

AD-A161 769 EFFECT OF INTERACTIVE VIDEO PRACTICE IN DETECTING
TECHNICAL ERRORS ON PERFORMANCE OF A SIMPLE MEDICAL
PROCEDURE(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA
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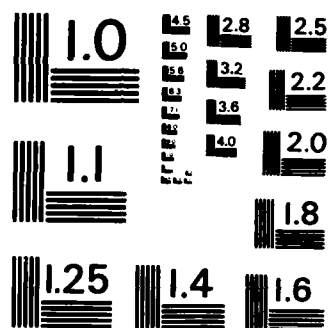
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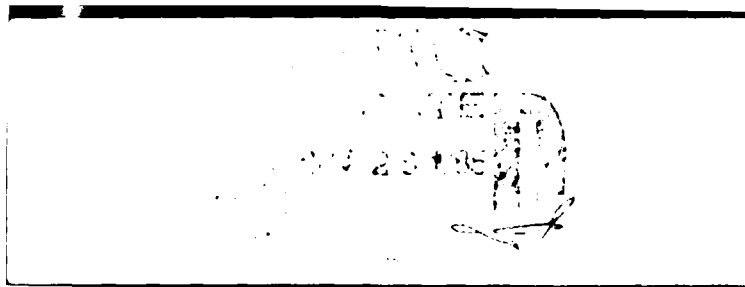
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**In Partial Fulfillment
of the Requirements for the Course
Education 795A-B Seminar
Dr. Alfred Merino**

by
Anne Marie Devney
August, 1985

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INTRODUCTION

Recent developments in the field of instructional media provide educators with individual learner feedback and remediation strategies. Traditionally, learners were exposed to fixed-pace delivery systems, e.g., lecture and films. Reaction to learner response was dependent on an instructor's timely perception and intervention. Therefore, filmed examples of procedural techniques were limited to presentation of the correct method and learner acquisition of misinformation often occurred. Lacking the capability of learner interaction as well as detection and diagnosis of learner acquired misinformation, filmic media falls short in many areas necessary for effective teaching of procedures.

A new instructional product, interactive video instruction (IVI), allows the demonstration of both correct and incorrect techniques. Based on the learner's response, this medium has the ability to branch to suitable instructional strategies. These microprocessing capabilities can ensure learner understanding and retention. For students in the health care delivery field, mastery of psychomotor skills is ideally practiced in a simulated environment prior to actual clinical performance. Under these conditions, correct behavioral patterns can occur, confirming the understanding of the careful performance of patient care procedures. The learner is thereby permitted to make errors and receive appropriate feedback, minimizing possible negative real-life consequences.

The IVI system also allows for the measurement of learner's detection of presented errors. This information can then be used in a way to enhance learner recognition and avoidance of future errors.

This paper describes the design, development and testing of a general model for using an IVI program to teach a simple medical procedure: aseptic gloving and degloving.

STATEMENT OF THE PROBLEM

The problem to be investigated in this study is the effectiveness of interactive video instruction as a supplemental instructional tool when compared to a linear videotape of the same content.

LIMITATIONS OF THE STUDY

Research literature for this study was obtained from journals, books, and the Educational Resources Information Center available at the Malcom Love Library, San Diego State University and the CDR Leon S. Thompson Library, Naval Hospital, San Diego. Little research has been done documenting the effectiveness of IVI programs. Sources employed include: Compendex, ERIC and Medline Computer Databases, the Nursing and Allied Health Index and Index Medicus.

The traditional lecture/demonstration class given on open aseptic surgical degloving technique was conducted from a standard lesson guide prepared by the Naval Health Sciences Education and Training Command, Bethesda, Maryland dated March,

1976. This study incorporates four assumptions: (1) that the two registered nurse instructors taught the same content and demonstrated the open aseptic degloving technique in the same way; (2) that the graded skills performance examination of a sterile dressing change, including aseptic surgical gloving and degloving techniques, was taught and evaluated in the same way; (3) that posttesting of the students was conducted uniformly by the instructors using the same principles of techniques; and (4) that the independent registered professional nurses who served as independent judges of the videotaped initial and delayed posttest performances used the same standards of performance.

A possible source of sample bias is the exclusion of female subjects from the sample population. Female subjects were not available for testing.

DEFINITION OF TERMS

Computer-based instruction (CBI) refers to the use of computer technology in presenting information to individual students in a classroom setting.

Filmic media refers to the use of film as a method of presenting visual information.

Flow chart is a diagram of interactive logic and program segments representing the possible paths a viewer may take in the exploration of the IVI lesson (Gayeski, 1983).

Hospital corpsman is an enlisted member of the Medical Department of the U.S. Navy. Hospital corpsmen are trained to provide basic health care under the guidance and supervision of

licensed physicians and registered nurses. Specialized skills may be attained through the completion of advanced technical schools, e.g., laboratory, x-ray, operating room technicians.

Interactive video is a form of instructional technology allowing the user to actively participate in a lesson by making choices at specific decision points. The program will vary depending on the viewer's responses (Gayeski, 1983).

Interactive video instruction is a fusion of two communication technologies -- computer-assisted instruction and instructional television for the presentation of real-life images and response to individual students (Gayeski & Williams, 1980).

Linear refers to a program style in which visual images are stored in a sequential frame-by-frame fashion. It is designed to be played straight through from start to finish (Gayeski, 1983).

REVIEW OF LITERATURE

Linear vs. Interactive Media

The appropriate role of instructional media in educational settings has been a continuing source of controversy for the last 50 years. The capabilities of new delivery systems such as interactive video (IV) allow the use of powerful instructional strategies which have previously been difficult to incorporate in mediated instruction. This paper reviews previous strategies for using film and videotapes to teach simple procedures. It proposes a general model for teaching procedures in which learners practice detecting and identifying common errors.

Filmic media certainly represent an important tool for

presenting instruction, however, several important limitations exist. Until now, producers were confined to a fixed-pace delivery system of filmed products. Instructional strategies using these films presented the learner with a linear program, usually of fixed length, designed to show the content from beginning to end. Sometimes, either or both the instructor or student wish to see part of the film again to clear up either misunderstandings or to clarify and discuss some concepts during the film, before proceeding. This procedure requires the student or instructor to stop the film, possibly rewind it, and then personally conduct the session. This is often awkward, cumbersome, time consuming and disruptive to the learning environment.

Filmic media lack the capability for measurement of overt learner response and, therefore, are unable to provide learner-oriented reinforcement or corrective feedback based on accurate assessment of the individual's progress. Thus, the learner may not have a clear understanding of the lesson and inadvertently acquire the wrong information. This can also happen passively by a loss of focused learner attention or poor transfer of prior knowledge to the new concept. Cognizant of this phenomenon, producers of films and videotapes have emphasized the presentation of correct process demonstration in an effort to prevent learner misunderstanding. Immediate accurate detection and diagnosis of misunderstanding depends primarily on the constant presence of an astutely perceptive instructor.

Prather (1971:378) stated that several "learning theorists (Holland, 1960; Skinner, 1968; Terrace, 1963) postulate that an

incorrect response interferes with the learning of the correct response." However, mistakes may function as powerful "stimuli" in the achievement of mastery or competency of tasks (Stevens, 1976). Additionally, practice-feedback sessions provide the learner with approval to learn from mistakes. The student then is encouraged to view mistakes in the practice arena from a positive viewpoint.

The instructional strategies used in this interactive product were designed to take advantage of the practice-feedback approach, encouraging the learner to benefit from errors made in learning a simple procedure. Corrective feedback concerning errors made was immediately presented to reinforce the proper sequence of performance.

Instructional films and now, videotapes, present sequences of events in realistic settings to heighten transfer of subject matter content to the "real world." Gagne (1965) noted that "motion pictures" serve the same instructional function as real world demonstration of events and procedures. A filmed demonstration can serve as an effective model for teaching procedures. It is well suited for this mode of delivery because of the advantage of standardized performance in a realistic setting and demonstration of equipment that may or may not be easily located in a classroom. However, procedural training with this medium is limited to demonstration only and generally, the learner is exposed just to correct examples. Prather (1971:378) in discussing "simple learning tasks, [noted that] errorless learning should be more efficient when training is restricted to

a few trials." Short, concentrated periods of instruction will enhance focused learner attention and prevent confusion and misunderstanding from information "overload." Filmic media can take advantage of this strategy and is generally used as an accessory for teaching procedures. Its use is closely followed by discussion and actual demonstration with real equipment, whenever possible. Student practice is then supervised by an instructor who provides relevant feedback and remediation to improve learner performance. The proper sequencing of the procedural steps is heavily emphasized to minimize learning interference from incorrect response behaviors (Prather, 1971).

However, linear filmic media do not have the capacity to handle an adult learner's acquired ability for analysis, evaluation and learning from trial-and-error experiences. Little use, therefore, is made of the potentially valuable procedural-practice-memory testing strategy. Here, the learner is tested on memorization of the specific sequence of events for a procedure (Ellis & Wulfeck, II, 1982). This strategy encourages frequent reinforcement of the correct chaining of stimulus-response cognitive behaviors. If essential physical skills are involved, then psychomotor process learning must be included (Stevens, 1976). Effective psychomotor process teaching must contain practice with knowledgeable feedback. Filmic media does not have this intrinsic capability.

Interactive video instruction (IVI) is the most recent product of instructional media development. Considered to be a major step toward a more natural learning process (Wilson, 1983),

this new educational tool offers many answers to the limitations posed by instructional filmic media.

IVI "combines the potential of many teaching devices...[and] brings together the emotional power of the television and the interactive power of the computer (Currier, 1983:51)." This unique combination of filmic media capabilities and computer-assisted instruction presents the learner with an opportunity to engage in a dialog with the computer and then view the resultant lesson. The flexibility of the computer allows the learner to engage in and use the instructional "response and feedback algorithms" to meet specific behavioral objectives (Jonassen, 1983:21). This capacity for interaction with a learner enables instructional designers to accommodate a greater array of instructional needs than is possible with filmic media. The key characteristic of IVI is that sophisticated programming enables learner responses to influence the selection of appropriate instructional strategies. These strategies may be either computer-based instruction (CBI) or video display. Depending upon the extent and depth of feedback algorithms, highly individualized instruction may result.

The evolving design of IVI incorporates several principles: interactivity, user control options, and feedback.

*Interactivity with a learner is the prime advantage of the system, so active learner participation is of major concern. The benefits to the instructor of this participation include meeting and adapting to major instructional needs manifested by the learner's prior knowledge or cognitive style.

*User control options provide the learner more freedom of choice in the selection of subject matter content, nonparallel review, remediation or testing.

*Feedback is based on measurement of student errors via process measurement of step sequences, textual review or evaluative questions. The feedback may entail alternative modes of presentation, i.e., textual display of revised/altered content, video replay of the same segment or display of a slightly different version (Jonassen, 1984:21).

Essentially, as noted by Cohen (1984:17), one of the most significant features of IVI is that the learner has the option to choose a nonlinear path through the program based on his/her needs. Depending upon the characteristics of the equipment at hand, i.e., videodisc or videotape, the learner can "alternate between still frames, moving video and computer frames" to acquire information. Videodiscs provide the greatest flexibility. Features pertinent in the design of videodisc materials as stated by Cohen (1984) include:

1. Feedback ensuring remediation via sophisticated branching of the computer program.
2. Modular organization of program content into small, functional units easily accessed by the learner. "Content menus" permit nonlinear sequencing of the modules and individualize the approaches possible to the learner.
3. Adaptability to meet the requirements of different audiences. Variations in computer programming can permit

use of the same visual imagery for the achievement of different instructional objectives.

4. Videodata bank to supplement video segments with still frames or other enrichment features, e.g., bibliographic information, a glossary of terminology, additional visual images.

The above summary of IVI design components enables the medium to function quite effectively as an electronic tutor. Depending upon the instructional design and the strategies used, IVI can "react" in ways similar to teacher-based instruction. Elements of reality introduced in simulation exercises bring a sense of real-life drama and even urgency to impress and motivate the learner. Filmic media's capacity to provide this feature is limited. IVI requires the learner to actively make decisions and deal with the consequences. Negative real-life situations may be avoided with this technique.

IVI clearly has the potential to overcome the limitations posed by fixed-rate linear media delivery systems. It enriches instructional dialog with the learner and provides a communication link that previously only a human instructor could provide when using linear filmic media.

Instructional Strategies for Teaching Procedures

Learning procedural skills is contingent upon proper chaining of appropriate stimulus-response psychomotor behaviors. "Correct sequencing of appropriate responses" is necessary for chain learning (Huckaby, 1980:60). But the presence of

appropriate psychomotor responses and individual stimulus-response behaviors must already exist within the learner.

Instructional presentation of psychomotor skill training is summarized by Biehler (1978:412) based on Gagne's Conditions of Learning:

1. Required stimulus-response (S-R) connections must have been previously learned.
2. Steps/links must be learned and performed in the correct order.
3. Individual S-R connections must be performed in close succession to create the chain.
4. Repetition of the steps is done to reinforce efficient performance of the task/chain.
5. The final step must be successful to strengthen the interdependency of the chain.
6. Generalization of the skill for transfer to other tasks may follow learning of the psychomotor skill.

The following theoretical considerations were used in the design of instructional strategy for the intended adult audience.

Individuals have used natural learning processes for the performance and refinement of psychomotor skills. Singer (1978) describes three phases of skill acquisition process as identified by Fitts and Posner (1967): (1) "early or cognitive" phase when the learner is coordinating situational demands and appropriate responses for "what needs to be done", (2) "intermediate or associative" phase where alternative learning strategies are assessed, analyzed and chosen, e.g., practice by trial-and-error, the importance of speed and/or accuracy in task performance, and (3) the "final or autonomous" phase -- reached when the learner has sufficient mastery of the task to perform with "apparent automaticity."

Singer further notes that the typical training program for

psychomotor skills emphasizes the "learning of specific responses to designated cues (1978:89)" and relies heavily on repetition of movements. Reinforcement of correct sequencing of those steps committed to memory is accomplished by specific feedback and remediation (Huckaby, 1980).

Adult learners enter learning situations with both a strong-self concept and a problem-solving approach, based on years of experience. They relate closely to past experiences in learning new activities and these experiences should "proceed in a logical sequence and at a comfortable pace (Puetz & Peters, 1981:8)."

The method most often used to teach psychomotor processes is demonstration. Stevens (1976:19) explores the method commenting that demonstration "combines explanation with exhibition and it correlates theory with practice. Principles are explained at the same time as they are demonstrated in the activity." A highly useful technique, demonstration uses several senses at once, i.e., providing an actual visualization of the process being explained. Discussion and questions should be followed by a learner active "hands on" practice session with immediate feedback. The practice and feedback sessions are particularly necessary in the resolution of unanticipated problems in handling equipment. It is important to note that the omission of practice/feedback sessions result in the exclusive teaching of content knowledge. Process knowledge of the sequence will not be reinforced.

Procedural content learning is usually depicted without any inaccuracies. Correctness of information is emphasized in order

to prevent error acquisition and the forgetting of corrections. Errorless learning is emphasized. In the acquisition of procedural process knowledge however, inclusion of errorful learning may be of value. As noted earlier, adult learners, in particular, have become efficient in benefitting from trial-and-error experiences. They have learned from mistakes before, which resulted in reinforcement of the correct process/es.

Recent work at the Naval Personnel Research and Development Center in San Diego, California in test item construction resulted in the development of a testing procedure classification model (Ellis & Wulfack, II, 1982). They defined a procedure as, "a sequence of steps that must be performed in order" (1982:14). Procedure objectives may be classified as a "REMEMBER-level" where memory of the steps only is required, or as "USE-level" where actual performance is done. The use level classification may be subdivided into aided or unaided performances (memory only).

Examination of the end-product, the performance process, or both factors is determined by the instructor. Process measurement is tested when specific error diagnosis is required concerning memory of the sequential steps as observed during actual performance of the procedure. Process testing is also done to evaluate a resultant behavior. If the testing situation of process-product measurement precludes the use of actual equipment, adjunctive instructional media may be used. Specifically, IVI can allow the learner to spend time on critical steps of the process by providing a safe, controlled, approved

environment for trial-and-error learning. Testing of process memory is easily done and timed when the learner perceives s/he is ready.

The Ellis-Wulfeck model also discusses the necessity for process analysis, development of rating scales for process and product measurement, determination of required repetitions of the procedure for testing, and the development of "REMEMBER-level" test items as needed.

IVI meets many of the necessary and desirable requirements needed for teaching both cognitive and psychomotor skills. It is emerging as a highly adaptive instructional media to assist with the teaching of procedures. As noted above, IVI provides an approved, protected environment for practice during situational examples of the procedure process. Depending on the sophistication of the programming, the learner receives appropriate feedback to correct diagnosed errors. The nonlinear feature enhances individualized approaches, increasing attractability, desireability, and effectiveness. It permits testing of memory by illustrating both examples and nonexamples of content or process, thereby reinforcing correct discrimination of the steps and principles. Testing can be accomplished at the learner's perceived optimal time.

Three notable examples of the interactive approach to procedure learning demonstrate the effectiveness of this strategy. A training program was prepared for the U.S. Army Signal Corps to teach communication personnel the operation of complex equipment items through the use of IVI. Comparison of learners who used

the IVI with those who actually worked on the real equipment "showed no difference in actual ability to operate the complicated communications equipment... (Young and Schlieve, 1984:41)."

David Hon (1983:23) developed a complex IVI system to teach basic cardiopulmonary resuscitation (CPR) life support for the American Heart Association in 1982. Mannikins were connected to a sophisticated "computer/video course and resulted in improved student performance. A higher number of students passed the course compared with an equal number taught by a live instructor.

A pilot study was recently conducted by the University of Alberta, Canada to test the efficacy of the American Heart Association/Actronics Inc. interactive videodisc system for CPR instruction of the lay public at both the Heartsaver and Basic Cardiac Life Support levels. Results of the pilot study with sixty-two subjects indicate that the system is at least as effective as traditional CPR instruction. A continuation study including over four hundred subjects is underway (Edwards & Hannah, 1985).

Further testing of this new medium needs to be done to provide designers and producers with useful information for successful future development.

General Model for Teaching Procedures with an IVI System

IVI presents a very fertile ground for the communication of procedure knowledge. With this concept in mind, a simple medical procedure was chosen for the development of a general model of IVI for this purpose.

The model implements several strategies for teaching procedures including practice, feedback with remediation and process memory evaluation. The computer-based advantages of user-options, random access to specific areas of content, and interactivity were employed.

The central component of the model, "Error Detection" (Fig. 1) incorporates a specific review strategy which requires the learner to actively detect observed errors in technique while watching the procedure. The system randomly selects from a pool of examples and presents the learner with a trial. The learner must evaluate the performance and, if an error is observed, overtly respond by immediately pressing the spacebar of the keyboard. If the learner detected the error within a pre-set "window" or timeframe, s/he is given positive feedback and asked to indicate what the error was by means of a multiple-choice test question. A correct response results in affirmatory feedback and the system presents the next trial. When the predetermined sets of trials have been shown, the learner is returned to the main menu for his/her next selection, e.g., procedure demonstration, practice or exit. Reselection of the error detection module is permitted without penalty.

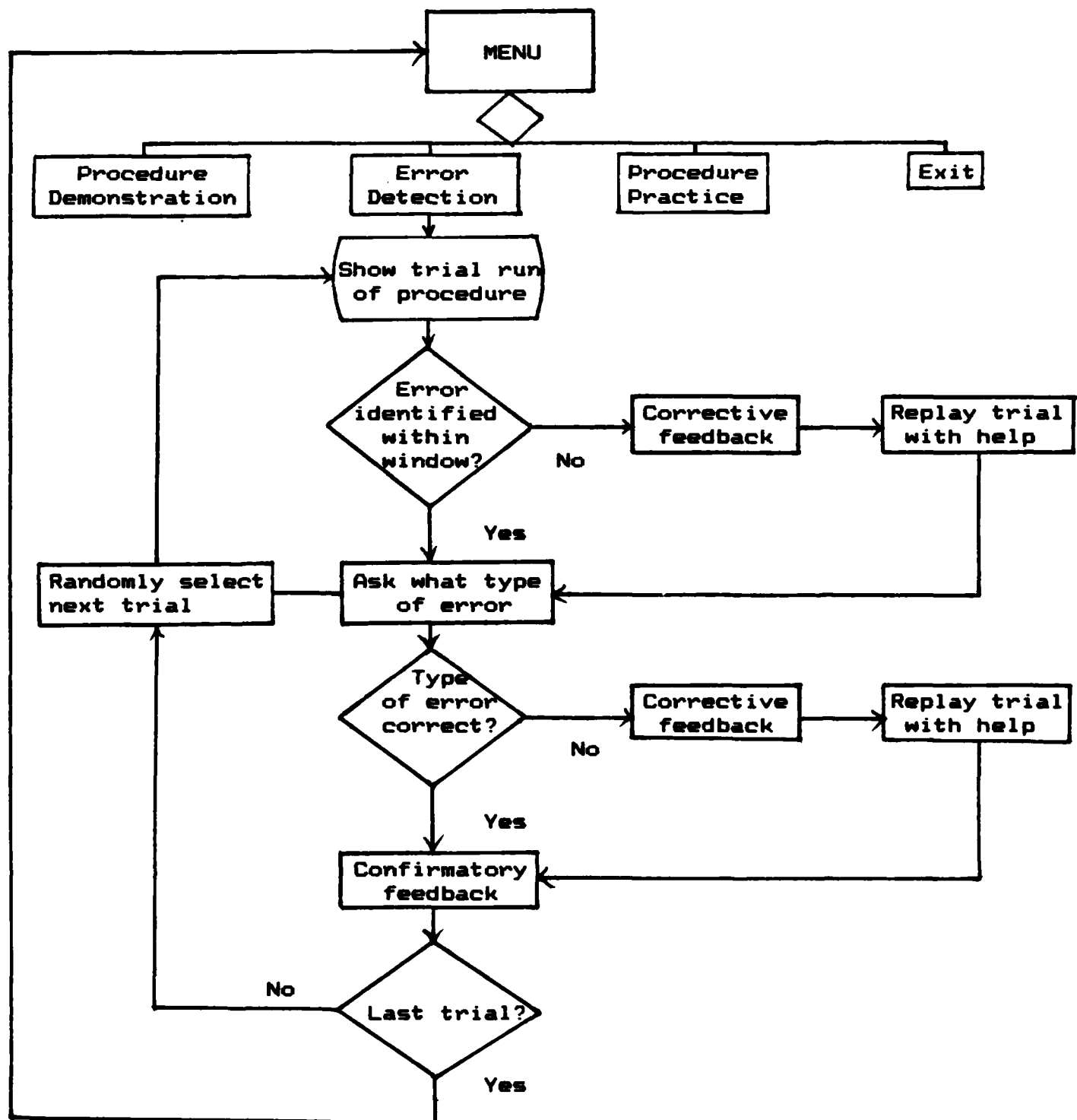


Figure 1. Practice in error detection. Flowchart depicts learner's progress through Error Detection Module.

Incorrect responses by the learner result in immediate feedback and remediation. Remediation can consist of a video replay of the segment with a verbal explanation and an audible signal heard at the moment of the error occurrence. Computer textual feedback may be used as well. Following feedback and remediation for the video error recognition segment, the system will continue on to the computer-generated text question concerning the type of error that was presented. Incorrect learner response to the multiple choice question will result in similar video and/or textual remediation. The system will then return the learner to the next step in the module.

Importance of the Study

The design of this module was developed to enhance successful memory of the procedural sequence and related principles. Effective use of this strategy should encourage successful transfer of the process to actual performance. Successful transfer of process learning should increase the learner's self-confidence and decrease the number of negative real-life consequences. This would be most valuable when safety during or after the procedure is a major consideration, e.g., with complex medical equipment or the avoidance of bacterial contamination of patient care medications or supplies.

System feedback can reinforce or remediate, resulting in highly individualized instruction. The added advantage of a timed "window" response frame provides the learner with a sense of reality and urgency to simulated procedures. Learners can

work with pseudoemergencies, visualize the results of their actions and learn from their mistakes similar to Hon's CPR program used by the American Heart Association. The model described here is similar to demonstration or simulation techniques but does not require the presence of actual medical equipment for the error detection module. An instructor can provide answers to learner's questions regarding transfer of content matter to real-life situations. Manipulation of equipment items can be done using the procedure practice module in which the learner may progress at his/her own pace in mimicking the visual demonstration on actual equipment. Step-by-step demonstration of the procedure, enhanced by computer-text reinforcement, is learner controlled.

Another major advantage to this model is its application to existing linear filmic media. This can result in a very cost-effective, pragmatic application to integrating IVI, facilitating its accessibility to today's educators and students. Again, the medium is still so new that much more research is required to provide producers and designers with appropriate direction for future development.

HYPOTHESIS

The experiment was designed to test the following hypotheses:

1. Subjects using the interactive videotape will evidence fewer errors on the initial and delayed skills tests than subjects viewing the linear tape.
2. Subjects using the interactive videotape will evidence fewer errors on the initial and delayed skills test than subjects in the control group.
3. Subjects viewing the linear tape will evidence fewer errors on the initial and delayed skills tests than subjects in the control group.

CHAPTER 3

METHODOLOGY

Experiment Design

The effectiveness of the interactive videotape was tested using a modified posttest-only control group design (Campbell and Stanley, 1964). Seventy-six hospital corpsmen trainees received a standard classroom lecture/demonstration on aseptic gloving and degloving procedures. They were then randomly assigned to one of three treatment groups. One group was shown the interactive videotape on degloving procedures. A second group viewed a linear videotape only, comprised of the same footage. The third group served as the control and received no supplemental instruction on the procedure. Scores on selected tests of the Armed Forces Vocational Aptitude Battery (ASVAB) were used for covariate control of general ability.

Subjects. Navy hospital corpsmen trainees in two nursing care classes were asked to participate in the experiment. The majority of participants were high school graduates. All were males. Female subjects were not available for the subject pool. Ages ranged from 18 to 33 years. Students with prior exposure to the aseptic technique were excluded from the subject pool.

Pre-treatment Training. Each participant viewed a standard classroom lecture/demonstration of aseptic gloving and degloving technique performed by a registered nurse, one day preceding

administration of the treatments. The class content was specified in the lesson topic guides provided by the Navy's Health Science and Education Training Command for the Basic Hospital Corps School curriculum.

Treatment Procedures. Treatments were individually administered in isolation carrels. The first treatment group was shown the interactive version of the practice and demonstration modules on degloving. The demonstration module consisted of a sequential performance of the procedure accompanied by a voice-over narration describing each step. Students in this group then used the practice module to identify errors in technique. Subjects were permitted to reselect either module without penalty.

Students in the second group viewed a linear version of the tape that covered the same content. The difference between the two versions of the tape can be summarized as follows. In the interactive version, students were required to identify any instances of contamination by pressing the spacebar on the computer console immediately after noting the occurrence. Correct responses resulted in confirmatory and congratulatory feedback. Incorrect responses resulted in re-display of the trial. The subject was then required to view the trial again and to identify the exact moment of contamination. A second error resulted in a replay of the trial, accompanied by a voice-over narration that described the error and the principle of asepsis which it violated. An audible tone indicated the exact moment of contamination. The subject then proceeded to the next trial.

No provisions for overt response were made in the linear version of the tape. The demonstration module was exactly the same as in the interactive version. In the practice module, each trial was represented twice. The first trial in each pair was exactly the same as the corresponding trial in the interactive tape (with no provisions for overt responses). The second trial in each pair consisted of a repeat showing accompanied by the voice-over narration and the signal tone. In other words, students who used the interactive version of the tape only saw the explanatory repeats of a trial if they failed to detect an instance of contamination, or if they responded when there was no contamination. Students who viewed the linear version of the tape saw each trial followed by an explanatory repeat. The difference between the two treatments was designed to contrast interactive video practice with equivalent content as it might be represented in a linear film or videotape.

Outcome Measure

The outcome measure consisted of a skill performance test. This test required the students to demonstrate the degloving procedure five times in succession. Each trial was videotaped. Each subject was assigned a code number. Only the hands and arms of the subjects were seen on the camera. Individual performances were judged by two registered nurses who used a standard scoring form to tally the number of errors observed. Judges were not informed of the treatment group assignment of the subjects.

Test Administration. Subjects were tested immediately following administration of the treatment, one day following the classroom lecture/demonstration. Subjects in the control group, who received no treatment, were also tested one day after the classroom session.

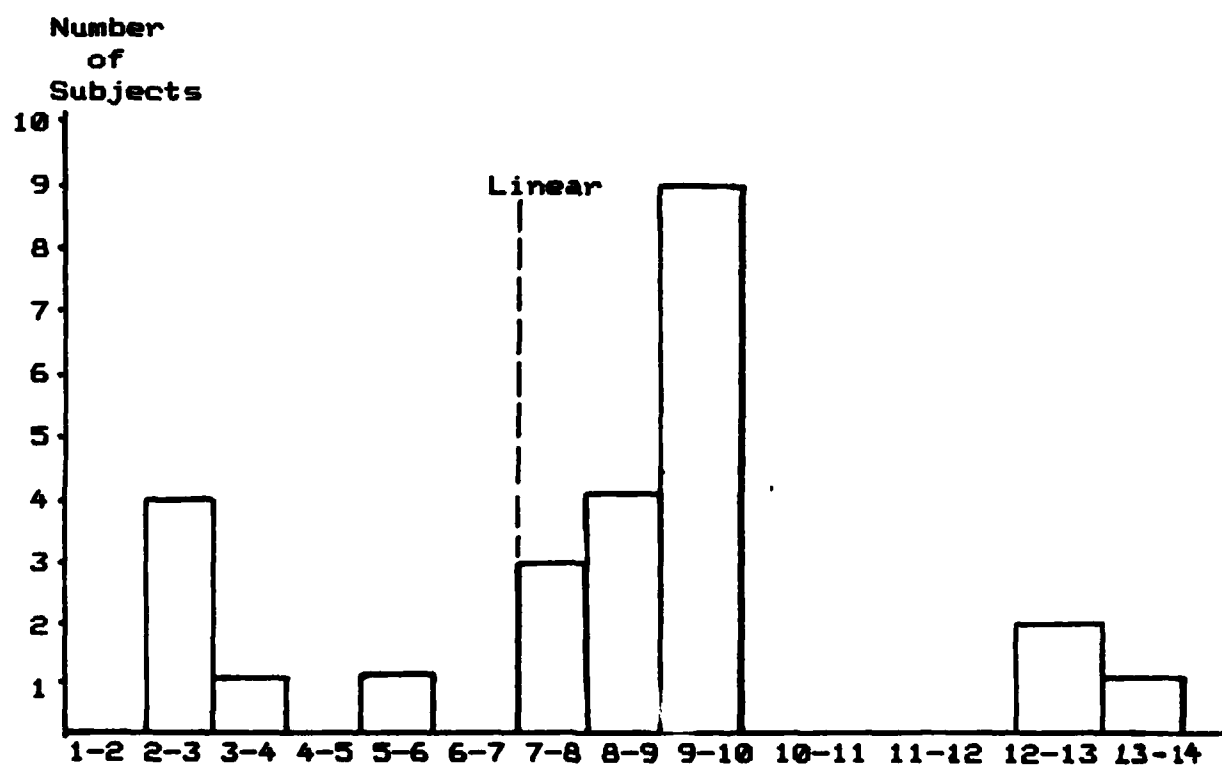
CHAPTER 4

DATA ANALYSIS AND FINDINGS

Time to Complete IVI Lesson. Subjects in the interactive group viewed the lesson and practice segments in varied amounts of time, i. e., from two minutes, 25 seconds to 13 minutes (see Table 1). The mean time was 7.74 minutes. Times reflected user module reselection, accidental keyboard presses, as well as system malfunction. The linear videotape version was seven minutes in length.

TABLE 1

Time to Complete IVI Lesson


 $\bar{x} = 7.74$ minutes

 $n = 27$

Minutes to Complete Lesson

Check for Pre-treatment Differences in Ability. Separate Analysis of Variance procedures were performed to determine whether there were any significant differences in pre-treatment ability for the experiment groups. There were no significant differences between treatment groups at the .01 level for age, educational level, or ASVAB scores.

Reliability of Outcome Measure. The judges' scores for the five trials were subjected to an item analysis. Each trial's rating was counted as a separate item. Both judges scores were included, for a total of ten items. Using this method of calculation, the test was found to have a high internal consistency, Cronbach's alpha = .91. However, occasional differences in judging the number of errors occurred between the two judges.

Test scores were subjected to an analysis of variance to determine if the differences between group means were significant (see Table 2). Alpha was set at .05. None of the hypotheses was supported by this test.

TABLE 2
Number of Degloving Errors
Means (and Standard Deviations)

Interactive Videotape	Linear Videotape	Control
n = 27	n = 28	n = 21
.71 (.94)	.71 (1.8)	1.29 (1.5)

CHAPTER 5

DISCUSSION

This experiment is viewed as a pilot study. The researcher is reasonably confident of the procedures and the outcome measure was shown to be highly reliable.

There were several problems that may have contributed to the study's lack of significant findings. These can be corrected in a follow-up study.

The power of the experiment can be increased by improving the scoring of the skills test. Although the reliability of this test was high, it is felt that it can be improved by requiring the two judges to review any conflicts in their scores. This would be done by replaying the subject's taped performance and asking the judges to resolve any differences in the assigned scores.

A more important way to improve the experiment involves enhancing the treatments to more adequately reflect the model algorithm for teaching error detection. The four modules in the degloving program formed a comprehensive strategy that was designed to optimize the implementation of the model algorithm. However, due to time constraints, only one of the four modules was tested. In a follow-up study, the complete version of the interactive program would be used and compared to an equivalent linear version of the tape.

Another problem with the design of this study was that the experimental treatments constituted a relatively small part of

the subjects' training in degloving. The subjects in our experiment were actual students and the subject matter content was critical to their training. Due to logistical constraints, it was not possible to substitute the experimental treatments for conventional training. Rather, the treatments were used as supplements to a standard classroom lecture/demonstration session. The mean time spent using the interactive and linear tapes was only about seven minutes. It is believed that the modest effects detected by this pilot study would be enhanced substantially if the experimental treatments were the sole source of training prior to administration of the outcome measure. Subjects who then failed to meet the Navy's minimum performance criteria, as assessed by our testing, could then be provided with remedial training in a standard classroom setting.

REFERENCES

- Biehler, Robert F. Psychology Applied to Teaching. 3rd ed. Boston: Houghton, Mifflin Company, 1978.
- Boen, Linda L. "Educational Research: Teaching with an Interactive Video-Computer System." Educational Technology. (March 1983), 42-43.
- Campbell, D. T., and Stanley, J. C. Experimental and Quasi-experimental Designs for Research. Chicago: Rand McNally, 1964.
- Cohen, Vicki Blum. "Interactive Features in the Design of Videodisc Materials." Educational Technology. (January 1984), 16-20.
- Currier, Richard L. "Interactive Videodisc Learning Systems." High Technology. (November 1983), 51-59.
- Daynes, Rod, Robert D. Brown, and Dianna L. Newman. "Field Test Evaluation of Teaching with Videodiscs." Education & Instructional Television. (March 1981), 54-58.
- Ebner, Donald G., et al. "Current Issues in Interactive Videodisc and Computer-Based Instruction." Instructional Innovator. (March 1984), 24-29.
- Edwards, Margaret J. A., and Kathryn J. Hannah. "An Examination of the Use of Interactive Videodisc Cardiopulmonary Resuscitation Instruction for the Lay Community." (A paper presented at the First Annual Nursing Conference for Computer-Assisted Interactive Video Instruction, Sacramento, February 28, 1985).
- Ellis, John A., and Wallace H. Wulfek, II Handbook for Testing in Navy Schools. Naval Personnel Research and Development Center, Special Report 83-2. San Diego: NPRDC, October, 1982.
- Gagne, R. M. The Conditions of Learning. New York: Holt, Reinhart and Winston, 1965.
- Gayeski, Diane M. Corporate and Instructional Video. Englewood Cliffs: Prentice-Hall Inc., 1983, 271-282.
- Gayeski, Dianne M., and David V. Williams. "Program Design for Interactive Video." Education and Instructional Television. (December 1980), 31-34.
- Hon, D. "The promise of interactive video." Performance and Instruction Journal, (November 1983), 21-23.

- Huckaby, Loucine M. Daderican. Conditions of Learning and Instruction in Nursing. St. Louis: C.V. Mosby Company, 1980.
- Jonassen, David H. "The Generic Disc: Realizing the Potential of Adaptive, Interactive Videodiscs." Educational Technology. (January 1984), 21-24.
- Kearsley, Greg. "Instructional Videodisc." Journal of the American Society for Information Science. 34, No. 6 (November 1983), 417-423.
- Laurillard, Dianna M. "Interactive Video and the Control of Learning." Educational Technology. (June 1984), 7-14.
- Prather, D. C. "Trial and error versus errorless learning, training transfer and stress." American Journal of Psychology, 84 (1971), 377-86.
- Puetz, Belinda E., and Faye L. Peters. Continuing Education for Nurses. Rockville: Aspen, 1981.
- Reeves, Thomas. "Alternative Research and Evaluation Designs for Intelligent Videodiscs." (Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, April 25, 1984, Session 31.33).
- Schram, Wilbur, ed. Quality in Instructional Television. Honolulu: The University Press of Hawaii, u.d.
- Singer, R. M. "Motor skills and learning strategies." In Learning Strategies Ed. H. F. O'Neal, Jr. New York: Academic Press, 1978.
- Stevens, B. J. "The teaching-learning process." Nurse Educator, (May-June 1976), 9-20.
- Wilson, Larry, "Interactive Video, A Step Toward Natural Learning." Performance & Instruction. (November 1983), 32-33.
- Winn, William. "Why Media?" Instructional Innovator. (February 1984), 31-32.
- Young, Jon I., and Paul C. Schlieve. "Videodisc Simulation: Training for the Future." Educational Technology. (April 1984), 41-42.

ABSTRACT

Recent developments in the field of instructional media provide educators with enhanced technological capabilities to teach procedures involving psychomotor skills. A general model for using an interactive video instruction (IVI) program to teach a simple medical procedure, aseptic degloving, was tested as a supplemental instructional tool. Seventy-six Navy Hospital Corpsmen enrolled in the Basic School, Naval School of Health Sciences, served as subjects. The design of the degloving module involved demonstration of the correct technique. The learners were then tested on their ability to observe errors in trial examples of the procedure. This strategy was developed to enhance successful memory of the procedural sequence, related principles, and subsequent actual performance. Three experimental groups were formed. Subjects viewed either the IVI lesson, a linear videotape of the same content, or received no supplemental instruction (control group). The outcome measure was a videotaped performance test which required the subjects to deglove aseptically five times in succession. The number of errors committed each trial by the subject were evaluated by two independent registered nurse judges. There were no significant differences found in performance of the subjects. Factors which may have contributed to the lack of significance are discussed. Further research is recommended.

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