

DESIGNER'S IMAGINATION AND EXISTING HARDWARE AND CREATIVE SOFTWARE PERFORMANCE-BASED MULTI-IMAGE INSTRUCTION

DENNIS DUKE
Education Specialist
and
MURRAY TESSER
Chief, TV Production
US Army Signal Center and Fort Gordon

Today's Department of Defense has made great advances in developing and utilizing innovative training materials within the last 10 years. The Army, for instance, currently employs the Instructional Systems Development (ISD) model in the design of all training material. This model is unparalleled in defining and analyzing instruction in a very logical and coherent manner. However, the model is only a tool. The development of quality training packages is dependent upon the competence and imagination of instructional designers. This paper seeks to review and transcend the ISD model in suggesting methodological training innovations for cost-effective strategies to improve instructional packages.

Basically, the ISD model is an instrument which enables training developers to perform task analysis and undertake instructional development via a proceduralized logical progression. Each of the five phases of the model incorporates evaluation criteria which require the designer to answer questions, state objectives, analyze behaviors, make key decisions, etc. Idealistically, the ISD model is the most effective and efficient method to develop a training program. Inherent within the ISD model are provisions which enable the designer to determine adequate levels of design and production value for specific objectives as well as apportion resources necessary to provide maximum perspicuousness.

Design value can be operationally defined as the sum of all learning paradigms applied to a particular package. It can be viewed as an idealistic striving toward perfect attainment of instructional objectives. The effectiveness of the design of a learning package is measured by the behavior of the participants. It is construed as being successful if the elements of the lesson's behavioral objectives have been attained and demonstrated by the participants.

Production value refers to the technology of the method of delivery in an information presentation. The production value of a particular training program is often assessed in terms of aesthetics; e.g., special effects, graphics, casting, director's style, etc. Often the effect of an instructional program

is determined by the amount of aesthetic distance that is felt by the audience. There are numerous variables which impinge upon this construct but generally the closer the aesthetic distance, the more favorably the program is received. We must concern ourselves with both the design value and the production value to successfully employ the ISD model in training for the modern Army.

Currently, Army developers are confronted with a serious and challenging training problem. The tactical equipment utilized in modern warfare is becoming increasingly complicated to both operate and maintain. This increased complexity of military equipment has caused the content of accompanying training packages to become commensurately more difficult. Along with this problem, the developer must deal with a target training population with demonstrated lower intelligence and reading scores than their counterparts of 10 years ago. (See Figure 1)

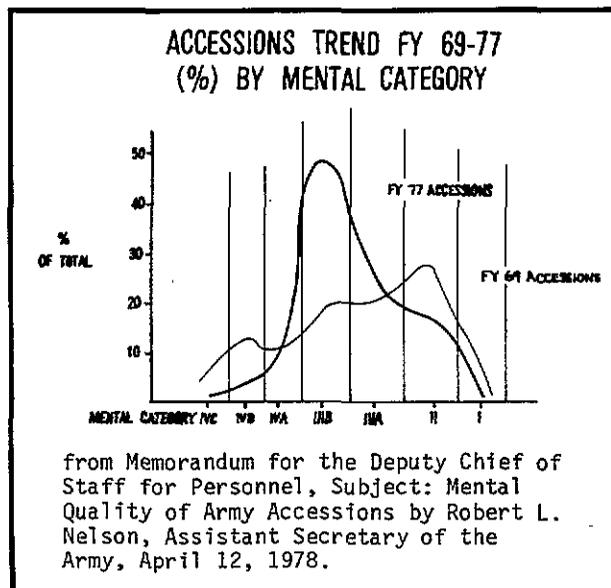


Figure 1. Mental Quality of Army Accessions

It must be noted though that this problem is not specific to the military. Educational researchers have discovered this problem to be equally prominent in business and industry as well as the technical schools and universities. (Duke, 1978) This treatise does not purport to examine the underlying causes for this demise of test scores but rather seeks to offer suggestions as to how we, as trainers, may cope with this demanding situation.

There is no singular straightforward answer that can be offered as a solution to the above problem. Many variables must be analyzed and different learning situations must be considered. Initially, though, we as developers must adhere to the postulate that regardless of the training situation there cannot be any compromising upon the design aspect of training development. This design value requires a great degree of time and attention paid to it by the designer. Although production value varies with each training situation, the design value of the ISD model must remain consistently high. Trainees with a great degree of intelligence and a high amount of motivation can effectively learn via any medium. "Slow" learners, on the other hand require training packages which are more elaborate and interesting. The production is thus inversely proportional to the analyzed intelligence and motivational level of the trainee. (See Figure 2)

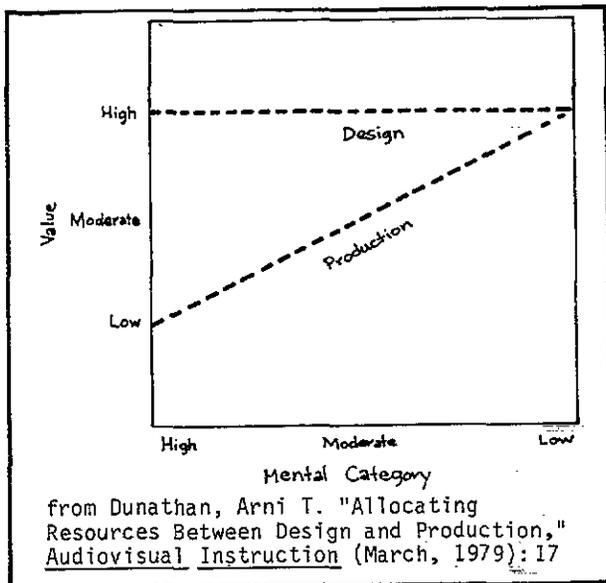


Figure 2. Design and Production Values

Up to this point we have established and provided a rationale for the importance of the absolute value placed upon the design of instructional materials. We have also determined that there must be an increasing amount of attention given to the production value of training packages. We will now elaborate upon a suggestion which may be utilized by training developers to improve the production value of their training packages.

If we examine the interests of today's student population (individuals aged 6 to 25 years), we discover many interesting anomalies from previous generations. These people were raised with automobiles, jetliners, humans walking on the moon, and, of course, television. They are used to being constantly entertained and having things done instantly. Research shows that adults spend approximately 28 hours a week watching television; children average 25½ hours a week. Unfortunately if we look in the classrooms of today's public schools, we see many bored individuals. The reason for this is that many of our teachers in public education are unable to update their teaching methodologies to cope with today's student generation. They also cannot compete with the fast movement of the television. Army developers recognize that today's recruit is "turned off" by irrelevant material. They desire all the information deemed "necessary to know" for their occupation presented in the most interesting and expeditious mode possible. How can we, as training professionals, satisfy these criteria while also developing a cost-effective training system?

One simple answer to this problem is to apply the following simple equation:

$$\text{Existing Training Material and Trainer's Imagination} = \text{Educational Innovation.}$$

Today's Army classrooms currently utilize a wide array of modern training aids such as simulators, audio tape/slide shows, videotapes as well as traditional instructor-made visuals and chalkboards. Varying training objectives require the use of specialized training devices. A question we must ask is, "Are the existing training programs the most interesting, expeditious and cost-effective possible?" The answer is "no"! This paper suggests we combine all of our existing media into one presentation. This training innovation, which the Army is currently researching, is called multi-image instruction.

Perin's (1969) definition of the concept of multi-image is elaborated upon to provide an operational definition of multi-image instruction.

Multi-image instruction refers to a system whereby three images are projected simultaneously on three connected but separate screens. The center screen is a television monitor connected to a videotape viewer. The left and right screens are condensed movie screens upon which juxtaposed cue-pulsed slides are projected from the rear. These slides usually provide complementary information, but can also serve to create a panorama. The system is totally self-contained as shown. (See Figure 3)

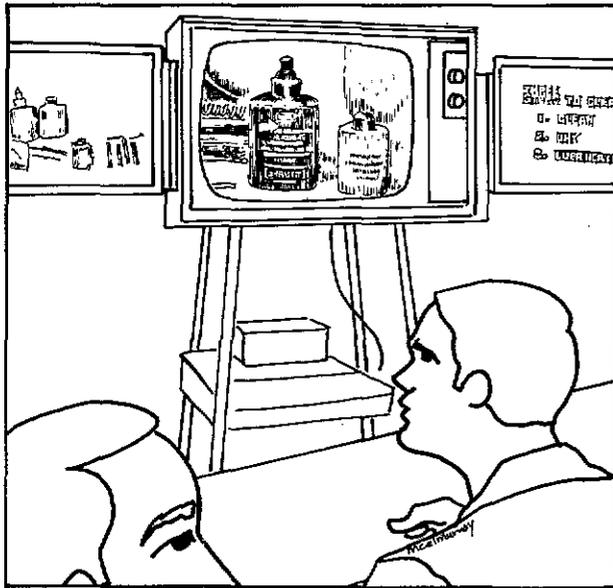


Figure 3. Multi-Image in Basic Training

The concept of multi-image presentations is not new--dating as far back as 1927. The advent of modern multi-image instruction occurred when James Finn and Robert Hall delivered a three-screen presentation in 1962. An evaluation report written on the program clearly demonstrated that, by utilizing larger screens or multiple screens with a battery of semiautomated equipment, it was possible to present many more concepts and much more complicated ideas to larger groups than had previously been thought possible.

Since that time, several studies have been undertaken in order to determine the effectiveness of multi-image presentations. Roshka (1958) and Allen and Cooney (1964) researched the effectiveness of multi-image instruction on the cognitive recall of children at the sixth-grade level and below. They found that the levels of recall are higher after multi-image presentations.

Reed (1970), using adult churchgoers as subjects, found that five screens were more effective than one in presenting religious information. Ingli (1972) demonstrated superior results with undergraduates using three screens to present information.

Brydon, working with trainees on blueprint writing at Lockheed Corporation Training Division, found that triple-image version of instruction was much more effective (.01) than a single-image version of instruction. Ausburn (1975) showed multiple imagery to be superior in aiding with visual location tasks. In addition, he found three screens to be extremely effective with haptic learners--an extremely significant finding for Army developers since the Army uses a great deal of "hands-on" training.

The results of research on multi-image are not overly persuasive about multi-image achieving superior results over conventional on screen or other training media. Research of the early 70's (Bollman, 1970; Atherton, 1971; Didcoct, 1972) shows no significant difference between the effects of single-image and multiple-image presentations. Conclusions of the research even state that multi-image presentations were interpreted as being so distracting that they were construed as detrimental to the learning process. Dyer (1975) offers an interesting rebuttal as an explanation of these conclusions. He maintains that the reasons for selecting the multi-image format range from its impact in emotional appeal to its effectiveness as an aid to instruction. Many developers neglect the design value of the presentation and rely solely upon the uniqueness of multi-image screening to evoke an audience reaction. He states:

No behavioral objectives are identified, no follow-up evaluation is planned, and there are actually no results to be analyzed. The success of the program is measured in terms of supposed audience approval. Such a program may be developed to present a feeling to visually stimulate the viewer and to arouse the audience through sight and sound.

The Army combines this unique and important component of production value with a thorough and logical design analysis utilizing the ISD model. Therefore, the importance of design value remains constant (a high-priority level) while the attention paid to production value is increased.

Fort Gordon is currently experimenting with multi-image instruction in Basic Rifle Marksmanship (BRM). The objective of the training, which employs multi-image instruction, is to

enable the student to disassemble, lubricate and reassemble the M16A1 rifle. This instruction is conferred upon a recruit who has just recently (5 days) been inducted into the active Army. The novelty of being in the Army causes a great deal of apprehension in the student which acts as a deterrent to effective communication transfer. The BRM personnel wanted to eliminate this tension as well as retain a performance-based type of instruction. Therefore, in conjunction with the designers and media specialists, the multi-image format was implemented.

The concept utilized existing hardware (e.g., 35mm carousel projectors, 3/4" video cassette players and television monitors) which can be found on all military installations. By combining the 35mm slide shows with the 3/4" videotape, a dramatic multi-image presentation evolved. Initially, the slides were changed manually, but the current multi-image presentation slides are automatically advanced via cue pulses on the secondary audio track of the videotape. Preliminary research results (Duke, 1979) show that recruits who view the multi-image presentation do as well on a performance test as troops enrolled in a traditional lecture class even though they complete the block of instruction in 65 to 75% of the time. This is due to the "hands-on" participation required by the multi-image program, the individualized instruction provided by BRM personnel and the standardization of the program.

The multi-image method of presenting training is not the best way to communicate all information. It is conditional in that its advantage over other media exists only where there is an increase in accessibility of relevant information. Nonetheless, multi-image can and does have application to numerous areas of training which require benefit from motion and/or animation. The avionic communication equipment MOS (35L), for example, can utilize multi-image training to create a pseudo three-dimensional effect as figure 4 illustrates.

The left screen provides elementary hierarchical skills which are needed to accomplish the task. Here, basic electronic circuits, which appear in the repair task, are explained. This screen complements the center screen by informing the student what theoretically is happening. The center screen is a television monitor providing the motion. It shows the student: 1. the actual location of the components in question, 2. how to use a test probe to measure voltage, 3. how to properly set up the test equipment and, 4. safety precautions. The right screen illustrates how the measured voltage would appear on an oscilloscope.

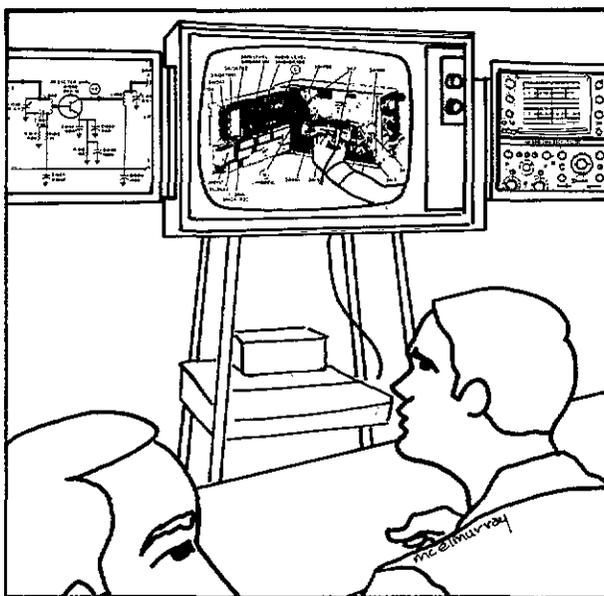


Figure 4. Multi-Image in Avionics Training

Multi-image instructional programs have many advantages. Listed below are several of these, but the list cannot be considered all inclusive--this is determined by the imagination of the developers. They are presented here to stimulate innovative thinking for those who are considering the merits of using this format.

1. The position of behavioral objectives in the ISD hierarchy will determine the objectives-sequential position in the course instruction. The basic objectives; e.g., basic transistor theory, Ohm's law, etc. must be learned before higher objectives can be comprehended. Usually, this basic instruction is extremely boring due to its lack of application. The multi-image mode of presentation enables one to present or elaborate upon a low-level objective, when needed, on one screen, while constantly providing a reminder to the student of the concept's need and applicability on another screen. Thus, introductory tasks can be presented in conjunction with higher level tasks.
2. Careful attention to design value of the training program can cause the student to become actively involved in the program rather than remaining a passive viewer.
3. Utilization of three screens enables the designer to provide close-ups on one screen,

show the close up as it relates to the whole on another screen, and offer a visual explanation on a third screen.

4. A designer can use three screens to help the viewer identify commonalities, similarities, or contrasts among several visuals. It is easier to detect differences when the images can be viewed simultaneously.

5. An instructor who is proctoring a class with multi-image can provide individualized instruction with minimum interruption.

6. A multi-image program can be designed to include instructor evaluations before it continues with the lesson. If an instructor feels it is necessary, he can "still-frame" the program and personally elaborate on the material. This helps to provide better understanding of concepts presented prior to that specific point.

7. Multi-image programming, by its very nature, is a fast-moving media. A viewer is bombarded by three times as many images as television. This naturally forces him to be more attentive. Preliminary opinion polls distributed to recruits in M16A1 classes informed us that the students felt the program was moving so rapidly that they didn't have time to daydream. The fast pace caused them to concentrate three times as much as they would in a regular lecture. It must be noted, though, that the program must possess a logical and lucid progression as well as a juxtaposition of images.

8. Properly designed, a multi-image presentation is actually a three-dimensional type of simulation device. With the exception of direct simulation, this is the closest approximation to the actual performance of the task that is possible.

9. A secure (secret) program can be exported with no threat of its being intercepted and interpreted if a multi-image format is employed. One would be able to determine the objective of the presentation only if and when all three portions of the program are combined. These portions would be distributed separately and only when delivery of the one sent out previously is acknowledged by the receiver.

10. The technique of multi-image presentations is extremely cost-effective. Its basic components are a TV monitor, a videotape playback unit, two slide projectors with rear screen material, and a device that interprets the cue pulses on the videotape's secondary audio track to advance the slides. The material on the slides and videotape is determined by the designer.

As was mentioned earlier, the elaborateness of the production value of training is limited only by the imagination of the designer. Once he becomes receptive to new ideas, applications and technologies, his horizons are infinite.

For example, an interesting sidelight developed from our research on multi-image: We were concerned about field training in areas where conventional methods of instruction are not practical or inappropriate; e.g., repairing an antenna, soldering connections in a satellite terminal with extremely limited space, etc. To rectify training problems of this nature, we are developing a hand-held viewer which can be taken anywhere and upon which any type of training material can be easily illustrated. This compact audio and visual viewer can be used as a training aid in almost any conceivable training situation. Operating on ac current, or self-enclosed batteries, the hand-held viewer provides an individual an opportunity to watch either 16mm or 8mm filmstrips with audio accompaniment at his own pace. It can be used for initial training and/or reference as shown in figure 5.

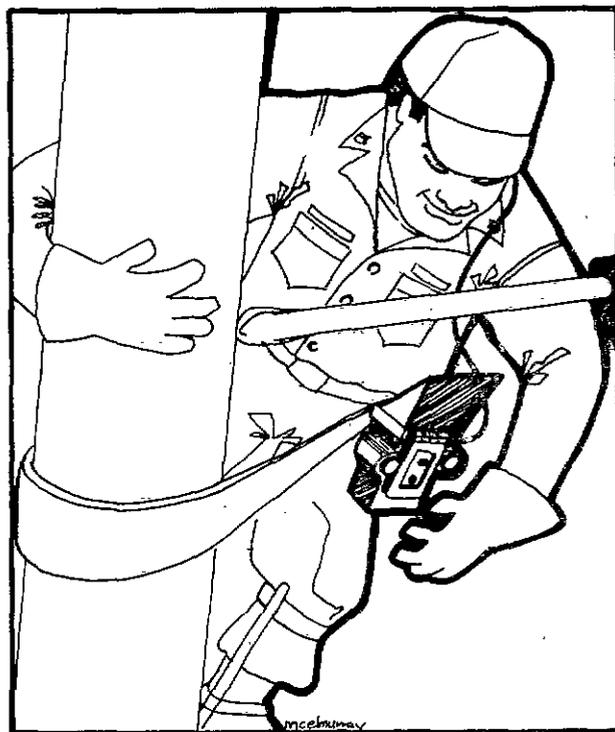


Figure 5. Hand-Held Viewer

In summary, this paper has sought to point out to educators that all the necessary ingredients of dynamic training programs are currently in existence somewhere in their immediate environment. By investing time

in a thorough design of instructional programs and relinquishing preconceived notions about traditional training programs, the instructional developer can creatively use his imagination to produce effective and innovative training material.

BIBLIOGRAPHY

- Allen, William H. and Cooney, Stuart M. "Non-linearity in Filmic Presentations." AV Communication Review 12 (Summer 1964) 164-176
- Atherton, Lawrence L. "A Comparison of Movie and Multi-Image Presentation Techniques on Affective and Cognitive Learning." Ph.D. dissertation, Michigan State University, 1971
- Ausburn, Floyd Bonness "Multiple Versus Linear Imagery in the Presentation of a Comparative Visual Location Task to Visual and Haptic College Students." Ph.D. dissertation, University of Oklahoma, 1975.
- Bollmann, Charles G. "The Effect of Large-Screen, Multi-Image Display on Evaluative Meaning." Ph.D. dissertation, Michigan State University, 1970
- Brydon, W. "Comparing Single Screen and Three Screen Presentations." Ph.D. dissertation, University Southern California, 1971
- Didcoct, Don H. "Comparison of the Cognitive and Affective Responses of College Students to Single-Image and Multi-Image Audio-Visual Presentations." Ph.D. dissertation, University of Wisconsin at Madison, 1972
- Duke, Dennis S. "Training for the Modern Battlefield." Educational Television Program presented at National Security Industrial Association Conference, Fort Gordon, Georgia, October, 1978.
- Duke, Dennis S. current research being undertaken at Fort Gordon, Georgia on the effect of multi-image instruction in the disassembly, lubrication and re-assembly of the M16A1 rifle.
- Dyer, Palmer E. "Why Multi-Image?" Paper presented at the Association for Multi-Image Symposium II, AECT Convention, Dallas, Texas, April 1975.
- Finstad, A. "Professional Sights Soar with Finn-Hall Spectacular," Audiovisual Instruction, 7 (June, 1962): 366-367
- Ingli, Donald "Teaching a Basic AV Course by the Multi-Image Technique." Southern Illinois University, April 1972 ERIC No. ED 060 634
- Lombard, E.S. "Multi-Channel, Multi-Image Teaching of Synthesis Skills in 11th Grade U.S. History." Ph.D. dissertation, University of Southern California 1969
- Perrin, D. G. "The Use and Development of Simultaneous Projected Images in Educational Communication." Ph.D. dissertation, University Southern California, 1969
- Reid, Robert O. "A Comparison of a Multi-Image and a Linear Film Format as Agents of Attitude Change." Ph.D. dissertation, Syracuse University, 1970
- Roshka, A.V. "Conditions Facilitating Abstraction and Generalization." Voprosy Psikhologii 4 (No. 6, 1958): 89-96 (Reported by I.D. London, Psychological Abstracts 34 [1960] : 85)

ABOUT THE AUTHORS

MR. DENNIS S. DUKE is an Education Specialist with the Design and Development Division of Directorate of Training Developments at U.S. Army Signal Center and School, Fort Gordon, Georgia. His primary responsibility is in design and development of training packages in avionic communication and navigational equipment repair. Past experience includes: Developing instructor training programs in equal employment opportunities for the Army; conducting research on the effectiveness of training at the Army Signal Center and School; adjunct professor at the University of South Carolina working in speech communications; and a member of the Advisory Board at Phillips College acting as a media consultant. He holds a B.A. degree in speech communications and a B.S. degree in secondary education from Pennsylvania State University and an M.A. degree in interpersonal communication from Ohio University.

MR. MURRAY V. TESSER is a Supervisory Television Production Specialist with the U.S. Army Signal Center and Fort Gordon in the Educational Television Branch where he is involved with training and informational recordings. He has 30 years of broadcasting experience including both commercial and educational broadcasting. Awards received include the TV Production Supervisory Peabody Award and the Civil Service Meritorious Award.