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# Interactive video: A new technology in the field of training development

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## Abstract

This research paper will examine interactive video and its uses and compare interactive video instruction with teacher-based instruction. The relationship between interactive video instruction and teacher-based instruction will be discussed in terms of cost, efficiency and effectiveness. Several case studies and experiments involving interactive video will be reviewed to determine if interactive video is capable of reconstructing the delivery system that involves training development.

# INTERACTIVE VIDEO: A NEW TECHNOLOGY IN THE FIELD OF TRAINING DEVELOPMENT

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Abstract

This research paper will examine interactive video and its uses and compare interactive video instruction with teacher-based instruction. The relationship between interactive video instruction and teacher-based instruction will be discussed in terms of cost, efficiency and effectiveness. Several case studies and experiments involving interactive video will be reviewed to determine if interactive video is capable of reconstructing the delivery system that involves training development.

# CHAPTER 1: INTRODUCTION

Interactive video (IV) is an instructional technology breakthrough of potentially revolutionary impact to education. IV enables the learner to actively participate in the unfolding of an educational television presentation which is individualized to the learner's own interest level, knowledge base, and learning rate. Like the reader of a book, the learner is in control of IV presentations. Unlike book information, however, IV information is presented through vivid personalities, multiple sounds and music tracks, colorful still frame images, and motion. Also, unlike a book, the IV presentation spontaneously reacts differentially according to the immediate decision of the learner. The goal of this paper is to examine IV and its uses and to compare IV instruction with teacher-based instruction. The relationship between IV instruction and teacher-based instruction will be discussed in cost, time and effectiveness.

Interactive video instruction involves three aspects: hardware, presentation techniques, and instructional design. The basic hardware ingredients are a videodisc, a videodisc player, a video monitor, a microcomputer, plus an interface device which allows the computer program to be linked to the video program. Learner responses can be input through a variety of devices including a computer keyboard, a light pen, or a sensitive touch screen monitor. Learner response is within the context of an instructional program, thus providing a stimulating and involving learning experience.

IV devices are structured in either normal or specialized configurations. The normal style consists of the basic hardware equipment used during the IV operation. Specialized configurations involve the use of additional equipment, such as devices to serve the handicapped and mentally retarded learners. The IV is designed to deliver individualized instruction. The various instructional material can be found within most media, and instructional designs.

The second aspect of interactive video is the presentation techniques. Once the IV system is assembled, the user can control the video program by selecting and interacting with various presentation techniques: forward, reverse, slow or fast motion, stop frame, freeze frame, dual audio channels. Within these particular techniques, any of the single images or motion sequences can be accessed within seconds by just touching a button.

The presentation techniques range from the simple to the most difficult design structure. The information presented in these units will be based on the content structure of its technique. The simplest presentation style is the freeze frame. In this style, the video sequence plays to its conclusion then stops automatically. The computer then generates its design questions. The learner responds by choosing the correct answer. The answer is scored by the computer, and feedback is given in the form of another frame or a sequence from that same video segment. The unique advantage of interactive video is its ability to combine the presentation techniques and

instructional designs contained within a single delivery system.

The third aspect of IV involves instructional design. Its features involve a logical, step-by-step process for identifying the task and activities needed in the production of validated instructional materials. There are several applications for instructional design. For example, with the tutorial model, a computer program provides tutor-like assistance to the learner by pointing out certain types of mistakes, providing review if needed, and skipping over areas in which proficiency is performed. Another application of instructional design is the simulation model: its programs allow skillful handling and interpretation of certain elements in relationship to a given physical or social event. This process takes place without the confinement of time, space, and equipment.

Dennis (1984) noted that "The total format of an interactive video instrument works best with a self-motivated learner who is willing to accept a partnership with their own growth" (p. 10). Due to the fact that IV lesson presentations are self-paced, IV has emerged as an instructional tool to use in the areas of education and training development. By offering learners the option to solve problems at their own speed and still receive the same level of instruction, IV holds great promise in many instructional settings. These settings are examined in Chapter 2 which follows. Chapter 3

discusses the literature review and sets the stage for Chapter 4 which projects future trends in interactive video instruction.

# CHAPTER 2: USAGE OF THE INTERACTIVE VIDEO INSTRUMENT

This chapter will focus on the use of interactive video (IV) in various settings. Several case studies and experiments involving IV will be reviewed. The literature review will include the cost, time, and effectiveness aspects of the instruments.

## Interactive Video Within the Educational System

Computer technology affords schools the opportunity to use a new instructional delivery system. By combining the power of television with the responsiveness of a computer, interactive video is transforming our vision of the classroom of the future. Interactive video is currently being used in several curricular areas.

### Mathematics

Interactive video is being used to assist elementary teachers in diagnosing difficult mathematics problems of students in grades one through three. Hofmeister (1983) explains that the mathematics assessment program is described as a 408 criterion-referenced item. These items are then divided into seven strands. Within each strand, the instrument states various questions which are then administered to that individual student, until that individual makes three consecutive errors. Developing from there, these errors will inform the system to branch that individual into the next set of strands (p. 2). The problem in each strand is presented in an ascending order of difficulty. Each strand is divided

into sections which contain various subgroups of learning skills.

In this project, the teachers were provided with two methods for administering tests. If the teacher desires to give a complete assessment and test to each student within all the training areas, the IV program performs that task automatically. If the teacher desires to focus on a particular area, the program allows the teacher to select a particular strand and section that will meet individual training needs. Project outcomes indicate that IV can assist a teacher in diagnosis by focusing the teacher's attention on areas in which the student shows weakness.

Teaching the Handicapped and Mentally Retarded

Interactive video has gained much attention in special education. According to Reinhold (1984), a special project was conducted by the University of Utah State to teach mentally retarded individuals how to function independently through the assistance of interactive video.

This project involved the use of a special CAI instrument to assist the learners in their training. The structure of this instrument was not developed in the same form as the traditional (CAI) instrument. This unit used a speech synthesis system in which instructions were verbally spoken to the individuals, instead of the printed out form over a T.V. monitor. In addition, a special touch screen panel was added to help assist the teachers during the course of the training programs. The panel consisted of a light interrupt system

which allowed the learners to interact nonverbally within the system by just touching the monitor screen after viewing and hearing the selected material.

The interaction system was designed in the same form as the traditional IV systems. For example, if a correct response was chosen by the learner, the systems would respond by finding and retrieving that segment on the videodisc, then offering the learner positive feedback in either a video or audio format. If an incorrect answer is given or a non-response occurs, that video segment will then replay the right information showing the learner which answer he or she should have chosen. The feedback appeared in the image of an animated motion picture along with the verbal languages.

Reinhold (1984) then added that the Utah state project involved four mentally retarded individuals. Their learning disabilities ranged from severely to mildly retarded. This project involved five learning skill tests:

1. Time Telling
2. Identification of Coins
3. Functional Words
4. Sight Reading
5. Directional Prepositions

The goal of these tests was to facilitate continuing development and to see if refinement of the system is needed.

An example of one of the tests was the Time Telling test. This test was only administered to four of the individuals. Three of these individuals were classified as learning disabled

and one as a mildly retarded individual. Test results showed that the students completed the time telling test within a six-week period and finished with an average score of 82 out of 100. The only training assistance they had was the help of an interactive video system which produced learning results just as effective as teacher-based instruction.

## Interactive Video Within the Medical Field

Interactive video provides a new means of training individuals in medical field technology. Several studies indicated that individuals are able to learn material faster, and retain that same material much longer with the help of IV. Broderick (1982) noted that the memory process is greater whenever the individual is encountering an experience that involves themselves. These experiences tend to occur whenever hands-on experience or role-playing is involved, common attributes of IV.

### Cardiopulmonary Resuscitation

The American Heart Association constructed a revolutionary interactive video program for the use of teaching and training individuals how to deliver Cardiopulmonary Resuscitation. Broderick (1982) stated that the basic hardware and software equipment was used during the experiment, although a mannequin was also used to serve as the victim. This mannequin was equipped with an array of sensors that gave precise feedback to the computer instrument. The function of the mannequin was to inform the learners, through the computer terminal, if any attempts of CPR were performed incorrectly.

During the instructional segments of the CPR program, the learner watches and listens to the video segments that appear on the monitor. The learner then responds to the various questions that appear on the computer screen. In response to the questions, the learner touches the computer screen with a light sensitive pen. The CPR program allows learners to recall the menu at their convenience, allowing the learner to replay materials, to skip over future materials, or to brush up on existing materials. The system was designed to train up to four individuals at one time, without the assistance of a human instructor. Broderick (1982) noted that the CPR program evaluates the technical skills performed on the mannequin. These areas involve chest compression and the proper mouth-to-mouth breathing techniques.

Test results indicated that the majority of learners using IV mastered the essential skills within a shorter time period than those individuals attending an instructor-led course. This experiment indicated two important factors: individuals are able to learn faster through the use of IV, and are able to use their psychomotor skills when applying the actual operation.

CMS Nurses and Interactive Video

As a training tool, interactive video is becoming a part of on-the-job training. An investigation was performed at the Florida Children's Medical Services (CMS) Institution which provides medical services to handicapped children. The instrument's purpose was to provide on-the-job training to

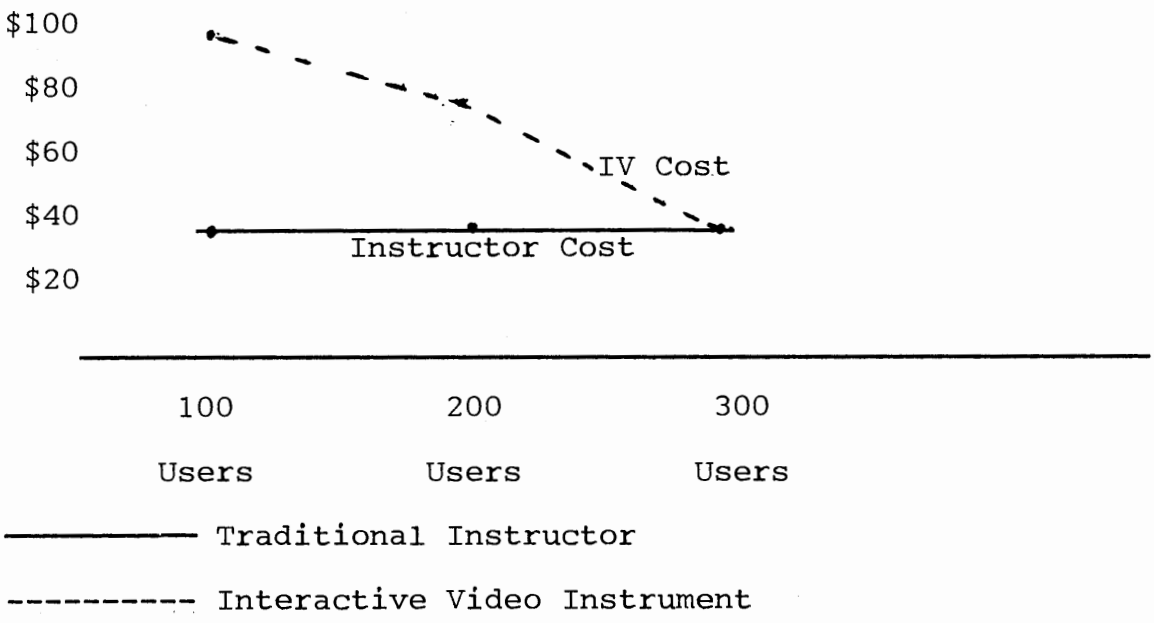
Florida's CMS nurses through the use of the basic IV hardware equipment. For example, Parker (1984) noted that the first video scene showed a picture of a nurse and the child's parent arguing about the child's physical condition.

During the course of the program, the learner viewed two different video segments. Each segment showed the nurse intervening in a different way. In the first segment, the nurse sided with the mother. In the second segment, the nurse sided with the patient. After viewing the video segments, the nurses then selected which segment was best according to their own judgement. The IV system then provided the nurse with the consequences that were drawn from the decisions made. The feedback was provided in both the audio and video formats.

A study was performed by the administration board of the CMS nurses to compare the cost of an instructor as opposed to the cost of IV. According to Parker (1983), "the cost per student hour dropped over a time period as the number of students increased within this organization." The data (see Figure 1) indicated that if a human instructor operated a workshop to train 100 individuals, it would cost $44.00 dollars per training hour, as compared to the IV instrument cost of approximately $100.00 dollars per training hour. These figures changed for the next 100 individuals using the interactive video instrument. The cost decreases were due to the cost reoccurence that involved the instructor work time and the maintenance that was needed for the IV instrument. Thus, IV eventually pays for itself.

Figure 1

Cost Analysis of Both Instructor and Instrument




## Teaching Medical Procedures to Physicians and Students

Hospitals are now using IV as an invaluable learning resource, providing instructional programs to help train physicians and students in areas where experience is vital. Meiger (1984) stated that "the designing structure of this instrument has the ability to provide such programs as appendectomy, emergency-room trauma procedures, and [illegible] applications" (p. 10). The reason for developing these programs was to place the learner in a real situation that required him or her to perform the duties of the physician.

In one physician-training program, a doctor questions patients about their health problems. At various points in the video segments, the doctor is provided with more questions concerning the patient's conditions. In addition, the doctor

is given the option to either view the current lab test or to select the proper diagnosis and treatment that is needed to help that patient get better. The doctor's decision is analyzed by the computer; the consequences of his or her decision are then presented in a video segment showing the patient's outcome. This experiment placed the learner in a role-playing situation which provided the learner the chance to encounter a semi-experience in the areas of treating an injured victim.

## Interactive Video Within the Military

Military educators have recognized that interactive video is a new way to solve many of their training problems. With the help of current technology, various programs have been developed to teach soldiers how to read maps, speak foreign languages, better their vocabulary and geometry skills, and also enhance their leadership abilities.

### Army and the Interactive Video

The use of interactive video is currently common in all branches of the military. The United States Army has created a research center for IV training development called the Army Communication Technology Office (ACTO). According to Meyer (1984), "the structure of the (ACTO) program is to involve a dozen army training schools in an effort to apply an interactive video instrument to their training functions" (p. 47).

All of the training reports involving the use of IV indicate that there were no training problems noticed in the

areas having hands-on experience with technical, military equipment. Meyer (1984) stated that "the results of one of the experiments performed by use of this instrument has provided the army with better results in the areas of training development due to IV's ability to give immediate remediation within its format" (p. 48). In addition, these reports have stated that the majority of bad habits had been corrected by using IV.

Among other experiences, the army has produced an IV program involving the Army Signal School at Fort Gordon, Georgia. The structure of this program was to develop a simulation for the equipment that is being used to help monitor satellites. Meyer (1984) noted that throughout this experiment the military was faced with many problems due to lack of equipment available to teach individuals how to monitor the satellites. With the help of IV, the military was able to overcome these problems through the use of selected videodisc programs. These programs offered the soldiers the opportunity to experience a new form of hands-on experience, through a simulation program. Meyer (1984) added that:

> The interactive video instrument has cut the time in half that was normally set aside for training development. With the high cost of military equipment, it makes increasing sense to use the simulation capabilities of an interactive video system within other training applications. (p. 28)

The cost to train individuals is a major problem in the military. Meyer stated that "the United States Department of Defense annually devotes $13 billion dollars to its educational and training departments" (p. 23). These departments usually involve over 100,000 employees. Their individual status ranges from platoon sergeant through officers with Ph.D. degrees. The training aspects of these departments involve an everyday usage of IV.

Another example of IV in the military took place at Fort Eustis, Virginia. The military developed an interactive video program to help inform all incoming soldiers listed as lieutenants how to apply good communication skills. Meyer (1984) stated that "this program was designed to teach and train the young lieutenants in the areas of how to relate to their fellow officers" (p. 48). The program placed each learner in an everyday learning situation that involved both themselves and a fellow officer. Its format was to show the lieutenants the common mistakes that are made before they enter the training grounds. Evaluation results indicated that IV has the ability to change an individual's attitudes, through the use of role-playing.

Air Force and Interactive Video

Interactive video has entered the Air Force branch of the military. With the use of the IV instrument, a special project was conducted to train soldiers to perform correct aviation skills. This experiment involved the use of a

computer-controlled simulator as a training tool for the individuals.

The simulator's ability provided quality interactive training. In addition, it offered the Air Force the ability to evaluate its decreasing cost in its budget. Individuals were able to operate and control the functions of a complex piece of equipment without having to touch any part of the equipment until the actual learning process was completed.

This IV instrument allowed the pilots to make the proper equipment adjustments while still being active within the system. The pilots' adjustments involved the connecting of cables, and the reading of digital dials through a series of directed slides. The structure of these slides was produced in a fashion that appeared like a motion animated movie. They provided the learner with the ability to view the actual adjustments being made onto the aviation equipment. The structure of the dials indicated to the learners when the connecting of the cables was made properly. Levin (1983) stated that this training procedure provided the learners with the opportunity to demonstrate their understanding of the principles needed. In addition, their test scores indicated that the IV was just as effective as the actual hands-on experience.

## Interactive Video Within the Private Sector

Interactive video has exploited its operations abilities into the areas of business industries. In both the Ford Motor

Company and a New York Bank, the IV has been used as a training tool.

Ford Motor Company and Interactive Video

In 1981, various divisions of Ford Motor Company took part in a training experiment involving the use of IV. The purpose of this experiment was to determine if IV has the ability to boost their employees' productivity, by increasing the quality of their training. This experiment involved over 5,500 different Ford-Lincoln dealerships across the country. Broderick (1982) stated that the Ford Motor Company's primary purpose involving the use of the IV was to train their dealers in the areas of sales, services and product knowledge. Its secondary purpose was to use the instrument as a training tool to improve their personnel salesmanship.

Studies revealed that IV training provided the Ford Motor Company with the ability to reduce most of their complex training problems. The nature of these problems occurred whenever training or re-training was to take place. Broderick (1982) noted that many of Ford's managers believe that they were able to provide far more information on a two-sided disc than any other form of media used previously. In addition, he added that the Ford companies have committed over twenty hours of their programmed instructions onto a videodisc unit.

After these experiments, a survey was conducted of Ford dealers to determine their feelings toward the use of the IV. Broderick (1982) noted that the survey indicated seventy percent of the dealers felt that it helped improve the quality

of their customer presentations, and over ninety percent of the dealers felt that the instrument improved the over-all quality of their sales.

Banks and Interactive Video

Today's technology has provided more corporations with the opportunity to use the IV instrument system as a means of producing training programs for employees. Several banks are providing services to their customers with the help of an interactive video-banking system. Diina (1985), noted that several banks in the New York area have used the instruments as a tool to help provide customer services. The cost factor concerning the IV is based on a dollars and cents standpoint. This video-banking center is capable of performing the same duties as customer service personnel. Diina (1985) noted that this instrument provided many advantages to its customers in the areas of innovative images, cross selling, minimizing errors, and the ability to avoid disruptions due to turnover within training.

The videodisc programs are presented to the customers in a forty-five minute presentation. For example, if a customer wanted to receive information about opening a checking account, the system will display all the needed information concerning that topic. The instrument will then offer that individual the opportunity to open an account. Diina (1985), added that "relevant information is needed if a customer decides to accept this instrument as a source of banking. The needed information will involve the individual's name, address,

social security number, and other identification material" (p. 31).

IV bank services have been tested and retested in the areas of screening out individuals who try to insert false information. Since fraud is a major problem, all documentations for any new account must be done by mail or that individual must appear in person at the bank in order to receive a new account.

# CHAPTER 3: DISCUSSION

The interactive video system has provided a new form of training within the areas of Education, Military, Medical Centers, and Corporations. The operational purpose of this instrument is to allow the users to participate actively in the unfolding of information, which is usually presented in the format of a videodisc. The videodisc structure is designed to help teach the user how to do a certain learning task. The interactive video instrument is also designed to branch the learner off into several different directions in which various levels of learning take place.

Each of the various cases presented in the previous chapter experimented with the operational functions of these instruments. Their objective was to see if the system could be used as a training tool within their own area. At the end of each of these projects, similarities were found between the conclusions of the case studies. These conclusions appeared in the areas of equipment cost vs. instructor's cost, instrument operational time vs. instructor's teaching time, and relative effectiveness of IV vs. teacher-based instruction.

The purchasing cost factor of the IV instrument ranges from 5 to 10 thousand dollars. These purchasing figures will vary according to its usage and format. For example, if the instrument is needed to help teach a deaf individual how to speedread, then a special unit must be added to the basic equipment in order for it to be workable. When comparing

the total cost of the IV to the cost of a human instructor, the IV will be more expensive, although the IV does have the ability to pay for itself within a fixed time period.

In both the educational and business case studies, these instruments are very expensive, and their future usage will depend greatly on how affordable these instruments become in the future. Although presently both studies indicate that their annual budgets cannot afford to obtain them, previous experiences have allowed them to explore less expensively, alternative but similar means of teaching and training.

These purchasing factors were not a problem for the remaining case studies. For example, both the military and medical case studies indicated that their organizations have received more experience with IV as opposed to the educational and business settings, since government funds are set aside yearly in order to improve their training programs.

Each case study has stated that the IV instruments have the ability to be just as effective as an instructor, whenever materials must be learned within a given time frame. The structure of these instruments is designed to pace the individual through various programs. The actual speed in which the pace will be performed will depend on the intelligence of the learner. For example, if the cognitive learning process of the individual appears slower than his or her peers, then the instrument will provide material at a slower pace. This process will give the learner the ability to achieve a much better understanding of the material given.

The final analysis drawn from these case studies indicated that material learned from the IV instrument has lasted longer in the cognitive stages of the learner. The learners tend to remember more information when encountering hands-on experience. These learning experiences are performed through role-playing. Its process involves placing an individual in a live situation that provides him or her the opportunity to experience different levels of learning. This style of learning then develops into a learning experience for that individual.

# CHAPTER 4: CONCLUSION

The interactive video instrument has provided a new dimension to training development. This relatively new form of technology has quickly challenged instructional developers in all fields. When combining both the dynamics of an interactive instrument and the learner's control with the sophisticated visual capabilities, one develops a powerful tool which demands unique treatment if its full potential is to be utilized. The preceding literature review points out the increasing interest in interactive video instruction. Educators in schools, corporations, and other settings are studying the relative value of interactive video. Also, attention is being focused on cost, efficiency, and effectiveness factors.

To analyze the future usage of this IV instrument within the area of expense, experts believe its cost will drop within the next ten or twenty years. With a decrease in cost, these systems have the potential to transform the training delivery system within public education. This process can only take place if high quality, comprehensive, stand-along courseware becomes available within a variety of subject areas.

In the future, there will be an increasing need for our school systems to shift from labor-intensive to capital-intensive instruction. This does not mean that the teacher will be totally eliminated, but the format of their delivery system will change. Interactive video may very well be the

cost-effective capital-intensive delivery system which meets their needs.

Focusing on the twentieth century, the key issues that will help determine the future usage of these instruments in the military and medical fields will include efficiency and effectiveness measures. In the military, with the proper usage of IV, the learner will be able to receive instruction in less time than with many other delivery systems. The use of IV will continually reduce the time it takes for training delivery. Experts say that a learner using IV will be easily motivated, learn faster, and retain information longer as opposed to the traditional learning method.

Several case studies done with the military indicate that the IV instrument has the ability to cut its training time in half. In the future, the military will find that there will be an increasing need for it to switch from its traditional style of training to the use of more simulation programs. This change will create hands-on experience and will reduce the time needed to develop the cognitive and psychomotor skills of the learners.

The effectiveness of IV instruction will also be improved by creating a high level of learning. Technology will lend itself to simulate the learning experiences through role-playing. This learning process has developed into an invaluable tool in preparing the learner for a "real Life" situation. A good example used from the literature is the Florida CMS Nurses Program. Researchers have indicated that

role-playing has no adverse effect on the learner's ability. The future use of the IV material will be based on its concreteness and the learning experiences it provides.

This paper has reviewed and synthesized literature on interactive video instruction. Also, it has identified future trends related to its utilization and impact. However, as Broderick (1982) noted, "one must keep in mind that the usage of an interactive video instrument is not a brand new phenomenon in the world of training, but the state-of-the-art for its hardware and software is changing so rapidly that to write anything today is to ensure that one's words will be obsolete tomorrow" (p. 365).

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