-hour lecture class, there is an assumption that some outside (home) work will be done. Outside work is not necessary with a good IVD course, since it includes presentation of content, drill and practice, and testing. Therefore, a student may be expected to spend more time with an IVD course than in a traditional lecture course.

The walk-in variable scheduling model is non-traditional and requires careful planning and administration. With this model, students can use the lab anytime it is open and work as long as they wish. The lab could be open as much as 24-hours a day, but in practice a 12- to 16-hour day is probably more realistic. In actual practice, the lab may be under-utilized or over-utilized at different times of the day.

Scheduling a walk-in IVD lab is probably best done with a sign-up sheet on a first come-first served basis, with the sheet maintained at the administrative workstation. If a lab has 30 workstations, 25 could be reserved and the remainder available for drop-in students. Administering a walk-in IVD lab has its problems; but if firm rules are established and enforced, this scheduling model offers students the greatest flexibility and provides the best setting for maximizing the potential of the IVD instructional system.

In an industrial training setting, any of the three scheduling models is possible. However, the longer, more flexible schedules are probably more appropriate for adult learners, who are self-motivated, and for workers, who have the motivation of job advancement or pay incentives tied to successful completion of job-specific IVD courses.

Clearly, implementation of an IVD instructional system as an alternative to traditional instruction will require much careful planning. Those who have implemented IVD suggest starting small. Begin with
a few workstations, gain some experience using different courseware, experiment with different scheduling models, and get feedback from both instructors and students. With a proven track record, there will then be justification for an expanded IVD installation.
Evaluating Student Performance

Our subjective sense of what is right, beautiful, and consistent with a just and sustainable society, and what contributes most to human fulfillment, ought to dictate our use of these exotic tools with their enormous potential. Productivity in human terms should prevail over productivity in machine terms.

— Thomas Sheridan

One of the problems of evaluating student progress in earlier personalized instruction programs that used paper-and-pencil testing was managing all the data that were generated. IVD has the capability of coordinating large quantities of data for each learner, which the teacher then can use to assess achievement and for diagnostic purposes.

Most testing in an IVD instructional system is criterion-referenced; that is, the test items are based on the instructional objectives being taught and are designed to measure whether the student has acquired these objectives. An arbitrary mastery level is established to determine if a student has passed a test. For example, a pretest or posttest may have a passing criteria of 70% or 80%, and a student would not be permitted to proceed to the next lesson until this mastery level is attained.

With criterion-referenced testing, either the criteria are met or they are not. If they are not met, then additional time is spent on the lesson and reteaching occurs until the criteria are met. Using this as-
essment approach has implications for grading. A sensible grading approach would be Pass (P) or Incomplete (I). Either a student has met the criteria and passed and receives a grade of P, or has yet to meet the criteria and receives a grade of I. There are no failures. This grading approach is a radical departure from the traditional A to F scheme; but if we expect all students to reach an established mastery level, then it makes a great deal of sense.

IVD can present the test items in open-ended, multiple-choice, true-false, or a combination of formats. Items can be presented using video or computer-generated graphics, allowing a student to be tested on an application by viewing a simulation. IVD provides for a greater variety of testing and evaluation procedures than is available using paper-and-pencil instruments.

Test items can be generated from an item pool randomly or, in such cases as arithmetic, by the computer. This makes it possible to offer a group of students multiple forms of a test that assess the same content or skills. It is also possible for a student to take a retest on the same content but with different test items.

Another benefit of IVD testing not possible in a paper-and-pencil test is the ability to eliminate certain items based on a student's response. This capability is especially useful for placement tests and final exams. If the course is structured using sequential topics or strands, the placement test can present easy items from the beginning of the strand. Then if several of these easy items are missed, the remaining items in that strand need not be presented. Thus, if a student knows little of the material in the placement test, the test may be quite short; whereas if most of the material is known, the test will take longer. Likewise, in a final exam, if the first items presented cover content at the end of the strand and are missed, the computer can work backward in the strand until the student can give the correct response to several items. In this way the student achieves some level of success but realizes that more work will be necessary to achieve mastery level.
With IVD and a well-designed administrative workstation, the teacher will have access to each student's level of progress, lesson by lesson or for pretests, placement tests, and final exams. The teacher can order a printout of a student's record to use in counseling, for diagnosis and intervention, and for reporting to parents.
Strategies for Implementing the Use of Interactive Videodisc

There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success than to take the lead in the introduction of a new order of things.

— Niccolo Machiavelli

Introducing new technology to education faces many obstacles, not the least of which is overcoming tradition or, more bluntly, inertia. Many educators are content to maintain the status quo, to stick with “the tried and true.” They are reluctant to embrace IVD or any other technology until it can be shown to be cost-effective and proven to be instructionally sound. However, these same persons are not willing to subject their traditional instructional approaches to these tests. Some critics would go so far as to say that education is the slowest change agent in society.

Other obstacles are lack of quality courseware, perceived costs of both courseware and hardware, and the fear of some teachers that their jobs will be replaced by machines. To implement the use of IVD will require strategies that address each of these obstacles.

Following are some strategies that have been successful in implementing the use of IVD in schools:

1. Identify two or more teachers or supervisors who demonstrate strong interest in implementing IVD.
The video production crew inspect footage to make sure the finished IVD courseware meets instructional objectives.

2. Arrange for these teachers to attend trade shows and workshops on IVD so they will be thoroughly familiar with the technology and be able to answer questions from peers and superiors about IVD. Also have them visit other schools or training departments of companies where IVD is in use.

3. Generate administrative support at both central office and building levels. Such support will be necessary first for gaining acceptance of the idea and then for funding the program.

4. Pursue grants to help fund the initial expense for hardware and courseware. If possible, obtain and study successful grant proposals other schools have used.

5. Start small. The first implementations may involve five or fewer workstations and 30 or fewer students.

6. Choose hardware and courseware carefully so it does not become obsolete quickly. Make sure servicing is available from the hardware vendor.
7. Collect as much documentation as possible from those who have used IVD — both teachers and students.

8. Invite peers, supervisors, and the community to an "IVD Open House" to experience IVD instruction firsthand.

Overcoming teachers' fears of being replaced by IVD is a matter of convincing them of the benefits IVD brings to the instructional process. (Interestingly, this fear is not a concern to industry. If a task can be performed more efficiently and economically with new technology, then eliminating workers or modifying a worker's task is industry's choice.) If an alternative instructional delivery system is more efficient and cost-effective, should it not be considered? To dispel teachers' fears, we will need to show them how IVD can save them hours used in correcting papers and other clerical duties, how the self-pacing features of IVD courseware can accommodate individual differences, and how the highly motivating video and computer graphics can make learning exciting to students.
The Educator and Technological Change

*If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves.*

— *A Nation at Risk*

Education has been one of the last professions to adopt technology as an integral component of the teaching-learning process. In too many classrooms, the lecture, textbook, and chalkboard constitute the major instructional delivery system. Too many teachers still view themselves as the disseminators of knowledge rather than facilitators of learning.

It is time to use technology to reach more students, to individualize and personalize learning, and to prepare students for lifelong learning. IVD may not be the only solution; but if given the chance, it has the potential for transforming the learning environment as we know it today. In the 1970s, the microcomputer opened up exciting possibilities for instructional innovation. In the late 1980s, IVD is offering even greater possibilities. In the 1990s and beyond, we can be assured that other innovative technologies will appear on the scene for improving instruction.

The challenge is here. If the education establishment does not meet the challenge, then industry will bypass it and take over the educa-
tion and training of vast numbers of workers (which is already happen-
ing in some places), or politicians will pass legislation mandating
change without any input from educators. Some forecasters have even
suggested that if the education establishment does not adapt and change
in the next decade or two, then it will cease to exist as we know it.
What is needed is a change in attitude as well as a willingness to de-
vote resources (time, money, and personnel) to implementing exist-
ing and evolving technologies in the teaching-learning process.
Bibliography


Miller, Rockley, ed. *The Videodisc Monitor*. Falls Church, Va.: Future Systems. (monthly news magazine)

Minnesota Mining and Manufacturing Co. *Interactive Video Served on a Disc*. 3M company brochure. n.d.


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