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ABSTRACT

Instructional development models have been primarily concerned with audience analysis, content, media selection and sequencing, rather than the design of the program. They fail to analyze either the interaction between the content, learner, objectives, and medium, or how best to design the content for presentation through the medium. This paper analyzes the television media in light of the above criteria and presents a model which prescribes the development of a program in three distinct parts: (1) different types of introduction that can be used; (2) treatment of the content in the body of the program; and (3) different strategies for ending a program. Though not a research review per se, all recommendations are supported by references to research in psychology and instructional science. (JVP)

THE DESIGN OF INSTRUCTIONAL TELEVISION PROGRAMS

by

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INTRODUCTION

Instructional television programs were first introduced into the classroom in the early fifties and have been diffused to almost every facet of education and training in this country. The programs have been highly criticized for both their aesthetic and instructional qualities. The aesthetic problems have been described in a previous paper (Aversa & Morrison, 1978), but little has been said about the instructional design of instructional television programs.

Carl (1976) reported on the instructional development models proposed by some 23 individuals and agencies actively involved in the design of instructional programs. Most of the models addressed the goals and objectives, the audience, content, media selection, program format, and production. It appears that these models are more concerned with audience analysis, content analysis, sequencing, and length, than the design of the program. They fail to analyze the interaction between the content, learner, objectives, and medium; and how to best design the content for presentation through the medium. It should not be assumed that the instructional development models are useless, rather another step must be added: the design of the instructional events for the medium.

The definition of an instructional television program should be clarified before proceeding. Aversa and Morrison identified three types of educational programs: instructional programs, educational programs, and cultural programs. An instructional program uses the medium to teach a well-defined objective(s) and the program is limited in scope to the stated objectives. The audience is specific, often captive, and presumably motivated by a need for the information. The instructional program is generally for nonbroadcast use. These are the parameters of the program for which the following instructional design can be used.

Bruner (1966, p. 40) states that any instructional theory should be prescriptive in nature. Although an instructional design model is not a theory of instruction, it has many of the same characteristics and performs similar functions. Therefore, an instructional design model should be prescriptive and set forth rules that describe the most effective means of achieving the objectives.

The Instructional Television Program

This model will prescribe the development of a program in three distinct parts. First, some of the different types of introductions that can be used in an instructional television program will be described. Second, the treatment of the content in the body of the program will be discussed. Third, some of the different strategies for ending a program will be described.

Assumptions and Limitations

Much of the research from which the following generalizations have been derived are print oriented and have not all been empirically tested with the television medium. If, as Salomon and Clark (1977, p. 101) point out, there is no difference in results if only the delivery device has been altered. Then, the results should be partially applicable to other media using an audio track since language is required for both aural and reading comprehension.

ESTABLISHING CONDITIONS FOR LEARNING

Experience has shown that certain conditions need to be established before efficient learning can occur. The learner must be ready for the instructional event and prepared to learn. Gagne (1970, p. 77) describes three conditions to learning: attentional sets, motivation, and the state of developmental readiness. These three conditions operate prior to the learning event and contribute to its probability of occurence in an efficient manner. The instructional television program can address the preconditions of attentional sets and motivation in the introduction to the program.

We have learned from commercial television programs that the beginning, whether it be a news program or one whose goal is entertainment, is very critical to the success of the show. If the viewers' attention is not captured during the critical opening seconds, they can easily turn to another channel to view a different program. The same principle applies to magazines and newspapers displayed on a rack--it's the one that captures your attention with the first pass that you are most likely to investigate further for purchase. Although the instructional television program is not normally competing against other programs due to the captive nature of its audience, it is competing with other stimuli

in the immediate environment for the learner's attention. Therefore, the opening of the instructional program is critical to the establishment of a learning set.

The openings commonly used in an instructional program can be classified into two categories: the informational opening and the motivational opening. The two can be used separately or they can be combined to be both informational and motivational.

Hartley and Davies (1976) refer to the informational openings as preinstructional strategies. These strategies include behavioral objectives, pretests, overviews, and advanced organizers. Each of these strategies describes the instructional event(s) that is about to occur. They organize the information and provide the learner with a framework for organizing the knowledge.

The second type of opening is derived from the commercial television model. Its purpose is to tease the learner through a change in stimulus, a novelty stimulus, or through variations in stimulus intensity. The typical commercial television tease presents the viewer with just enough information to "whet" one's appetite, creating a desire to know more. The parallel in an instructional program is to show a need for viewing the program, to identify a problem, or to show the effect as part of a cause and effect.

The next section of this paper will present a review of the research to determine which strategy is most effective in a given environment. The following guidelines will provide the instructional designer with a prescription for meeting the preconditions to learning.

Objectives as an Informational Opening

The objective is often used to introduce a lesson. It may appear as a goal statement, a loosely written behavioral objective, or a very precise Mager type behavioral objective. In theory, an objective is a measureable statement of proposed change in a learner (Mager, 1962, p.3 and Davies, 1976, p. 15). The research results can be classified as to the types and uses of objectives, learner and objective interaction, and task and objective interaction. The following is a report of the results in each category.

Types and Uses of Objectives. Davies (1976) completed one of the most extensive reviews on objectives to date. He concludes from two separate data bases that there appears to be no significant differences between learning outcomes when general objectives are used or when the more specific Mager type behavioral objectives are used. One series of studies concentrated on the effect on student learning when specific and general objectives were used by the teachers. Davies (p. 86) reports that there does not seem to be any empirical advantage to the specific objectives. Another series of studies attempted to determine the effect of general versus specific objectives on student learning when the objectives were given to both the teacher and the student. Again, Davies (p. 89) reports that there does not appear to be a significant difference in the effect on learning outcomes when specific or general objectives are used. The main criteria, however, is that an action verb be used (p. 86). Melton (1978, p. 294) reports that an objective can become ineffective if it is too general or too ambiguous to be of particular assistance.

It appears that how the objectives are used is more important than the type of objectives used. Melton (p. 293) reports, "Clearly, it is not sufficient to simply provide students with behavioral objectives. They must also be aware of them." Awareness, as we have learned from writing behavioral objectives is vague. The research studies have taken two approaches to making the learner "aware" of objectives. The first, and least successful, approach is to teach the learner how to use objectives in a method similar to that used with the training of teachers. Davies (1976, p. 87) reports that of four studies which taught the learner how to use objectives, only one found a significant effect. The effect occurred, however, only after a rather long training program. The second approach is an informal training program which explains the relevance of objectives and their relationship to the test items. Davies (p. 87) reports that two studies found this approach to be very positive in its effect on learning outcomes. Gagne and Rothkopf (1975) provide additional support to this study. Melton (1978, p. 294) reports that students may ignore the objectives either because they are unaware of their existence or because prior experiences have indicated that the objectives are unimportant. The objective then, is unlikely to be an effective teaching tool.

The research then, indicates that the most important part of an objective is the action verb and that the learner needs to be cognizant of the purpose of the objectives and their relationship to test items.

Learner and Objective Interaction: A number of studies have been conducted which explore the interaction between the learner and the objective. Davies (1976, p. 91) concludes that an objective can help the learner overcome initial anxiety that is the result of the introduction of a new topic.

Two of the reviews reported an interaction between objectives and learning styles. The first review reports that children exhibiting an independant frame of mind might benefit less from objectives than children who are more dependant (Davies, 1976, p. 91). The second study states,

> ...individuals with an articulated cognitive style are likely to have internalized frames of reference to which they adhere as guides to self-definition...Those with a global style tend to rely more on external referents for self definition. On the basis we may expect that field-dependant students would be more likely to require externally defined goals and reinforcement than field-independant students...(Witkin et al, 1977, p. 19)

The interaction between objectives and learner ability has also been investigated. Davies (p. 91) concludes that objectives appeal more to middle ability learners than either higher or lower level learners. Melton (1978, p. 294) reports that objectives may be of little consequence if the learners are so highly motivated or conscientious that they will achieve the objectives even if they are not stated. And last, Hartley and Davies (1976, p. 251) concluded that the grade level does not appear to affect the learner's use of objectives.

The research tends to support the notion that objectives can reduce the initial anxiety manifested by a new subject, and objectives may be more useful to learners who are dependent upon external goals. Objectives also appear to be effective at all levels of education from primary to university.

Task and Objective Interactions. Gagne and Rothkopf (1975, p. 449-450) report that goal-descriptive directions (a non-Magerian type objective) are most effective when there is a correspondence to the sequence presented in the directions (objectives) and the sequence presented in the learning materials. If there is a difference in the sequence of the materials, the objectives are effective for only the first element. Hartley and Davies (1976, p. 259) concluded that objectives might best be used to preface long periods of instruction which has a dominant structure. Davies (p. 89) on the other hand reports that only 25 percent of the studies which involved nontraditional teaching methods (eg., independant study, computer assisted instruction, and prestructured learning) favored the use of objectives as opposed to the 60 percent of the studies using traditional methods. A question arises as to the effectiveness of objectives with highly designed instructional materials. Davies continues by stating, "Possibly they serve as useful guides in more dynamic teaching situations, and are superfluous when highly structured, predetermined materials are utilized."

A closer examination of what Davies describes as nontraditional study methods indicates that the learning is highly directed with the student being allowed very little freedom of choice other than turning the computer terminal off or closing the programmed instruction book. "Nontraditional" methods of instruction are not necessarily synonymous with long periods of instructional development. Rather, the instructional development process can produce both traditional and nontraditional instructional products. Therefore, it might be concluded that objectives are less beneficial with those methods of instruction which allow the student very little in the way of control of the sequence as in programmed instruction which requires mastery of one frame before progressing to the next. And, objectives are more useful with those methods that are not as restrictive on student progress through the material. The objectives are more effective when they introduce the structure of the material and the same sequence is found in the material

Pretests as an Informational Opening

A pretest is probably not thought of often as a preinstructional strategy as the other methods presented in this paper. However, there is some research to support its use as such. When used as a preinstructional strategy, the pretest consists of a series of questions, related to the instructional objectives, which are presented in their entirety at the beginning of the instructional sequence. It should be noted that there is a difference in function when pretests are used as a preinstructional strategy and when used

as embedded questions. The pretest when used as an embedded question occurs before the paragraph, section, etc. to which it is relevant. The test items are interspersed throughout the text of the material. As a preinstructional strategy, however, the test items are all presented at the beginning of the instructional sequence. A large amount of the research on pretests has investigated the effect of the embedded question on learning.

Rothkopf (1970, p. 328) believes that pretests, in reference to mathemagenic behaviors, serve as an orienting strategy and keep the learner's attention focused on the learning subject. Hartley and Davies (1976, p. 241) report that the pretest can alert the learner to information that might have normally been overlooked and left unlearned. These points of view differ from the traditional use of pretests to assess the learner's entry behavior.

Use of Pretests. Hartley and Davies (pp. 248-249) report four conditions in which pretests are effective as preinstructional strategies.

1. The period of teaching following the test was relatively short in duration.
2. The teaching was not 100% effective. (eg. not criterion based).
3. Students were of high ability, or were of greater maturity in years.
4. Students knew something about the material on which they were being tested.

A final conclusion by Hartley and Davies (p. 249) stated that knowledge of the results of the pretest can have a positive effect on the subsequent learning.

It appears, then, that pretests are best used with older learners who know something about the material to be learned and the instructional event will be relatively short.

Overviews as Informational Openings

As compared to objectives and pretests, overviews are different in that they generally appear as prose rather than statements or questions. Overviews can take other forms such as outlines, algorythmns, and possible typographical headings. However, they appear most commonly as prose. Ausubel and Robinson (1969, p. 316) have defined overviews as having the same level of abstraction, generality, and inclusiveness as the materials they introduce. In a sense, the overview is a short summary of what is to be learned that achieves its goal through the repetition and prefamiliarization with the materials. The overview prepares the learner for the task by establishing a mental set while the objectives alert the learner to the coming tasks (Davies, 1976, p. 190).

Use of Overviews. Hartley and Davies (1976, p. 252-253) make three generalizations from the research concerning the use of overviews. First, the time spent on an overview might have been better spent viewing or reading the lesson again. Second, short overviews interspersed in the lesson proved to be more beneficial than one massive overview in

learning an assembly task. Third, lower ability students tend to gain more from overviews dealing with factual information while higher ability students gain more from overviews dealing with principles. Ausubel and Robinson (p. 316) caution that a learner may overlook the material not presented in the overview and assume that the material is only incidental in the learning process.

Advance Organizers as Informational Openings

Another type of informational opening is the advance organizer which also is commonly presented in a prose format. Unlike the overview, the advance organizer is written at a higher level of generality than the material it introduces (Ausubel, 1978, p. 253). The advance organizer is more abstract than the stimulus material while the overview is written at the same level as the stimulus material. The advance organizer seeks to provide the learner with a superordinate structure under which a series of subordinate concepts can be grouped (A more detailed discussion can be found in Ausubel).

Uses of Advance Organizers. After reading four reviews on advance organizers, one is left with the feeling expressed or implied by the authors, that the issue of the effectiveness of advance organizers is confusing. Barnes and Clawson (1975, p. 651) state, "We must conclude from this review that advance organizers, as presently constructed, generally do not facilitate learning." Lawton and Wanska (1977) offer several criticisms of the Barnes and Clawson study and make three recommendations for the use of advance organizers.

1. ...expository teaching should incorporate references to super - and - subordinate concepts and their critical relationships...

2. ...the critical attributes of high-level concepts or high-order rules should be reidentified during the related learning activities...

3. ...an opportunity for the application of high-level concepts and high-order rules should be provided by presenting a variety of problem-solving tasks. (p. 256).

The major problem with several of the studies is with the construction of the advance organizer. The designer is cautioned to carefully review Ausubel's procedures for developing and using advance organizers. Barnes and Clawson (p. 653) suggest that there maybe some practical significance for some learners having access to advance organizers. However, the designer must consider the additional cost of developing the advance organizer and ask if the cost of development is worth the projected effort.

Summary

Four types of informational openings have been identified thus far. The results of several reviews on the effectiveness of objectives, pretests, overviews, and advance organizers have been presented. The results of these reviews are summarized in Table 1. The second type of opening is the motivational opening.

The Tease as a Motivational Opening

There appears to be no reserach on the effectiveness of a tease in an instructional program. However, there are several studies which can be reviewed to produce a set of guidelines which can be helpful to the designer in developing an opening tease.

The tease is a strategy for gaining the viewer, or in this case, the learner's attention at the outset of a program. The tease is frequently used in commercial television to keep the viewer from changing to another station. The tease may take the effect of showing the "star" of the program in a problem situation or in a life or death situation. The producer gives the viewers just enough information to make them want to know how or why the star is in the situation and how they will get out of the situation. Parallel situations can be developed for instructional programs by posing problems and situations with the which the learner may be faced.

Attention can be divided into two categories, preattention and attention. Fleming (1970, p. 103) describes preattention as peripheral vision encompassing the whole visual field. Attention is described as being largely foveal and of a narrow angle. Attention goes from the specific to the general. A means of controlling attention is to make a change in the preattention vision through a variation in brightness or movement. Auditory attention can be controlled by changes in volume, pitch, and direction (Fleming, p. 104). A stimulus change, then in the preattention realm, may control the learner's attention.

Gagne (1970, p. 278) states that attention is controlled by designing a stimulus that contains novelty, change, and variations of intensity. And Fleming (p. 104), adds that the stimulus must stand in contrast to the immediate past experience or lifelong experience. "In a sense, the more that a new stimulation differs from the prevailing, the more distinctive or attention-getting it is" (Fleming, p. 110)

Table 1

Effectiveness of Preinstructional Strategies

	Objectives	Pretests	Overviews	Advance Organizers
Function	Alerts the learner	Alerts the learner	Prepares the learner	Prepares the learner
Learner	Most effective with field dependent learners		Lower ability learners do best with overviews constructed with facts	(No conclusion could be drawn from the research)
	Best for middle ability learners	Best with high ability learners		
	Of little consequence to highly motivated learners	Best with very mature learners		
	Can reduce initial anxiety caused by new material	Best when learner has knowledge of the content		
Task	Use before long periods of instruction with a dominant structure	Use before short periods of instruction	Massive overview at the beginning is not as effective as several short overviews interspersed throughout the material	
	Content follows structure presented by objectives	Not criterion based instruction		
		Knowledge of pretest results has a positive effect on subsequent learning		
Notes	Action verb is very important			The designer is reminded that Ausubel's criteria should be consulted before attempting to develop an advance organizer
	Learner must be aware of the purpose of the objective for it to be useful			

The design of the tease should be in direct contrast to one's immediate past experience and to one's life experiences. It's the novelty or change and variation in stimulus that attracts the viewer's attention. The novelty might be in terms of the audio or the video stimulus or it might be in terms of the content. For example, one may remember Stan Freberg's script for radio (Hilliard, 1976, pp. 14-15). This script demonstrates stimulus novelty by having an announcer describe the draining of one of the Great Lakes, filling it with hot chocolate, topping with whipped cream, and finally a cherry towed and dropped from several jets. The produced script is novel and tends to immediately grasp the listener's attention.

Summary. The tease is used to capture the learner's attention through a change in the stimulus. The change can be a change in preattention audio or visual stimulus to direct the learner's attention to the relevant point. The tease can often occur in the content by presenting the learner with point of conflict or stress.

This paper has identified two types of openings--the informational and the motivational opening. The designer can select any one of the five possibilities to introduce a learning event, or combination of the openings could be written. For example, it might be possible to write an advance organizer or overview in the form of a tease. Or, the designer might choose to use both a tease and objectives or pretest to introduce the learning event.

The next step after the introduction is the learning event or presentation of information that supports the achievement of the objectives.

DESIGNING THE LEARNING EVENT FOR TELEVISION

The majority of the research conducted with instructional television has been what Salomon and Clark (1977, p. 102) describe as research with the media. The majority of these studies have dealth with intermedia comparisons, eg., is television more effective than a slide show, a lecture, or print? Several of these studies as well as a number of others on the environment and physical variations are reported by Chu and Schramm (1967). The media in most of these studies has not been used as a common carrier for information. The researchers, and designers, have failed to capitalize and exploit those attributes of a medium that can transform a message and the psychological effects this transformation can have upon the learner. This type of research is referred to as research on the medium and asks how the medium can affect learning (Salomon & Clark, p. 102).

Unfortunately, there have been relatively few studies conducted on the medium from which generalizations can be drawn for the instructional designer. An alternative approach then, is to try to determine how we should be designing materials for instructional television.

How many filmstrips, slide shows, television programs, and texts have been developed and produced that were nothing more than a listing

of the information to be learned? It seems that many of the media products being produced today merely present the audio and the visual stimuli in association with another. This stragegy is similar to Bruner's "original word game" (Bruner, Oliver, & Greenfield, 1967, p. 32). This strategy may be adequate for the lower levels of learning, however, these facts are later mediated for higher level learning tasks (Gagne, 1970, p. 91). Something else must occur for learning to take place other than the simple presentation of information. Rothkopf (1970, p. 325) states, "Mathemagenic behaviors are behaviors that give birth to learning." What are these behaviors that facilitate learning?

Mediation Response

In the original word game, the child points to an object and in response hears the name of the object. After an appropriate learning time and proper reinforcement, the word becomes conditioned to the object. On subsequent presentation of the stimulus object, the proper word is given as a response. This behavior can be compared to the simple S--R paradigm.

Osgood (1953) has suggested that there is an intervening variable that occurs between the presentation of the stimulus and the response presentation. According to Osgood, a covert set of behaviors occur when the stimulus is presented to the learner. Upon presenting the stimulus, the learner produces an implicit response, r_m, which produces an implicit stimulus, s_m, causing the overt response R (see Figure 1). The implicit

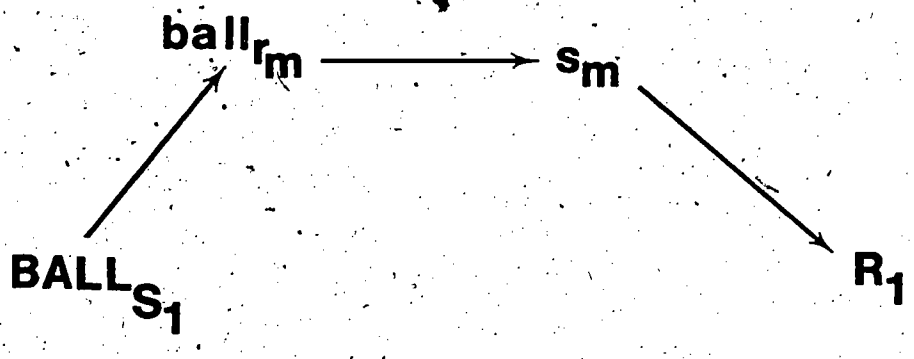

Figure 1. Mediating Response

or covert behaviors are referred to as a mediation response (Osgood, p. 396). When a response has been conditioned to a stimulus "The stimulus-objects elicit a complex pattern of reaction from the organism, some of which are dependent upon the sensory presence of the object for their occurence and others of which can occur without the object being present," (p. 396) It is these behaviors that Staats (1961, p. 191) refers to as the meaning of the word or stimulus. In the end, it is those attributes which Osgood refers to as detachable which compose the meaning of a word.

Let's take a closer look at an example of the mediating response. A child has been conditioned to the word ball in the presence of an actual ball. When presented with the stimulus word ball (S1), an image of the ball is evoked which contains the detachable attributes (r_m). The mental, covert response, serves as stimulus (s_m) for the final response, the production of the word ball (R_1). The detachable attributes might include roundness and spherical in shape. Those attributes which occur only in the presence of the stimulus object, grasping the ball, placement of the hand, throwing, and catching would not be present.

Mediation and Instruction

What implications does the mediation response have for instruction and particularly the design of an instructional television program? The answer may be found in Ausubel's meaningful learning paradigm (Ausubel & Robinson, 1969). For meaningful learning to occur, the learner must have an understanding of the relevant ideas (p. 53). Meaningful learning can then take the form of representational learning, concept learning, and propositional to name a few.

Ausubel (p. 59) describes representational learning as learning the meaning of individual symbols. This learning is similar to the classical conditioning as described previously by Osgood. The meaning, then, of the symbols is derived from the mediating response. The second step of meaningful learning described by Ausubel (p. 61) is concept learning which is the grouping of phenomena together on the basis of common characteristics. Staats (p. 199) refers to concept formation as involving "complicated principles of learning, communication, and mediated generalization." The concept category derives meaning from the mediation response which identifes the detachable (critical) attributes of the category. The third type of meaningful learning is propositional learning (Ausubel & Robinson, p. 64) which is the expression of a relationship between two or more concepts. The proposition gains its meaning from the meaning of the elements that constitute the proposition. Again, the mediating response is used to give meaning to knowledge.

From the foregoing discussion, the following hypothesis can be derived. The teaching of the mediating response for representational learning, concept learning, and propositional learning will facilitate meaningful learning. In application, if the designer were to construct an instructional strategy for teaching a concept, the strategy should verbalize and/or visualize the mediating response for the concept. Accepting this hypothesis as viable, the next step is to determine how the visualization or verbalization of the mediation response should occur.

Representation of the Mediation Response

The mediation response has been characterized as a covert, internal response. The response is a form of mental imagery which can take on the characteristics of nonverbal imagery or a verbal process. Paivio (1971, p. 465) describes a two process theory which emphasizes these two modes,

> The two process theory, which emphasizes functionally distinct nonverbal imagery and verbal processes as the bases of linguistic meaning and memory coding, has generated specific predictions that have been uniformly supported in research to date.

The mediation response then, is a form of mental imagery. For the purposes of instructional design, Bruner's three modes of representation may provide a more useful paradigm.

Bruner (Bruner, et al, 1967) proposes three sequential levels of representation. The first is enactive which requires the action of an event to create the mental image. For example, one may not be able to

describe the location of the "W" on a typewriter without first going through the psychomotor action of imitating typing. The action is used to evoke the image of the keyboard and the location of "W". The second level is ikonic representation. This level uses image and spatial schema to represent reality. The image of an object is relatively stable and can be evoked without the action or presence of the stimulus object. The last level is the symbolic level in which the world is represented in symbols. Language can be used to describe reality as opposed to actions or concere images.

The mediation response, being a mental image, can occur in one of three modes as described by Bruner. The research by Bruner et al (1967) and Paivio (1971) support this contention. Therefore, referring back to the original hypothesis that the mediation response should be verbalized and/or visualized, there are now three modes for accomplishing this strategy: enactive representation, ikonic representation, and symbolic representation. For example, if the mediation response for the concept box were to be represented, the ikonic mode might be selected to present the learner with a concrete image of the critical attributes of the concept box.

Mediation Response and Supplanting

Salomon and Snow (1968, p. 226) state, "The unique attributes of the medium...will have (a) unique psychological effect only if they arouse in the viewer mediating mental processes which are relevant to the particular learning task at hand." Salomon (1970, p. 47) equates mediating with

supplanting and defines supplanting as, "the function accomplished by an explicit presentation of what would otherwise have to be done covertly by the learner..., such that a certain learning objective will be attained." For example, in teaching fractions, the teacher might show the students a whole, then divide it into four parts to represent fourths. The four pieces could then be reassembled to show that four fourths equals one. The function of supplanting is to provide the learner with the mediating response between the stimulus and the response as discussed earlier (see Figure 2).

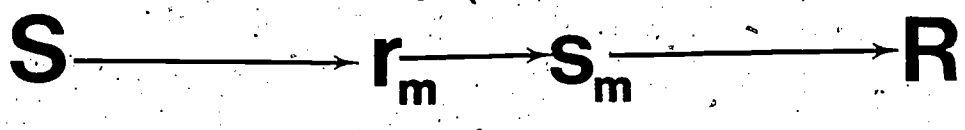

Figure 2. Mediation Response

The supplanting process can provide the learner with mental representation that is necessary for the learning of specific information which the learner has not yet developed. The process provides the learner with a mental image to think with, rather than requiring the learner to develop the mental image through possibly somewhat less efficient strategy. Once this image or mediating response is stored (or conditioned to the stimulus and response) it can be evoked for use as the covert mediating response.

Salomon defines four levels of supplanting (pp. 50-52). The first stage involves the least amount of supplanting and is a strategy which attempts to induce the necessary mental activities by presenting the learner with the stimulus. Of course, this assumes that the learner has the necessary mental processes to be evoked by the stimulus. The second level is the presentation of the stimulus and the response or as Salomon labels them, the initial situation and the final transformation. This is the process of "short-circuiting" in which the learner is expected to recall the appropriate transformation. At the third level, the learner is presented with the stimulus or initial situation and its transformation. The learner is supposed to respond by supplying the final response. In this strategy, the learner is actually shown the mediating response. And the fourt level of supplanting is the total process by showing the learner the stimulus, the mediating response, and the response.

Ausburn and Ausburn (1978) propose still another form of supplanting. They propose (p. 343) that conciliatory supplantation can be used to capitalize on the use of an instructional mode that a learner prefers. Thus, rather than present a poor reader with print material, the learner might be presented with an audio tape to supplant the written information. However, there is little reason to believe that the mental process is supplanted in this particular instance. The mode has not been changed or transformed, rather, it is simply presented though a different channel.

No transformation of the message has been achieved. And, as pointed out by Salomon and Clark (1977, p. 101) there are very few significant effects found in changing only the channel of delivery. Therefore, the concept of conciliatory supplantation is rejected.

Research in Support of Supplanting

Salomon (1974) and Salomon and Cohen (1977) have conducted two experiments using a supplanting technique in film and television. In each case the subjects were shown a film that either zoomed in on a part of the picture or went from a full shot to a close up of one aspect of the picture. The process to be supplanted was the connection between the parts and whole. The results of both experiments suggest that the format of zooming can supplant a mental skill.

Carrier and Clark (1978) used a teacher as a model to supplant the mental skills needed to perform a geometry task (surface area calculation). They concluded that the modeling strategies were of benefit to both high and low ability groups.

The cited research findings are based on the results with children. One must be careful in making generalizations to adult learners. However, it might be hypothesized that, if the adult learner is lacking the necessary mediation response to complete a learning task, this task could be supplanted.

Implications for the Design of Instructional Television

The research and theories suggest that a television program might be designed to supplant the mental representation needed to achieve a particular objective. How can this task be accomplished?

First, the instructional designer will need to identify the mediating response that needs to be supplanted. Refering to Ausubel's (Ausubel & Robinson, 1969) types of meaningful learning, the tasks can be analyzed. For example, if the learning task is representational learning, then the mediating response to be supplanted is the meaning of the word. A learning task involving concepts would use supplanting to teach the critical attributes of the concept. The critical attributes of the concept would be the detachable attributes defined by Osgood. Representational learning as defined by Ausubel could be taught by supplanting the realtionship between the two concepts. It is assumed that the learner would have grasped the meaning of the concepts involved in the proposition prior to learning the proposition.

Second, a decision must be made of presentation for the supplanted task. Using Bruner's conceptualization of representation, the instructional designer has three levels to choose from--enactive, ikonic, and symbolic. Bruner et al (1967, p. 11) explains the conceptualization system.

> To sum up, we have seen that representation can be effected in the media of symbols, images, and actions and that each form of representation can be specialized to aid symbolic manipulation, image organization, for the execution of motor acts. Each of the media accomplishes each objective in its own terms. Plainly, the three representational systems are parallel and each is unique, but all are also capable of partial translation, one into the other.

The different forms of representation can be used to teach representation at another level. For example, an ikonic image can be used to develop a symbolic representation. The transformation, thus, provides a means for communicating with a learner who has not yet developed the appropriate representation structure. The result is a supplanting of a higher order representation by using a lower order representation.

Paivio (1971, p. 532) suggests that it may be more effective to move from the concrete, ikonic examples to the more abstract symbolic examples. Rohwer (1970, p. 402) also suggests that acquisition can be improved if the instruction moves from the concrete to the abstract.

Third, the unique attributes of a medium must be identified and used to transform the knowledge for the learning event. Salomon has identified the techniques of cutting and zooming as two specific aspects for television. What are the unique attributes of the television media and what psychological response do they evoke in the learner? Table 2 identifies five attributes of the medium and a hypothesis of the psychological response they evoke. It should not be assumed that this chart is all inclusive. Producers, directors, and editors may have additional attributes which they use to intentionally evoke psychological responses in the viewers.

Table 2

Television Attributes and Psychological Responses

Attributes	Psychological Response
Cut	Changes the thought pattern. Ends a line of thought. Refocuses attention. Relates parts to the whole. Collapses time.
Zoom	Focuses attention. Relates parts to a whole. Emphasizes one aspect. Shows spatial relationships.
Dissolve	Indicates a passing of time. Collapses time.
Animation	Reveals unobservable events by looking inside solid objects, slowing events, and making simultaneous events linear.
Split Screen	Shows simultaneous events. Shows cause and effect and before and after

Application of Supplanting to the Design of Instructional Television

The previous section identified three steps for designing instruction for supplanting. First, the task to be supplanted must be identified. Typically, this step would be the end product of the task and/or concept analysis. Second, a mode of presentation for the information to be supplanted must be selected. Third, the mode of presentation must be matched with a medium whose attributes can evoke the appropriate psychological response.

An analysis of the task of teaching Boyle's Law indicates that the mediating response for the proposition,"pressure varies inversely with volume,other things being equal,"needs to be supplanted. The ikonic mode of representation has been selected. The psychological responses to be evoked are the recognition of an unobservable event and cause and effect.

The television program then, will illustrate the proposition, Boyle's Law, through images. The psychological responses to be evoked will illustrate the compression and expansion of molecules; and the cause, increases and decreases in volume; and effect, increases and decreases in pressure.

The video portion of the program will use a canister with a moveable lid (see Figure 3). Inside the canister there will be circles representing molecules in space. As the lid moves towards the bottom of the canister, the volume will be decreased and the molecules will be forced closer together. At the same time, the manometer will show a rise in pressure. The audio will explain the proposition in the symbolic mode.

This example illustrates how instructional television can be used to supplant the mediating response for an abstract proposition. And, how the medium can be used to evoke specific psychological responses to amplify the supplanting task. Similar instructional strategies can be developed for representational and concept learning.

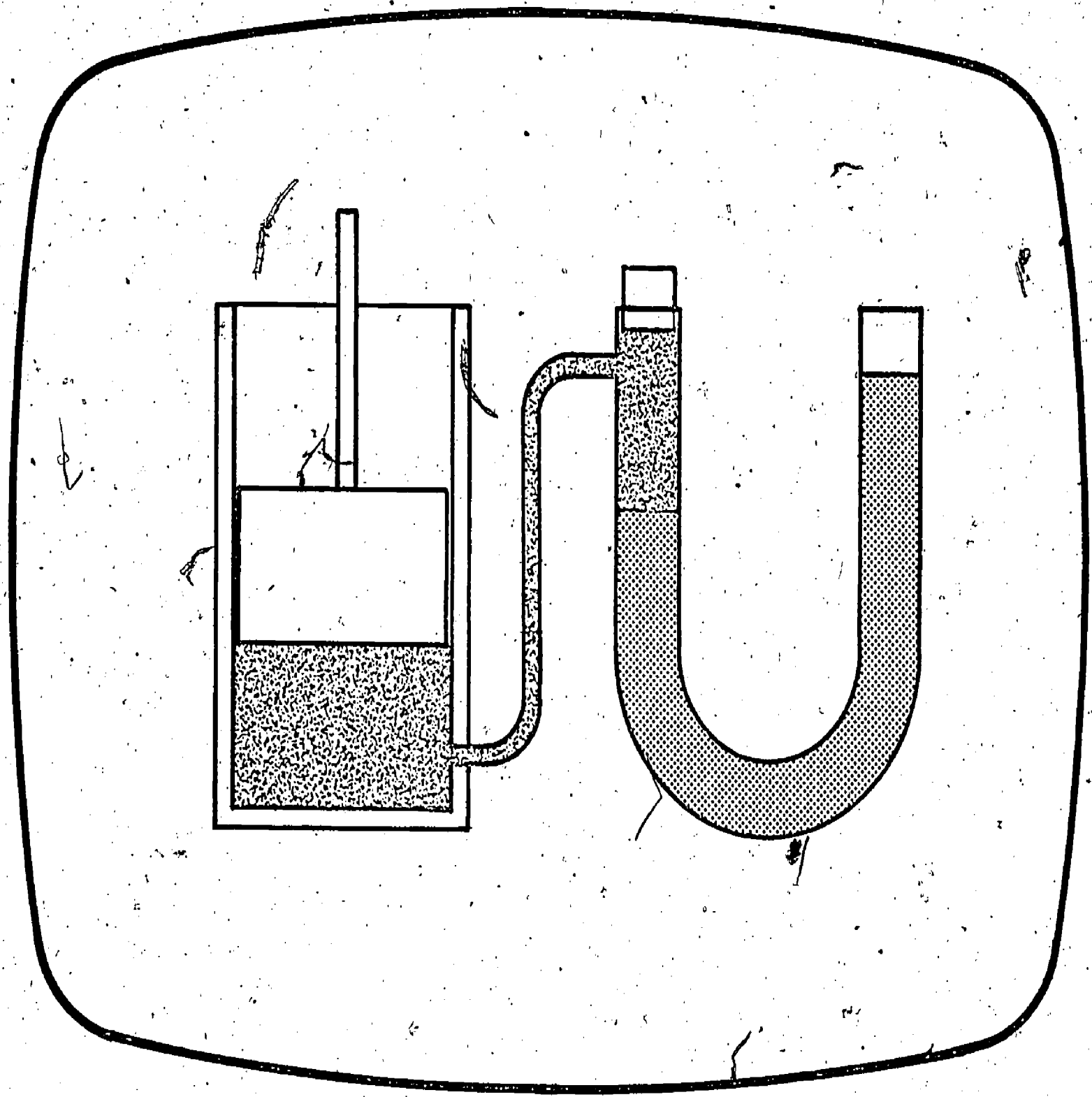

Figure 3. Video Supplanting

Summary

Supplanting is the process of presenting the learner with a mental process which can be used as a covert mediation response. The mediation response is both a covert response and stimlus which gives meaning to symbols. This response can be supplanted through four different levels varying from evoking the mediating response to the presentation of the stimulus, mediating response, and response. The supplanting presentation can be presented in one or more of three forms of mental representation. A medium can then be selected which evokes the appropriate psychological response. Five different attributes and their hypothesized psychological responses were presented in Table 2. The configuration of television design factors are presented in Table 3.

The last section of the instructional television program is the review or summary. The next section will present the research which suggests the type of structure the instructional program review should take.

Table 3

Television Design Factors

Learning Task	Mode of Representation: Enactive	Ikonic	Symbolic
Relational			
Conceptual	Psychological Responses		
Propositional			

USING A REVIEW

Logic would seem to suggest that a review is a good instructional strategy to include in any form of instruction. Most textbooks have a review at the end of each chapter and it is a strategy or tradition which seems to have been supported through time. However, a review of the literature for the past ten years found only a few studies on the effectiveness and design of reviews for any medium.

A discussion of reviews for instructional television programs should begin with an explanation of what are the various stragegies available for use as a review. Potentially, the review might take the format of an advanced organizer. These two strategies could serve to provide the learner with the appropriate superordinate categories. A third alternative would be postquestions based on the objectives for the program. The postquestions could provide a means for involving the learner in the learning process. The fourth alternative would be the restatement of the behavioral objectives. However, one might question the usefulness of restating the objectives at the end of the program. The objectives may "reorient" the learner to the major ideas presented, but the timing of this strategy may be of little use.

Research Supporting the Use of Reviews

Ausubel and Robinson (1969, p. 316) report on one study which concluded that overviews and summaries did not appreciably improve learning from instructional films. They also suggest that summaries will be less effective than overviews because they are retroactive rather than proactive to the learning task. However, the summary may provide a rapid review of the material at the expense of other significant points not included in the summary.

Melton (1978, p. 296-297) concludes that postquestions can be effective in improving learning. One should, however, review the literature that Melton quotes before making a decision on the use of postquestions as review strategies since many of the studies he reviewed dealt with inserted questions.

Summary

There appears to be very little research upon which to base decisions concerning the design and use of review strategy. The review of the literature found only a few studies which dealt directly with the effectiveness of reviews. As cited earlier, one might even be cautious of the use of reviews.

SUMMARY

This paper has attempted to make some generalizations on the design of instructional television programs based on the research findings found in the literature. The program was divided into three segements: preinstructional strategies, instructional events, and reviews.

In designing a preinstructional strategy, the designer can choose between two types of program openings--informational and motivational. The informational opening includes objectives, pretests, overviews, and advance organizers. These various preinstructional strategies can be combined to form a uniqe approach.

It was suggested that the design of the instructional event should be based upon the presentation of a mediation response through one or more representational modes, and the use of the attributes of a medium which can arouse a psychological response in the learner.

The research on the design and use of reviews was found to be very minimal. It was suggested that a review could take the form of an overviews, advance organizer, postquestions, and behavioral objectives. However, there was information that suggested structured review at the end of a lesson might not be beneficial to learning.

The designer of instructional television programs is encouraged to use these various strategies in the design plan and to test their effectiveness either through formative evaluation or summative evaluation studies.

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