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About this issue...

This is the first issue of JID to be published by the Learning Systems Institute on behalf of AECT. No major changes in the editorial review procedures or publication policies are anticipated as a consequence of this. As in the past, the JID Editorial Board will periodically review these procedures and policies to ensure the continuing improvement of the journal.

Manuscripts submitted for publication should be sent to Dr. Ken Silber, Governors State University, who is continuing to serve as JID's editor. For your reference, you will find reprinted in this issue the criteria for selection of JID articles and instructions to authors on the preparation and submission of articles to JID. — Robert M. Morgan
The Use of Positive and Negative Examples During Instruction

Some Important Issues Related to the Design and Development of Instructional Materials

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Abstract. This article is concerned with three main issues related to the use of positive and negative examples during instruction. The issues discussed are: sequence, quality, and quantity of positive and negative examples. Several ground rules concerning terminology and the place of examples in the instructional content have been established before elaborating on such issues. The article not only presents these issues, but also suggests some possible resolutions based upon the available research evidence and theoretical work in the field. The need to shift the emphasis from merely presenting both types of examples to the qualitative and quantitative relationships among them is stressed. It is hoped that the resolutions offered to the issues discussed will provide the intended users (teachers, instructional developers, etc.) with a natural starting point from which to master the technique of using effective positive and negative examples during instruction.

In recent years, the importance of providing students with both positive and negative examples during instruction has been widely recognized and strongly emphasized by many instructional psychologists and developers (Fleming and Levie, 1978; Merrill, 1977, 1978; Merrill and Tennyson, 1974; and Travers, 1977). The basic premise is that the use of both types of examples would prevent certain classification behavior errors from occurring during instruction; these are overgeneralization, undergeneralization, and misconception.

An overgeneralization error, which refers to a broad generalization, occurs if the student classifies the negative examples of given generality (a concept, a rule, or a procedure) as positive examples of that generality. On the contrary, an undergeneralization error, which refers to a narrow generalization, occurs if the student classifies the positive examples of a given generality as negative examples of that generality. A misconception error, which means using the irrelevant attributes of the examples presented as being relevant attributes, occurs if the student classifies the positive examples which do not have such attributes as negative examples and the negative examples that do not have these attributes as positive examples.

The proponents of the previous proposition claim that a wide range of positive examples prevents undergeneralization, while a good selection of negative examples prevents overgeneralization. Accordingly, they conclude that a set which contains both types of examples should be used during instruction so that the student will not only learn the relevant attributes of the positive examples, but will also be able to discriminate against the attributes of the negative ones.

The previous proposition is supported by the theoretical work of Mechner (1965). Maltke and Tiemann (1969), Merrill (1971) and Woolley and Tennyson (1972), as well as the empirical evidence derived from research on the role of positive and negative examples during instruction and on the relationships between these examples (Bourne and Guy, 1968; Hutenlocher, 1962; Merrill and Tennyson, 1978; Tennyson, Woolley, and Merrill, 1972; and Tennyson, 1973).

Mechner (1965) pointed out that in order to assess concept acquisition, the learner must be presented with both positive and negative examples until his/her ability to generalize to new positive examples and discriminate them from new negative examples is observed.

Maltke and Tiemann (1969) claimed that unless the relevant and irrelevant attributes of positive and negative examples were clearly contrasted, one of the three errors mentioned before would result. Merrill (1972) agreed with Maltke and Tiemann that both positive and negative examples should be used during instruction and that the relevant and irrelevant attributes of these examples must be contrasted.

Woolley and Tennyson (1972), in their attempt to develop a theoretical model for concept learning, relied on the idea that positive and negative examples should be used together during instruction.

Although some studies on the role of positive and negative examples during instruction indicated that a set of positive examples alone was better than a set of negative examples alone or even a set of mixed positive and negative examples (Bourne, 1966; Hovland and Weiss, 1953; and Smoke, 1933), other studies showed that a set of both types was better than a set of all positive or a set of all negative examples. Hutenlocher’s (1962) findings as well as Bourne and Guy’s (1968) results indicated that a set of positive and negative examples was superior to a set of all positive ones.

Merrill and Tennyson (1978) found significant differences between students receiving positive and negative examples and students receiving a placebo in place of these examples in favor of those given both types of examples.

In light of the previous presentation, it might be expected that most instructional designers would readily agree that presenting the students with both positive and negative examples is an essential element in designing and developing any piece of instruction.

Merrill and Wood (1974), in their attempt to develop an instructional
strategy taxonomy, indicate that effective instructional strategies often make use of what they called “nonexamples” (negative examples) as well as “examples” (positive examples) in presentations. Wager and Broderick (1974) also point out that any materials designed to teach concepts must provide the students with what they termed “instances” (positive examples) and “noninstances” (negative examples), because both are apt to be important to the learner’s understanding of the concept.

The use of both positive and negative examples in instruction, however, creates some important issues which the instructional designers and developers have to deal with when they attempt to design and develop a piece of instruction. Such issues are related to the sequence, quality, and quantity of the examples presented. Specifically, these issues are concerned with the way positive and negative examples should be arranged and ordered in a set which contains both types, the characteristics or features of the examples in such a set, and the number as well as the ratio of these two types of examples. Apparently, such issues deal with some of the most important variables and parameters of instructional design which, when determined and specified, might have value in the construction of a viable theory of instructional design.

Before elaborating on these important issues, two points need to be presented and clarified to establish several ground rules or points of view that may provide some new insights in this field. The first is related to the different terms used to designate the two types of examples. The second deals with the place of these examples in the instructional content.

Eliminating Confusion About Terminology

A survey of the literature dealing with the use of examples during instruction indicates that terminology in this area has not yet been standardized. There is a great deal of inconsistency, not in defining the examples, but in using the terms which designate their types. Most instructional designers refer to different terms to mean the same thing. Some refer to examples and non-examples; others use instances and non-instances. Still others refer to positive examples and negative examples. Some other terms, such as exemplars and non-

exemplars, positive instances and negative instances, are also being used.

It should be noted here that a necessary first step toward the construction of a viable theory of instructional design is to establish a common terminology or vocabulary for the components of any proposed instructional strategy. Accordingly, it is important that confusion about terminology in this area be eliminated.

Two of the terms mentioned previously will, in this writer’s opinion, help facilitate the communication process among designers, developers, writers, and even the average reader.

For purposes of clarity and simplicity this writer prefers the use of the terms “positive examples” and “negative examples” to the other previously mentioned terms. Accordingly, the reader will find an internal consistency in using these two terms with the rest of this article.

The Place of Positive and Negative Examples in the Instructional Content

This writer is opposed to the proposition taken by some instructional designers that positive and negative examples belong only to the area of concept learning. The use of both types of examples should not be limited to this particular area simply because school subjects include different content areas. A short instructional unit or even a typical instructional lesson would include various types of content such as rules and procedures.

Positive and negative examples are needed in rule learning to illustrate the scope of the rule’s application and to focus the learner’s attention on the different situations where the rule can or cannot be applied. Additionally, the use of both types of examples would focus the learner’s attention on the relevant features of the rule statement (generality which describes the rule). The same can be said in the case of procedure learning.

The nature and definition of positive and negative examples which belong to concepts, however, differ from those which belong to rules and procedures. This demands that positive and negative examples which belong to each content area be defined.

Necessary Definitions

Positive example. For a concept, a positive example is a true member of the concept class which contains all the critical attributes of the concept in their appropriate relationship. For a rule or procedure, a positive example is an appropriate and correct application of the rule or the procedure.

Negative example. For a concept, a negative example is a false member of the concept which contains none or some of the critical attributes of the concept in their appropriate or inappropriate relationships. It may also contain all the critical attributes of the concept, but in an inappropriate relationship. For a rule or procedure, a negative example is an inappropriate application of the rule or the procedure.

Concept. A class of events or symbols that share critical attributes, can be referenced by a name, and have different individual members.

Procedure. A series of steps showing how to perform a task.

Rule. A relation which states how to produce one thing given another.

Although many studies have dealt with the use of positive and negative examples in concept learning (see Clark, 1971), little has been done on the use of these examples in rule learning. The role of both types of examples in procedure learning has not yet received any attention.

Issue 1: Sequencing of Positive and Negative Examples

Sequencing of positive and negative examples used during instruction has been a topic of debate and a subject of research in recent years. The basic issue is whether positive and negative examples should be sequenced by example type or according to the characteristics of these examples. Sequencing by example type refers to grouping of each type of example together, that is, presenting all positive examples followed by all negative ones or vice versa. Sequencing by characteristics refers to the ordering and arranging of the examples based upon the nature of the relationships between them.

Resolving such an issue also requires supplying answers to questions like the following: Which type of example should be presented first? Having decided on which type should precede the other, should the positive and negative examples be presented to the learner side by side, or should they be presented to him/her one after another?

The sequence issue and the questions which stem from it might be related to
suggestion general criteria for the sequencing of both positive and negative examples. Accordingly, the issue of sequencing by example type versus sequencing by characteristics might be resolved. Simply, positive and negative examples should not be sequenced by example type, that is, by grouping each type of examples together. Instead, pairs of one positive followed by one negative example should be presented. The relationship between the one positive and the one negative example is the factor that should determine, not only each positive/negative example pair, but the order of all pairs. Obviously, the emphasis here is on the characteristics and relationships of both positive and negative examples.

Two questions are related to this issue. First, in each positive/negative example pair, should the positive example be presented before the negative one, or should the negative example precede the positive one? Second, having decided on which type should precede the other, should the two types in each pair be presented side by side or one after another?

Concerning the first question, some available evidence on the use of positive and negative examples indicates that positive examples are more effective than negative examples as usable sources of information (Bourne, 1966; Hovland and Weiss, 1953; and Smoke, 1933). Negative examples provide less information about the task being taught than do positive examples. This is because negative examples do not include all the critical attributes of the task. Accordingly, if the initial example presented was a negative one rather than a positive one, the difficulty of the task might be increased.

Based upon the focusing strategy proposed by Bruner, Goodnow, and Austin (1956), without the use of a positive example as a focus, a negative example alone provides less information about the task under consideration and requires more time for processing. By choosing a positive example as a focus, the complexity and abstractness of the learning task can be decreased because it helps direct the attention of the student to the relevant attributes of such a task. Accordingly, the initial example presented should be as representative of the task being taught as possible, that is, a positive example.

With regard to the presentation of positive and negative examples one after another or side by side, there is some evidence that the side by side format facilitates learning (Travers, 1977). But the decision in this case depends upon the nature of the examples. Pictorial examples can be presented side by side for this helps the learner distinguish between the two. Verbal examples can be presented one after another if they are too lengthy, otherwise, they should be presented side by side.

The relationship between positive and negative examples which determines each positive/negative example pair and the order of all pairs involves variables such as divergency, convergency, match, and probability. These are elaborated below.

Issue 2: Quality of Positive and Negative Examples

Almost all the proponents of using both positive and negative examples during instruction would readily agree that students learn better when they are presented with "good" positive and negative examples. But, what are the characteristics of good positive and negative examples?

In fact, the degree of relatedness among positive and negative examples used during instruction is more important than just presenting the learners with both types of examples. Merrill and Tennyson (1978) indicate that merely presenting positive and negative examples is not sufficient for adequate instruction. What seems to be more critical for adequate instruction is the nature of the relationships between these examples.

The instructional developer who uses both positive and negative examples faces some questions like the following: Should positive and negative examples be similar to each other, or should they be different? Should the negative examples presented be similar to each other, or should they be different? Should the positive examples presented be similar to the negative ones, or should they be different? Should the positive examples be contrasted with the negative ones? Should both types of examples be difficult, that is, too abstract, or should they be easy, that is, too concrete?

Resolving Issue 2

It is suggested by many instructional scientists that there are qualitative relationships between all positive examples,
all negative examples, and both positive and negative examples. The presence of such relationships increases the effectiveness and efficiency of the instructional material which includes both types of examples. The theoretical work of Merrill and Wood (1974) identifies qualitative relationships. The empirical work of Tennyson and Tennyson (1975), Tennyson and Tennyson (1975), and Tennyson, Woolley, and Merrill (1972) has proven that these qualitative relationships are necessary for the effective and efficient use of positive and negative examples during instruction.

The qualitative relationships among the examples, which can be called the attributes of good positive and negative examples, are presented below.

Divergence. Divergence refers to the qualitative relationship between positive examples presented. That is, positive examples should be as different as possible in terms of their irrelevant attributes.

It should be noted here that there are relevant and irrelevant attributes of the examples presented. Relevant attributes of an example are those distinctive features of the example which make it differ from other examples, so they should be common or similar across positive examples. Irrelevant attributes are those which are not basic to the presentation of the examples; they can be varied across examples.

Irrelevant attributes include features such as size, shape, and length. Positive examples can be made divergent by changing their size, shape, and/or length. These help learners focus on distinguishing characteristics and recognize new positive examples which differ from those used during instruction, thereby preventing undergeneralization.

Convergence. Convergence refers to the nature of the relationship among negative examples. Little has been written on such a relationship. Merrill and Wood (1974) mention that, for most situations, such a relationship is not of interest to many designers and developers. One might speculate that this relationship is not of interest to the learners. In fact, while positive examples should be divergent, negative ones should be convergent or similar. The main purpose for using negative examples is to call learners' attention to the critical attributes of the positive ones; therefore, using divergent negative examples does little for understanding. Moreover, the use of divergent negative examples might only confuse learners.

Match. Match refers to the nature of the relationship between positive and negative examples. In this case, the irrelevant attributes of positive and negative examples should be similar as possible. The negative example should be as similar to the positive one as possible without sharing the critical attributes. Both can be of the same type and style. The use of similar positive and negative examples helps learners recognize features which characterize the positive ones. Using the negative example in this case sharpens learners' capacity to distinguish between the generalities under consideration and other similar generalities. This prevents overgeneralization.

Probability. Probability refers to the range of both positive and negative examples used. Not all examples presented should be easy, neither should they all be hard. If easy examples are presented, learners may have trouble identifying hard ones. On the other hand, if hard examples are used, the students may have trouble identifying new ones. In such a case, the learning task will be unpleasant. As a result, range of easy-to-hard examples should be used.

The difficulty level of examples used can be determined experimentally or by using criteria related to the nature of the examples. Tennyson and Boutwell (1974) describe a procedure for determining the level of difficulty of the examples prior to the development of instruction materials. Such a procedure results from item analysis.

Examples range from very concrete to very abstract and from highly personal to highly impersonal. There is some evidence that concrete information is easier to learn and remember than abstract information (Fleming and Levine, 1978). Accordingly, the use of concrete examples should precede the use of abstract ones. Similarly, personal examples should be presented, whenever possible, before impersonal ones.

Another way to arrange examples by difficulty level is related to the number of irrelevant attributes that the examples possess. Examples can be made easier to learn by reducing the number of irrelevant attributes included in the examples. Increasing the number of irrelevant attributes would increase the difficulty level of the examples presented. Accordingly, initial examples presented should include few irrelevant attributes to make the critical attributes obvious. Then those examples which have more irrelevant information should be presented. Simplified drawings can be used in presenting the initial examples because they reduce irrelevant attributes.

Issue 3: Quantity of Positive and Negative Examples

This issue is receiving much attention. Quantity refers not only to the number of examples presented but to the ratio of positive to negative examples.

A question of considerable practical importance in the design of instructional materials is the extent to which learners can be expected to profit from a specific number and ratio of positive and negative examples used in a given learning situation. In fact, the number and ratio of positive and negative examples are related to the length and time variables of instructional design. From an economic point of view, the use of a short segment of instruction would cut the time and effort expended by both the developer and the learner who is to work with the material. Some important questions are related to the number and ratio of examples: How many positive and negative examples should be presented before or after a given generalization to increase the effectiveness and efficiency of the instructional material? What ratio of positive to negative examples would increase the effectiveness and efficiency of the instructional material that includes both types of examples?

Resolving Issue 3

Concerning the ratio of positive and negative examples, the results of many studies in this area suggest that increasing the proportion of positive examples facilitates learning. The findings of Hurley (1973), and Smuckler (1967) indicate that the 3:1 ratio of positive to negative examples is better than 1:3 ratio. In addition, the findings of Dussey and Henderson (1974) show that the 2:1 ratio of positive to negative examples is better than the 2:1 ratio.

In a study conducted by this writer (All, 1990), ratios of 2:1, 2:1, and 3:1 positive to negative were found equal in terms of three dependent variables: (a) number of errors occurring during instruction; (b) posttest time; and (c) posttest score. In terms of learning time,
however, the 1:1 ratio produced significantly less mean learning time than the 3:1 ratio of positive to negative examples.

The results of these studies indicate that instructional materials should not include more negative than positive examples. The number of positive examples should be equal to or greater than the number of negative ones. Using positive/negative example pairs suggests that the 1:1 ratio of positive to negative examples should be employed.

The total number of examples (both positive and negative) to be used depends upon the nature of the task under consideration and the characteristics of the student who is to work on the material. Moreover, the optimal number of examples used depends upon the type of learning environment (i.e., mastery and nonmastery conditions).

Studies dealing with the optimal number of positive and negative examples to be used during instruction need to be conducted. Until the findings of such studies are available, four examples (two positive/negative example pairs) would be as many as could be presented before or after a given generality. The underlying assumption of this article is that more than one positive and one negative example needs to be presented before or after a given generality.

The term “rational set” proposed by Markel and Tiemann (1969) is used here to refer to the total number of examples that should be presented for a given generality. Accordingly, one would say that each rational set should include a total of four positive and negative examples. It is recommended that the learner be tested upon the presentation of each rational set by determining his/her ability to discriminate between positive and negative examples and recognize new ones not used during instruction. If the learner does not demonstrate such ability, that is, if the criterion is not met, another rational set belonging to the same generality should be presented to him/her. The procedure should continue in the same manner until the criterion is met.

Implications

The issues presented in this article and the resolutions suggested have a number of important practical implications for the development of instruction, the construction of a theory of instructional design, and the conduct of instructional research. A deliberate attempt has been made to separate and identify the resolutions suggested.

1. Instructional developers should consider both positive and negative examples as important and necessary components of any instructional strategy.

2. Including positive and negative examples in any instruction does not guarantee that such instruction is effective. To be effective, the qualitative and quantitative relationships among the examples should be taken into consideration.

3. The resolutions offered to the issues presented might lead to the construction of a useful and valid instrument that could be used in examining different instructional materials to determine the effectiveness of positive and negative examples. An instrument like this could be used, not only as an analytic tool, but as a design-decision tool as well.

4. The issues presented in this article reveal the necessity for the construction of a strong theory of instructional design. The resolutions offered might have value in providing information concerning some of the variables of instructional design such as those related to sequence, quantity, and quality of the components of any proposed instructional strategy.

5. The attempt made in this article to resolve the issues presented might contribute to progress toward the construction of a prescriptive theory of instructional design by stimulating further empirical and theoretical work in this important area of instructional science. If this happened, agreement on basic terms might be reached and the variables, parameters, and principles of instructional design could be identified.

6. Results of studies revealed in this article indicate that additional field research needs to be conducted to determine the interactive relationships between the qualitative and quantitative variables of instructional design as they may relate to the use of positive and negative examples during instruction. Such qualitative and quantitative variables have been studied independently without giving attention to their interactive influences. This suggests types of instructional research needed to supply answers to questions like the following:

   a. How many elaborated examples (as opposed to non-elaborated examples) should be presented before or after a given generality?

   b. How many examples with attention focusing devices (as opposed to examples without attention focusing devices) should be presented before or after a given generality?

References


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FALL 1981, VOL. 5, NO. 1
Effect of Teaching a Conceptual Hierarchy On Concept Classification Performance

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Abstract. Sixty-four adults, divided into four groups, individually studied a lesson about six types of sailboats. One group studied a lesson in which the hierarchical relationships among sailboat types were depicted both graphically (through a tree diagram), and verbally (through a description of the tree diagram). The second and third groups studied lessons containing either the graphic or verbal representation of the hierarchical relationships, while the fourth group studied a lesson containing neither. On a posttest, which required classification of unencountered instances, administered immediately, and on a similar posttest administered one week later, the participants in the first three groups scored higher than those in the fourth group. The results support the proposition that instruction designed to teach concepts belonging to a conceptual hierarchy should explicitly portray (graphically and/or verbally) the hierarchical relationships among those concepts.

Concepts may be grouped on the basis of shared features. The resultant categories may, in turn, be chunked or classified into other categories, which may be further subclassified. Such recursive categorization generates a conceptual hierarchy, a term used by Wittrock and Carter (1975). A conceptual hierarchy is not merely a tree structure of concept labels. Each location or node of a conceptual hierarchy represents one or more features that its branching or lower-level nodes have in common. Synonyms for conceptual hierarchy include: decision tree (Hunt, 1962), organizational hierarchy (Mandler, 1968), hierarchical retrieval plan (Bower, 1972), hierarchical conceptual structure (Underwood & Zimmerman, 1973), conceptual network (Mackie, 1978), and kinds taxonomy (Keil, 1966; Merrill, Wilson, & Spiller, Note 1).

Collins and Quillian (1969), Bobrow (1970), Bower (1970), and Meyer and Schvaneveldt (1970) reported considerable evidence that people can sometimes organize what they learn in the form of conceptual hierarchies. Furthermore, Bower (1972) proposed that hierarchical organization of information in memory provides an effective plan for retrieving that information.

At least eight research findings support Bower's proposition. First, persons who grouped randomly ordered words into categories had higher recall of those words than persons who did not group them into categories (Kulhavy, Haynes, & Dyer, 1975; Mandler, 1967; Ornstein, Traub, & Johnson-Laird, 1974).

Second, persons made aware of possible categories for grouping information they were given recalled more of that information than persons not made aware of those categories (Balser, 1972; Strand, 1975). Third, persons were better able to recall lists composed of words from several categories than to recall lists composed of unrelated words (Bower, 1970, p.37; Coffer, 1967, p.182-185; Pellegrino & Battig, 1974: Puff, 1970).

Fourth, persons exhibited greater recall on information when it was presented in a blocked fashion than when it was presented in a mixed fashion (Balser, 1971; Ceppi, 1973; Coffer, Bruce, & Reicher, 1966; Dallett, 1964; DiVesta, Schultz, & Dangel, 1973; Frase, 1969, 1973; Myers, 1974; Myers, Pender, & Couleson, 1973; Perlmutter & Roer, 1973; Puff, 1966; Schultz & DiVesta, 1972; Strand, 1975; Underwood, Shaughnessy, & Zimmerman, 1973; Underwood & Zimmerman, 1973; Yekovich & Kulhavy, 1976). In a blocked presentation, all the information pertaining to a particular category is presented before information pertaining to the next category. In a mixed presentation, information pertaining to a particular category is spread throughout the other information. The facilitative effect of a blocked presentation probably occurs because it helps persons recognize the category membership of what they study.

Fifth, the number of levels of specificity in a conceptual hierarchy of which persons were made aware was proportionate to the amount of most specific or lowest-level information of the hierarchy that they recalled (Friedman & Creitz, 1972; Underwood & Zimmerman, 1973; Wortman, 1973). For example, Underwood and Zimmerman (1973) observed that college students who were made aware of the categories living and nonliving as well as the more specific categories animals, musical instruments, and weapons recalled more words belonging to those categories than students who were made aware of only the categories living and nonliving.

Sixth, persons who viewed a tree diagram of concept labels, systematically arranged in a general-to-specific fashion, were more successful in recalling those labels than persons who viewed a randomly arranged tree diagram of the same labels (Bower, Clark, Legold, & Winzenz, 1969; Wittrock & Carter, 1975). A randomly arranged tree diagram of concept labels is one in which the labels are randomly assigned to positions or nodes in the diagram. A systematically arranged tree diagram of concept labels better represents a conceptual hierarchy than a
Seventh, persons supplied with an outline representing a conceptual hierarchy recalled a greater number of verbatim statements they had read in a prose passage constructed from the information in that hierarchy than persons not supplied with an outline (Glynn & DiVesta, 1977).

Eighth, persons tended to recall category labels in a general-to-specific or top-to-bottom order (Bower, Clark, Lesegold, & Winzenz, 1969; Segal, 1969). This indicates that during recall, the more general, higher-level nodes in a conceptual hierarchy act as retrieval cues for their lower-level nodes, which, in turn, act as retrieval cues for their lower-level nodes.

The only measure of learning employed in any of these studies was verbatim recall of response items. Anderson (1972), however, pointed out that verbatim recall is not a valid measure of concept comprehension, whereas classification of unencountered instances is. Nevertheless, in order to correctly classify unencountered instances of a concept, a person must be able to recall the set of distinguishing or critical features associated with that concept.

As previously mentioned, a number of research findings support Bower's (1972) proposition that hierarchical organization of information aids in retrieving that information. According to this proposition, recall of sets of critical features may be improved by organizing them in memory as a conceptual hierarchy. It follows that in teaching concepts belonging to a conceptual hierarchy, it would be beneficial to make their superordinate and subordinate (hierarchical) relationships conspicuous so that students are more likely to mentally organize a conceptual hierarchy that contains those concepts.

This proposition was advocated by Susan Markle (1978) and David Merrill (Note 2), two instructional designers known for their work in teaching concepts. But these designers have not presented empirical evidence that directly supports their stand. The purpose of this experiment was to obtain such evidence.

We arbitrarily selected two of many possible methods of making conspicuous the hierarchical relationships among six sailboat concepts in a conceptual hierarchy. One method consisted of displaying the decision diagram shown in Figure 2. The other consisted of providing verbal messages about the diagram's nodes (e.g., "First consider the number of masts" and "A ketch's tiller or wheel is located behind the second mast") in a one-branch-at-a-time, top-to-bottom sequence. These two methods were employed in an experiment with the following treatments:

1. Diagram with verbal messages (diag-verb)
2. Diagram without verbal messages (diag-no verb)
3. No diagram but with verbal messages (no diag-verb)
4. No diagram and no verbal message (no diag-no verb)
5. No instruction (control)

In this experiment, each of the participants, except those in the control group, studied a definition and three examples of each sailboat type.

At the conclusion of the instruction, the participants were given a posttest that required them to classify unencountered pictures of sailboats. A similar test was administered one week later. We hypothesized that participants who viewed the decision diagram and received a verbal description of its nodes would score higher on the posttests than participants who either viewed the decision diagram or received a verbal description of its nodes. We further hypothesized that participants who either saw the diagram or received a verbal description of its nodes would score higher than those who neither saw the diagram nor received a description of its nodes. Those in the control group, who were not exposed to any instruction, were expected to perform more poorly than instructed participants.

Method
Subjects
Eighty persons (41 males and 39 females) took part in this study. Their ages ranged from 18 to 53 years, and their mean age was 24.45 years. Each subject received a movie ticket for participating.

Materials
We prepared a separate tray of color slides for each treatment group. The contents of these slide trays are depicted in Figure 1.

We photographed 11 different pictures of each of 6 types of sailboats.
Figure 1. General appearance of lesson slides, their sequence in the slide tray of each treatment group, and the number of seconds each slide in each tray was displayed. Abbreviations: CA-catboat, CU-cutter, KE-ketch, SC-schooner, SL-sloop, YA-yawl.
random order was sloop, ketch, schooner, cutter, catboat, and yawl.

Each slide of each treatment tray was displayed for the number of seconds specified in Figure 1. These time lengths were established from data collected during a pilot study. Although each tray had a different number of slides, overall lesson presentation time was kept the same for each treatment group by varying the display times of slides.

Research indicates that varying display time beyond the time necessary to read the slide would have no measurable effect. The display time in all cases was clearly sufficient for even a poor reader.

We developed two, twenty-four question, multiple-choice posttests, each consisting of four slides of each sailboat type; the response sheet alphabetically listed the sailboat names for each question item. The slides were randomly ordered.

Procedure
An advertisement offering a movie ticket in exchange for participation in this experiment was circulated at a university married students housing complex. Those who responded were randomly assigned to treatment groups and given an appointment.

Upon arriving at the appointed time, each participant in the instructed treatment groups was asked to read this passage:

You will be asked to study a lesson about sailboats. This lesson will consist of a series of slides. The amount of time each slide is displayed will be controlled by the machine (a Caromat Projector). Please be attentive once the lesson has begun because some slides will be shown for very short time intervals. At the conclusion of the lesson, you will receive a 24-item test. For each test item, 1) you will be given the same set of six alternative responses (catboat, cutter ketch, schooner, sloop, yawl), 2) you will be shown a picture of a sailboat that you have never seen before, and 3) you will be requested to circle the response that you think indicates the type of sailboat displayed in the picture. After the test, you will be asked to take another test one week from now. This second test will be similar (same length and same kind of questions) to the first test. Once you have completed the second test, you will be given a movie ticket. Please do not take any notes during the lesson.

Information pertaining to the lesson was omitted from the passage each member of the un instructed control group was asked to read.

Just before receiving the immediate posttest, the participants were requested to provide their name, age, and sex. The posttest had no time limits. However, a participant, having made a response to any one question, was not allowed to change that response. Participants were told not to search for information about sailboats until after they had taken another posttest one week later. They were also informed that there would be no review of the lesson. The delayed posttest was administered in the same fashion as the immediate posttest.
Table 1

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>Immediate posttest score</th>
<th>Delayed posttest score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Diagram verbal</td>
<td>16.00</td>
<td>4.50</td>
</tr>
<tr>
<td>Diagram-no verbal</td>
<td>15.51</td>
<td>5.44</td>
</tr>
<tr>
<td>No diagram-verbal</td>
<td>15.44</td>
<td>5.03</td>
</tr>
<tr>
<td>No diagram-no verbal</td>
<td>12.56</td>
<td>2.78</td>
</tr>
<tr>
<td>Control</td>
<td>4.94</td>
<td>2.23</td>
</tr>
</tbody>
</table>

Note. There were 16 subjects in each treatment group. The maximum score on each posttest was 24.

Results

Table 1 reports the means and standard deviations of the immediate and delayed posttest scores for each treatment group.

Two-Way Analysis of Variance

A two-way ANOVA was conducted with the immediate and with the delayed posttest data of the instructed treatment groups. Control group data was excluded from both of these analyses. A significant diagram main effect was found for the immediate posttests, $F(1,60) = 5.46, p = .023$, and for the delayed posttest, $F(1,60) = 6.95, p = .011$. A significant description main effect also was observed for the immediate posttest $F(1,60) = 8.98, p = .017$, and for the delayed posttest, $F(1,60) = 6.44, p = .014$; the interaction was not significant for the immediate posttest, $F(1,60) = .007, p = .935$, nor for the delayed posttest, $F(1,60) = .418, p = .520$.

Instructed Versus Control

A one-way ANOVA with planned orthogonal contrasts was conducted with the immediate posttest data and with the delayed posttest data. The instructed groups scored higher than the control group on the immediate posttest, $F(1,75) = 78.74, p < .0001$, and on the delayed posttest, $F(1,75) = 47.45, p < .0001$.

Pairwise Comparisons

For immediate posttest scores, Newman-Keuls pairwise comparisons of means showed that the diag-verb treatment group excelled the no diag-no verb treatment group, and that each of the instructed treatment groups surpassed the control treatment group. For delayed posttest scores, pairwise comparisons of means indicated that the diag-verb, diag-no verb, and no diag-verb treatment groups performed better than the no diag-no verb treatment group and that each of the instructed treatment groups outdid the control treatment group. All other pairwise comparisons of means were nonsignificant ($p > .05$).

Discussion

The results of this experiment indicate that making apparent the hierarchical relationships among concepts of a conceptual hierarchy enhances learner performance in classifying unencountered instances of those concepts. This finding supports the recommendation of Markle (1977) and Merrill (Note 2) that instruction designed to teach concepts belonging to a conceptual hierarchy should portray the hierarchical relationships among those concepts.

The two methods used in this experiment are not necessarily the “best” ones to depict hierarchical relationships among concepts. Other methods, such as the classification table (Horn, 1976) or an outline (Glynn & DiVesta, 1977), also might prove to be effective ways of conveying information about hierarchical relationships in a concept learning situation. A combination of methods might be even more effective. In this experiment, for instance, both methods together produced somewhat higher scores than either method by itself.

Conceptual hierarchies abound. For example, you probably have studied taxonomies of living organisms, minerals, musical styles, painting styles, and equations. You also likely have developed instruction designed to teach concepts that are hierarchically related. When you develop instruction to teach concepts with shared features, our ad-

vice based on this experiment’s finding is as follows:

1. Figure out how the concepts are hierarchically related. In other words, fit them together into a hierarchy.

2. Show off the conceptual hierarchy. In this experiment, we did this by displaying a decision tree representation of the hierarchy, verbally describing the hierarchy, and sequencing the definitions and examples according to the hierarchy.

Yes, there is more to teaching certain concepts than merely presenting definitions, examples, and non-examples.

Reference Notes


References


Ceppl, C.M. Effects of presented and requested organization on children's recall of semantically-categorized sentences (Doctoral dissertation,

EDITOR'S NOTE
We've had such a good response to the publication of the classic "The Heuristic Dimension of Instructional Development" (JID, 4, 2, Winter 1960-61) that we've decided to re-print another landmark ID article, the first article in AVI to use the term instructional developer, and was one of the first in the entire literature to use it (Glasser's article in a 1966 AVCR was, we believe, the first). But Fast was the first one to not only use the term, but also to show a model of instructional development and to list the competencies such a person should have. It is interesting to compare this early effort with the current list of ID competencies generated by the DID Committee—also printed in this issue of JID—to see both the similarities and the new things we've learned about our field in 13 years. We hope you find this historical look at the field, and the comparison with present thinking, to be both interesting and useful.—K.H.S.

FALL 1981, VOL. 5, NO. 1
Task Force on ID Certification
AECT Division of
Instructional Development
Madeline Beery
University of North Carolina
Maurice Coleman
Arthur Andersen and Company
Joseph Durzo
Forum Corporation
Rob Foshay
DELTAK, Inc.
Barbara Fowler
University of Wyoming
Sharon Shrock
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Thomas Schwen
Indiana University
Ken Silber
Governors State University
Duane Stevens
Michigan State University
Bill Terrell
Naval Training Command
Ralph Wileman
University of North Carolina
Barry Bratton
University of Iowa
(Chairperson)

This "final" list of core competencies for instructional/training development professionals was developed over a three-year period by a special task force appointed by the Board of Directors of the Division of Instructional Development within the Association for Educational Communications and Technology. The list is "final" only to the degree that it will not be modified further until the task force explores ways by which the competencies might be evaluated. The task force feels strongly that the list should never be considered final in the absolute sense, given the evolving nature of the field.

The task force made several assumptions in order to proceed with its work in a systematic way:
1. Only core competencies were included—competencies which reflect the skills of a professional developer regardless of his/her current job, academic degree, or type of training.
2. The competencies are performance-oriented rather than academic-oriented.
3. While some employment situations may proscribe a developer from using every competency, all professional developers should be able to perform most if not all of the competencies if given the opportunity to do so.
4. The competencies reflect the skills of experienced professional developers as opposed to students, trainees, or entry-level developers.

The task force believes the competency list will be valuable in many ways:
1. It can provide experienced developers with a tool for self-assessment and professional growth.
2. It can provide a common set of concepts and vocabulary which will improve communication among instructional/training developers and between developers and other professional groups.
3. It can provide the academic and professional preparation programs for instructional/training developers with information for program development.
4. It can provide a basis for potential professional certification.
5. It can aid employers in identifying qualified practitioners.
6. It can provide a basis for defining the emerging field of Instructional Development—one mark of a true profession.

The attached list of competencies is the product of much hard work by the task force over the past three years. The Division of Instructional Development Board of Directors appointed the task force to investigate the area in 1978. The first draft list of competencies appeared in February 1979. A second draft was written in February 1980 and a third was created in September 1980. The third draft was subjected to extensive evaluation. In January 1981 it and an accompanying response questionnaire were mailed nationally to all members of the Division. Over 200 members responded with about 350 specific suggestions for revisions. In March 1981 the draft was presented at a local chapter meeting of the American Society for Training and Development and feedback was gathered from the participants. In May 1981, it was presented at the National Society for Performance and Instruction Convention where participants critically examined each competency and offered ideas for improving the list. All of the feedback data were taken into consideration when the attached list was developed at a meeting of the task force in June 1981. It is "final" in the sense that it will not be revised again until preliminary assessment data are collected during 1981-1982.

Instructional/Training Development Core Competencies

Note: In the following list, the competencies are not listed in any particular order of importance. Each is an integral part of the core.

A competent instructional/training development specialist is able to:

1. Determine Projects Appropriate for Instructional Development
   * Analyze information regarding potential projects and decide if instructional development is appropriate.
   * Discriminate situations requiring instructional solutions from those requiring other solutions (e.g., job redesign, organizational development, etc.).
   * Judge the appropriateness of project selection decisions and provide a rationale for the judgment.

2. Conduct Needs Assessments
   * Develop a needs assessment plan including selection of procedures and
3. Assess Learner/Trainee Characteristics

* Distinguish among entry skills assessment, prerequisite assessment, and aptitude assessment.
* Identify a range of relevant learner/trainee characteristics and determine methods for assessing them.
* Develop and implement a plan for assessing learner/trainee characteristics.
* Judge the appropriateness, comprehensiveness, and adequacy of a given assessment of learner/trainee characteristics.

4. Analyze the Structural Characteristics of Jobs, Tasks, and Content

* Select and use a procedure for analyzing the structural characteristics of a job, task, or content which is appropriate to that job, task, or content and state a rationale for the selection.

5. Write Statements of Learner Outcomes

* Distinguish objectives stated in performance/behavioral terms from instructional goals, organizational goals, learner activities, teacher activities, and objectives written in other styles.
* State an outcome in performance terms which reflects the intent of instruction.
* Judge the accuracy, comprehensiveness, and appropriateness of statements of learner outcomes in terms of the job, task, or content analysis, and/or judgement/opinions of the client (e.g., subject matter expert, faculty, etc.).

6. Analyze the Characteristics of a Setting (Learning Environment)

* Analyze setting characteristics and determine relevant resources and constraints.
* Judge the accuracy, comprehensiveness, and appropriateness of a setting analysis.

7. Sequence Learner Outcomes

* Select a procedure for sequencing learner outcomes appropriate to a given situation, sequence the outcomes and state a rationale for the sequence.
* Judge the accuracy, comprehensiveness, and appropriateness of a given sequence of learner outcomes.

8. Specify Instructional Strategies

* Select a strategy which is appropriate to information about the learner characteristics, resources, and constraints, desired learner outcomes, and other pertinent information and state a rationale for the selection.
* Judge the appropriateness of a specified instructional strategy for a given situation.

9. Sequence Learner Activities

* Specify a sequence of learner activities appropriate to the achievement of specified learner outcomes and state a rationale for the sequence.
* Judge the appropriateness and completeness of a given sequence of learner activities.

10. Determine Instructional Resources (Media) Appropriate to Instructional Activities

* Develop specifications for instructional resources required for explicit instructional strategies and learner outcomes.
* Evaluate existing instructional resources to determine appropriateness for specified instructional strategies and learner outcomes.
* Adapt existing instructional resources.
* Prepare specifications for the production of materials where required (e.g., storyboards, lesson plans, script outlines, etc.).

11. Evaluate Instruction/Training

* Plan and conduct a formative evaluation (e.g., trials with subjects, expert review, analysis of implementation considerations, etc.).
* Develop a range of information-gathering techniques (e.g., questionnaires, interviews, tests, simulations, observations, etc.).
* Generate specifications for revision based on evaluation feedback.

12. Create Course, Training Package, and Workshop Management Systems

* Determine the components of a course/training package/workshop management system and state a rationale for the selection.
* Judge the appropriateness, comprehensiveness, and adequacy of a given management system.

13. Plan and Monitor Instructional Development Projects

* Develop and monitor an instructional development project plan (including timelines, budgets, staffing, etc.) which is appropriate to the nature of the project and the setting.
* Judge the appropriateness and comprehensiveness of a given instructional development project plan.

14. Communicate Effectively in Visual, Oral, and Written Form

15. Demonstrate Appropriate Interpersonal, Group Process, and Consulting Behaviors

* Demonstrate interpersonal behaviors with individuals and groups and state a rationale for using the behaviors in given situations.
* Demonstrate group process behaviors and state a rationale for using the behaviors in given situations.
* Demonstrate consulting behaviors with individuals and groups and state a rationale for the behaviors in given situations.
* Judge the appropriateness of interpersonal, group process, and consulting behaviors in given situations.

16. Promote the Diffusion and Adoption of the Instructional Development Process

* Select strategies appropriate for promoting the diffusion and adoption of the instructional development process in a given setting and state a rationale for the strategies.
Would You Believe an Instructional Developer?

Gene Faris

Would you believe that in the not too distant future an issue of Audiovisual Instruction under the section "Professional Placement—Positions," will include the following?

**Director of Instructional Development**—Person to work with faculty members in the development of instruction, including the analysis, design, and evaluation of instructional practices. Must be capable of guiding the activities of an interdisciplinary team in the performance of above tasks. Doctorate preferred with major in instructional development. Salary: $20,000 for 12 months.

Believe it or not, the day is fast approaching when such a job description will appear in some professional journal. Whether it appears in AVI or not depends to a great extent on the focus of the media field in the immediate future.

The need for a professional developer is certainly substantiated by the emphasis being placed on "development" at all echelons of our educational system. No less a person than R. Louis Bright, associate commissioner of education for research, United States Office of Education, in forecasting the future sees a significant increase in development activities. Bright, speaking at the 1967 meeting of the American Association for the Advancement of Science, indicated that there is little chance that in the future educational research will attract government support "on its own merits." What will probably happen instead is that aid to research will "piggyback" on aid to development.

Associate Commissioner Bright went on to say that "Development is a new concept that is very different from research. It's not the search for knowledge. Rather it is devising a solution to a problem."

Are media specialists in the business of devising solutions to problems? The answer to this is certainly a resounding "Yes." In fact, many professionals in the field would be quick to indicate that they have spent 10, 15, or even 40 years devising solutions to instructional problems. This being the case, I say great, if the problems tackled have been significant ones and the resulting solutions worthy of note when evaluated in terms of student learning. Unfortunately when these two criteria are applied with much rigor, many of us in the media field strike out as instructional developers. In some instances we have made a hit and even scored a run; however, too frequently we have devised earth-shattering solutions, based upon our hunches drawn

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**Semester Course**

![Diagram of Semester Course](image)

**Figure 1**

The arrows represent the type of "cybernetic" action that can occur at any point in the flowchart.

<table>
<thead>
<tr>
<th>Competency</th>
<th>Areas of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application of System Design Concepts to Instructional Development</td>
<td>The study of the characteristics of a system approach to instruction and the application of systems methodology in instructional development. (ID) Internship in instructional analysis with emphasis on the first nine steps of the ID flowchart.</td>
</tr>
<tr>
<td>Analysis of Learners</td>
<td>Psychology or Educational Psychology with focus on the identification and analysis of learner characteristics relevant to the instructional task. Measurement procedures for identifying learner characteristics.</td>
</tr>
<tr>
<td>Specification and Evaluation of Educational Objectives</td>
<td>Programming with particular emphasis on writing behavioral objectives. Statistical analysis in discipline that is the “best fit” for the students. Options include Sociology, Psychology, Educational Psychology, Mathematics, and Business.</td>
</tr>
<tr>
<td>Analysis and Sequencing of Tasks</td>
<td>Specification of learner behaviors required to achieve objectives and the proper sequencing of these behaviors. Relevant principles extrapolated from the behavioral sciences for sequencing tasks in the cognitive, affective, and psychomotor domains.</td>
</tr>
<tr>
<td>Competency</td>
<td>Areas of Study</td>
</tr>
<tr>
<td>Conceptualization and Application of Instructional Strategies</td>
<td>The theory and practice of curriculum development including theories underlying curriculum development and patterns of curriculum organization. Choosing appropriate strategies for differentiated learning situations. Electronic data processing and its application to the development of instruction. Instructional television design and production. Motivation, perception, and learning theory in the learning and communication processes.</td>
</tr>
<tr>
<td>Production of Stimulus Materials</td>
<td>Theory and practice relative to the application of graphic and photographic techniques in effective communication.</td>
</tr>
<tr>
<td>Application of Adoption Strategies</td>
<td>Study of proposed models for gaining acceptance of innovations in education. Application of management principles in the administration of Instructional Development program.</td>
</tr>
<tr>
<td>For those individuals with the aptitude to undertake a following competency would be added.</td>
<td>Advanced research methods and design. Advanced statistics. Successful completion of a doctoral study.</td>
</tr>
</tbody>
</table>
from experience, to some trivial problems, or we have been confronted with some salient problems without being able to invent solutions of equal import. What, then, is demanded of the media field if we are to strengthen our position and provide the leadership we must in the development of instruction? What problems in our own house are in need of solutions?

John W. Gustad, past chairman of the NEA Committee on Teaching of the Association for Higher Education, has identified one of the basic problems, if not the most pressing one, confronting the media field. In the March 1964 issue of the NEA Journal, Gustad observed:

At one time or another, radio, motion picture, films, language labs, and teaching machines have been hailed as the savors of education. So have large classes, small classes, seminars, tutorials, independent study, years abroad, work-study programs, midwinter reading periods, and year-round operation. None of these is either as bad as detractors assert or as good as zealots claim. Locking on an adequate theoretical framework in which to place these innovations, the pendulum continues to swing wildly from euphoria to cynicism. (Italics added)

The need for such a framework, as called for by Gustad, is especially crucial if this new kind of professional, an instructional designer or developer, is to become a reality. What does such a person do? What training and competencies should he possess? Such questions must be answered within some theoretical framework or model.

This was a problem I faced in attempting to structure an Institute under Title VI B of the Higher Education Act. As proposed, the Institute was to focus on the improvement of undergraduate instruction, with "instructional developers" guiding the activities of teams of faculty members in the systematic study of the instructional process. Cognizant of the necessity for a conceptual framework to guide the activities of both faculty members and the neophyte instructional developers, Richard Stowe, assistant director of the Institute, and I designed the flowchart or model shown in Figure 1.

This flowchart was utilized to guide the activities of the Indiana University Faculty Development Institute during the past year. Although a detailed rationale for the sequence of steps in the flowchart is not required here, an explanation of the overall schema suggested for the development of instruction is needed.

Note that the flowchart begins with a single discrete unit from a semester course. Although we typically hear individuals talk about analyzing, revising, or developing a course, the position taken here is that the course must be broken down into smaller segments for effective development to take place.

In the Faculty Development Institute, the maximum segment (unit) analyzed consisted of approximately 18 hours of student learning time. The 18 hours included both in-class and out-of-class time. The entire unit is subjected to intensive analysis through Block 8, and the components are then synthesized into a final instructional segment. Much of the actual analysis and synthesis goes on at the "message level" (message here is roughly the equivalent of one confrontation with the learner). When a number of messages have been completed, validated, and revised, they are then synthesized into an integral unit. An important feature of the flowchart is the provision for feedback loops (suggested by the arrows on the chart). From any block the team may "loop back" to any prior block to correct errors, strengthen its analysis, or make needed revisions.

Field testing the instructional development flowchart came during the Faculty Development Institute, and two questions of particular interest emerged. One of these focused on the "powerfulness" of the flowchart to develop a validated instructional unit. It will suffice to say at this point that the staff and participants were, in most cases, extremely happy with the utility of the flowchart for developing instruction. The second question dealt with the competencies an instructional developer should possess to coordinate the efforts of an interdisciplinary team as they worked through the flowchart. The answers to this question were most enlightening.

Eight doctoral students in the Educational Media Program at Indiana University, under the guidance of the Institute director and assistant director, served as the instructional developers for thirteen faculty teams during the development of thirteen units of work. Although the students performed well in this new role, it became clear early in the project that new skills and knowledge were demanded of these students that they had not developed during their doctoral programs. The consensus of all concerned held that the role played by the students was significant and that an interdisciplinary training program should be established to train instructional developers. It appeared from this experience that the disciplines to be drawn upon in such a program would include the behavioral sciences, curriculum, measurement, media design and technology, system design, and management.

Following this lead, an interdisciplinary program has been established in the Educational Media Division at Indiana University to train instructional developers. The program is designed to develop the competencies in individuals that will enable them to guide a team of teachers and specialists through the flowchart presented in Figure 1. The competencies deemed necessary to accomplish this feat, according to our present thinking, are presented in Table 1 along with broad curricular areas in which the students will receive their training.

Should the media field include a specialist in instructional development as presented here? Initial reactions of students and professional educators, both media and nonmedia oriented, have been overwhelmingly in favor of the program. In fact, the reinforcement has been so strong that I am prompted to start a campaign to change the name of DAVI to AID (Association for Instructional Development), or some similar name that would emphasize the increasingly important role of the media specialist in the design of instruction.
An Approach for Structuring Instructional Developer-Client Consulting Experiences

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Abstract. The need for a dependable population of "clients" for instructional design seminar students led to the idea of engaging student teachers in this role. Graduate students in instructional supervision who were taking an ID course were paired with middle school student teachers. The under-graduates were taught how to identify and articulate instructional problems and the ID students were trained in instructional design and consulting skills as regular components of their respective seminars. Structured interaction between the two groups was on an individual basis via personal contact, telephone, audio tapes and written reports. Instructional problems encountered ranged from motivation to knowledge of resource materials and teaching strategies. Alternatives presented by the developers included flexible grouping, contracting for interest and motivation, and action plans for the student teachers' perceived self-inadequacies. This approach was highly successful in terms of the ID course objectives for an early consulting experience and in that it became something of an entry vehicle for establishing the credibility and demand for instructional developers within public school systems.

Rationale for the Approach

One pressing demand on those who train instructional supervisors in ID is that they engage students in designer-client relationships so that the students can begin to connect theory to practice. A recurrent problem in this aspect of training has been the availability and suitability of a client population. The trainers' initial experiences in consulting ideally should be with clients who can articulate valid instructional design problems but who do not represent excessive psychological threats. Such a clientele would enable the students to sharpen their consulting skills while gaining personal confidence through coping with "real" contexts. The ID teacher, however, is rarely able to provide such ideal clients in sufficient number or on a timely basis. Teachers often make what arrangements they can, tell class members to find their own clients, or let students redesign some of their own instruction if they currently were teaching. Many students, as a consequence, have not been systematically required to engage in the important consulting experience during their training.

A corresponding problem facing those who educate preservice teachers is that the tendency to provide earlier and more extensive field experience does not always result in a positive impact on the attitudes and behavior of the student teacher (Zeichner, 1978). Part of the difficulty is the lack of support the student teacher receives when proposing instructional strategies or problem solutions which often are not equally favored by the cooperating teacher. The student teacher's university supervisor, ordinarily the only other observer, is in an evaluative role (Blumberg, 1974) and is not likely to encourage deviation from the cooperative teacher's routine practices or to foster open expression of concerns about survival skills such as class control, content adequacy, evaluations by supervisors and pupils, and evaluation of pupils (Fuller, 1969; Fuller, Parsons & Watkins, 1973).

During a discussion concerning the difficulties affecting both preservice and graduate student groups, the idea of using students enrolled in the teacher education program as clients for the graduate instructional design students arose. The major goal was to create a realistic and mutually supportive environment in which the student teachers and neophyte instructional designers would have all of the advantages of a "client-consultant" relationship without the dysfunctional element of professional evaluation. It seemed to the authors that setting up this context would lessen the severity of the impact of the existing evaluative roles on both groups of students who were at a point in their professional training where the freedom to experiment and grow should be of paramount importance.

The specific advantages of structuring an instructional developer-client relationship between the two classes were perceived to be that:

• Graduate students in an instructional design "consultant" role would have a dependable population of clients who could provide valid instructional problems but who would not be excessively threatening;

• Preservice student teachers would have an opportunity to develop the skill of articulating and defining classroom instructional problems; and

• The student teachers would have a "consultant" to work with who was not in a traditional evaluative role.

The "consultants," for the most part, were experienced classroom teachers and/or administrators enrolled in various doctoral programs and, unlike the student teacher supervisors, cooperative teachers, and seminar professors, were not put in a position of evaluation and recommendation. The mutually supportive environment, it was believed, would also ease the transition of undergraduates to classroom teachers and the graduate students to instructional designers and supervisors. These assumptions and convictions led to some modification of the two courses involved and to the structuring of a trial interaction between the two groups.
The Instructional Design Course Plan

The graduate course in instructional design was developed to provide the participants with the basic analytical, consultative, and prescriptive skills of the profession (Davies, 1972, 1973, 1975, 1976, and personal communications, 1974-77; Davis, Alexander, & Yelon, 1974; Thiagarajan, 1976a, 1976b) along with an awareness of organizational behavior (Schein, 1970; Vroom & Deci, 1970).

All of the participants were experienced classroom teachers, and most of them were employed as school administrators and/or supervisors of instruction. Interviews with them revealed that they possessed high-level ID entry skills but that none of them had previously taken a course in instructional design. Further questioning indicated that they preferred to work independently and in small groups on readings, exercises, and case study materials rather than learn via the lecture method.

Given the course objectives and learner characteristics, a plan was devised that consisted of nine units: planning instruction; objectives and competencies; task analysis; learner analysis; motivation and organizational behavior; consulting; Instructional strategies and formats; teaching skills, concepts, and principles; and evaluating instructional outcomes. Each unit corresponded with a weekly class meeting. Each unit consisted of readings, exercises, and posttests. After individually completing the units, the class met as a group to discuss the material and to practice applying the material to printed and video tape case materials in small groups. The participants were required to master the first seven units before engaging their clients.

The unit on instructional strategies and formats required a familiarity with the four families of the Models of Teaching (Joyce & Well, 1972; Well & Joyce, 1978a, 1978b, 1978c). Although most of the graduate students were already familiar with the "models" approach, the authors considered this material to be of sufficient importance to require a demonstrated ability to prescribe a category of models for specified instructional outcomes.

The unit on consulting consisted of sensitizing the graduate students to the nature of the human relationships involved in the consultation process and of teaching specific skills. They were required to master (measured by unit posttest and instructor observation) the techniques for entering, maintaining, and terminating a consultant-client relationship, and to describe the successive stages in the relationship: problem analysis, interpreting data, and generating alternatives (Davis, 1975). The problem analysis skill component required mastering the ability to analyze five types of instructional problems: direction (goals or objectives not known by students), evaluation (evaluation procedures are not known by students), content and sequence (content is missing or there is no attempt at logical structure or sequence), method (poor conditions to motivate or promote learning), constraints (resources such as instructor skills, student abilities, and schools' resources are ignored) (Davis, Alexander, & Yelon, 1974).

The remaining four sessions of the class were to be used for group discussions of the clients' instructional problems and of the consulting process itself. Additional office hours were kept by the authors during this period to permit individual consultations.

Strategies for Interaction

The two groups (24 persons in each) were brought together in an informal social setting during the 9th week of a 13-week semester. Introductions took place wherein each student told briefly what his or her professional activities and leisure interests were. The instructors suggested that the groups mingle and ultimately select a person from the other group with whom to work based on introductory comments and subsequent conversations. Most pairing resulted from the undergraduates finding a "consultant" interested in their particular school setting.

Once the student instructional designer/student teacher teams were formed, each was required to schedule four contact sessions. Considerable flexibility was allowed here because of the geographical distances separating the graduate students from student teachers who were scattered over a rather large region. Contact requirements could be met by any one of the following (rank ordered by the authors in terms of perceived value):

1. personal meetings,
2. telephone calls,
3. exchange of audio tapes,
4. written journals.

Journal and audio tape mailboxes were provided at a location convenient to both groups.

Each contact required a written summary of the encounter. The student teachers could include this summary in their weekly journal to the instructor of the preservice seminar and the instructional design students wrote response sheets that summarized their diagnoses of the problems and alternatives proposed for resolution. As planned, subsequent sessions of the instructional design course and individual conferences with the authors were used to share consulting experiences and discuss the broader issues of "consultation" and student teacher relationships as they arose.

Before meeting with the developers, the student teachers participated in brainstorming sessions that led to narrowing and clarifying instructional problems in terms of the kind of information that a "consultant" would require (Davis, Alexander, & Yelon, 1974). This part of the experience proved to be particularly beneficial for the student teachers. It was apparent from the difficulties the student teachers encountered while trying to come up with accurate descriptions of classroom problems that more of this type of experience should be included in the teacher education program. Student teachers cannot solve instructional problems if they are unable to define them. This inability of the client to clearly define instructional problems is also an important aspect of the reality faced by ID practitioners: It is good experience for the supervisor-developer to begin to deal with this problem in a training situation.

Results of the Trial Interaction

Instructional problems as defined by student teachers were many and varied. A forced collapsing across categories yielded the results shown in Table 1.

Discipline was the major concern, followed by feelings of inadequacy about the student teachers' knowledge of the curriculum and the materials deemed helpful for various content areas. Paralleling the feelings of lack of knowledge about curriculum were concerns about how to interest and motivate students. Many of the student teachers felt children were bored with the classroom work and they felt un-
prepared to deal effectively with the resultant "poor attitudes toward school."

| Table 1 |
|-------------------|-------------------|
| **Instructional Problems Articulated by Student Teachers** |                  |
| **Problem**         | **Frequency**   |
| Discipline in classroom | 6   |
| Lack of knowledge of teaching methods | 5   |
| Curriculum Design Constraints | 3   |
| Lack varied & interesting instructional materials | 2   |
| Lack knowledge of subject matter | 2   |
| Lack familiarity with alternative evaluation/grading strategies | 2   |
| Disliked by students | 1   |
| Tired | 1   |
| Problem reports not submitted | 2   |
| **N = 24** |                  |

For the purposes of this project, which was to determine if pairing student teachers with graduate students or "consultants" would lead to a mutually beneficial learning experience, the following specifics can be delineated:

1. **Student teachers can be a dependable population of clients who provide realistic instructional problems but are not intimidating to graduate student instructional design consultants.**

The population proved to be dependable and challenging to the graduate students' entire repertoire of skills. There were no prerequisites for this course but the prior professional experiences of the "consultants" proved to be beneficial in dealing with the student teachers. As clients for advanced graduate students, most of whom would be employed in school districts as instructional supervisors or building administrators, the student teachers provided outstanding examples of personal and instructional problems in realistic environments. Furthermore, they were scattered among widely differing school systems which provided a multitude of administrative philosophies, socioeconomic conditions, and ethnic populations.

From an instructional designer's point of view, however, participants experienced a somewhat limited opportunity to apply purely instructional remedies because of the student teachers' overriding anxieties concerning personal adequacy. As a consequence of the emergence of student teacher problems with classroom discipline, teacher self-concerns, and ambiguous curricula, the remaining sessions of the instructional design class were focused on motivation, pacing, learner analysis, and clarity of instructional intent. The instructional design students found the student teachers to be a particularly stimulating yet nonintimidating client group with whom to work. It was of particular importance to be able to deal with them without the overriding threat of evaluation that a supervisor encounters when dealing with inservice teachers in the field. The context, in fact, enabled future instructional supervisors to experience first hand the complexities teachers face and to empathize with the day-to-day problems they encounter.

The fact that the instructional design students were also experienced teachers and administrators was of considerable benefit in that they were familiar with how to implement change within an educational system. The range of consultant-proposed strategies included flexible grouping, contracting for discipline problems, and meetings with building supervisors. The strategies also included coaching teachers about the real and assumed constraints imposed by curriculum guides and evaluation/grading requirements, learner analysis and materials matching/pacing for interest and motivation, and content/skills self-assessment (with action plans) for student teacher perceived inadequacies. The challenge for the professor was to structure the approach in a way that kept everyone on task while leaving room for innovative interventions when the situations dictated a need for them.

2. **Preservice student teachers would have the opportunity to develop the skill of articulating and defining instructional problems.**

The difficulties encountered by the students during the process of narrowing and clarifying the problems as they perceived them were substantially alleviated by structuring this activity as a seminar. These problems, as they were ultimately defined within the consultation session, were not the typical kinds of difficulties the students expressed in routine supervisor/student teacher meetings (such as those concerning subject matter particulars and workshop ideas). Rather, they were more closely patterned on student teacher concerns about self-adequacy and the hidden curriculum such as Fuller (1969) and her colleagues (Fuller & Brown, 1975; Fuller, Parsons, & Watkins, 1973) found in autonomous clinical settings. This allowed the seminar and design class professors to focus on the real problems of the student teachers rather than on those that are ordinarily presented in a restrictive setting.

3. **The student teacher would have a consultant to work with who was not in a traditional evaluative role.**

The student teachers were able to express their concerns openly and honestly to the graduate instructional design consultants. At this point in their development, the student teachers needed to be able to express their anxieties. Yet, it has been the usual procedure during this phase of teacher education to surround them with three evaluators (the professor in charge of the student teaching, the student teacher supervisor, and the cooperating teacher). This has the effect of keeping them on the defensive and, if teaching competence is a developmental phenomenon, it could well have the effect of impeding critical professional maturation.

**Conclusions**

In summary, this project did in fact demonstrate that bringing together future professionals in a joint undertaking to improve classroom instruction is a viable new direction to be considered for instructional design professors involved in teacher education programs. There are a number of benefits in addition to those discussed in the preceding section.

First, there are no expenditures of dollars or other resources required to put the model into practice. Faculty time required to execute the design is very modest.

Second, the approach has stimulated interest on the part of other faculty members in improving the integration of learning experiences that constitute teacher education and the acquisition of instructional design skills. Graduate students in some programs are often assigned to the role of "mini" researchers or teaching assistants: They are an untapped resource with a broad potential for qualitatively improving the level of teacher training. The closeness with which the graduate students worked
with each of their clients, and the overwhelming positive response to the experience that was received from both groups of students indicated that this was an approach that had encouraged introspection on the part of the participants concerning their individual needs and their growth within their professions.

Third, this project had the indirect but powerful effect of interesting some of the teachers and supervisors in the participating school systems in further exploring ways instructional developers could be used to improve instruction in their schools. It opened a traditionally closed line of communication and, at least in some instances, demonstrated what the profession can do for teaching when given the opportunity.

Fourth, university faculty members who participated in this design were forced to keep in constant touch with classroom realities in the public schools (all of those complexities that teachers have to cope with but which rarely fit in neat theoretical frameworks).

Fifth, the structuring of non-evaluative interaction between preservice student teachers and graduate instructional design students tends to remove the status barriers that traditionally exist between these two groups. Based on the authors’ conversations with some participants, the experience has led to associations and friendships that went beyond the depth and duration required by the structured activities.

These benefits are exciting, but moving graduate students into a “real” environment places additional responsibilities on the ID professor. Foremost among these responsibilities, the authors believe, is accurately informing their students about what they are going to encounter.

First, the participants must be aware of the influence a system can have on its personnel. Often what are expressed as classroom problems are merely symptoms of more pervasive problems with the social system (such as racial or economic prejudice and cheating) or with the school system (such as inflexible curricula and authoritarian leadership styles). It is important that the graduate students recognize the constraints under which they operate, and that their interventions be designed to go no deeper than the client will accept and for which the client will allocate resources.

Second, they should be prepared to deal with clients who are not skilled in articulating instructional problems. An important part of their consultation will be the redefinition and clarification of these problems. As the seasoned practitioner often finds, what the client initially expresses as a problem rarely is the problem.

Third, when working with beginning teachers, the consultant must be able to deal with their self-adequacy concerns as well as with instructional problems. Just anticipating these concerns will be helpful, as will open discussions of them with the client. Several of the student teachers in this trial were actually doing quite well in their classrooms but felt very inadequate about teaching. Some basic information-gathering interventions (such as student evaluations of teaching and performance contracts with the cooperating teacher) can be extremely effective in providing realistic feedback to the beginner.

The real environment entered by the graduate student consultants in this trial was not as “clean” as the customary academic setting, but it was manageable. The authors believe the participants grew qualitatively both as professionals and as persons during the experience. It is only in realistic but non-evaluative environments such as the one created by this project that real, personal, and urgent problems are openly expressed. These problems must be expressed if we are to deal with them, and we are obligated to deal with them if we are to keep abreast of the changing realities in education. If professional competency is at all developmental—or even if it simply exists in identifiable stages that are potentially alterable—training programs should attempt to structure experiences that will enhance the transitions that occur between the academic and practitioner stages. Student teachers are readily available as a “client” resource for instructional design trainees within most schools of education. Engaging them in this role offers one way to structure the consulting experience that is important for professional growth.

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An Evaluation of the Elaboration Model of Instruction from the Perspective of Assimilation Theory

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Abstract. This paper provides a critical analysis of Merrill & Reigeluth’s “elaboration model of instruction.” First, the elaboration model is briefly described, with special focus on the concepts of “sequencing” and “synthesizing.” Second, positive features of the theory are discussed, including the authors’ emphasis on making connections between presented material and existing knowledge. Third, critical comments are provided concerning the clarity of the model, the availability of empirical support, and the failure to describe underlying theoretical mechanisms. The final section of the paper explores the relation between the elaboration model of instruction and cognitive theories of learning such as the “assimilation theory.”

EDITOR’S NOTE
This paper was originally presented at a symposium on the Elaboration Theory of Instruction at the 1980 AERA Convention. The papers referred to by the author are not printed in JID, but the reader unfamiliar with the Theory being discussed is referred to:

Introduction
In this paper, I review the “elaboration model of instruction”—an emerging instructional theory developed by David Merrill, Charles Reigeluth, and others—that is based partially on existing cognitive theories of memory. The authors have provided the interested reader with an extensive documentation of elaboration theory. In preparing this short report I became acquainted with over a dozen documents, totaling more than 500 pages, describing elaboration theory. Thus, the job of discussing elaboration theory is aided by the fact that the authors have been willing to describe the theory in detail.

I will address four questions in turn: (1) What is elaboration theory? (2) What are the positive features of elaboration theory? (3) What features need further development? (4) How does the theory fit in with cognitive theories of human learning and memory?

Definition of Elaboration Theory
Elaboration theory has three general characteristics: (1) It is a prescriptive theory of instruction rather than a descriptive theory of learning, aimed at telling “how to” instruct rather than “how” people learn. (2) Elaboration theory is concerned with the structure and organization of material rather than the specific material itself. (3) Elaboration theory attempts to be consistent with existing research findings concerning human learning, memory, and cognition. It attempts to be consistent with cognitive psychology.

Two principle features of elaboration theory are mentioned repeatedly in the writings. First, instruction should proceed from the general to the specific. The authors refer to this issue as “sequencing.” Second, each part should be related to the general context and to other parts. This issue is referred to as “synthesizing.” A typical quote from the authors shows the importance of sequencing and synthesizing: “The elaboration model of instruction starts the student with a very broad, general view of the subject matter to be taught. Then it divides the subject matter into parts, elaborates on each of those parts, divides those parts into parts, elaborates on each of those subparts, and so on until the knowledge has reached the desired level of detail and complexity.”

I am particularly interested in the two ideas of sequencing and synthesizing. In describing the sequencing procedure, the authors introduce the “epitome”—a very general and brief summary of the to-be-presented content area. In some ways the epitome is like an advance organizer, because it is intended to provide a general context for all new, incoming information. The authors give the impression that generating epitomes for subject matter is a crucial step.

The description of the process of synthesizing emphasizes learning by understanding—that is, on learning by mapping new information into existing knowledge. For example, the synthesizing procedure “makes parts of subject matter more meaningful to the student by showing their context, that is by showing how they fit into a larger picture.” This “fitting into a larger picture” is, then, a powerful and central idea.

The authors claim that elaboration techniques result in “meaningful learning.” In various papers the elaboration theory is purported to enhance long-term retention, student enjoyment, and student motivation.

Useful Aspects of Elaboration Theory
Elaboration theory provides potentially useful distinctions and taxonomies, i.e., the distinction between sequencing and synthesizing. I agree with the authors that the creation of a general theory of instruction would be a great aid to teachers, curriculum designers, and others. The authors have attempted to base their theory on existing psychological literature.

The general principles that are the
basis for elaboration theory resonate well with our current understanding of human learning and cognition: (1) emphasis on the context of learning, (2) emphasis on elaboration or connections with cognitive structure, and (3) emphasis on “fitting into a larger picture.” All of these ideas are consistent with current emphasis in cognitive psychology on the role of organization and structure, the role of rehearsal and elaborative processes, the relation between new knowledge and prior knowledge.

These general ideas are also consistent with a long history of research on the psychology of meaningful learning. Many of the general comments I read in the documents that were sent to me could have been written by a Bartlett or a Katona. For example, Bartlett’s famous emphasis on “effort after meaning” is based on the idea that learning involves “connecting something that is given with something other than itself.” Katona’s famous distinction between learning by memorizing and learning by understanding plays on allowing the learner to build "structural relations,” i.e., to see how each part fits into the larger structure.

Critical Issues of Elaboration Theory

Vagueness. My first concern is the level of specificity of elaboration theory. There is a sense that the authors are working against the zeitgeist because they are building a general theory at a time when most psychologists have opted for building very small theories for very limited domains. Thus, although elaboration theory does define each term—such as epitome or synthesizing—it does not achieve the level of clarity and specificity that one would prefer. The ideas sound reasonable at a general level but it is hard to define such terms as “fitting into a larger picture” or “providing a general structure.”

Empirical tests. A second comment concerns the need for empirical support of aspects of the theory. Many of the terms that are defined with a sense of authority, such as “general-to-detailed” sequencing or “providing epitomes,” can really be thought of as empirical questions. What is an epitome? What is synthesizing? What effects do they have on learning? These empirical questions require greater attention than they have been given.

Theoretical mechanisms. Unless we know how and why elaboration techniques work, we do not really have an elaboration theory or model, but rather an elaboration technology—a “how to do it” procedure. We need to know what are the cognitive mechanisms which underlie the effectiveness of the instructional techniques.

Analysis of Stimulus. Finally, there is a sense that this theory focuses more on an analysis of the stimulus than on an analysis of the learner’s information processes. It seems to fit within the task analysis tradition. While task analysis has proven to be both a powerful tool and a useful tool, it would be even more effective if it focused on the learner. A theory of instruction should be based on analysis of the information processing of the learner as well as on analysis of the stimulus materials. I am suggesting that the theory focus more on the learner and what is going on in the learner’s head.

In summary, my reading of the “basic” papers of elaboration theory to date suggest that the technology of elaboration is running far ahead of the science of elaboration. By this I mean that elaboration theory seems to do a better job of telling us “how to do” than of telling us “why to do.” This problem can be attacked on each of the fronts I have outlined above: by being more specific (e.g., by telling what “fitting into a larger picture” means, or what defines a “general context,” or what is the nature of “meaningful learning”); by providing empirical tests of the predictions of elaboration theory; by specifying the cognitive mechanisms which underlie elaboration theory; and by focusing on internal cognitive processes and states. In short, we need to know how and why elaboration techniques influence learning.

Comparison with Cognitive Learning Theories

My fourth task in this presentation is to compare the elaboration theory of instruction with existing cognitive theories of human learning, and in particular, with what has been called “assimilation theory.” How are cognitive theories of instruction (such as elaboration theory) similar to cognitive theories of learning (such as assimilation theory)? Both deal with how information is acquired, stored, and retrieved by a person. Both deal with factors which influence the outcome of learning. However, the two types of theories also differ in important ways. Elaboration theory focuses on a technology for presenting the stimulus material to achieve various desired outcome performances. Cognitive theories of learning focus on the information processes and structures which are involved in learning new information. If we view the main variables as the stimulus, the response, and the internal cognitive activity, then the present version of elaboration theory focuses on the stimulus while cognitive theories of learning focus on the internal activity.

Elaboration theory is designed to be a general theory of instruction which is consistent with cognitive theories of human learning. Many of the criticisms I raised in the previous section could be alleviated if elaboration theory was related to a correspondingly broad theory of learning. Unfortunately, cognitive psychology has not yet developed a general theory of learning. The closest we have come to developing general cognitive theories of learning are what the organizers of this symposium call “assimilation theory” and “schema theory.” I will focus on what has been called “assimilation theory.”

I suggest that there is no one “assimilation theory.” The term has been used by Bartlett to describe learning and memory for pictures and folk stories, by Piaget to describe the process by which knowledge grows in developing humans, by Ausubel to describe expository learning from prose, by myself to describe “meaningful learning” processes that result in creative problem solving, and by many others. Unfortunately, there has not been universal agreement on what process of learning is reflected in the term “assimilation.” Since the work of each of the relevant authors is readily available, I will focus my discussion of assimilation theory from my own point of view.

There are several basic ideas in an assimilation theory of learning which are most relevant for an elaboration theory of instruction, (1) Meaningful learning involves the following cognitive processes: the to-be-learned information must be received by the learner (e.g., the learner must pay attention); the learner must possess a relevant set of existing concepts which can be used to assimilate the new material (e.g., the learner must possess an assimilative set); the learner must actively use the assimilative set and integrate new information with existing
knowledge. (2) Instructional variables may influence any one or more of these processes. For example, behavioral objectives and adjunct questions may affect what incoming information the learner pays attention to; advance organizers may serve to provide an assimilative set; and discovery or student elaboration activities may serve to encourage active integration of old and new knowledge. These all are, of course, empirical questions which must continue to be tested and clarified. (3) Differences in the process of learning can result in structurally different learning outcomes even when identical information is presented. Since the outcome of learning involves both the stimulus materials and the cognitive structures to which the materials are assimilated, it is possible that some learners may use one assimilative set while others use another. In this case structurally different outcomes would result. Structural differences can be indicated not by differences in overall amount retained, but rather by differences in the pattern of transfer or the pattern of recall performance by type of information.

The foregoing brief summary of assimilation theory provides an agenda for work on elaboration theory. First, it would be useful for elaboration theorists to explicitly describe the information processing variables (such as attention, availability of the assimilative set, integration, etc.) that are affected by various elaboration techniques such as sequencing and synthesizing. Next, a description of the predicted learning outcome could be generated for cases in which the technique is or is not present. Predicted differences in learning outcomes should be measured not only in a quantitative way but also in a qualitative way. If elaboration theory allows for broader, more integrated outcomes, these should be manifested in the pattern of transfer performance and pattern of recall by type of information. To date it appears that the authors of elaboration theory have focused mainly on how much is learned rather than on what is learned under elaboration techniques. Assimilation theory provides very specific predictions concerning interactions involving the degree of transfer, the ability of the learners, and the familiarity of the material. These may also be applicable to tests of elaboration theory.

One final important link between elaboration theory and assimilation theory concerns the respective roles of epitomes and advance organizers. Much of the work on assimilation theory has involved a study of the effects of advance organizers on prose learning. In our own studies we have attempted to test the claims that concrete analogical models provide an assimilative context and encourage learners to map new information onto this context. The relation between these two ideas and elaboration theory's "sequencing" and "synthesizing" need to be explored in more detail. One major research question in assimilation theory concerns the identity of the features of a good advance organizer. Ausubel argues, for example, that an outline is not a good advance organizer. It strikes me that the definition of an epitome should be consistent with what we know about the characteristics of advance organizers, and should be tested in the same way.

Summary and Recommendations

A review of the current state of elaboration theory encourages further work toward the development of a cognitive theory of instruction. Although it is still not clear what shape that theory will take, future work should address the following recommendations:

Instructional theory should be usable. The theory should be stated with enough clarity and specificity to allow one to successfully apply the theory to a particular instructional situation.

Instructional theory should be valid. The implications of the theory should be tested in rigorous ways. Evaluation studies comparing the "treatment" and "control" groups on gross measures are not enough.

Instructional theory should be theoretical. A good instructional theory involves more than a "how-to-do-it" cookbook. It needs to explain why or how a particular instructional procedure "works."

Instructional theory should be cognitive. The useful developments in the cognitive psychology of learning and memory should be incorporated into a general theory of instruction. During the past 10 years there has been an explosion of knowledge concerning human cognitive processes and memory structures. A good theory of instruction must exploit this useful database.

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In Search of a Metaphor for Instructional Development

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Abstract. The use of metaphor is helping certain professionals discover new dimensions of their practice. The method holds attractive possibilities for instructional developers. This article explores the potential through an analysis of the functions and limitations of metaphors as applied to instructional development. Existing metaphors are critiqued, and new metaphors are presented.

Metaphors have become popular and useful descriptive tools in several disciplines recently. Writers in educational evaluation, for example, have used such metaphors as painting, photography, art criticism, the judicial process, and investigative journalism in an attempt to clarify the role, function, and activities of their profession.

When a shift from traditional paradigms or practices occurs, a metaphor can provide an organizing principle for new ideas. Metaphors can serve such a function in instructional development (ID), a profession that is still in the formative stages of growth.

Rationale for the Use of Metaphor

Ortony (1975) presents a three-fold rationale for the use of metaphor. Each aspect of the metaphor has practical value and utility for characterizing an emerging branch of study. The first aspect is “compactness,” the power of a metaphor to condense a larger construction. Communication can take place without the need for long, detailed, explicit (and possibly boring) explanations. More importantly, the metaphor is closer to a real-life continuous experiencing of the referent than is any verbal description.

The second aspect considers the possible “inexpressibility” of some facets of the referent that can be captured by the metaphor. Where definitions are hazy or boundaries uncharted, a metaphor can establish temporary limits and allow time for theory and research to catch up with practice. The use of metaphor should help practitioners discover unexplored areas of instructional development.

The third aspect of the metaphor described by Ortony is its vividness. It gives both emotional and cognitive meaning to the referent and often calls to mind sensations from all modalities simultaneously.

The communicative and emotive powers of a metaphor are considerable; however, there are limitations to this method of conceptualizing. Students in literature classes often have difficulty comprehending that Poe’s “Haunted Palace” is figuratively a disturbed mind or how Sandburg’s Chicago can laugh “the stormy, husky, brawling laughter of youth.” It must be explained to them that these metaphors are not designed to represent or accurately depict the referent object, action, or state of mind but rather to communicate information concerning it in a meaningful way. A metaphor thus cannot provide an isomorphic representation of the ID process; instead it should provide an understanding of this process.

Selection Guidelines and Requirements

As easily as they can lead, figurative uses of language (metaphors, similes, and analogies) can mislead. “A metaphor used successfully can give in-
sight and comprehension, used unsuccessfully it can generate confusion and despair" (Ortony, 1975, p. 52). Certain guidelines are needed for testing the utility of any metaphor.

1. There should be reasonable fit of salient attributes: that is, the characteristics called to mind by the metaphor should have some connection to the referent. This is not so that the referent can be accurately represented, but so that aspects of the metaphor cannot be inappropriately attributed.

2. The comparison should have face validity. It would be difficult to explain a banana by comparing it to a boomerang, despite the several shared characteristics of these items. This criterion is the major downfall of using the painting metaphor for evaluation.

"The good metaphor satisfies while it starts" (Goodman, 1968, p. 79).

3. The figurative item or process should be familiar to the addressee. It would be useless and perhaps even harmful to use an obscure metaphor. It is critical that the author of a metaphor realize what that image communicates to the addressee.

Along with the preceding rationale and selection guidelines, the special demands that the ID referent places on the metaphor selected must be considered.

The professional practice of ID has become broad in scope and, in addition to the original areas of product and course development, now includes faculty development and organizational development (Durzo, Diamond, & Doughty, 1979). An appropriate metaphor would apply equally well to each of these areas.

To be used successfully a metaphor should be independent of the size of the ID project and should apply whether its developer is working alone or with other developers on a project with a single client or multiple clients. The metaphor must also be independent of the setting in which the ID work is done and thus should apply to ID in schools and universities, health services, business and industry, government, and the military.

Of the metaphors that have been suggested for evaluation, many apply best in situations in which the evaluator is the data gathering instrument. This method does not appeal to evaluators who are more quantitatively oriented. No single metaphor can completely capture all philosophical stances. Despite the demands placed on them by the breadth of the ID field, instructional developers should not despair of finding one or several metaphors that can help them form a better sense of identity as developers.

Examples of Metaphors

Given the power of metaphor, it is not surprising that several have already appeared in the ID literature. The referent for these existing metaphors is most often not the instructional developer but the educational technologist or media generalist. Because ID is usually classified as instructional technology, the applicability of these metaphors should be carefully considered. The first selection criterion is designed to prevent the misunderstandings that can result when the metaphor provides too much information about the referent.

Educational Engineer

This metaphor has its roots in an article by Charters (1945). Bern (1967), in his follow-up article suggests that the concept is perhaps a quarter-century older. Melton (1959) and Galser (1965) both use this term in predicting the development of a new professional specialty in education. A recent article by Lutz (1980) which calls for the "selection, training, and assignment of a cadre of professional educational engineers" (p. 357) reflects the persistence of the image. Does the instructional developer fill this role? Each of these authors offers a slightly different perspective.

The Charters metaphor parallels Lumsdaine's (1964) description of educational technology as a prescriptive science that applies behavioral psychology to instruction. Programmed instruction designers would fit this conception of the educational engineer, as would performance engineers as described by Gilbert (1978).

Using an odd collection of "data," Bern (1967) purports to prove the persuasiveness of the trained engineer in education. Electrical and industrial engineers are believed to have the skills required for using modern hardware in the design of "much needed control systems" for student minds (p. 235).

The project described by Lutz indicates a broader vision of the engineering metaphor. The team of educational engineers are variously labeled linking agents, problem solvers, and process generalists. "The collegial partnership of administrator, teacher, and educational engineer helps to identify district resources, analyze specific student needs, consider special conditions and influences pertinent to engineering changes, and resolve differences that could impede solutions" (Lutz, 1980, p. 357).

The outcomes mentioned range from curriculum guides and in-service teacher training to individualized student conferences and improved parent communication. In ID jargon, the team of engineers accomplished course development, faculty development, and alteration of organizational variables. The outcomes indicate that the activities of the professionals extended beyond the role definitions Lutz supplies. Rather than "making specific practical applications of knowledge gained by research" (p. 358), the engineers guided and facilitated the problem-solving process.

The engineering metaphor, then, breaks down when carried over to current instructional development practices. It cannot account for the variable human element so critical in development. Consultant-client interactions and student learning experiences defy prediction and control. The metaphor would have the educational engineer apply learning research to practical problems. What is unknown about human learning, however, so overshadows what is known that many prescribed applications of theory could as easily be wrong and harmful as right and helpful.

Architect

Moll and Kaufmann (1978) offer another metaphor, aimed specifically at ID. They parallel the work of a developer with an instructional client to that of an architect with a house-building client. This comparison highlights the service nature of development, the ultimate inviolability of the client's wishes, and the creative collaboration that occurs. An examination of the house-building process will illustrate the utility and the drawbacks of this metaphor.

Step 1. Finding the professional. The best selection of a professional is made by questioning those who have had experience with different developers. Without such contacts, developers are often hard to find. (Unlike architects,
developers are seldom listed in the Yellow Pages).

Step 2. Getting to know you. This "courtship" phase allows the architect to gather information needed to formulate a plan.

Step 3. What will the client do with it? Outcomes and special conditions are identified (e.g., in house building, the need to accommodate a billiards table; in ID, the need to provide laboratory experiences).

Step 4. Dream statements. The architect creates numerous alternatives for the client. After weighing the advantages and disadvantages, the client determines which arrangements suit his or her needs.

Step 5. Reality statements. The best arrangements are drawn up in a blueprint, and the expertise of various other professionals is used if appropriate. (In ID, these may be computer programmers, film librarians, measurement specialists.)

Step 6. Gathering. The builder replaces the architect and collects materials and fixtures that match the blueprint and the client's taste.

Step 7. Assembling. Materials are delivered. The architect is consulted when specific elements cannot be provided and substitutions must be made.

Step 8. Moving in. The house is "field-tested" with furniture and occupants. Inadequacies are noted.

Step 9. Remodeling. As families change, needs change, and modification of the house may be required. The client must decide whether to contact the original architect, find another architect, or attempt to remodel the house without assistance.

Step 10. Starting over again. The house is no longer adequate, and the client decides to build a new one.

Although the house-building metaphor provides an interesting view of the ID task, it is misleading in several ways. Throughout the metaphor, the goal of a "comfortable, homely fit of house to family" models the "comfortable teaching-learning situation." Most instructional development activities, however, require that instructional effectiveness be the primary consideration.

A second inappropriate aspect of this metaphor is that the architect always designs a product; the instructional developer does not. The architect automatically agrees that the client needs a new house because the client wants a new house. Most in-house instructional development agencies will not permit that assumption to be made. The metaphor assumes that the client would not find a satisfactory home by consulting a realtor. If certain family needs are common enough to support large subdivisions of similar homes, an existing construction design might be found to suit present needs. The approach of instructional developers also differs from that of most architects in that sometimes they determine at Step 2 that the project does not merit the effort involved and suggest terminating the relationship.

The house-building metaphor is probably useful for describing the kind of "off-the-shelf" ID process most teacher clients would engage in with a district curriculum designer; however, it does not apply as well to other settings. This example clearly demonstrates how metaphors used in instructional development can restrict understanding as easily as they can improve it.

Craftsmaker

Mager (Note 1) uses a metaphor to describe the instructional technologist as a craftsman who brings power to instruction through skillful analysis and sensitive application of technique. The dictionary defines a craft as a skill in planning, making, or executing that combines manual dexterity (i.e., technical expertise) with artistic ability.

A potter or wood-carver possesses several specialized skills that are applied in various combinations to create a unique product. The artistic judgment of the craftsman is used as the technical tools and skills are brought to bear on the lump of clay or block of wood. The final results are determined entirely by the craftsman, limited only by his or her skill and imagination.

Fleip (1967) has also used this metaphor in discussing the development and application of computer-assisted instruction. In an interesting way, he extends the analogy to the learner as well. Through hands-on experience with equipment in a process that provides immediate feedback and alters direction as the result of the learner's actions, the learner "creates his own instructional 'work of art' from start to finish, as did the craftsmen of old with their products" (Fleip, 1967, p. 104).

Few would argue against viewing the instructional developer as both technician and artisan. This combination describes experienced developers as well as professionals who are successful in other fields, such as managers (who combine task and people concerns) and musicians (who combine technique and expression). Craftsmen, like architects, are product-oriented, however, and the nature of the work encourages them to work alone, rather than in teams. Seldom do craftsmen work in close collaboration with a client. The metaphor thus conveys a rather isolated role for the instructional developer, one that is not congruent with current thinking (Swen, Leitzman, Misanchuk, & Foshay, 1979).

The three metaphors presented all concentrate on the behavior of the instructional developer, not on the ID process. They attempt to capture the kinds of things the person does and the roles that are adopted. Effective metaphors for evaluation focus on the actual process, not the people.

Biological System

Gustafson (Note 2) found the use of a metaphor helpful in formulating an early definition of the field of instructional development. He suggests viewing ID as a system comparable to a biological system. He points to the interdependence of elements in the system, the simultaneous progression of numerous functions (as opposed to a linear process), and the transfer of information from one element to another. Many useful insights into the ID process become immediately evident through this metaphor; the dynamic nature of development, the unpredictability of environmental intervention, and the naturalness and inevitability of "death," or obsolescence. This image encourages reflection and holds much more meaning than can be elaborated on here.

Although the biological system metaphor holds promise as an exploratory tool within the discipline, it would not mean much to one who was unfamiliar with the purposes and practices of ID. This weakness indicates that function should be a fourth criterion for judging the utility of a metaphor. Metaphors for exploration may or may not serve as metaphors for explanation.

New Metaphors

The four metaphors presented (engineering, house building, craft-
making and biological system) probably do not exhaust those present in the ID literature. Metaphors are not easy to find, yet they seem to appear when least expected. The power and utility of metaphors make them worth uncovering, but only if they are then used consciously and cautiously. Sensitivity to the quality of ID metaphors greatly enhances their potential contribution to the profession.

This article would be incomplete without some new metaphors with which to expand the repertoire. The following are presented in an attempt to demonstrate the diversity of possibilities. The reader is encouraged to mercilessly apply the criteria and guidelines outlined above in establishing the merit of each metaphor. Two of the metaphors presented attempt to describe the ID process and to picture the developer's role.

Gustafson's biology metaphor might be extended much further by likening the ID process to enzymatic biochemical reactions. Enzymes are proteins generated by the body that initiate and moderate certain kinds of vital chemical functions. They often act as catalysts: they speed up an inefficient reaction without affecting its essential nature or products. Enzymes are known to be useless under conditions that deviate too much from normal body states; extremes of environmental variables have a disabling effect on the process.

One could also compare ID to choreographing a new ballet—deciding on the movements and their sequence, preparing the dancers, and coordinating costumers, set designers, and musicians. The success of instructional development activities explained with a ballet metaphor would be determined through evaluation conceived of as artistic criticism.

A possible metaphor for the developer's role is legal counseling. As often occurs in instructional development, the events that precipitate the encounter with the lawyer influence the direction of the outcomes. At the client's request, the legal expert may draw up a will or contract, represent the client's interests in dealings with others, or explain applicable rules and practices to enable the client to make a more informed choice of a course of action.

Perhaps the work of an instructional developer may most usefully be compared to that of a plumbing contractor, who is likely to be a system designer today, system analyst tomorrow, and system repair person the next day. In plumbing, as in education, poor functioning is seldom noticed until the system comes to a halt. It is the plumber's job to locate the snag, remove it, and try to prevent a recurrence by redesigning the transport system or re-educating the users. The plumber might also help create and install a new system for a subdivision or modify an existing single residence to accommodate a new water-softening unit.

The value of metaphor for explaining and exploring the field of instructional development should not be judged by the success of these or any other specific metaphors the reader may have encountered. The potential can hardly be tapped by the uncritical efforts of a few authors. As suggested earlier, the search may end with several solutions rather than one all-inclusive metaphor. The purpose of using the metaphor is to amplify and understand the instructional development profession and those who practice it, with the hope of aiding its growth.

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Reference Notes


Incorporating Experimental Research into the Instructional Development Process: A Study of Psychomotor Practice in a Mediated Instructional Program

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Abstract. Two versions of an instructional program designed to teach student nurses to perform intravenous infusions—a no-practice version and a more costly version involving individual practice with simulated arms—were developed using systematic development procedures. Effectiveness of the two versions was compared during field testing in two separate research studies, one conducted with students who had had prior training on a task (venipuncture) with several similarities to an infusion and one with students with no such prior training. In both studies, students using each version attained mean posttest scores above 80% in performing the infusion on a live subject and near 90% on the cognitive test. Surprisingly, there were no significant differences in effectiveness of the practice and no-practice versions in either study. The results indicate that experimental research incorporated into the development process can yield valuable information that enables program developers to make informed, data-based decisions about potential components of an instructional program.

The concepts of “research” and “development” are linked very closely in education, as in many other fields. Educators typically think of research and development in education either as a single field or as two closely related fields. While a close relationship between educational development and research certainly seems to be highly desirable, this relationship is seldom reflected in the actual process of developing an instructional program. Experimental research is not included as an explicit component of the development process in most models or systems of instructional development (e.g., Gagne and Briggs, 1979; Merrill and Tennyson, 1977; Popham and Baker, 1971), and there are few reports in the professional literature of experimental investigations conducted as a part of the development of a new instructional program. The low incidence of experimental research during development of instructional programs is somewhat surprising in view of the difficult decisions that instructional developers must often make about which of two or more instructional procedures or types of materials will work best in the program they are developing.

The present project involved development and field testing of an instructional program and incorporation of two experimental research studies as part of the development process. The instructional program was developed to teach student nurses the psychomotor skills of starting and discontinuing an intravenous infusion. The program was intended for regular use in a clinical laboratory setting as a part of an undergraduate nursing curriculum at the university level. The research studies were designed to determine which of two versions of the instructional program, one version of which was relatively costly, was most effective with students from the population of intended users.

Administering an intravenous infusion involves both cognitive and motor aspects. Student nurses cannot be provided with repeated practice of the psychomotor skills on live subjects, of course, because it is impractical and unsafe. Realistic simulated practice can be provided using plastic injectable training arms which are very similar to real human arms, but the simulated arms are costly (about $400 each) and additional learning and instructor time is required for the practice.

Because of the cost of the materials for providing psychomotor practice, the instructional designers made the decision to develop the program in two versions that could be compared experimentally during program tryouts. One version did not include psychomotor practice and was therefore relatively inexpensive. This version was designed to provide a considerable amount of exposure and focused training related to the criterion tasks and to be as effective as possible without providing psychomotor practice. It included two components, an instructional videotape and a live demonstration by the instructor, designed to portray realistically the step-by-step procedures for performing the criterion task. The psychomotor practice version of the program incorporated the entire no-practice version, plus individual practice of the intravenous infusion procedure with a simulated arm.

The effectiveness of the psychomotor practice and no-practice versions of the program were compared in two experimental research studies. The instructional materials and procedures for the two versions of the program had been formulated and developed using the instructional development procedures described by Sullivan (1971). The experimental investigations of the comparative effectiveness of the
two versions were incorporated into the field testing stage in the instructional development process. The field testing and associated research were conducted with student nurses representative of the population of intended users. Two criteria were used to assess student learning from the program: (1) performance on a paper-and-pencil test covering the procedures for an intravenous infusion and (2) performance in actually setting up and discontinuing an intravenous infusion on a live subject.

### Instructional Program

The instructional program was designed to be administered by a qualified nursing instructor and to be used with professional nursing students as a part of their nursing curriculum. The instructional objectives for the program are that the student will successfully (1) start and (2) discontinue an intravenous infusion on a live subject.

The two versions of the program consisted of coordinated sets of materials and procedures developed expressly for the program and designed to produce student attainment of the instructional objectives. The components described below were identical for both versions.

- A single-spaced, seven-page, 8 1/2 x 11" booklet consisting of a task-by-task description of the procedures for starting and discontinuing an intravenous infusion. Included at appropriate points throughout the text in the booklet were illustrations of specific steps in the procedures.
- A checklist summarizing in sequence each step for starting and discontinuing an infusion.
- A 10-minute color instructional videotape demonstrating the entire process of starting and discontinuing an infusion on a live subject. The infusion procedures demonstrated in the videotape were identical to those described in the booklet and summarized in the checklist.
- A live demonstration of the intravenous infusion process performed by the laboratory instructor using a simulated arm.

Psychomotor practice in starting and discontinuing an infusion was included in the practice version of the program but not in the no-practice version. Each subject in the practice version was given a simulated arm and a set of materials needed for starting and discontinuing an infusion (needle, tubing, fluid, tourniquet, tape, etc.). The student then individually practiced the intravenous infusion process, with each student using a simulated arm, for 15 minutes under instructor supervision in regular clinical groups of five to eight trainees. Except for this component in the practice version only, the two versions of the program were identical.

### Study 1

**Method**

**Subjects.** The subjects were 40 upper division nursing students in the third semester of the undergraduate nursing program at Arizona State University. The subjects had no prior experience in starting or discontinuing intravenous infusions. They had been trained earlier in the semester in the skill of drawing blood through venipuncture, a skill which entails several procedures that are somewhat similar to the intravenous infusion procedures.

**Instructional Materials.** The instructional materials used in the study were the materials comprising the instructional program as described earlier—in the instructor's guide, the illustrated booklet describing the step-by-step procedures for an intravenous infusion, the checklist summarizing the procedures, and the 10-minute color videotape demonstrating the procedures for an infusion on a live subject. Also included for the groups in the psychomotor practice version was a simulated arm for each subject and the materials required for performing the infusion procedure.

**Procedures.** Six regular clinical groups composed of six to eight students each and comprising the total of 40 subjects were randomly assigned to the two versions of the program. The booklet and checklist on starting and discontinuing an infusion were distributed to all students at the regular class session preceding the laboratory session in which the remaining components of the program were administered. Students were instructed to study the booklet and checklist and to learn their content prior to the laboratory session. Self-report data on a questionnaire administered at the end of the study indicated that students in each version of the program spent an average of 30-40 minutes studying these materials.

Each clinical group participated in its own regularly scheduled 90-minute laboratory session attended only by members of that group. At the beginning of the session, the videotape was shown to the group. Following the showing of the videotape, the laboratory instructor gave a demonstration of the infusion procedure using a simulated arm. The instruction was completed at this point for the no-practice groups. Each student in the psychomotor practice version was provided a simulated arm and materials at this point. The students in the practice version then received 15 minutes of practice with the simulated arms, supervised by the laboratory instructor.

The criterion measures described below were administered to each group immediately after the students had completed their version of the program—that is, to each no-practice group after the demonstration by the laboratory instructor and to each practice group after psychomotor practice with the simulated arms.

**Criterion Measures.** Two performance measures and an attitude inventory were employed in the study. These measures were administered after the instructional portion of the program in the order that they are described below.

The multiple-choice posttest was an 18-item test consisting of four-choice items assessing student knowledge related to the intravenous infusion procedure. The items, which were derived directly from information in the instructional booklet and videotape, covered the component skills for starting and discontinuing an infusion.

Student performance in actually setting up and discontinuing an infusion on a live subject was assessed by having each student perform the process one time from beginning to end on a laboratory partner. Each student was given the set of materials needed for starting and discontinuing an infusion (needle, fluid, tourniquet, etc.). The student's performance in starting and discontinuing the infusion was
evaluated individually by one of two evaluators, both of whom were experienced registered nurses. The two evaluators had been given detailed prior training, designed to yield consistency in the evaluation process and had been directed to intervene at any point in the process if the safety of the student on whom the procedure was being performed was in question. Using a checklist, the evaluator assigned a "yes or no" rating to each student's performance on each of 18 subskills comprising the entire procedure, resulting in a maximum score of 18 on performance of an actual infusion on a live subject. The evaluators were summoned to the laboratory after the instruction was completed so that they would not know which program version the students had completed. Interrater reliability for the two evaluators, computed on their independent step-by-step ratings of the performance of each individual in a clinical laboratory group not included in the study, was .88.

The attitude questionnaire administered at the conclusion of the laboratory session consisted of eight Likert-type items, rated on a five-choice scale from "strongly agree" to "strongly disagree," and three open-ended questions. The questionnaire was designed primarily to assess student attitudes toward each version of the instructional program. Items were identical on the questionnaire for each group with the intentional exception of the item dealing with practice on a simulated arm. The wording of this item for the psychomotor practice groups was "Practice on a simulated arm increased my ability to perform the skill." For the no-practice groups, the words "would have" were inserted before "increased my ability..." Students also were asked on this questionnaire to report the amount of time they spent studying the instructional booklet.

<table>
<thead>
<tr>
<th>Criteria Measure</th>
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<tr>
<td></td>
<td>Psychomotor Practice</td>
<td>No Practice</td>
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<td></td>
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<tr>
<td>Written Posttest</td>
<td>16.6 (92%)</td>
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<td>16.25 (90%)</td>
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<tr>
<td>Performance Test</td>
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NOTE: Maximum score on each measure is 18. N = 20 subjects in each program version.

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NOTE: Maximum score on each measure is 18. N = 20 subjects in each program version.

Data analysis. Mean scores were computed by program version on both the 18-item multiple-choice posttest and the performance of the infusion procedure on a live subject. The mean scores on the posttest and on the infusion procedure were analyzed independently for differences between the two groups using two separate analyses of variance.

Results

The mean scores by program version on the 18-item multiple-choice posttest and on performance of the intravenous infusion procedure are shown in Table 1. It can be seen from the table that there were only very minor differences in scores between the two groups. The mean scores on the written posttest were 16.6 items correct (92 percent) for students using the psychomotor practice version and 15.9 items correct (88 percent) for students in the no-practice version. The mean scores on the infusion performance test were 14.8 of 18 possible (82 percent) for the psychomotor practice subjects and 15.0 (83 percent) for subjects in the no-practice version. As was to be expected from the small observed between-group differences in mean scores, neither the difference between the two groups on the written posttest nor on the performance test was statistically significant.

Responses to the attitude questionnaire revealed highly positive attitudes toward the instruction from both groups. On the seven five-choice items that were identical for both groups, the mean scores were 4.64 (5.0 = most positive, i.e., subject marked "strongly agree" response choice for positive statements) for the practice group and 4.59 for the no-practice group. The one questionnaire item which was slightly different in wording for the two groups was the only item on which the response pattern differed appreciably between the groups. Twelve of the 20 subjects (60 percent) in the psychomotor practice group indicated strong agreement with the statement that "Practice on the simulated arm increased my ability to perform the skill," and 18 subjects in this group (90 percent) indicated either strong agreement or agreement. In the no-practice group, only four subjects (20 percent) indicated strong agreement that practice would have increased their ability to perform the skill, and only 11 (55 percent) indicated either strong agreement or agreement with the statement.

Study 2

It had been expected that the psychomotor practice version of the program would yield significantly better performance in Study 1 than the no-practice version, at least on the criterion task that required actual performance of an intravenous infusion on a live subject. One possible explanation for the lack of a significant difference between the practice and no-practice groups on this task was related to the prior experience of the subjects. Subjects had been trained earlier in the semester in drawing blood through venipuncture. It seemed plausible that there may have been a positive transfer effect from this procedure, which has several similarities to an intravenous infusion, that could have contributed to the performance of the no-practice group and offset the potential effects of psychomotor practice of the infusion process.
Because of the unexpected results from Study 1 and the possibility that they were related to the subjects' prior experience with venipuncture, a second study was planned. This study was conducted with subjects, who had no prior experience with venipuncture.

**Method**

Subjects for Study 2 were 34 nursing students in the same semester of the same program as the subjects in Study 1. The subjects in Study 2 followed a sequence through the curriculum that was slightly different from the sequence for the students in Study 1. Unlike the Study 1 subjects, they had had no prior experience with venipuncture or with any other procedures having similarities to intravenous infusion.

Due to the slightly smaller number of subjects in the Study 2 group (34 as compared to 40 in Study 1), the size of the regular clinical groups was five to seven students, instead of six to eight as in the earlier study. The number of subjects in each version of the program, was determined through random assignment of the regular clinical groups, with 15 in the psychomotor practice version and 19 in the no-practice version.

All procedures for Study 2 were identical to those in Study 1. The only differences in method between the two studies were the differences in prior experience and numbers of subjects described above. Self-report data on the questionnaire administered at the end of the study indicated that the students in each version spent an average of 30-40 minutes studying the booklet and checklist prior to the laboratory sessions.

**Results**

The mean scores for Study 2 by program version on the 18-item posttest and on performance of the intravenous infusion procedure are shown in Table 2. Again, there was very little difference between the mean scores of subjects in the two program versions. On the written posttest, the mean scores of both groups were identical, 16.3 correct out of 18 (91 percent). The mean scores on the infusion performance test were 15.7 (87 percent) for the practice group and 14.6 (81 percent) for the no-practice group. This difference did not approach statistical significance.

Responses to the attitude questionnaire again were highly positive for both groups. The mean scores on the seven items, that were identical for the two groups were 4.51 for the psychomotor practice group and 4.48 for the no-practice group. A similar pattern to Study 1 also occurred on the item dealing with practice on a simulated arm. Ten of the 13 subjects (77 percent) who completed this item from the psychomotor practice group indicated that they strongly agreed that practice with the simulated arm increased their ability to perform an infusion, whereas only four of the 19 students (21 percent) from the no-practice group strongly agreed that such practice would have increased their ability.

**Discussion**

The present development and research effort was conducted to (1) develop an instructional program to teach professional nursing students to perform an intravenous infusion on a live subject and (2) to determine the relative effectiveness of two versions of the program that differed markedly in cost. The overall results served to validate the effectiveness of both versions of the instructional program, one with simulated psychomotor practice and one without, and to indicate that the two versions were about equally effective. Across the two studies conducted to compare the two versions of the instructional program, subjects under each version attained mean written posttest scores near 90 percent—91 percent for the practice group and 89 percent for the no-practice groups. Mean scores across the two studies on performing an intravenous infusion on a live subject exceeded 80 percent for each of the two program versions—84 percent for students in the psychomotor practice groups and 82 percent for those in the no-practice groups. Students under each version indicated highly positive attitudes toward their particular instructional program.

The two experimental research studies incorporated into the field testing provided data that were very useful to the program developers and to instructors who planned to use the program. It had been expected that, at least for the criterion measure involving actual performance of an infusion, the version that included psychomotor practice with a simulated arm would be more effective than the no-practice version. Yet, scores on the performance measures were not significantly higher for students in the psychomotor practice version than those in the no-practice version, even when students had had no prior clinical experience that was remotely similar to performing an intravenous infusion. Based on the results of the two studies, the no-practice version of the program was selected for use in the regular undergraduate nursing curriculum at Arizona State University. With a maximum clinical group size of eight students, the initial cost of materials for the psychomotor practice version is

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**Table 2. Mean Scores for Study 2 by Program Version**

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**NOTE:** Maximum score on each measure is 18. N = 15 in psychomotor practice version and 19 in no-practice version.
about $3000 more than for the no-practice version. In the opinion of the program developers and clinical laboratory instructors, the slight, statistically unreliable, differences in performance associated with use of the psychomotor practice version did not justify the additional cost of using this more expensive version in the regular curriculum.

The negligible effect of the psychomotor practice is undoubtedly due in part to the general effectiveness of the non-practice components of the instructional program, as indicated by the performance scores of 89 percent on the written posttest and 82 percent on the actual infusion process for subjects in the no-practice version. The non-practice instructional components—the booklet, checklist, videotape, and live demonstration—were intentionally designed to provide highly relevant training, but no psychomotor practice on the criterion tasks. Apparently, practice in performing an intravenous infusion with a simulated arm, at least in the amount that could feasibly be provided in the present laboratory setting, is not enough to produce a significant improvement in cognitive knowledge or actual performance over these combined non-practice components. In view of this finding, students in the no-practice version showed considerable insight when they generally did not indicate strong agreement with the statement on the attitude questionnaire that "Practice on a simulated arm would have increased my ability to perform the (intravenous infusion) skill."

The incorporation of experimental research into the development of an instructional program has generally been overlooked as a means for determining the final form of the program, both in models of instructional development and in the actual practice of development. Often, however, adequate information is not available to enable program developers to make decisions with confidence about which of two or more types of materials or sets of instructional procedures will be more effective, even in the case of material or activities that may vary considerably in cost and/or learner time required. As the present studies indicate, experimental comparisons of alternative materials and procedures during the development process can yield information that enables program developers and users to make informed, data-based decisions about the potential components of a program.

Two closely related recommendations, therefore, seem well justified. One is that, in the process of formulating and developing an instructional program, the developers should intentionally consider feasible variations in the program and the desirability of investigating the effects of the variations. The second is that an explicit reference to experimental research on the effects of alternative materials and procedures in an instructional program should be incorporated into models of instructional development as an optional step in the development process.

References


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Professor of Educational Technology
San Diego State University
San Diego, California 92182-0311

The book review section is the second place I turn upon receiving a professional journal. (The first place is the Table of Contents.) I've asked some colleagues, and they share similar dependence on book reviews. How else can we find out what new trade and textbooks are available? Where else can we look for description and evaluation of professional and student development materials? In what other spot in the journal might opinion and subject matter be neatly woven and presented?

I'd like to ask BJR readers to participate in making this section very appealing and useful. Contact me if you'd like to be a reviewer. Let me know what books you'd like to have reviewed. Suggest a new slant on the way we do reviews. Comment on the reviews that have appeared in the Journal.

The book reviews in this issue are informative and disparate. Drs. Hearold and Braden tell us about Leslie Briggs' and Walter W. Wager's Handbook of Procedures for the Design of Instruction. They offer detailed, fully explicated opinions about the Handbook, opinions which are very different and intriguing.


Every now and then a special book comes along. I'm not talking about just another good book. After all, in every season some new books are better than others. No, I mean a special book. A book that will endure. A book that will be well received immediately, well known quickly, and well used eventually. Such a book is Briggs and Wager's Handbook of Procedures for the Design of Instruction (Second Edition). As the title implies, this is a book about instructional design. As the title does not imply, this is both textbook and workbook, and it is very different in form and content from Briggs' 1970 work of the same name. This so-called handbook contains a wealth of information about many things, but the content is not necessarily assembled for easy reference as one would expect of a true handbook. Printed on 8-1/2 x 11 tear-out pages, the contents are assembled in a paperback that has blanks and spaces for student written responses. In other words, Briggs and Wager have produced a first edition of a (mostly) new textbook-workbook (not a handbook) that has been very carefully designed to be used by the students and teachers of instructional design.

The Handbook was written to be the focal point of a design skills graduate course, taught to a group, using a "workshop" atmosphere. To achieve that purpose, the authors offer a complete organized package of philosophy, theory and procedures for the aspiring instructional designer. The book does not have a single major thesis, but rather unfolds a complex system of interrelated ideas about learning, learners, instruction, and instructors. Importantly, the theoretical framework is systematic and intellectual consistent. The purpose and the target reader are never forgotten by the authors.

How good is this book as a textbook? That isn't a question that this reviewer can answer with certainty. Only a teacher or a student who has a wide frame of reference and who has used this book in an attempt to teach or to learn instructional design could answer that question. Even then the answer would be contaminated unless the user had followed the unlikely practice of using the book exactly as it was intended to be used by its authors. Then the question would become: How good are Briggs and Wager as teachers? Faced with the revised question this reviewer could only go to his list of superlatives and speculate.

Instead, a more useful approach might be to point out that as a textbook this contribution by Briggs and Wager has much to commend it. The Handbook is part of a larger body of interrelated material that as a unifying thread. It is organized for sequential development of the topic. It is chunked and chaptered for easy adaptation to either a quarter-length (10 weeks) or semester-length (15 weeks) course. It is written so that the internal format of the chapters follows a pattern to facilitate learning. It identifies easily accessible outside reading assignments, and even provides tests over the information it contains. The Handbook, in other words, is designed to be used as a textbook. The curriculum decisions are already made and the course has been mapped. The book is its own best example of the Briggs and Wager system of instructional design.

In a sense, the contents are eclectic. Most of the concepts have been drawn as bits and pieces from earlier work and refined for use in this context. Some of the main topics, contentions, and special attractions of the book are: stages of design, the six level model for top-down instructional design, five types of needs and 17 steps for needs assessment, alternate delivery systems, domains and sub-domains of learning outcomes, inter-domain relationships, five-component objectives, instructional curriculum maps, media selection via matrix or by using a 14 step procedure, an outline of formative
evaluation procedures, and a variety of forms and worksheets to help keep the instructional designer organized.

Usually it is unfair to criticize a book for what it is not. This time the reviewer wishes to make a brief exception. The greatest strength of the book—its relationship to a body of supportive literature written by Briggs, Gagné, Kaufman, and English—is also the book’s major shortcoming. Bluntly, the Handbook of Procedures for the Design of Instruction is incomplete. There is no reasonable alternative which facilitates using the Handbook without the four cited supplementary texts. Thus, the novice instructional designer may find that a frustrating road lies ahead learning “How to Do It” (a well used Briggs and Wager sub-title) without a full set of the recommended references. This is not merely an imaginary shortcoming. For one thing, there is a full vocabulary of jargon which has been generated by the Gagné-Briggs school. Unsuspecting students who have never previously trod the Florida State path of educational psychology need a set of operational definitions. It isn’t that the definitions don’t exist. They do—in the glossary of Briggs’ earlier book Instructional Design: Principles and Applications. Similarly, only passing reference is made to conditions of learning because “Gagné has devoted an entire book to this subject.” Considering that the concepts related to conditions of learning are critical to the procedures of the Handbook, a more appropriate course might have been to give as much explanation as students need for understanding. Let’s get my small criticism into perspective: This is a memorable book, a useful book, maybe even a classic book in its field. Even so, it would have been better with its own glossary and all of its own basic explanations.

When it is suggested that this may be (or may become) a classic in its field, some explanation is due. First, there are only a very few books, recent or ancient, that have ever been written to help somebody do the things that go into instructional design. Of a rare breed, the Handbook is the latest, the intellectually strongest, and in many other ways the best of the species. Whether one ascribes philosophically to the underpinnings of information-processing theory or procedurally to the mechanistic approach as exemplified in this work is unimportant in this context. The theory and the approach are well established and their future pre-eminent advocate may well be this volume. Try it, you might like it.

Leslie J. Briggs is an internationally known psychologist and a professor of instructional design at Florida State University. His Ph.D. is from Ohio State and he has had a distinguished career with industry, the military and the academic world. His co-author, Walter W. Wager, is also widely known and a member of the faculty at Florida State. Wager’s Ed.D. is from Indiana University. He has been active in the ID field for the past decade and is a frequent author of provocative and insightful articles of interest to instructional developers. Together Wager and Briggs are a formidable writing team. We can only hope that they will continue to collaborate.—Reviewed by Roberts A. Braden, Instructional Developer, Virginia Tech, Blacksburg, VA 24061.

Handbook of Procedures for the Design of Instruction, by Briggs and Wager.

The adage that a half-filled glass may be viewed optimistically as half full or pessimistically as half empty applies to the evaluation of this book. Were the Handbook of Procedures for the Design of Instruction (Second Edition) by Briggs and Wager a first edition, prematurely published to meet an urgent need for instructional materials in the infancy of instructional design courses, I would be inclined to see its fullness. However, the senior author has had almost ten years to reflect on his initial work. During these years the field has passed into relative maturity warranting a fully developed textbook—a textbook that lives up to the instructional presentation prescribed in its own pages. My comments reflect the pessimistic view that we have been given a half empty book.

The Handbook is Not a Handbook

My initial negative response was engendered by the book’s misleading title. The potential user is lead to expect a handbook—a compact reference manual, guidebook—of instructional design procedures. I would suggest that “workbook” more accurately reflects the contents and context of this book. Most of the chapters include a list of recommended readings, an introduction, an information test (which doubles as information-level objectives), a list of performance objectives, background, how-to-do-it explanations, examples, exercises and exercise answer keys. Every page is perforated for easy removal to turn in as homework. The Handbook is not indexed or organized for quick referencing and much information is omitted because the authors send the students to read three companion texts. A workbook may not be less valuable than a handbook, but it connotes different purposes, content and users. The Handbook can only be a disappointment to the professional in the field expecting to purchase a comprehensive reference manual. The Handbook’s rightful place is as a supplemental workbook in a first course in instructional design. The Handbook must be supplemented by both an instructor and other texts. An instructor is required to provide feedback to the student on how well the performance objectives are completed. Three additional textbooks are necessary to obtain a complete instructional program. The texts are Briggs’ Instructional Design: Principles and Applications, Robert Gagné’s The Conditions of Learning, and Principles of Instructional Design, Second Edition, by Gagné and Briggs. The three companion texts cost $19.95, $14.95, and $15.95, raising the cost of materials for the program to over $70.00.

Limitations of the Instructional Presentation

When evaluating the Handbook as a workbook, my expectation of a model product was quickly dashed. I expected that the instructional components—e.g., objectives, examples, exercises—would be consistently and appropriately provided. They are not. I also expected that the relative emphasis and comprehensiveness of topic coverage would be appropriate and adequate. They are not.

Completeness of instructional components. The fifteen step ISD model subscribed to by the authors is presented in eleven chapters and decomposed into thirty performance objectives. Two chapters have no performance objectives. Complete examples of the performance objectives are provided in seven chapters, two
chapters have incomplete examples, and one has no examples. There are eleven exercises. Three chapters, with a total of seventeen performance objectives, have no exercises. Four exercises are practice of performance objectives, six are practice of enabling skills, and one exercise is information recall. Answers are provided for all exercises although with no or little elaboration to clarify how the answer was obtained or why it is correct. There is only one criteria checklist.

**Appropriateness of instructional components.** To know what the information-level objectives are for each chapter, one must read an incomplete statement or a direct question and then flip to the back of the *Handbook* to complete the thought. For example, one objective/item for the chapter on designing lessons and materials is:

- The function of teachers as well as print and non-print media is to provide the relevant .......... of .......... and .......... of ..........

I find this unsatisfactory as either a lesson objective or a test item. It is ambiguous, it is text specific, and it requires the student to restate only a specific fact rather than to summarize meaningful or substantive learning. If the reader completes the page of objectives in the chapter and tears it out as an assignment, the objectives are no longer available in the *Handbook*: the stem of the item is not repeated on the answer page. But who would want to turn in information-level assignments which involve the regurgitation of facts stated in the text? As a junior high student I was annoyed by such assignments. As a university student I would have been appalled.

In the chapter titled “Determining Needs, Goals, Priorities,” two sets of steps for conducting needs assessment are followed by two examples. Neither example illustrates either of the steps which had been taught. Rather they are examples of much less formal approaches to needs assessment. How can we condone this lack of congruence between content and example?

**Comprehensiveness of instructional content.** The most completely developed chapters are on writing objectives, organizing the course, organizing the unit, organizing the lesson, and selecting media. If the reader subscribes to the authors’ models for these activities, the student examples, worksheets, and exercises should prove useful. The authors introduce the chapter on teacher training, summative evaluation and diffusion with a realistic qualifier—they are not attempting to provide skills, but rather “merely to describe the purpose of these three functions to complete our account of the total instructional design process” (p. 206). This more modest goal would have been appropriate for the chapters on determining needs, student assessment and formative evaluation as well. There is not sufficient substance to the *Handbook* to allow the reader to complete the performance objectives in these chapters.

The most deleterious omission is in chapter on design. Most designers would agree that the heart of the ISD process is the actual step of designing the lessons and materials. That the three recommended readings devote three, seven, and nine chapters to this topic supports this belief. In the *Handbook*, lesson design is covered in a single 26 page chapter, most of which is devoted to media selection. The authors purposefully did not discuss the conditions of learning, or in other words, how the eleven types of learner capabilities (e.g., discrimination, rule using, recall facts) translate into instructional strategies. The authors state “one reason for the omission of a presentation on conditions of learning is simply that Gagné (1977) has devoted an entire book to this subject...” (p.153). In contrast, essentially two chapters are devoted to media selection. Rationally, emphasis should be determined by importance and difficulty. In 1980 Briggs wrote:

> My conclusion is that within limits it is how the media are scripted that determines the success of the training. That is, as long as one avoids an obviously inappropriate medium, such as giving a printed text to learners who cannot read or a picture to a blind learner, the strategy built into the medium is more important than the medium per se. (p. 48)

Briggs continued that teachers can easily accept and recognize the concept of instructional events, but “the more complex matter of incorporating the appropriate conditions of learning into each event seems more difficult for them to grasp” (p. 49). Given the difficulty of the skill, a simplified systematic presentation of the conditions of learning in the *Handbook* would seem to be warranted.

**Limitations of the Instructional Design Model**

So far I have accepted as “given” the ISD model that the authors are teaching. Certainly a user of the *Handbook* should endorse their approach. The appropriate components of a behavioral objective is one area in which we disagree.

The authors prescribe a five component behavior objective (composed of situation, capability, object, action, and tools/constituents) rather than a simpler one, such as Robert Mager’s three component objective of conditions, standards, and behavior. Their examples of situation and tool/constituents are not mutually exclusive. The idea of more precisely specifying conditions seems sound; however, I would consolidate conditions and tools/constituents, specifying that when creating this component, the conditions of time, tools, assistance, and location should be considered. I agree with the authors’ decision to omit standards as a part of the object; but I omit standards for the same reason I would omit the component called “action.” Both refer to how the behavior will be assessed, and testing should be addressed separately from the learning objective. The authors state that the typical action verb for a fact is “in writing.” Do we really want the student to be able to reproduce a fact only in writing? Aren’t we hoping, even expecting, that the fact can be stated orally or in writing? If not, then asking students to answer questions orally in class is not appropriate practice or reinforcement for the objective.

I feel that the purpose of an objective is to enlighten the students about the knowledge and skill they are to acquire and to direct the development of the instructional strategies and materials. The limitations placed on assessing competence should be dealt with separately and can be so conveyed to the student. Otherwise, if we are to be consistent, we will be reduced to teaching only to the format that we can test. Given the forty pages devoted to writing five-component objectives, it is ironical that none of the objectives provided for the user of the *Handbook* follows the authors’ prescriptions.
An important topic which is ignored in the Handbook and the authors' ISD model is the acquisition of new subject matter. The assumption seems to be that the instructional designer is a content expert, an unrealistic situation for most instructional developers. How to acquire knowledge from subject matter experts, observation, and manuals should be considered a critical skill for instructional designers (see Bratton, 1981; and Wallington, 1981). Its omission leaves the students of the Handbook unprepared for completing many instructional design jobs.

Summary

The Handbook is a workbook to accompany an earlier textbook by the senior author. It has some useful examples, worksheets, and exercises for learning selected components of the authors' ISD model. However, it is comprehensive neither in content nor instructional components. At $20.95, it is an expensive workbook. My major criticism of the Handbook stems from the inconsistency between the espoused instructional model and the materials provided, based on the premise that we cannot teach effectively what we do not model in our own work.—Reviewed by Susan Ihearold, Navy Personnel Research and Development Center, San Diego, California 92132.

References


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This three-faceted investigation included a critical analysis of Witkin's conceptualization of cognitive style gleaned from his field dependence/field independence continuum, identified cognitive style components within the instructional development literature, and constructed a paradigm of the intersections and commonalities between the instructional development and field dependence/field independence literatures. Witkin's research was reviewed, as well as the research delineating cognitive style aspects of instructional development. A paradigm linking field dependence/field independence and instructional development was then constructed. It was concluded that (a) instructional development can optimize concept learning; (b) instructional treatment can be specifically designed to match the cognitive style learning trait of students so as to produce significantly greater concept learning than when such design and matching do not occur; (c) field independent persons are generally superior in learning achievement to field dependent persons; (d) field dependent persons are more likely to use external social frames of reference; and (e) the development of cognitive restructuring skills can be fostered by appropriate educational effort. A list of references is attached.—Microfiche 91*, paper copy $3.65 plus shipping as document ED 196-421.


The functional typology of verbal instructional tasks for advanced classroom instruction and inservice training which is described and illustrated is based upon functional definitions of elementary and conceptual behavior, and incorporates the kinds of goals and objectives that surveys and research have shown to be important for experienced learners within B. F. Skinner's verbal classification system. Procedures for selecting proficiency criteria for tasks in the typology are described, and the advantages presented by current schemes for classifying objectives are discussed as well as the problems. Also reported are a series of validation studies in which ten subjects read a subsection of an instructional program designed to teach the typology and classified 20 tasks taken from various sources. It was found that high agreement was attained between typology designer and subjects' classification of tasks after a short training session, and that subjects were unable to list any objective that could not be classified in the typology. The data are discussed in terms of subsequent improvement of the typology and program, future validation studies, standardization of instructional research and practice, implications for research on transfer of control across classes of verbal behavior, implications for research on building fluency of adult behavior, and efficiency in instructional design.—Microfiche 91*, paper copy $3.65 plus shipping as document ED 197-334.

Computer-Managed Instruction in the Navy: I. Research Background and Status, Nick Van Mante. San Diego,
This computer managed instruction system operated by the Navy involves approximately 9,000 students per day in ten technical training schools, and the research and development effort described was carried out to ensure that it would be the most cost-effective and productive technical training system. Major system problems were identified and suitable research proposals were developed through a four-phase effort: (1) identification of system problems through observation, questionnaires, and interviews with CMI management, instructional staff, and student personnel; (2) review of other CMI systems; (3) development of candidate research and development proposals to support the major problem areas; and (4) setting R&D priorities. Initial research efforts on the six proposals given the highest priority status are described, including the effects of incentive charts on rate of progress through a CMI course, instructor role in a CMI environment, computer generated reports for the management of student learning, development and incorporation of automated performance tests into the CMI system, development of alternate test strategies to improve mastery and retention in selected CMI courses, and development of computer software to aid data summarization for research and management analysis. —Microfiche 91*, paper copy $2.00 plus shipping as document ED 196 411.

The procedure documented is used for the system wide planning of curriculum development in Montgomery County, and consists of three parts: a planning and review process, an instructional design and development model, and a proposed calendar for cyclical review of programs. Specific positions responsibilities, organizational charts, and task responsibility charts are included. The six stages of the planning and review process are outlined, and the instructional design and development model shows the process and components used in implementing curricular change in compliance with local regulations. The components—curriculum, instruction, evaluation, reporting, and management—are described, and an application in the development of a ninth grade health curriculum illustrates the process. Sixteen programs and their divisions are listed on the proposed calendar for program reviews, and appendices include a copy of the form used for transmitting the proposed curricula and the regulations covering curriculum development and approval. —Microfiche 91*, paper copy $2.00 plus shipping as document ED 196 127.

Both general and specific guidelines are proposed for the use of different types of graphics under specified conditions which would be relevant to various instructional applications of the videodisc. The general guidelines cut across several conditional variables—e.g., color, realism, motion—while the specific guidelines are directly related to the following 11 behavior categories: rule learning and using, classifying, identifying symbols, detecting, making decisions, recalling bodies of knowledge and using verbal information, performing gross motor skills, steering and guiding—continuous movement, recalling procedures—positioning movement, voice communication, and attitude learning. Also included in this report are discussions of dynamic computer graphics; the relationship of graphics to learner characteristics; graphics and the videodisc, including integration of motion sequences and still frames, ability to slow or freeze action during demonstration of procedures, and different branching strategies; the ability of the intelligent videodisc to combine the advantages of the book, television, and computer-assisted instruction; changes in current methods of media selection which will be required by videodisc; and implications of this study for further research. More than 50 references are listed. —Microfiche 91*, paper copy $5.30 plus shipping as document ED 196 413.
Criteria for the Selection of JID Articles

Types of articles appropriate for publication

1. Theories, models, conceptual frameworks of instructional development;
2. Techniques for designing and evaluating instructional systems;
3. Reports on evaluations of instructional development projects;
4. Case studies of instructional development projects;
5. Summaries and abstracts of instructional development projects;
6. Instructional materials designed to improve the skills of instructional developers.

In addition, JID will publish:

7. Critical reviews of important literature related to instructional development;
8. Critical reviews of generally available instructional systems;
9. Letters to the editor.

Articles submitted for publication in JID are refereed by an Editorial Board using specified criteria. There are two sets of criteria. The first set applies uniformly to all types of articles.

General Criteria for All Manuscripts

A. Purpose and scope. Does the manuscript fall within the purpose and scope of JID?

B. Contribution. Does the manuscript make a new contribution to the field of instructional development by presenting a new point of view or presenting a new look at a traditional point of view?

C. Literature-based. Does the manuscript indicate that the author is aware of, and incorporates, what others have already reported in the literature about the topic being addressed and related topics?

D. Generalizability. Does the manuscript present theory, procedures, or results in the form of conclusions which can be generalized and used by other instructional developers:
   1. Logical extension. Are the general conclusions logical extensions of the work reported?
   2. Utility. Will the general conclusions be useful to other developers as guidelines for their work in other settings?
   3. Clarity. Are the general conclusions stated in a clear enough manner for other developers to envision how they might apply the conclusions in other settings?

E. Readability. Is the writing style of the manuscript readable, clear, and understandable to the reader?

F. Conciseness. Does the manuscript merit the length it takes to say what it has to say?

Specific Criteria

The following set of criteria (Verifiable, Disciplined, and Conceptual Structure) will be applied to all manuscripts, but different questions will be used to judge manuscripts that fall into different categories. Manuscripts will be placed in one of three categories:

1. Theory/Procedure/Approach—dealing with the why, the what, or the how of instructional development.
2. Case Studies—dealing with a specific application of the what or the how of instructional development in a specific setting.
3. Inquiry—data-based studies dealing with evaluation and/or validation of instructional development techniques or products.

The specific criteria, by category, are as follows:

1. Theory/Procedure/Approach

G. Verifiable. Is the theory, procedure, or approach presented in sufficient detail so that an informed reader could test the theory or replicate and apply the procedure and approach?

H. Disciplined. Does the description of the theory, procedure, approach, contain: (a) the assumptions on which it is based; (b) terms that are clearly defined with examples; (c) procedures that are clearly and completely explained so they can be followed by an informed reader?

I. Conceptual Structure. Does the description of the theory, procedure, or approach indicate how it is different from, or an extension/elaboration of, current theory, procedure, approach, and are these theories, procedures, approaches identified, described, and/or referenced?

2. Case Study

G. Verifiable. Is the project described with sufficient detail so that an informed reader could replicate the technique or products used?

H. Disciplined. Does the description of the project include the audience; instructional setting; subject matter content; instructional development approach used; delivery system; instructional management and implementation procedures; validation procedures and results; limitations and constraints of the specific case?

I. Conceptual Structure. Is the project an example of a particular procedure or approach? If so, is the procedure or approach clearly described or referenced, and is the way the case is related to the procedure or approach clearly specified?

3. Inquiry

G. Verifiable. Are the instruments, activities, materials, and steps used in the inquiry described with sufficient detail so that an informed reader can understand, examine, and to some extent replicate the plan used in the inquiry?

H. Disciplined. Does the description of the inquiry include its assumptions and boundaries; hypotheses; methodology; results; conclusions? Are these elements logically consistent?

I. Conceptual Structure. Does the inquiry go beyond the day-to-day tasks of instructional development to address a fundamental question related to instructional development is the theory, procedure, or approach being questioned described or referenced? Is the way in which the inquiry is related to the theory, procedure, approach clearly specified?