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NOTICE: Starting with the fall issue, JID will be managed for AECT by Robert Morgan of the Learning Systems Institute, Florida State University. The addresses for submission of manuscripts and for subscriptions renewals and inquiries remain the same. More information will be published in the fall issue.

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Preliminary Guidelines for Employing Graphics in Instruction

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Abstract. The purpose of this article is to propose some guidelines, based on instructional design theory and empirical findings, for employing various types of graphics under specified conditions. The guidelines are directly related to Gagne's types of learned capabilities: concepts, discriminations, rules, problem solving, verbal information, motor skills, and attitudes. A categorization scheme is proposed for different types of visual displays. The role of these different kinds of graphic visual displays within each of Gagne's types of learned capabilities is discussed.

Educators and media specialists have extolled the virtues of visual aids and graphics for many years. Acceptance of the adage, "A picture is worth a thousand words," has led to the use of numerous forms of visual or graphic material in instruction: pictures, line drawings, schematics, graphs, charts, slides, filmstrips, motion pictures, television, etc. In a recent report Moore and Nawrocki (Note 2) described the historical arguments for using graphics and reviewed the research literature on the effects of instructional graphics. Their overall conclusion based on this review was that the assumptions about the inherent value of graphics for instruction are unsubstantiated by empirical research findings. However, they cite several studies that show that graphics can and do have a positive effect in some specific instances.

The variable results obtained in the research studies reviewed by Moore and Nawrocki lead to the obvious conclusion that the appropriate question is not, "Do graphics improve the effectiveness of instruction?" but, rather, "What types of graphics, if any, will improve the effectiveness of instruction under different conditions?" The purpose of this paper is to propose some guidelines, based on instructional design theory and empirical findings, for employing various types of graphics under specified conditions. Because of the current state-of-the-art, some of the guidelines given are necessarily only hypotheses and will require verification in future research studies.

Types of Visual Displays

In order to address the question, "What types of graphics should be used under various conditions?" it is necessary to identify and define different types of visual displays. The categorization scheme proposed here is based on the previous work of Merrill, Trowie, and Merrill (1975), Tosti and Ball (1969), and Moore and Nawrocki (Note 2):

A. Alphanumerics: 1. textual, 2. tabular.
C. Objects or Events: 1. real objects or events, 2. models, mock-ups, or simulators.

Alphanumerics

This category basically includes the set of characters available on a standard typewriter keyboard. The category is subdivided to distinguish between textual displays and tabular displays. Although both can be generated on a standard typewriter, tabular displays are considerably more difficult to design and construct and are, therefore, generally more expensive to produce. Reading and understanding tabular displays also may require different abilities on the part of the learner than are required by reading and understanding textual information.

Graphics

This category basically includes all nonalphabetic, two-dimensional displays and has been divided into four subcategories: figural, symbolic, schematic, and pictorial. This distinction between alphanumeric and graphics displays may seem similar to the categories "digital" or "symbolic" (words and numbers) and "iconic" (pictures and diagrams) (Knowlton, 1966; Morris, 1938). However, the authors agree with McDonald-Ross' (1977a) assertion that

Authors' Note. The authors would like to acknowledge the assistance of Joseph Lipson and Mike Hetzel in the preparation of this paper. Mr. Hetzel helped identify reference material, and Dr. Lipson reviewed the entire report and offered many valuable suggestions. However, the authors accept full responsibility for the content of the report.

This paper is a summary of a report (Merrill & Bunderson, Note 1) funded by the U.S. Army Research Institute for the Behavioral and Social Sciences through a contract with WICAT, Inc. and a subcontract with the David O. McKay Institute, Brigham Young University. Copies of the full report, which includes several illustrative graphics, may be obtained from the Army Research Institute, Alexandria, VA 22333.
too much generally is included under the iconic category. Thus, in the categorization scheme presented here, the pictorial and schematic subcategories might be considered iconic, although the symbolic and figural subcategories would not be considered as either iconic or digital. The authors feel that these categories represent a better solution to the digital versus iconic problem than McDonald-Ross (1977a) classification according to purpose.

The pictorial and schematic subcategories include all two-dimensional representations of objects or events where the representation has some degree of resemblance or fidelity to the physical characteristics of the real object or event. The distinction between pictorial and schematic basically is one of degree of fidelity. Pictorial displays, which include photographs, paintings, drawings, etc., have greater fidelity than schematics, which include circuit diagrams, maps, blueprints, etc. Knowlton (1966) has suggested that the fidelity of a representation of an object or event can be thought of as having three “parts”: the elements, their pattern of arrangement, and their order of connection. A graphic must have some fidelity in the elements in order to be classified as pictorial. On the other hand, a schematic graphic would have the elements arbitrarily portrayed, while the pattern and/or order of connection would be isomorphic with the actual object or event. A highway road map would be classified as schematic since the elements (towns and cities) generally are represented by arbitrary geometric forms (circles and stars) although the pattern and order of connection of the cities and roads is isomorphic with the actual state of affairs.

The symbolic category refers to those graphic displays that have no resemblance or fidelity to actual objects but serve as arbitrary nonalphabetic signs of the objects or events. Examples of symbolic graphics are a red cross, a trademark, and an officer's insignia.

The figural category includes graphic displays that are used to show relationships between abstract ideas and generally do not serve as signs for actual objects or events. Line graphs, flowcharts, and histograms are examples of figural graphics.

The graphic displays described above also could be categorized along several other dimensions such as still or motion (including animation); color, halftone, or black and white; degree of aesthetic value; degree of complexity or realism; and/or analogical reference (see the section on concepts). The various subcategories of these dimensions could be thought of as sub-subcategories under each of the four principal subcategories of figural, symbolic, schematic, and pictorial. The relevance of these other dimensions will be addressed in appropriate sections throughout the remainder of this paper.

**Objects or Events**

This category includes real-world objects and various three-dimensional representations of objects such as models, mock-ups, or simulators. Real objects might include a flower, truck, or building. Events could include a session of the state legislature, a rock concert, or a walk on the moon. Models, mock-ups, and simulators could include a plaster of paris skeleton or a scale model of a lunar exploration vehicle.

**Guidelines for Employing Graphics**

The employment of graphics does not automatically increase the effectiveness of instructional materials. The instructional usefulness of a specific graphic may lie somewhere on the following continuum:

- Common
- Distinct
- Neutral
- Helpful
- Vital
- Fusing
- Ining

Under certain conditions a given graphic might be confusing and have a negative effect on student achievement. Under other conditions a graphic might be vital for learning to occur. Under still other conditions the use of graphics may have neither positive nor negative effects on student performance.

The purpose of this paper is to propose some guidelines for employing various types of graphics under different conditions. These guidelines will be categorized according to Gagne's (1977) taxonomy of learned capabilities. Gagne has proposed five major domains of learned capabilities: intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes. The intellectual skills domain has been divided further into subcategories such as concepts, discriminations, and rules.

**Concepts**

Concept learning enables a student to classify correctly unencountered objects, events, or symbols (or a representation or description of such objects, events, or symbols) as a member of a specific class. Classifying behavior is required in a great number of tasks and is often prerequisite to the learning of other behaviors such as rule using and problem solving. For example, students may be required to classify examples of insects, adjectives, assets, or vectors.

Several studies (Merrill & Tennyson, 1977; Tennyson, 1975; Tennyson, Woolley, & Merrill, 1972) have shown that concept learning is greatly facilitated by showing the trainees several divergent examples and matched nonexamples and then allowing them to practice classifying unencountered examples and nonexamples. Pictorial graphic representations should be used as examples in the initial learning of concepts that have concrete referents (Levie & Dickie, 1973). In general, the pictorial graphics used as examples should be simplified so that the number of irrelevant cues is reduced and the redundancy of relevant cues is increased (Dwyer, 1978; Levine & Dickie, 1973; Black, Note 3; Travers, Note 4). If the example is too complex or realistic, it may be difficult to perceive and distinguish the attributes of the example that are critical to appropriate classification. This is especially the case in fixed-pace presentations where the trainee cannot control the rate of exposure. However, as training progresses, more difficult and complex examples should be used that approximate the real-world environment or task. Actual objects or realistic pictorial graphics could be used at the beginning of training to add interest, to motivate the student, and to provide an orientation to the real world. Simplified pictorial graphics could then be used to isolate and highlight the critical attributes, followed by more realistic pictorial graphics or actual objects to facilitate transfer. Critical attributes could be highlighted through the use of other graphic elements such as arrows, texture, shading, or color (May, Note 5).

Many of the research studies on instructional graphics have found no significant differences in student achievement when instructional treatments that use graphics are compared with those that do not. There are probably many reasons for these nonsignificant differences. However, we would like to
suggest that one of the major reasons graphics have a neutral effect is because they are used as signs (Knowlton, 1966) for concepts with which the individual has had considerable previous experience. This previous experience can be recalled by the individual and used to create a mental visual image. Such a visual image can be triggered by symbols that, though arbitrary, have been learned previously as labels for the object or event. Under such conditions, the added external visual or graphic is redundant with the individual’s mental visual image and thus does not improve learning.

Once a concrete concept is learned, the concept label can trigger the generation of images from the entire set of instances of the concept. Under such conditions a concept label or word “may be worth a thousand pictures.” Once a concept has been learned, it would not be necessary or efficient to continue using pictorial graphics when referring to the concept. (However, if the picture is a divergent unencountered example, it may serve to further refine the learner’s “understanding” of the concept.) In fact, one picture does not adequately represent a concept or class of objects. This is especially true for general or superordinate concepts. For example, a picture of Lassie represents the concept collie fairly well, but is a less adequate representation of the superordinate concepts of dog, mammal, and animal as the degree of generality increases. Thus, although several divergent pictorial graphic examples may facilitate the learning of a concept, once the concept is learned, the symbolic name or label is a more effective and efficient representation for communication.

In considering the employment of graphics, we should not overlook the significant power of word pictures. Great story tellers and novelists are able to capture the attention and imagination of their audience by triggering mental images through the use of word descriptions. These word pictures may be more effective than actual pictures in directing attention to specific relevant details that would go unnoticed in a casual viewing of an actual picture.

Pictorial graphics become helpful and vital when learners are exposed to new concepts, objects, or events for which they have no labels and/or corresponding visual images. However, even when learners have had no previous experience with an object, they often can be taught various aspects of a new object through the use of verbal analogies where the new object is compared with or likened to a known object for which visual images are available in memory. Novelist and poets use analogies effectively to increase the power of their word pictures in generating mental images.

Pictorial graphics generally are not useful for teaching intangible or abstract concepts such as democracy, freedom, or guilt that do not have concrete referents (Levi & Dickie, 1973). Verbal definitions usually are necessary to present the critical attributes of such concepts. These concepts may be best exemplified through the use of verbal descriptions, stories, and analogies.

In general, color has little effect on performance (Levi & Dickie, 1973; Kanner, Note 6; Travers, Note 4). However, color may enhance learning when used to emphasize relevant cues and to aid in making appropriate discriminations. Using color in this way is illustrated by instructional materials developed for the TICIT Project (Bunderson, Note 7; Mitre Corp., Note 8).

Discriminations
Learning discriminations enable students to distinguish one object, event, or symbol from others. The most common observable behavior that serves as an indicator of discrimination is stating names for the objects to be discriminated. However, the behavior could take other forms such as pressing a button on a machine or playing a specific tone on a musical instrument. Discrimination behavior is involved in identifying specific letters of the alphabet, identifying a particular individual, or identifying symbols on a topographical map.

Although it may be possible to describe certain objects, events, or symbols verbally, learning will be much more efficient if actual objects, pictorial graphics, or symbolic graphics are used. Only five to nine items should be taught simultaneously. Once these are learned, new items may be added with regular review of those previously learned. Multiple discrimination is basically a paired-associate task and requires considerable drill and practice where the student is repeatedly shown the objects or symbols to be learned in random order and is asked to respond with the appropriate label that corresponds to each object or symbol. When an error is made, corrective feedback should be given.

If identification of an object or symbol requires color discrimination, then color should be used (Travers, Note 4). Motion is necessary only if movement is a critical attribute required for proper discrimination. If the movement involved is fairly simple, as with hand signals, it could be indicated adequately through the use of arrows on still pictorial graphics. However, some practice and the criterion test should require the trainee to identify the objects or symbols in actual motion, if the objective requires such skill.

Rules
Rule-using behavior occurs when a trainee is able to respond to a class of stimulus situations with a class of performances, the latter being predictable related to the former by a class of relations (Gagné, 1977). Rule using behavior is involved in such tasks as spelling words, using proper grammar, and performing mathematical operations.

Usually the most effective instructional strategy for teaching rules involves: (a) the presentation of a verbal statement of the rule, (b) a demonstration of the application of the rule to several example problem situations, (c) the provision of several unencountered problem situations where the trainee is asked to practice applying the rule, and (d) the provision of corrective feedback.

The role of graphics in teaching rules depends upon the nature of the class of stimulus situations corresponding to the rule and the nature of the demonstration required to show the application of the rule. If the stimulus and demonstration involves only symbols and their manipulation as in spelling, grammar, and mathematical rules, then pictorial graphics generally are not necessary for effective instruction.

On the other hand, if the stimulus and/or demonstration involves actual objects and their manipulation, then the actual objects or a pictorial graphic representation or simulation may be required. However, if the class of stimulus situations consists of real objects, and the class previously has been learned as a concept, then pictorial representations of the stimuli would not be necessary. For example, instruction on the "selection of proper fire extinguishers for different types of fires" would require only
pictorial graphics if the types of fire extinguishers and fires had not been previously learned or could not be recalled (see the section above on concepts).

Complex rules often involve a series of operations and conditional decision points. Such rules are actually procedures. The steps and the order of the steps that make up the procedure may be represented in several ways. If the procedure is fairly simple, the steps may be presented as textual prose. However, more extensive linear procedures are easier to understand if the individual steps are separated and presented in a list format. If the procedure involves several decision points and loops (the same steps are repeated several times), then a figural graphic such as a flowchart, decision table, or decision tree will facilitate learning. For example, Lewis, Horabin, and Cane (1967) found that calculating the amount of tax owed was greatly facilitated through the use of a flowchart diagram. Wilcox (Note 9) found that the classifying of various types of sailboats was significantly improved through the use of a decision tree. A more extensive treatment of alternative representations of procedures may be found in Merrill (1980).

Many procedures are so complex and/or the consequences of error are so great that it is impractical to require students to memorize the sequence of steps. In such cases, a job aid that lists the steps or presents a flowchart of the steps should be used.

If the procedure involves extensive motor skills, the steps of the procedure and the motor skills could be taught simultaneously by live demonstration, motion pictures (with slow motion if real time is too fast), or with a series of still pictures (see the section below on motor skills). If film or still pictures are used to demonstrate the steps of the procedure, the performance should be photographed so that the representation shown has the same view or angle that the trainees would see if they were doing the procedure themselves (Hoban & Van Ormen, Note 10).

If the procedure involves the assembly of a piece of equipment with many parts and the motor skills required already exist in the repertoire of the learner, graphics would not be necessary to show the actual motor skills required. However, pictorial or schematic graphics would be necessary to show the various parts of the equipment and their relationship to each other. The graphics would need to be supplemented with verbal or textual instructions that list the order in which the various parts should be assembled.

Cognitive Strategies (Problem Solving)

Problem solving behavior involves the discovery of a higher order rule (often a combination of previously learned rules) that enables the student to generate a solution for a novel problem. Problem solving entails more than applying a previously learned rule to solve a specific problem that belongs to a class of problems known by the individual to be solvable using the given rule. Problem solving refers to the identification and generation of solutions to novel problems. Problem solving is required in such tasks as generating a new poem, composing a new musical score, or inventing a new labor-saving device.

The most effective strategy for teaching problem solving skills is to provide the trainee with a wide variety of appropriate problem solving situations. These situations should be novel or unencountered and correspond to the student's capabilities. In early stages of learning it is often necessary to provide some guidance to the students to channel their thinking in fruitful directions. However, this guidance should not present the actual solution to the problem.

The role of graphics in problem solving instruction is highly dependent on the nature of the problem solving situations presented to the student. If the information or data relevant to the problem are verbal or numerical in nature, then graphics may not be necessary or useful. However, relationships among numerical data sets may be understood best when represented by a line graph (figural graphic) that shows trend directions. On the other hand, if the problem situation requires the use of data that involve the perception of characteristics of objects or events, then the use of pictorial or schematic graphics might be required. However, if the trainees have had considerable experience with the relevant objects or events and can visualize the characteristics in their mind from a verbal description, then graphics may not be necessary.

Computer graphic terminals rapidly are becoming more sophisticated and prevalent. These terminals and corresponding software make it possible for students to dynamically manipulate pictorial or schematic graphic representations of complex objects or phenomena (Kay, 1977). Three-dimensional line drawings of automobiles, city streets, or aircraft carrier decks can be created, displayed, and manipulated (Sutherland, 1971). These drawings can be rotated and viewed from several perspectives. Such computer graphic simulations have great potential for increasing the efficiency and effectiveness of problem solving activities.

Verbal Information

A student who can use verbal information is able to tell, state, or verbalize a fact or idea in the form of a proposition. Generally, it is not necessary that the proposition be restated exactly word for word. (Notable exceptions include recitation of a poem or famous speech or relating a coded message.) However, it is necessary that the restatement of the proposition in the trainer's own words convey the same meaning as the original fact or idea. Verbal information may be classified into three subcategories: names or labels, facts, and collections of facts organized as connected discourse (Gagne, 1977). Recalling verbal information is involved in such tasks as stating the name of a particular building or mountain, listing the first six presidents of the United States, or describing the major campaigns in World War II.

Learning the name or label for a single object is quite an easy task. However, the task becomes more difficult if several different names must be learned for several different objects at the same time. Confusions occur because of the process of interference. This interference can be overcome by making the association between the label and object more distinctive or meaningful.

Verbal information is learned and recalled more easily when it is "meaningful." Real words are easier to remember than nonsense syllables, and words that form sentences are easier to learn and recall than random word lists of the same length. Labels are easier to learn if they can be meaningfully connected to the corresponding object through the use of mediating verbal links or images. These mediating links may include various mnemonic devices. The learning of facts is facilitated if they can be related or subsumed (Ausubel, 1968) into an already existing cognitive structure.

The learning of verbal information often is aided by the use of some organizational device. Facts organized by
topic sentence may be learned more efficiently than those presented without a topic sentence (Gagné, 1968). A figurative graphic representation of the relationships between facts can provide organization and meaning to facilitate the storage and retrieval of verbal information (Holliday, 1976). When a large amount of numerically related information is being presented, the use of tables, charts, or figurative graphs may make the presentation more efficient, provide organization, and show relationships. Maps (schematic graphics) can be efficient and vital representations of many different types of spatial information, and tables and charts are vital representations of complex time schedule information. However, explanatory information and examples should be provided to assist trainees in reading any tables, charts, maps, or graphs used. Further prescriptions on the use and construction of tables and figurative graphics can be found in McDonald-Ross’ (1977a, 1977b) recent reviews.

Pictorial graphics such as photographs or line drawings are inserted in textual verbal information material for illustrative purposes. Although these illustrations may increase interest and enjoyment, they may not increase understanding or learning. This is often the case because the illustration shows an example of a concept that previously has been learned by the trainee or could have been visualized easily in the mind of the trainee from the verbal description provided in the text. Some illustrations that are added to spruce up the text actually may be confusing or distracting.

However, Levin and Lesgold (1978) recently reviewed 12 studies that showed that pictures (pictorial graphics) facilitated prose learning of unfamiliar fictional narratives presented orally to elementary school children. The pictures were consistent with and redundant to the story content. Cued factual recall questions were used in the achievement instruments. In these studies the pictures may have helped illustrate unfamiliar concepts.

In our search for efficiency and effectiveness, we should not overlook the role of aesthetics in life or in learning. Attraction, attention, interest, and motivation are all important aspects of learning. Students cannot learn unless they attend to the instructional materials. If attention is not maintained, then students will not learn what they could and may drop out altogether.

Neither color nor motion has been shown to facilitate the learning of verbal information. However, research (Levie & Dickie, 1973) has shown that pictures, color, realism, and motion increase the attraction and interest value of materials and are preferred by learners of all ages. Moore and Nawrocki reported a study by Wal (Note 11) that showed that preference does significantly reduce attrition.

Special effects, optical effects, and music have not increased learning (Hoban & Van Ormen, Note 10). Dramatic sequences, comedy, singing, and realistic settings have not increased learning of factual verbal information (Hoban & Van Ormen, Note 10; Travers, Note 4). However, we hypothesize that realistic dramatic sequences may have considerable value in increasing interest, motivation, emotional impact, and in changing attitudes (Scanlon, 1970; Fleming, Note 12).

Motor Skills

Motor behavior occurs when a trainee is able to execute a physical movement with precision and appropriate timing. Motor skills are involved in such tasks as swimming, typing a report, or adjusting a microscope. Motor behavior often involves the execution of a series of several coordinated movements. The order in which those individual movements are performed may be governed by an executive routine or procedure (Gagné, 1977). The cognitive aspects of the procedure may be taught simultaneously with or independently from the actual movements. For example, the order in which the parts of a piece of equipment are assembled may be taught independently from the motor skills required to put the parts together. The role of graphics in teaching procedures is described in the above section on rules.

It is difficult to imagine a student being able to learn a complex motor skill solely from verbal or textual information. The movements must be demonstrated to the student either by an instructor or through the use of some pictorial graphic representation. In some situations, a live demonstration may not be ideal if the model is unable to perform the movement slowly enough for the trainee to see the critical aspects of the movement. The serving of a tennis ball is difficult to demonstrate for this reason. A series of still pictorial graphics that shows various positions or aspects of the movement across time may be more instructive. However, the critical continuity of the movement may be lost. Motion pictures have been shown to be effective in teaching skills involving motion (Levie & Dickie, 1973; Allen & Weintraub; Note 13; Silverman, Note 14). However, motion pictures have some of the same advantages and disadvantages of a live demonstration. If the movement is shown in real time, it may be too fast. Slow motion demonstrates the continuity of the movement while slowing it down so that the critical aspects can be perceived.

Repetitions of the demonstration or motion picture can improve the learning of motor skills (Hoban & Van Ormen, Note 10). Learning also may be facilitated if the trainee can stop the motion picture film and practice the motor skill rather than attempt to practice the skill while the film is in progress. Even mental practice, where the learner thinks through the various motions, may be effective (Bandura, 1977; Travers, Note 4). The new videodisc technology may make a significant contribution in this area (Merrill & Bennion, 1979). The videodisc will enable the students to adjust the speed of the motion sequence, stop on a single frame and look at the "frozen motion" for as long as they wish, step through a series of frames one at a time, reverse the play and repeat the sequence (at any speed), stop a sequence to practice the movement, and then repeat the motion sequence for comparison with their own performance.

Practice is crucial in the learning of a motor skill. However, practice is beneficial only if the learner receives some feedback. This feedback may be intrinsic to the task as when the correct letter is typed on a piece of paper, or may require the judgment of an instructor. Many complex motor skills are difficult to learn because trainees cannot observe their own responses and thus are unable to compare their responses with the correct form (Bandura, 1977). This problem could be alleviated by videotaping the trainees' performance and using the videotape for feedback.

Attitude Learning

An attitude is an internal state that influences an individual's choices of actions towards a class of persons, objects, or events. An attitude is a response tendency (Gagné, 1977). Possess-
TABLE 1. Summary of guidelines for using graphics in instruction.

<table>
<thead>
<tr>
<th>Subcategory</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts</td>
<td>Pictorial graphics should be used as examples of concepts that have concrete referents. In the initial stages of training, simplified pictorial graphics should be used in order to isolate and highlight critical attributes. Later stages of training could employ more realistic graphics in order to facilitate transfer to the real-world environment or task. Pictorial graphics are not necessary and may be distracting if they are used as signs for concepts, objects, or events with which the learner has had considerable previous experience. Under such conditions, the added external visual or graphic is redundant with the learner’s mental visual image and, thus, may not facilitate performance. Pictorial graphics become helpful and vital when learners are exposed to new concepts, objects, or events for which they have no labels and/or corresponding visual images.</td>
</tr>
<tr>
<td>Discriminations</td>
<td>Considerable drill and practice with corrective feedback using graphics of actual objects or symbols may be required in order to learn discriminations adequately. Color may enhance learning when used to emphasize relevant cues and when actual color discrimination is required.</td>
</tr>
<tr>
<td>Rules</td>
<td>The learning of complex procedural rules can be facilitated through the use of figural graphics such as flowcharts. These graphics can portray the order of the operations of the procedure and alternate paths that could be taken at various decision points.</td>
</tr>
<tr>
<td>Problem Solving</td>
<td>Training in problem solving should involve instruction in the use and interpretation of various numerical relationships represented in tabular displays and figural graphics. Computer graphic simulations may increase the efficiency of problem solving activities.</td>
</tr>
<tr>
<td>Verbal Information</td>
<td>A figural graphical representation of the relationships between various facts and ideas can provide organization and meaning to facilitate the storage and retrieval of verbal information. Pictorial graphics that are inserted in textual verbal information often have a neutral effect on performance since they only illustrate concepts that could have been visualized easily in the mind of the reader from the verbal description provided in the text. However, pictures, color realism, and motion increase the attraction and interest value of materials. These characteristics are preferred by learners of all ages and may significantly reduce attrition.</td>
</tr>
<tr>
<td>Motor Skills</td>
<td>The demonstration of a complex motor skill in real time may be too fast. However, slow motion pictorial graphics can demonstrate the continuity of the movement while slowing it down so that the critical aspects can be perceived. A videotape of a trainee’s performance of a motor skill may be a valuable feedback device.</td>
</tr>
<tr>
<td>Attitudes</td>
<td>Human modeling seems to be the most applicable, and probably the most effective, approach for attitude learning. Attitude learning involves the imitation of a credible and respected human model’s choices of action. A human model may be presented in several ways: The model may appear in person, in still pictures, in movies or TV, or merely be described in a novel, history text, or biography.</td>
</tr>
</tbody>
</table>

The demonstration of a high level of knowledge or skill does not ensure that an individual will always perform in accordance with that knowledge or skill. The purpose of instruction in attitudes is to strengthen an individual’s internal state, thereby influencing his or her tendency to respond with the appropriate actions at the appropriate time and place.

Attitude learning is associated with almost every other type of learning. Attitudes are involved in choices of action such as complying with safety procedures, conforming to dress, grooming, and cleanliness standards, and obeying commands and instructions of officers.

As mentioned above, communication of information and skill alone has little effect on attitude learning. Those learning situations that have had significant effects on attitude change include classical conditioning, reinforcement or experience of success, and human modeling (Gagné, 1977). Of these three, human modeling seems to be the most applicable and probably the most effective approach for attitude learning. Attitude learning results in an imitation of the human model’s choices of action. This imitation occurs only if the model has credibility and is admired and respected by the trainee. Attitude change is increased if the model is rewarded or punished for appropriate or inappropriate behavior or choices, respectively (Bandura, 1969, 1977; Goldstein & Sorcher, 1974).

The credible human model may be presented in several ways. The model may appear in person, in pictures, in movies or TV, or merely be described in a novel, history text, or biography. It is not necessary for the human model to actually demonstrate the appropriate choice of behavior; the model may need only to describe the situation in which he or she engaged in the desired choice behavior and indicate the reinforcing events that resulted from that choice (Bandura, 1977).

The principal aspects of human modeling can be demonstrated effectively in motion pictures or television dramatic presentations. Realistic motion pictures are preferred by most individuals; they can reach a large audience and can portray the consequence of certain choices or behaviors that would be too costly or unethical to demonstrate "live."

It is also important that the students be reinforced or experience success when they actually engage in the desired
choice behavior that previously has been modeled (Goldstein & Sorcher, 1974). Such reinforcement will strengthen their attitudes. Individuals enjoy and have positive attitudes toward activities at which they succeed. Repeated failure will produce negative attitudes.

Most television commercials are excellent examples of the use of all three approaches to attitude change. The products are paired with positive situations, they are used or chosen by credible human models, and the models are reinforced for their choice of the product.

Graphic signs such as, “Keep off the grass” or “If you drink, don’t drive,” will have little effect in changing attitude. However, they may serve as a reminder or reinforcement for those who already have some response tendency in the desired direction. If the verbal message on the sign is accompanied by a pictorial graphic of a respected human model, then some attitude change might occur.

Summary

The purpose of this paper was to propose some guidelines, based on instructional design theory and empirical findings, for the use of various kinds of graphics under specified conditions. In order to address the question, “What types of graphics should be used in various conditions?” it was necessary to identify and define different types of visual displays. The following categorization scheme was proposed:

A. Alphaneuners: 1. textual, 2. tabular.
C. Objects or Events: 1. real objects or events, 2. models, mock-ups, or simulators.

Several guidelines for employing various types of graphics under different conditions were presented. The guidelines were directly related to Gagné’s (1977) types of learned capabilities. The guidelines presented in the body of the report are summarized in Table 1.

Reference Notes


References


Relevance Revisited Systematically

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Abstract. Everyone wants to develop and experience relevance in instruction; some have wanted it badly enough to protest militantly a status quo perceived as irrelevant. This article uses the language and processes of instructional design and development to attempt a definition of relevance and then to apply that definition to what is and isn't being done in instruction. The instructional developer's role in an era of declining enrollments and accountability mandates must expand to screening for and increasing instances of relevant instruction. What is relevance? How does it manifest itself in single courses? In sequences of courses? Why is it important? These questions are addressed through a model that emphasizes time, instructor control, and location for practice opportunities as they relate to course and program objectives.

Introduction

Although there have been many pleas for relevance in education, few tangible definitions exist to guide the instructional developer or teacher in developing relevant courses or materials. Shanahan (1979) highlighted the definitional problem yet failed to go beyond the vague suggestion of relevance as education that fosters responsibility in the learner. The very first entry on relevance in the Education Index (Wagner, 1969), published in Audiovisual Instruction, parallels the Shanahan emphasis on responsibility in a way congruent with the politics of the late 1960s. Wagner defined a relevant education as one that leads to change in the establishment. Reporting on a speech by Edmund Gordon, Wagner offers a strong political mandate, but no algorithm for effecting relevance through systematic instructional procedures.

Kahn (1971) describes public education in the 1950s as responsible for "carrying out mandates of the establishment" (p. 49). He points to 1963 as the date when harmony between school and society was shattered with widespread agitation for relevant education. The mid- and late 1960s offered a definition of relevant education as a political instrument to change society in the direction of peace and equity. Schools that were relevant would serve "as a model for the ideal of equality in American society" (p. 52). An update on Kahn's 1971 piece is worth composing here.

The 1970s brought us out of Vietnam and into a definition of relevant education that immediately benefits the individual—especially the individual's emotional growth as expressed in values growth and self-concept education. The late 1970s continued the emphasis on the individual, but redirected it to the development of the individual's ability to function in society. This has been translated into accountability mandates through minimal proficiency legislation, swelling enrollments in engineering, business and premedical programs, and standing-room-only crowds at workshops on "How to Write a Resume." Relevant education, then, as measured by student choice, may be education that prepares one to get a job and earn money (The Chronicle of Higher Education, Jan. 20, 1980, p. 3).

If relevant education involves tangible benefit to the individual or the group and the benefit must be immediate, what about Shakespeare? Thorndike?
Dante? Dewey? How does studying them provide contemporary tools for solving problems? Does education have some irrelevant purposes or can the definition of relevance expand beyond immediacy and tangible benefit? Recent statements provide support for the latter opinion. Dimmer (1979) argues that the purpose of education is to go beyond drills for skills into preparing students to deal with issues and controversy. Thomas (1979) goes so far as to state that "the loss of Homeric and Attic Greek from college life was one of the century's disasters" (p. 73). For these educators and the others who have recently drafted traditional, generalist requirements for graduation from many prestigious universities, the relevant education of 1980 is not only for immediate application of skills to personal or even societal concerns. Relevant instruction also develops learners who will eventually speculate, contemplate, evaluate, tolerate, embrace, and create. The elements of future and intangible benefit are introduced and supported.

While some instructional developers will find themselves embroiled in the ubiquitous debate over relevant purposes for education, all instructional developers must be involved in ensuring that the processes of instruction exist and are perceived to be relevant. Professionals familiar with a systematic approach to the design of instruction can use their system to define relevant education as education not only relevant in purpose but also relevant in "feeling" as it is experienced by the learners who are engaged in it. It is time to use systemic and systematic interventions to screen and establish strategies for ensuring relevance in instruction. It is a role for which instructional developers are prepared; it is an area of need into which we will be pressed, if we do not go willingly.

Relevance Systematically

Who?
Systematic approaches to developing relevance in education begin with questions of who gets educated or trained and how their needs are ascertained. Assumptions of irrelevance aimed at local education agencies and institutions of higher education may sound like this: "Your institution is not relevant to our community. What have you done for illegal aliens or Indochinese immigrants or older adults or displaced homemakers?" or "Sure you have calculus courses, but what about math anxiety?"

A relevant instructional process automatically extends beyond traditional student populations to identify, investigate, and meet the needs of the underserved. Surely this means engaging in a highly political process involving priorities and thorny questions of resource allocation. Yet systematic data gathering involving the opinions and perceptions of many constituencies will ensure the ability to decide whether, for example, to spend money to recruit inductees from all over the country or to look beyond the usual trainees to local women and minorities—potential, though nontraditional, trainees.

Instructional development provides precedent and procedures for expanding learner populations. If women are to learn to operate lathe, then needs assessment and critical incident analysis will have to supplement performance elements gleaned only through task analysis of model performers. All the data sources (Tyler, 1949) should be consulted in an effort to identify the discrepancies between optimal and actual performances unique to the group under study. For example, basic math skills and/or preparation for explaining the demands of night- and swing-shift machine operation to families might be part of this training program.

If the instructional developer draws upon such diverse sources as federal mandates and family members in articulating performance demands, those served and the results of that service are much more likely to be judged as relevant. Thus Roger Kaufman's (1978) Alpha Needs Assessment serves the developer who wishes to ensure relevance in populations served and instructional priorities addressed. Toot and Carlson (in press) label and urge just such a proactive approach to instructional development.

What?
While education literature reiterates concern about relevant purposes for instruction, educators often fall to convince learners that what they are learning is relevant. Much learner displeasure comes from feeling disenfranchised, as if not enough schooling is "learner activated" (Kapfer, Kapfer, Woodruff, & Stutz, 1970, p. 29). Some dissatisfaction comes from not knowing exactly what instruction is about—why it is happening, why in this particular way, and why for these purposes.

Instructional developers often get teased for saying what the learner will be able to do, presenting it, asking the learner to do it, and then going on with feedback on how well he or she did it. In fact, these very familiar events within instruction, the statements of purpose and opportunities for practice and feedback in tangible "learner will be able to or learner will choose to..." formats contribute to establishing relevance. If educators can be encouraged to present their purposes behaviorally, then they and those affected can discuss (debate) what the course is about. This interaction can include questions of applicability to individual goals and societal needs and the immediacy of that application. These questions of relevance can be argued fruitfully only if their presentation transcends glitzy generalities. This occurs through the statement of behavioral terminal and enabling objectives presented in some public, visual relationship to each other and to the learner and societal needs they are supposed to address. Potent substantiation for this is provided by recalling the way students scrutinize statements like, "When you leave this workshop, you'll be able to..." or "Students who have done this module are now able to..." "Attention is glued to those statements because of their surmisem relationship with external, environmental conditions.

How?
Education deemed relevant is experienced by the learner as meeting needs that regularly appear in life.

Figure 1 illustrates a useful method for increasing the actual and perceived relevance of educational processes. In flow chart format, the educator-controllable and uncontrollable basic elements of instructional sequences are presented within the context of opportunities for relevance.

1. Practice: If the information (generalities, helps, cues, etc.) relating to a particular objective are presented and then followed with in-class practice opportunities (Level I Practices on Figure 1), elicitors of the desired behavior, then students will perceive immediate relevance. This sensation of relevance will be short-lived unless quasi-natural or controlled real world conditions and eventually, natural practice opportunities also provide
An example from the field of instructional development will further illustrate the importance of location and control of elicitors for performance in the perception of relevance. The general topics of the history of instructional development and task analysis procedures provide useful, dissimilar topics, one of which is more likely to be perceived as relevant to a student of instructional development. The history of instructional development, on the other hand, because of the difficulty in establishing anything beyond Level I Practices (through test or classroom discussion), would be perceived as less relevant. Faculty controlled and on-the-job requirements would ensure demands for task analysis skills; this is probably not true of the knowledge attached to the history of the field. (Relevance, although the subject of this piece, is, of course, not the only criterion for inclusion in a curriculum.)

When?

What of the very young learner or the student not yet working at a job related to his or her education or training—the student collecting fees at the racquetball court or driving a glass-bottom boat? This student will not have the opportunity for natural practice during only one course. The shaded area in Figure 1 will not relate to classroom instruction. This student must trust in sequences of courses to perceive and experience relevance (see Figure 2).

All the more dependent on the quality of manipulated (classroom exercises) and quasi-natural practices (e.g., field work or internships), such a student can benefit from what Kapfer et al. (1970) termed “carrier projects.” These are opportunities for learners to encounter “some of the objects and processes that constitute his environment.” Though not necessarily based on new content, these practice projects ask the student to try out skills and ideas on real world concerns. A “relevant” example is the pressing mandate to teachers of social studies and the history of Western civilization, provided by the crises in Iran and Afghanistan. The technology of 1980, which trumpets international and national challenges, can also play a role in increasing the likelihood that manipulated classroom stimulus conditions will link with and resemble real world circumstances. Audio and videotape can capture diverse opinions and challenges; microprocessors can present...
simulation opportunities. Manipulated and quasi-natural experiences can diminish the students' discomfort at having to wait to use what they've been taught.

Time is a central element in the judgment of relevance. When will use(s) for the learned material present themselves? Will the demands for use continue? Why is there a gap between what is being learned and the natural elicitors that surround one at home and at work? Were the learners asked when they had last applied skills and information presented in class (Svoboda, 1974)?

Most learning situations promise deferred application, relevance that will come later in situations the learners are preparing to face. Of course, this is the litany of the elementary and, often, the secondary schools. This could be translated into, "While you don't need to know the major products of the regions of the U.S.A. while living at home with your parents or for writing criterion-referenced items in your job collecting fees at the racquetball court, I promise you that you will need to know that later." Promises of future relevance work splendidly for educators who do at least some of the following:

1. Select some of the course objectives on the basis of how immediately those skills will be demanded in the student's real world. If there is no way to be assured of natural stimulus conditions for any objectives relating to your course (e.g., Shakespearean literature), then build quasi-natural opportunities (e.g., play attendance and scene performances) into the syllabus.

2. If learners are promised that this or that skill will be demanded in the near future, make sure it happens. The educator who promises and then is proven honest in those promises can do it again. The student may return and say, for example, "You forced us to practice explaining test scores to parents and I admit I thought it was silly, but then Mr. and Mrs. Q burst into my classroom, Ms. Stone had gone home early. I was substituting and they demanded immediate explanation of these test scores. I had to do it—I even did it well."

3. Encourage current and former students to bear witness in public of eventual applicability. Educator promises are bolstered by the words of learners with whom students can identify.

4. Screen each objective for its applications over time. An example is instruction for students in administering a particular test; while that test may be relevant to P.L. 94-142 in 1980, it will no doubt be altered or abolished as sharper assessment devices appear. That is, current relevance does not ensure future relevance. Include generic skills (e.g., general test result explanation or test direction giving) to ensure future applicability in addition to immediacy.

5. Familiarize students with the idea of relevance in time. Figure 3 can be used to share your concern that the purposes and the processes of instruction are relevant to them.

The letters X, Y, and Z represent varying potential course contents (take, for example, X for media selection skills, Y for knowledge of the differences between objectives written in Gagné or Mager formats, and Z for the ability to explain what an instructional developer does in response to queries by skeptical subject-matter experts.) These examples enable us to perceive relevance in time as we examine the likelihood of natural opportunities for practice existing in the shaded area outside the course environment (i.e., the real world). Has the student been confronted with questions like, "Which medium would be best for this map reading unit or what objectives within this traffic controller training program should include visual display with the computerized voice synthesizer?" or "What's the difference between the way my objectives look and the way yours look?" or "How can you possibly develop training programs for turbine engines when you never saw one until last month?"

Manipulated and quasi-natural elicitors can be provided within the boundaries of the course experience, but especially in a professional preparatory or skills training program, they will not substitute interminably for elicitors that came before or during the course. Faith in future opportunities for application will directly and positively re-
late to evidence and quantity of previously and currently usable material in the course.

Why?

Legislatures mandate it. The judiciary rules in behalf of it. Students select in favor of it. P.L. 94-142, Title IX, the Lau Decision and full time equivalent (FTE) trends—all are manifestations of the constant, public pressure for relevance in education. This press involves identifying problems and challenges external to the school and the expectation that the school will prepare students to act upon these problems. Thus education should smudge the boundaries between the school and the world, enabling students to move between educator-controlled and natural environments, practicing new skills and ideas.

Relevant education links the centers of learning with individual, community, and societal needs. This paper has linked instructional development with analysis of and strategies to achieve relevance.

Through development. Demographically, the dwindling pool of traditional learners now forces teachers, principals, deans, and professors to become even more sensitive to the desires of students. Certainly relevance in instruction is one such desire. Jerome Bruner said, “Let knowledge as it appears in our schooling be put into the context of action and commitment” (1973, p. 115). Working with individual teachers, professors, and trainers, instructional developers can systematically design responsive and therefore relevant instructional experiences and sequences. This will improve instruction through provision of manipulated, quasi-natural, and natural practice opportunities. More effective instructional sharpened purposes and processes will affect enrollments and, ideally, ensure demand for instructional development activities.

Through assessment. Taxpayers have been sending clear messages to educational institutions about their dissatisfaction with today’s education. The absence of relevance is one cause for this dissatisfaction. Instructional developers, using the model presented here, can work with institutions to increase their relevance and with the public to weigh the value of immediate and deferred applications. Constituents inside and outside educational institutions can turn to instructional developers to assist in varying definitions of relevance for different kinds of centers of learning. This definition offers another perspective for an ongoing discussion of the different purposes and processes of, for example, universities, community colleges, and adult skills training centers.

Through understanding. Lofty promises or pleas for relevance can be replaced by the language and processes of instructional development. While few would argue the desirability of a relevant education, in the past still fewer have been able to define or address it. That has been started—in words, processes, and visual representations potentially translatable into homework assignments, syllabuses, and school and university projects.

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Applications Research in Instructional Systems Development

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Abstract. The Interservice Procedures for Instructional Systems Development project (IPISD, 1973–1976), which the author directed, brought instructional systems development (ISD) to the training schools of the U.S. armed forces. This article recounts the history of that project, emphasizing the problems faced, the choices made, the focus chosen, the difficulties encountered, the product that resulted, and the outcomes of the project. The author draws conclusions from this large-scale military ISD project that are applicable to applications research projects in other organizations.

This article describes the development of a large-scale instructional technology project in the military training system and some lessons learned from it. The Interservice Instructional Systems Development project was undertaken by the author and a number of associates at the Center for Educational Technology (CET) at Florida State University between 1973 and 1976. The center's mission is to take the findings of educational research out of the laboratory into the real world and to devise ways of applying those findings to produce educational results that are more economical and more effective than the alternatives. For the most part, we work with large organizations and institutions.

To carry out that mission, the center engages in applications research in a variety of related areas. Here, applications research may be defined as: the study of the processes, techniques, and variables that affect the relative success of institutionalization of research-based approaches to training technology.

Applications research cannot be conducted in a laboratory; it must be conducted in the target institutions and organizations. Consequently, it will be a long time before applications research becomes a science, or, for that matter, even an accomplished technology. Although the aim is clearly an attempt to isolate and apply valid knowledge through a systematic developmental approach within existing institutions, the majority of our operations and conclusions are based principally on observational, impressionistic, reactive, and anecdotal data. Rather than repeatedly reapplying a narrow specialty, CET has sought out a progression of assignments that give us the experience to tackle problems of increasing depth, scope, and difficulty. Currently—in preparation for some as yet unknown application—we are conducting independent research into the problems and potential of videodisc players interfaced with microcomputers.

CET has been able to carry out a wide range of projects through the use of a general systems approach to educational technology. It was our experience with the general systems approach that enabled us to analyze and deal with the project described in this article. This approach has been used in even larger scale development projects by others (Morgan & Chadwick, 1971). See particularly Morgan's (1979) article on the Korean Educational Development Institute.

The same systematic approach used here with the Army project has been used previously by the author in a variety of instructional settings, including:

- Oakland Community College, where an entire curriculum was orchestrated through a systematic approach to audiotorial instruction (Manilla, 1971)
- The Parks Job Corps Center in California, a residential vocational school for high school dropouts (Branson & Wilkey, 1969)
- The United States Naval Academy, which served as the host institution to an applications project sponsored jointly by the Navy and the United States Office of Education (Branson, Note 1)

Although each of these projects had its own objectives, organization, curriculum, and problems, we used essentially the same systems approach for each project. The experience gained allowed us to expand systematic approaches beyond their previous limits. It was with this background that we approached the Army's training program.

The Army School System

The Army school organization resembles a typical state multiversity consisting of 25 schools, each serving a limited number of occupations. The Army's chief training officer, a two-star general in the Training and Doctrine Command (TRADOC), is charged with the design and delivery of effective training. Each of the major schools, essentially equivalent to individual universities, is headed by a general of equal rank who has a high degree of autonomy in day-to-day school operations.

Our efforts were cosponsored by the Chief of Naval Education and Training...
the senior training officer in the United States Navy. Although somewhat smaller than the Army's, the Navy school system is organized similarly (Scanland, 1978).

Most of the work on the inter-service instructional systems development (ISD) project was done in the Army training system. Here, the distinction between "education" and "training" lies in the degree to which one can predict the proximate occupation of the trainee. The Army trains for a highly predictable environment and exerts a considerable effort to ensure the content validity of its training programs.

The Initial Survey

In the spring of 1973, my associates and I concluded an extended series of visits to Army schools to provide an assessment of Army training. What we found in that initial survey absolutely staggered our imaginations. First, we were overwhelmed with the scope of the problem. Second, we discovered that within those schools existed some of the best and the worst examples of training we had ever observed. Third, we found that the Army had made such a faithful copy of a general academic environment, that it had even copied the lack of a quality control or quality assurance system.

We reviewed critically the way different schools evaluated trainees, trainers, managers, and training, and concluded that a major improvement in the evaluation system would cause improvement in the entire training system. Based almost entirely on norm-referenced models, the existing system required that about 5% of any class be designated as honor graduates and an equal number as failures or repeaters.

Not surprisingly, we found that most instruction followed a rigid fixed-process-variable-result instructional management model (see Figure 1). At that time, the "all volunteer Army" was just becoming a reality and a gradual decline in the aptitude and ability scores was observed. The decline in aptitude among recruits, combined with the increasingly complex nature of warfare, threatened to produce a serious shortage of well trained, skilled, and capable soldiers.

As we critiqued its schools, we also became increasingly aware of the Army's basic strengths. One of these was the ability to manage skillfully a variety of large training programs. We soon became convinced that the Army would be able to execute any innovations we might suggest (see Roberts, 1978).

As part of our review, we interviewed those who receive the graduates of the training: the field commanders. Their responses raised a number of questions regarding the quality and appropriateness of the recruits' training. These reports indicated that Army trainees were deficient in a number of areas, and, in particular, there often appeared to be a mismatch between training content and job requirements. We were later to discover that this mismatch was both serious and well documented. Its elimination remains one of the more challenging problems the Army faces.

Army Regulations

We analyzed the regulations and guidance documents, finding substantial discrepancies between what the regulations required and what was actually being done (Ricketson, Schulz & Wright, 1970). For example, in 1968 the Army issued a regulation, The Systems Engineering of Training (Department of the Army, Note 2), which called for the faithful application of a systematic approach to the design, development, execution, and quality control of training programs.

When the regulation was issued in the spring of 1968, it required schools to report by July 15 of that year the number of courses that had been "systems engineered" in conformance with the regulation. In the schools we visited, the only way they could respond in so short a time to the regulation was to short-circuit the critical steps and, instead, apply a makeshift systems engineering process to existing courses, rather than doing a valid front-end analysis as the regulation required. Only by using existing and out-of-date job information could they report "progress" between the issuance of the regulation and the required report date.

This tight schedule created a wave of hostility and frustration toward the entire systems-approach-to-training process within the Army schools. Having studied the regulation at some length, we were clear to us that the only honest answer to the question, "How many courses were systems engineered by July 15th?" would have been "zero." A valid application of the process was prevented by unrealistic management-reporting requirements, not by any inherent fault in the regulation.

Staffing Formulas

The Army's training productivity guide resembles the standard formula used in state universities, where full-time equivalent positions are allocated according to the number of credit hours generated in each department (Department of the Army, Note 3). Staffing in Army schools was directly based on platform hours of instruction delivered. Thus, any effort to develop more effective instruction had to come from time invested by the department head sponsoring the program (Wager & Branson, Note 4). The regulation required the systems engineering of training, yet the staffing guide penalized any-
thing but standard, stand-up platform instruction. In the Army, as in most institutions, when a conflict arises between program and budget, budget inevitably wins. Once established, budget stays fixed while program quality varies.

Instructor Training

We examined the training program that prepared regular and noncommissioned officers to conduct instruction in the schools. The teaching method used was, for the most part, standard platform-delivered instruction. Although this instruction was of a high quality, this teaching method was the implicit model for all future Army instructors. Regardless of its appropriateness to instructional requirements, the model remained fixed. By the time the officers and noncommissioned officers had gone through 12 years of elementary and secondary school, with many attending 4 years of a university, the implicit model was well established. It is within this context that change was attempted.

Evaluation of Results

Finally, we examined the quality control and quality assurance programs, required by regulation, and found them to be totally deficient. The students were rank-ordered and the instructors rated, but no attempt was made to evaluate the instruction or the outcomes, making it impossible to isolate problems associated with poor students, poor instruction, and poor evaluation.

In Lessinger's (1976) distinction, quality control ensures that students are taught well. Quality assurance, on the other hand, ensures that they are taught the right material—content that enables them to perform their jobs, content that could be developed correctly only through the complete front-end analysis required by the regulation. A thorough review of the Army's quality assurance program showed it to be based mainly on hearsay and anecdotal evidence passed back and forth in a sort of "teachers' lounge" environment. Because they are based on gossip instead of measurements, such evaluations may be the greatest deterrent to the improvement of education and training.

Based on these initial extensive observations as well as on a thorough document analysis conducted prior to the site visits, we recommended fundamental and thorough corrective action (Brannon, Stone, Hannon, & Kayner, 1973). The recommendations were briefed to a number of key general officers in the spring of 1973; the final report was published later that year.

The Systems Approach to Training

There were two major considerations in the design approach: (a) the general theory and practices of the systems approach to training and (b) the specific data collected during the analysis phase of the Army project.

Whether the procedures are called the systems approach to training, systems engineering of training, or instructional systems development (ISD) they all follow a similar path toward a common goal: providing more competent workers through better training. The key concept in all these approaches is planning, which involves:

- accurate identification of job requirements and problems
- setting specific performance objectives
- application of analysis techniques to the problem
- regular measurement of job performance and training results
- comparison of results to plans

When we began our project, there already were isolated examples of well-designed and delivered systematic instruction in Army schools. Though there were these impressive exceptions, the Army had traditionally followed a block-scheduled model that required a fixed-time and a fixed-training process, yielding variable results.

More recent developments in instruction strive for a greater uniformity of results through the use of variable-process, variable-time instruction including, but not limited to, self-paced instruction. In many traditional approaches (such as the Army's), the processes of training are kept constant although the results vary. One class may be about trucks and another about communication, but both are taught alike. In ISD, outcomes are identified and held constant, but the learning processes are varied in order to develop the best training to meet those outcomes. Figure 2 indicates the basic choices available to instructional designers, either fixed-time/variable-result or fixed-result/variable-time.

Design Objectives

The first design objective was to provide for adequate quality control and quality assurance. The initial step in quality control was to replace a significant amount of norm-referenced testing with criterion-referenced performance tests. The objective in quality assurance was to provide a constant check on the validity of course content. This may seem an obvious step, but in a recent article Andrews and Goodson (1980) indicated that even now a large number of published models for the systems approach to instructional design and development totally lack internal and external validity checks. At the time of this project, new technologies were emerging that permitted for the first time the collection, analysis, and utilization of huge amounts of occupational information in the Army (Berger & (Continued on page 27)
INTRODUCTION

The last 10 years have brought an increasing interest in assessing needs along with a responsibility for accomplishments. Consequently, several varieties of needs assessments have appeared, each with its own assumptions, scope, tools, and procedures (Witkin, 1977). In this paper we explain and differentiate among several types of needs assessment. Furthermore, we recommend one type—the external needs assessment—as a most useful starting point for planning and accomplishment. Finally, we present the steps for implementing this and other types of needs assessments.

Upon completion, you should be able to discriminate between needs assessments and quasi-needs assessments. You also should be able to describe the processes of external and internal needs assessments and relate them to organizational efforts and organizational results and then further relate these to organizational impact upon society (the Organizational Elements Model). Our intention is for you to discriminate among and be able to employ various models and techniques for developing a program of interventions based upon needs, implement it and evaluate it—all for an effective and efficient identification as well as a solution of any problem.

This unit consists of 10 sections:

Sections 1-4 provide definitions and explanations of basic concepts that are used in this instructional unit.

Sections 5-8 deal with the processes of needs assessments, planning, implementation, and evaluation (the "how-to-do-its").

Sections 9-10 provide checklists to summarize the steps involved in needs assessments, planning, implementation, and evaluation.

Each section is numbered to identify it for later summary questions and review. If you think you already know the content, go directly to the questions embedded in each section and to those at the end of this unit. If you do not know it, proceed through the content and upon completion check your understanding by answering the questions at the end.

DISCUSSION OF BASIC CONCEPTS

1. Need Defined

The term need is used here in a unique and singular way; need (a noun) is a gap between "what is" and "what should be" in terms of results (Kaufman, 1972). Defining need as a gap between desired results and observed results ensures that no solutions, how-to-do-its, or processes for closing the gap will be included in the need statement. It avoids the confusion of means and ends. Including any type of means,
solutions, or processes in a statement of need will reduce the options for meeting that need and, thus, foreclose the possibility of finding new or creative ways of closing the gap. Furthermore, by using need as a verb (e.g., “We need more money”), we risk implementing a solution (money) that may not fit with the basic underlying gap in results (the real need). A need is a discrepancy—a difference in results—not necessarily a deficit or deficiency. An assessment that produces statements such as, “We need to provide more in-service training for the supervisors,” or “We need more audiovisual equipment for our staff training program,” would fall into a “wish list” category because the statements assume that important gaps in results exist—an assumption that a needs assessment should verify or reject with valid, objective data. Further the statements assume that these solutions will close those gaps ... by “wishing” for a solution vehicle instead of documenting a gap in results before considering possible means for closing a gap.

PRACTICE EXERCISE 1

1. Which of the following statements are “means” and which are “ends”?
   a. John should get a training program.
   b. John should get more education.
   c. John should be able to support himself and his family.
   d. John’s wife should learn how to keep spending within the family budget.

Answer:

2. Which of the following are not “needs” as defined in this section?
   a. We “need” instructor training.
   b. We have a “need” for a needs assessment.
   c. 37% of our graduates are on unemployment, and our target was to have 90% fully employed.

Answer:

2. External and Internal Needs Assessment

Derived from our definition of a need, the term needs assessment simply means determining gaps between current results and desired or required results and selecting the most critical gaps for closure.

There are two possible overarching referents for needs assessment: one that looks at needs from a holistic point of view outside the organization—in society, and one that looks at needs as seen within an organization. The first is called external needs assessment, and the second is termed internal needs assessment (Kaufman & English, 1979).

An external needs assessment attempts to identify the results that are important in order for someone to be, at least, self-sufficient, self-reliant, and not economically dependent once he or she is outside the organization (educational or industrial). The requirements for this “independence” should be used as the basis for planning (Kaufman & Carron, 1980). In other words, an external needs assessment considers what individuals will have to do to be self-sufficient once they exit the educational or training system. Can they get and hold jobs? Survive socially and personally? Maintain physical and mental health? Make contributions to their community and society? If there are gaps between what individuals can do in the current situation (the “what is”) and what they should be able to do (the “what should be”) with regard to the criteria of self-sufficiency and contribution, then action should be taken to close these gaps.

Once these external criteria are set, the internal varieties of needs assessment become useful because fewer assumptions are required regarding the organization’s effect or impact on society. The social usefulness of organizational efforts thus can be increased and maintained.

An internal needs assessment attempts to identify gaps in organizational goals and objectives and, thus, enables one to correctly identify means for accomplishing the results previously determined through an external needs assessment. This linking of external and internal reduces the chance of developing “blue sky” internal objectives. Unfortunately, most efforts in needs assessment are currently of the internal variety only, i.e., restricting the investigation to gaps in accomplishing current goals and objectives within a particular organization. Internal needs assessment is best augmented with external needs assessment data (Kaufman & English, 1979) to ensure that organizations will be useful means to societal ends.

Consider a major automobile manufacturer that has been suffering great losses in sales. What will it do? Before considering doing anything, it would be wise first to take into account external criteria such as: What are major trends in societal requirements for cars (e.g., safety, fuel efficiency, environmental impact)? What is the customer looking for? How affordable is the product to the buying public? What is the cultural and physical environment demanding? Then consider an internal point of view that looks at the goals within the organization: how to produce more cars (of the correct type) in less time and at lower cost and sell them as profitably as possible. Since societal criteria will undoubtedly affect sales, they ought to be considered first. Increasing productivity without a receptive market might doom the company.
PRACTICE EXERCISE 2

Which of the following are external factors:

a. 27% of the 1979 production was recalled because of safety hazards.
b. Cars should be stylish and appealing.
d. Car sales should be up 46% in 1981.
e. Quality control shows a 31% rejection rate of transmissions.

Answer: (Only item a is an external factor. Items b, c, d, and e are not.)

3. The Organizational Elements Model (OEM)

In conducting an external needs assessment, it is necessary to relate both to people within the organization under study as well as to the reality of what people have to know and do outside that organization—currently and in the future. These relationships (shown in Figure 1) can be clarified according to an Organizational Elements Model (Kaufman, 1979; Kaufman & English, 1979) that will serve as the major tool for relating needs assessments, program development, implementation, and evaluation.

The organizational elements are:

**Inputs:** The existing, available raw materials, ingredients, and starting conditions that an organization has on hand to which to achieve its mission:

- Needs
- Money
- Policies
- Goals
- Equipment
- Facilities
- Personnel
- Laws
- Plans
- Learners

**Processes:** The methods and means, the ways, and the how-to-do-its by which ingredients and materials are staged, managed, modified, and put into action such as:

- Instructional programs
- Management by objectives
- Staff development
- Participative management
- Supervision
- Production lines
- Curriculum
- Computer-assisted learning
- Systems approach
- System approach

**Products:**

| e.g. Courses Completed | e.g. Jobs
---|---
| Validated Learning Materials | Entry skills
| Acquisition of a specific skill, knowledge or attitude | Licenses

**Outputs:**

| e.g. Graduates | e.g. Individual and group self-sufficiency
---|---
| Job—Entry skills | Contribution (current and future)
| Licensure | Finished automobiles
| Discharged Patient | 

**Outcomes:**

**Figure 1.** The Organizational Elements Model including some educational examples of each and the relationship between the elements and the Internal and External frames of reference. (After Kaufman, 1979)
c. 315 people last year committed suicide because of depression over inoperable tumors, and the number must be reduced to no more than 75 by next year.
d. The current discharge rate of patients from the Block Memorial Hospital is 93%, and it should be 99% within 2 years.
e. Scores on the functional literacy test for entering freshmen at the State University is 9.2 grade level, and it should be 10.8 or above.
f. At this time 90% of all students pass physics, and at least 96% should.

Answers:

4. Needs, Quasi-Needs, and the Organizational Elements Model

Figure 2 shows a representation of the Organizational Elements Model with two added dimensions: "what is" and "what should be." This figure suggests that a procedure (the solid arrows) that incorporates both internal and external needs assessment would include determining, progressively, "what is" for inputs, then move to processes, then to products, then outputs, and finally to outcomes. The purpose in following this sequence is to determine linkages and the required level of congruence between the organizational elements.

Figure 2. A sequence for determining "what is" and "what should be": Needs Assessment (open arrows 11, 12, and 13) and Quasi-Needs Assessments (cross-hatched arrows 14, 15).
2. Which of the following should qualify to be on a "wish list" rather than a listing of "needs"?
   a. Train nurses in social skills.
   b. Hire three instructional technologists.
   c. Use instructional computing.
   d. Use multimedia.
   Answer: "All of the above" is a sound option. The terms "wish list" and "needs" are not mutually exclusive.

3. Classify the following statements as needs or quasi-needs. Specify whether they are internal or external, and indicate the organizational element they fit under.
   a. Sales of new medication should increase by 50% by January 1982.
   b. Experimental research should be conducted.
   c. Physicians should develop a new, improved type of medication by January 1981.
   d. Two experts in biochemistry should be assigned to the research project before February 1981.
   e. 100% of patients treated with the new, improved medication will become healthy and will function normally following 7 days of treatment.
   Ansers:

FROM CONCEPTS TO APPLICATION

5. Partnership Planning

To determine accurately "what is" and "what should be" for a particular set of symptoms or conditions, representatives of groups affected by the problem and its solution should be involved formally in the needs assessment effort. By involving those people who will be, or could be, affected by the outputs of the system, there will be a higher probability of acceptance of the results and a higher probability that all important aspects of the problem(s) will be identified. Partnership planning is an integral component of any useful needs assessment.

Partner group representatives—e.g., learners, educators, and community members; or patients, health practitioners, and community members—have the responsibility of determining gaps between current results and desired (or required) results according to their values. The partner groups then compare their "perceived needs" in order to find and agree upon a common set. These perceived needs should be justified and documented by empirical external data concerning requirements for self-sufficiency in order to include both "felt needs" as well as externally documentable and empirically justified needs.

Frequently, disagreements arise over means (processes) or how-to-do-its rather than over gaps in results; e.g., pa-
tient care versus patient health. There are times when people argue about means and believe they are dealing with ends. Agreement and consensus usually are increased by shifting all discussions from means to ends, ideally, to gaps in outcomes.

6. Change and Maintenance Requirements

Given the data base compiled from the partner groups plus the data for self-sufficiency requirements, the needs assessment process determines the actual gaps between "what is" and "what should be" for each of the organizational elements, shown as open and crosshatched arrows in Figures 2 and 3. Then, a useful analysis may be made to develop a listing (shown in the bottom two rows of Figure 3) of that which should be changed—change requirements—as well as a determination of that which should be continued and maintained—continuation or maintenance requirements.

A useful criterion for selecting needs is on the basis of considering costs and results to select needs by asking (and answering) the dual questions:

1. What does it cost to meet the need?
2. What does it cost to ignore the need?

Listing that which is to be changed as well as that which must be continued highlights the fact that needs assessment and planning not only deal with change but also with pre-

<table>
<thead>
<tr>
<th>WHAT IS</th>
<th>WHAT SHOULD BE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change Requirements</td>
<td>Continuation Requirements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHANGE REQUIREMENTS</th>
<th>CONTINUATION REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Present curriculum does not contain objectives dealing with money management and career problem solving</td>
<td>e.g., Problem curriculum objectives dealing with attainment of money management and career problem solving</td>
</tr>
<tr>
<td>e.g., Math and science teachers lack knowledge of sufficient strategies to solve real world problems in quality terms</td>
<td>e.g., Students should acquire skills related to solve everyday money management problems</td>
</tr>
<tr>
<td>e.g., Students should acquire skills related to solve everyday money management problems</td>
<td>e.g., Only 50% of all learners quality to graduate, and only 63% of graduates are gainful employment</td>
</tr>
<tr>
<td>e.g., Only 50% of all learners quality to graduate, and only 63% of graduates are gainful employment</td>
<td>e.g., 16% of graduates are either unemployed or are in schools for more than 30% of their earnings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POSSIBLE INTERVENTIONS</th>
<th>SELECTED INTERVENTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Write new objectives</td>
<td>e.g. Write new objectives</td>
</tr>
<tr>
<td>e.g. Acquire brand new textbooks</td>
<td>e.g. Acquire brand new textbooks</td>
</tr>
<tr>
<td>e.g. Acquire computer based learning materials</td>
<td>e.g. Acquire computer based learning materials</td>
</tr>
<tr>
<td>e.g. Conduct staff development</td>
<td>e.g. Conduct staff development</td>
</tr>
<tr>
<td>e.g. Hire new teachers</td>
<td>e.g. Hire new teachers</td>
</tr>
</tbody>
</table>

Figure 3. Identifying requirements for change and continuation from needs assessment data and linking problem solving and planning to needs assessment information (Using an educational example).
serving that which is in-process and useful. Also, because of the wide use of discrepancy models, it is important to note that a discrepancy is not necessarily a deficiency (Scriven & Roth, 1978).

**PRACTICE EXERCISE 6**

1. A needs assessment:
   a. Identifies only what should be changed.
   b. Identifies gaps in resources and tools necessary to bring about change.
   c. Identifies both change and continuation requirements.
   d. Identifies deficiencies or deficits of the current system.

   **Answer:**

   *Only item c is correct.*

2. The "need" to be selected for resolution is selected by:
   a. Majority vote of the partners.
   b. Relating costs and results for meeting or ignoring the need.
   c. Taking the need with the greatest gap.
   d. All of the above.

   **Answer:**

   *Item b is correct.*

**7. Methods and Means: Relating Intervention to Objectives**

When the listing of change and maintenance requirements is completed, the needs (gaps in results) are placed in priority order. Then, the balance of planning may be continued with the derived data. As shown at the bottom of Figure 3, planners or designers should list the possible methods-means or interventions (programs, projects, curricula, techniques, etc.) that might serve to close the gaps and/or maintain those results that have been selected for continuation. Then, the interventions that meet feasibility and effectiveness criteria are selected (see row marked "Selected Interventions"), and implementation is ready to begin. Up to this point, the process has yielded the requirements for maintenance and change for each of the organizational elements and, further, has identified possible methods and means (strategies, tools, and procedures) for reaching the required products and outputs.

One should make functional decisions among possible alternative ways and means for doing a job based upon the results, both internal and external, that have to be achieved. Asking people about what resources or tools they want without prior reference to justified required results is a poor method for useful planning and development.

**PRACTICE EXERCISE 7**

The most useful time to select an intervention (or a methods-means) is:

1. Whenever you get the money.
2. After completing the needs assessments.
3. After completing the quasi-needs assessment for processes.
4. Whenever there is justification from task analysis.

**Answer:**

*The correct answers are items 2 and 3. The needs assessment will produce the gaps in results that are to be closed, and the quasi-needs assessment for processes will identify the gaps in inputs and outputs that will be most acceptable in closing.*

**8. Evaluation and Needs Assessment**

After implementing the selected interventions, formative evaluation should take place. Figure 4 shows evaluation activities as broken arrows. Evaluation starts by going

![Diagram of Evaluation Processes](attachment://diagram.jpg)

*Figure 4. Evaluation (shown as broken lines) is the determination of, "Have we accomplished that which we set out to accomplish?" (Note that the "what is" row is re-named "what is - revised" to show the current results based upon the previous efforts.) (After Kaufman and Thomas, 1980)*
through the "what is—revised" elements and relating each to the "what should be" requirements to determine the extent to which the gaps actually have been closed and continuation requirements met. Notice that because implementation already has taken place, there is a "what is—revised"—resulting from the actions that have now been completed. This evaluation phase determines the extent to which one has achieved that which has been planned. Summative evaluation takes place when one compares expected results with actual results—when one examines products, and, more appropriately, outputs and outcomes.

Evaluation examines gaps between what was intended and what actually was accomplished, but needs assessment examines the gaps between what should be accomplished and that which was actually accomplished.

Evaluation looks at an existing context, but needs assessment may identify new goals or contexts—what should be.

Finally, one should use this evaluation base for continuing the needs assessment by a shift to the new "what is" for each of the elements, which has been newly created by implementation of that which was planned. Then, in the same manner, as shown in Figure 2, repeat the process based upon the changes wrought through previous efforts. Needs assessment, thus, is a continuing process and may be linked with planning, development, and evaluation.

4. Obtain data on future outcome requirements and subsequent output, product, process, and input requirements of the organization.

5. Working with the partners, determine the gaps in the organizational elements and place gaps to be resolved in priority order based, perhaps, on the "cost" to close the gap and the "cost" to ignore the gap.

10. Implementation and Evaluation Checklist

1. List change and maintenance requirements.

2. List and select possible interventions (methods and means) that might serve to close identified needs (gaps).

3. Determine the extent to which you have accomplished what you set out to accomplish.

4. Be prepared to consider new needs that might arise during the course of planning.

5. Repeat, at least periodically, the needs assessment procedure.

TEST YOURSELF

Part I

Test yourself on the main concepts that have been covered. (The number of each question is the same as the section that presents the concepts)

The correct answers to these 10 questions are presented at the end of this module.

1. Define the concept of need and explain the pitfalls encountered when using more than one definition.

2. Define what is meant by external and internal needs assessment.

3. Define the five basic parts of the Organizational Elements Model and relate each one to the others.

4. (a) Which organizational elements relate to the external needs assessment? Internal needs assessments? Quasi-needs?

(b) Explain why all gaps between each of the organizational elements are not necessarily needs.

(c) What is a "wish list"?

5. Explain the importance of partnership planning in needs assessment.

6. Define what is meant by change requirements and maintenance requirements.
7. Define the role of needs assessment in determining methods and means.

8. Explain the relationship between evaluation and needs assessment.

9. What are the steps in conducting a needs assessment?

10. What are the steps required to implement and evaluate after completing a needs assessment?

PART II

The concepts of needs assessment are useful in education, industry, and the military—anywhere interventions are designed and used to improve results. The challenge is to select the appropriate method to correctly analyze and diagnose organizational problems. A classification table has been prepared to assist you in making such decisions. Review the type of problem and the recommended actions shown in this table. Then proceed to analyze the hypothetical scenario that appears below. After you finish, compare your responses with those at the end of the module.

---

**Classification Table:** Types of Problems and Recommended Actions

<table>
<thead>
<tr>
<th>TYPE OF PROBLEM</th>
<th>RECOMMENDED ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Adequacy of raw materials, personnel, ingredients, facilities</td>
<td>Determine input gaps</td>
</tr>
<tr>
<td>B. Effectiveness and efficiency of organizational processes</td>
<td>Determine process gaps</td>
</tr>
<tr>
<td>C. Quality of products/subcomponents produced</td>
<td>Determine product gaps</td>
</tr>
<tr>
<td>D. Quality or quantity of organizational “deliverables” to society</td>
<td>Determine output gaps</td>
</tr>
<tr>
<td>E. Organizational or individual self-sufficiency and impact on society</td>
<td>Determine gaps in societal outcomes</td>
</tr>
</tbody>
</table>

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The Scenario

The Great Atlantic Fuel Company has been having problems with fuel shipments that have been found to be contaminated. In analyzing the problem the company found that loaders often leave tank valves open and unattended after filling shipping tanks. The contamination problem was first noted when a jet plane crashed into a tenement area, narrowly missing a housing development but destroying a local job placement center. Fortunately, no one was killed on the ground; but low-income people in the neighborhood were slower in finding jobs after the crash and resulting devastation.

Examples from this scenario have been selected and listed in the accompanying problem table. Using information given in the classification table, state the actions that should be taken to assess needs in relation to the specific problem data. For example: To determine the impact of the property destroyed by the plane crash, would you implement an external needs assessment, an output-related needs assessment, or a product-type needs assessment?

---

### Problem Table

<table>
<thead>
<tr>
<th>Data regarding the problem</th>
<th>Recommended action (type of gap analysis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Impact on inhabitants of property destroyed by plane crash</td>
<td>1.</td>
</tr>
<tr>
<td>2. Contaminated fuel shipments</td>
<td>2.</td>
</tr>
<tr>
<td>3. Workers responsible for loading tankers</td>
<td>3.</td>
</tr>
<tr>
<td>5. Decreased rate of job placement</td>
<td>5.</td>
</tr>
</tbody>
</table>

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References


ANSWERS TO “TEST YOURSELF”

Part I

1. The definition of need as a gap between “what is” and “what should be” in terms of results is a more useful definition than those that mention solutions or processes in their need statements. Using need as a verb may foreclose the possibility of finding new or creative ways of closing the gap or from dealing with the actual, more basic problem.

2. An external needs assessment attempts to identify the results necessary for individual self-sufficiency in society—currently and in the future. Once self-sufficiency criteria are set, an organization can use an internal needs assessment method to identify goals and objectives for accomplishing required societal results.

3. Inputs—raw materials, ingredients, and starting conditions used by an organization to achieve its missions.

   Processes—methods and means by which ingredients and materials are managed, modified, and put into action to create useful results.

   Products—on-route results produced by an organization.

   Outputs—that which an organization delivers to society.

   Outcomes—impact of outputs in society.

Inputs and processes are the organizational efforts that lead to organizational results in the form of products and outputs. All four of these “internal” elements impact on society by producing results that are termed outcomes.

4. (a) Inputs and processes relate to quasi-needs. Products and outputs relate to internal needs assessment. Outcomes relate to external needs assessment.

   (b) Need is defined as a gap between “what is” and “what should be” in terms of results. Results include products, outputs, and outcomes. Gaps in inputs and processes, therefore, should not be called needs.

   (c) Gaps in processes are frequently just “with lists”; they assume solutions rather than consider all possible interventions based on a careful assessment of gaps in results (i.e., needs assessment).

5. By involving those people who will be, or could be, affected by the outputs of the system, there will be a higher probability of acceptance of the results and a higher probability that all important aspects of the problem(s) will be identified.

6. Change and maintenance requirements are lists of those things to be changed or continued within each organizational element to ensure that gaps between the “what is” and “what should be” will be closed and that those things that are working well and should be maintained will be.

7. Methods—means are those interventions that might serve to close identified gaps or maintain those results that have been selected for continuation.

8. Evaluation is the determination of “have we accomplished what we set out to accomplish?” Needs assessment in its most basic form determines gaps between “what we accomplished” and what we should accomplish. We compare “what is” (observed results) with “what should be” (standards) and then make judgments based on the importance and size of the discrepancy noted. These judgments provide a basis for selecting gaps to be removed.


10. See checklist in section 10.

PART II

1. Impact on inhabitants of property destroyed by plane crash—conduct external needs assessment to determine the impact of delivering contaminated fuel to society.

2. Contaminated fuel shipments—conduct internal needs assessment focusing upon outputs to determine if organizational results are aligned with societal results.

3. Workers responsible for loading tankers—identify input and process gaps to determine possible problems in quality or quantity of workers and loading techniques at the Great Atlantic Fuel Company.

4. Filling fuel containers—identify process gaps to determine possible problems in method used to fill fuel containers.

5. Decreased rate of job placement—conduct external needs assessment to determine the impact of plane crash, and what caused it, on the self-sufficiency of people in the areas surrounding the plane crash site.
Prior to these new computer-based methodologies—called the Comprehensive Occupational Data Analysis Programs (CODAP)—it was impossible to identify all the tasks that comprised soldiers’ jobs in their various assignments. Without that knowledge it was impossible to design efficient training (Christal, Note 5).

The second design objective was to provide an empirical procedure for selecting media, learning events, and activities for each category of learning. Our surveys had shown us that existing training programs seldom recognized that different categories of learning existed.

Because the number of tasks performed in many Army jobs is so vast, there is no possible way they could all be learned during the short time spent in school. The third design objective was, therefore, to provide a decision-making model to select which tasks should be taught in schools and which in on-the-job training programs. This decision-making procedure proved to be quite complex.

A fourth design objective was to promote the use of appropriate cost models to aid in the design and management of training programs.

The establishing of valid measures of job performance was a fifth objective. The testing methods used at that time to evaluate soldiers were coming more and more under question from equal opportunity administrators and other legal sources; they were also a source of great frustration among soldiers who could perform the tasks well, but who could not pass the pencil and paper promotion tests.

Finally, since we hoped to introduce several new kinds of learning formats (including, where appropriate, self-paced instruction), our last objective was to establish a training program for the instructors and supervisors who would be in charge of these classes. We hoped that the military would adopt our overall program as a model for designing future courses.

Design Constraints
In any large project, there are always design constraints: some real, some imagined. In this case, time was the true critical constraint, because we had to implement the project before the sponsors were reassigned to other duty. Because virtually all the impetus in the Army for this study came from individual officers bound for promotion and transfer, it was absolutely essential to avoid getting caught by the changing of the guard.

In the Navy, on the other hand, the single strongest proponent for the ISD system was a senior civilian who was likely to be around for a long time. Many academic instructional developers have faced this same problem when the faculty member for whom they were developing an innovative course accepted a job at another university, and the new professor proved totally uninterested in improved instruction.

A significant design constraint required that the model and procedures be acceptable to key opinion makers and potential blockers within the schools. The purpose of the project was to produce a methodology that would cause individuals in the schools to do their jobs differently and, we hoped, better. Any time one tries to change people’s established daily work habits, friction is inevitable. Dealing with that friction was a critical part of the project.

A third design constraint, which proved to be virtually insurmountable, was that of designing the materials so that they could be used by untrained junior officers and noncommissioned officers. Although there are ways this can be done, the implementation process is long and cumbersome. It is not difficult to train people to be effective entry-level employees in well supervised instructional development departments where there already exists a storehouse of knowledge in the state-of-the-art. In that situation the experienced people can bring the apprentice along at an appropriate pace. Where there are not well trained and experienced managers and technical staff in a department, the conversion problem is much more difficult (Montemero & Tennyson, Note 6).

A related constraint had to do with the efficient training of new instructors, because each person assigned to an Army school as an instructor is transferred within 3 years. The Army cannot devote a large percentage of those 3 years just to getting the instructors ready to produce. And the problem is not just to provide instructors with training, but to train them to teach in new ways, requiring them to overcome the burdens of their prior experience and modeling from their early school observations.

Development and Implementation
The methodology for producing systematically developed products is generally well known and will not be discussed in depth here. There were, however, two particular principles that we were trying to follow simultaneously. The first of these, the integration of implementation with design and development, is illustrated in Figure 3, where 100% of the total project effort is represented by summing the two curves at any point on the x-axis. The first principle requires devoting some effort to implementation from the very beginning of design and development. It further implies that the relative amount of effort devoted to development should fall dramatically after the initial draft of the product is achieved. And, as the project develops, most of the time should be spent on implementation and only a little in development, to revise and fine tune (Burkman, 1974, Note 7).

The second major principle was to get a general framework and complete first draft of the intended product distributed before attempting to adjust its various parts. We believe that strategy provided for the maximum ability to revise and allowed us to make significant revisions at the latest possible time. Although these have been referred to as principles of applications research, they are, more simply, lessons forced upon us by past failures.

Early Implementation Efforts
During the initial survey of Army
schools, we tried to locate staff members who were competent in ISD in order to build a wide base of support for future activities and to establish a resource pool to whom we could pose questions of importance. On every possible occasion we visited, consulted with, and tried to extract products or commitments from the key opinion makers, some of whom became substantial contributors. We identified active and passive blockers. Active blockers spend time and effort directly opposing the project, and passive blockers are unwilling to take any positive steps to support the project—perhaps because they have no opinion on the matter or because they have little ability or power to act.

A third stage in the development was the convening of a number of advisory committees to whom early draft documents could be circulated. It was during this step that we discovered a new pool of talented contributors without whom the project could not have been successful (see Burkman, 1974).

### Project Chronology

At the same time we began the project, and independent of it, a committee with representatives of the four military services was established to produce a common glossary of training terminology. When the chair of that committee became aware of our efforts, he approached our sponsor, the president of the Army Combat Arms Training Board, and asked for the interservice committee's participation. Subsequent to that meeting, the Interservice Committee for Instructional Systems Development became the official sponsor for the project. The major project events are listed in Table 1.

Table 1 contains a long list of project review procedures and meetings. These meetings were not intended primarily to improve the quality of the product; rather, they were intended to broaden the base of support and to identify the potential facilitators and blockers. The tryouts and revisions of the workshop materials were intended to improve quality.

 Probably the most remarkable entries in Table 1 are the last two. As indicated, the version now used in the field is the "second draft" version. The initial project plan called for the issuance of the draft to the field, and, after a period of 1 year's use, the final revision was to be made. Had the final version been published, it would have been based on actual field usage data. It appears that changes both in personnel and in priorities have delayed the final revision of the material. As a result, the version now in existence is the "second draft," lacking a final revision.

### Results

The contract called only for the delivery of the materials specified in Table 2 and nothing else. No mention was made of any kind of implementation strategy or staffing policies. One result of the project was the actual publication and issuance of the materials to the Army and Navy training communities.

---

**Table 1. The major milestones and events in the development and implementation of the Interservice Procedures for Instructional Systems Development, 1973–1976.**

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract award, initial survey</td>
<td>1/15/73</td>
<td>Initial problem analysis</td>
</tr>
<tr>
<td>General officer briefing</td>
<td>4/1/73</td>
<td>Recommended actions</td>
</tr>
<tr>
<td>Contract award</td>
<td>4/20/73</td>
<td>Development of ISD Model</td>
</tr>
<tr>
<td>Interservice committee</td>
<td>7/25/73</td>
<td>Representatives of all four services agreed to sponsor project</td>
</tr>
<tr>
<td>Meetings and review</td>
<td>various</td>
<td>Committee reviewed all materials and procedures developed</td>
</tr>
<tr>
<td>First staffing review</td>
<td></td>
<td>Army personnel asked to participate and contribute</td>
</tr>
<tr>
<td>Phases I and II individual trials</td>
<td>Summer 1974</td>
<td>Workshop materials used with individual members of target population</td>
</tr>
<tr>
<td>Phases I and II group trials</td>
<td>November 1974</td>
<td>A group of 40 people @ Ft. Benning spend 1 week going through material</td>
</tr>
<tr>
<td>Phases I-V group trials</td>
<td>February 1975</td>
<td>In San Diego 30 people go through complete workshop</td>
</tr>
<tr>
<td>Major revisions</td>
<td>February–August 1975</td>
<td>First draft major revisions</td>
</tr>
<tr>
<td>First draft printing</td>
<td>August 1975</td>
<td>Published in limited quantities for full staffing in all services</td>
</tr>
<tr>
<td>Staffing revisions</td>
<td>August–December 1975</td>
<td>Cleanup of editorial, technical problems; artwork</td>
</tr>
<tr>
<td>Air Force authorization</td>
<td>September 1978</td>
<td>Air Force regulation adopts Interservice version for optional use</td>
</tr>
<tr>
<td>Contractor's plea for final revision</td>
<td>February 1979</td>
<td>Decision not to issue a revised first edition</td>
</tr>
</tbody>
</table>
The essence of our project, the IPISD Model, is presented in Figure 4, and the manuals referenced in Table 2 are available from the National Technical Information Service (Branson, Rayner, Cox, Furman, King, & Hannum, 1975). The model and procedures produced in this project were approved as the official procedures for interservice training. Following that, each service on its own decided to use or not to use the materials. The Army and Navy adopted the materials essentially as they were produced. Three years later the Air Force adopted the materials by issuing a regulation making them optional. To this date, the Marine Corps has not adopted the materials. One of the recommendations made at the time of final delivery was that each service adapt the materials by inserting its own examples, form numbers, and references to regulations as well as other supporting literature.

Although the direct results of the project are relatively straightforward, we believe the unanticipated results are more important. One early indirect result was a substantial reorganization of individual Army schools to provide an organizational entity responsible for each of the functions called for in the IPISD model. In that revision, called School Model '76 (Department of the Army, Note 3) the first three phases of the model were assigned to a single department (see Figure 5). The fourth phase, implementation of training, was assigned to a second department, and the fifth phase, quality control, was assigned to the evaluation directorate.

A second indirect result of the project was the requirement for Army contractors to use the IPISD materials in developing the training and technical documentation for new hardware systems. We think this was a major and significant breakthrough into the materiel procurement area. In the past, the Army, as did most other military and industrial organizations, accepted delivery of new systems and hardware without first receiving technical manuals or valid training material to support them.

Although the Center for Educational Technology staff did develop the IPISD model, we modestly refrain from taking the credit (or blame) for the Army's decision to impose it on the contracting community.

**Conclusions and Observations**

In an attempt to advance the field of applications research, we have tried to derive a number of tentative conclusions and observations based on the experience of this project. First, the fact that we were dealing in a military environment does not make the project essentially different from others of its kind in other environments. The military, to a great extent, resembles any other large bureaucratic organization. Many people believe, erroneously, that anything can be done in the military simply by having the commanders issue an order. That is exactly what happened in April 1968, when the systems engineering regulation was first issued. Although there were outward signs of compliance, our investigation revealed (and others confirmed) that the situation simply had been set up so that true positive results could not be achieved.

There are many similar instances in universities and community colleges in which instructional design and development projects have not realized their full potential benefit. Most often, these failures are not caused by a shortfall in the product, but by faulty implementation procedures. The most common of these is the failure of the designer to analyze the project in the context of the system in which it must operate. We once tried to install a self-paced criterion-referenced physics course at the U.S. Naval Academy (Branson, Note...
1. The course was a complete success from the independent standpoint of instructional design and a complete disaster from the standpoint of the Academy. Because class standing was so important to them, the midshipmen strongly resisted a course in which they were required to meet an absolute criterion. They wanted to be graded only on the curve so that they, and not the faculty, could decide how much time and effort to put into the course.

As a general rule, in large-scale training projects, the true discriminator is whether or not the trainees are paid. If the trainees are paid, their salaries usually account for most of the cost of training. Hence there is tremendous pressure to reduce the cost by reducing the time spent in training. If trainees or students are not paid, priorities are completely different. Schools and universities have no true interest in instructional efficiency if they must invest resources to achieve it (see Braby, Henry, Parrish, & Swope, Note 8).

Third, we want to emphasize that a systems approach model for any institution must be tailor-made for that particular institution, even though it may be based on well known generic systems models. If such a specific application is not made, the people who utilize the material will be forced to make their own assumptions and translations, and these may have low fidelity. We have commented previously on the essential part that a quality control-quality assurance program plays in the implementation of any systematic approach to training. The IPISD calls for both an extensive internal evaluation and, in order to validate the training system, a considerable external evaluation as well. The primary intent of trying to ensure the collection of evaluation data is that once the data are collected and organized to provide the basis for reasonable conclusions, they can often serve as a forcing function to require its use.

Because the IPISD system is designed to be revised on the basis of empirical data, a considerable amount of management attention must be focused on data collection in order to achieve the full payoff from the training system. Technically, this is a fairly simple matter, but technology does not achieve results, managers do. And, it is forcibly difficult to get managers to make data-based decisions when they have been accustomed to making decisions by generalizing their limited experience. We believe that we have helped the Army move a step closer to that goal.

Reference Notes

References
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Using Student Characteristics as the Focal Point for Improving Instruction

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Abstract. This article describes an instructional improvement program currently underway at the University of Minnesota. The program's overall goal is to help faculty become aware of and adapt their instructional strategies to the developmental and learning characteristics of students. The first section provides an overview of the assumptions that underlie the program. The next section discusses the roles of the faculty consultant and faculty member and discusses the process used in the faculty consultation model. Finally, a sample of discussion from one of the faculty seminars is used to highlight the process.

College teachers are an anomaly within the professions. Unlike other professionals, college teachers typically have had little or no formal preparation for the very activity that will demand much of their professional time and energy—classroom teaching. In contrast, consider the preparation of other professional groups: Surgeons perform numerous operations in the course of their residency training; architects apprentice with experienced professionals before acquiring a license; public school teachers study the psychology of student learning, are introduced to a variety of teaching techniques, and have the opportunity to practice their craft in a classroom before obtaining their first teaching assignment.

But the college teacher, who may teach as many as four or five classes a semester, is usually unprepared to teach. Historically, knowledge of subject matter alone was considered the hallmark of good teaching in higher education. Consequently, most college teachers are well versed in their disciplines but have inadequate knowledge about the processes of teaching and learning. Nor is help readily available once one's teaching career is in progress. Few teachers have had their classes observed by anyone other than their own students. To make matters worse, most faculty members are reluctant to discuss their teaching concerns with colleagues. As Kozma, Belle, and Williams (1978) observe, "Until recently, there has been a conspiracy of silence about teaching and learning in academic culture" (p. 22).

Fortunately, teaching at the post-secondary level now appears to be coming "out of the closet." Efforts aimed at improving teaching in higher education have proliferated in the last decade (Gaff, 1975). At every institution, from the two-year community college to the large research university, monies are spent to support programs designed to improve the instructional climate. This article describes the theoretical orientation and summarizes the procedures used in a new model for teaching improvement currently being tested at the University of Minnesota. The staff of the Teaching Improvement Program assumes that if faculty members are to make meaningful changes in their instructional environments, they must begin by first coming to understand their current "theories" of teaching and learning. With the help of a consultant, teachers can then begin to enrich their theories and make corresponding adjustments in their teaching practices. The following paragraphs provide a rationale and description of this consultation model.
Assumption 1: Teachers' have personal theories of teaching that guide their behavior in the classroom.

I use the term "personal theory" to refer to that configuration of intuitive assumptions, guiding principles, and stored perceptions or models that comprise a teacher's understanding of the teaching-learning process.

Although college faculty members typically have had no formal teacher training, most have a set of implicit beliefs about what constitutes effective teaching. Sources for these beliefs vary from teacher to teacher. Former teachers, regardless of their actual teaching competence, serve as models for a teaching ideal. Personal experience in the classroom is a powerful shaper of conceptions about teaching and learning. Other factors such as values, philosophical orientation, or personality attributes are likely to contribute to one's beliefs as well.

These individualistic belief systems are important because they appear to influence a teacher's behavior in the classroom. In a study of teaching, Clark and Young (1977) describe an ethnographic study by Janesick (1977) in which the researchers spent 7 months observing a sixth-grade teacher. On the basis of these observations, extensive field notes, and interviews with the teacher, Janesick concluded that the dominant characteristic of this teacher's orientation toward teaching was the importance of creating a stable, cohesive group in the classroom. Viewing himself as the group leader, the teacher modeled behaviors of cooperation and respect for group members and encouraged group activities. Other researchers have noted similar underlying constructs. Marland (1977) identified five such principles that seem to guide a teacher's behavior. One of the five, for example, is the principle of power sharing, which occurs when teachers use the informal peer power structure to help maintain better control of the activities of other students. These and other studies suggest that teachers, although they may be unaware of it, attempt to bring their teaching behaviors in line with their beliefs.

As well as being revealed by actual behavior in the classroom, personal theory is reflected in the way a teacher perceives his or her role. Axelrod (1973) describes four characteristic roles or styles: content-centered, instruction-centered, intellect-centered, and person-centered. Adherents of each style view the goals of teaching differently, and their viewpoints affect the quality of their interactions with students. Teachers who are content-centered, for example, place stress on students learning the facts, concepts, and principles of the field. They feel successful when students master the content of their courses. Intellect-centered teachers are less concerned with content, encouraging students to acquire rational inquiry skills. Their focus is on the process of learning rather than its product. From the intellect-centered teacher's point of view, successful students are those who can reason logically and demonstrate problem-solving skills.

Hunt (1976), who uses the phrase "implicit theories of teaching," reasons that one way to begin to assess a teacher's orientation is to draw out his or her personal constructs about key elements in the teaching environment. He uses a modified version of Kelly's Role Construct Repertory Test (Hunt, 1977) to examine both the number and quality of teachers' constructs about students, teaching approaches, and teaching outcomes. The "teaching approach" component, for example, included 12 different dimensions scored (e.g., content focus, student participation, teaching aids). One teacher's constructs might be representative of only one or two of these twelve dimensions but another's constructs could represent a greater range. Analyzing a teacher's constructs can provide greater clarity about his or her orientation toward teaching and learning.

Implications for the Teaching Improvement Consultant. Each teacher comes to the consulting relationship with his or her own personal theories. Regardless of how impoverished or enlightened, these theories are the starting point for the relationship. Hunt reasons that one vital role of the consultant is to encourage teachers to make their implicit beliefs explicit. In other words, by the dual processes of supporting and challenging, the consultant helps the teacher reflect on his or her assumptions about students, teaching strategies, the nature of the content, outcomes of instruction, and so on. Consider the teacher who says that he or she dislikes class discussion because it interferes with "getting through all the content." What this teacher communicates is an assumption that simply exposing students to subject matter is more beneficial than having them actively respond during the teaching process. Once teachers become aware of their own assumptions, they usually see a need to make adjustments. From our example, the teacher who comes to recognize the limitations of viewing "covering all the material" as top priority may wish to try out strategies that encourage more student interaction. The consultant can play a central role in this process. Through questioning, observing teaching, and interviewing students the consultant helps teachers understand their assumptions and provides support as the teacher makes changes.

Assumption 2: Teachers' personal theories are especially weak with respect to understanding important developmental and learning characteristics of their students.

The college years represent an important time in our lives. Enormous intellectual, emotional, and attitudinal changes occur as the student begins to identify as an adult and as a professional. How college students think, feel, and behave has been the focus of a number of theories (Parker, 1978). Although no comprehensive theories of student development exist, models that focus on aspects such as the psychological, moral, and intellectual development of the college student have been proposed. As a result of such theorizing and research we now have a better understanding of the ways that students change as they progress through their 4 years.

Perry's (1968) work is especially relevant to faculty in higher education because it provides a description of the intellectual development of college students. Growing out of his observations of undergraduates, Perry proposed a nine-position continuum to describe how college students develop in terms of their views of the nature of knowledge, the meaning of truth and values, and their responsibilities in the world. These nine positions can be consolidated into four broad categories: dualism, multiplicity, relativism, and commitment.

Students in the dualism category have a highly simplistic view of knowledge.
Things are right or wrong, black or white. Dualists perceive that their task in college courses is to find the "right" answers, to "psych out" what the authority (i.e., professor) wants, and to regurgitate it. In the classroom, these students display faulty logic, resist offering personal opinions, and prefer tests that allow for reproduction rather than transformation of information.

Multiplicity is the next broad category. Students who are in the multiplicitic stages begin to question the assumption that absolute right answers exist. But, although recognizing that more than one truth is possible, they have difficulty adopting a point of view because they haven't learned to weigh evidence when making decisions. In class, such a student might assert that he or she can't possibly take a position on an issue because everyone has the right to an opinion and nobody is more right than anyone else. These students' opinions may also change frequently on an arbitrary basis.

With the next step, relativism, the student goes beyond accepting a plurality of points of view. He or she now perceives the importance of context as a frame of reference for interpreting knowledge. This student is able to engage in higher level behaviors of analysis, synthesis, and evaluation. Committed relativism, the fourth broad category, occurs when an individual chooses to act with the full appreciation of the relativistic nature of knowledge.

Implications for teaching improvement consultants. That students differ from one another in many ways is an observation shared by teachers from nursery school through graduate training. Looking at student differences in a systematic way, however, requires that we focus attention on those differences that might reasonably interact with the instructional process. For college teachers, student development theories offer promise for providing a framework for understanding familiar but often puzzling behaviors.

When faculty members begin to view students from a developmental perspective, they naturally become curious about ways to accommodate different kinds of students in their teaching. Put simply, how can teachers match the teaching environment with the needs of individual students? Hunt argues that teachers must worry about two kinds of matches—contemporaneous and developmental. From a contemporaneous or short-term perspective, the teacher must accommodate the student's current level of understanding or developmental stage. The dualistic student who has a high need to believe in authority figures needs to encounter caring teachers who are patient with the need for absolute answers. From a developmental perspective, the teacher needs to arrange conditions to help dualistic students move to a more advanced view of knowledge. To do so, the teaching environment must be one that gradually begins to challenge an overly simplistic view of the world.

The consultant contributes in several ways to the accommodation of teaching environments to students. First of all, faculty members usually have inadequate knowledge about students' developmental and learning characteristics. The consultant, by combining direct instruction with readings and discussion, introduces teachers to the literature in this area. The consultant also helps them assess their own students. Together the consultant and teacher might examine student responses to tests or assignments, discuss observations from class, or administer instruments designed to assess the characteristics of interest. Finally, when the teacher and consultant have agreed upon an adaptive strategy, the consultant can collect data that assess its effectiveness.

Formats for Consultation
This teaching improvement model uses three formats for consultation: individual consultation, classroom observation with follow-up feedback, and the group seminar. Although faculty members sometimes choose to be involved in only one or two formats, the staff encourages participation in all three because each format makes a unique contribution to the process.

Through individual consultation the consultant and teacher begin to build a relationship involving trust and mutual respect. The relationship can be thought of as coordinate status consultation (Parker & Lawson, 1978), meaning that both participants recognize the expertise of the other and join together to pursue some common goals. In other words, the relationship is one of equal status where neither participant is superordinate to the other.

Individual consultation usually begins with an initial interview; the consultant might ask the teacher some general questions about the kinds of classes taught, number of students, and so on. As the interview continues, the consultant may ask the teacher to describe the types of students he or she enjoys working with, what teaching methods he or she uses, and what student learning outcomes are valued. The consultant also will encourage the teacher to discuss general teaching concerns or specific problems he or she would like to explore. The culmination of this initial stage (which may involve two or more separate sessions) is an informal contract between the two, specifying initial problem areas to be addressed and perhaps the strategies to be used. During these conversations, the teacher has an opportunity to query the consultant about his or her role and possible contributions.

Over time, of course, each relationship between teacher and consultant takes on its own unique identity. One teacher may openly solicit suggestions, and another may accept only indirect hints. The consultant must remain flexible and adapt his or her approach to the needs of each teacher.

Classroom observation and follow-up feedback is an invaluable format of the teaching improvement consultation process because it gives the consultant an opportunity to see the teacher's actual interactions with students, choices of teaching strategies, and so on. Typically, consultants attend class and record their observations in notes. The goals of observations vary. Sometimes teachers want information about specific behaviors. Are their lectures well organized? Do they accept student ideas? Are students taking notes or reading the assignment for another class? At other times, the consultant may be checking out hypotheses (e.g., "The teacher expresses impatience when we discuss students of lower ability. Is this reflected in his or her treatment of such students in class?") In other cases, the consultant looks for salient behaviors on the part of both teachers and students that indicate problem areas. He or she might note, for example, that the instructor appears to address most questions to only a few students or that some students seem unwilling to give their own opinions on a topic. Being unfamiliar with specific content, consultants may "play" student in order to assess the clarity of the instructor's presentation. If they become
confused, need more examples, or can't keep up, students are likely to be experiencing similar difficulties.

Once an observational session is complete, teacher and consultant meet to review the findings. If specific areas of concern were delineated, the two review data relevant to these concerns. If the consultant has other perceptions or information to share, she or he must make a judgment about their appropriateness and usefulness. Raising too many issues too quickly may overwhelm the teacher and lessen enthusiasm for future observation.

The seminar is the third format for consultation in the program. Meeting on a weekly basis, the seminar brings together the consultant and a small group of faculty members. A session might begin with the consultant posing a hypothetical problem involving some type of teaching concern. This problem then serves as the basis for a discussion in which teachers share possible solutions and relate their own experiences in handling similar problems. Faculty members may also come to the seminar seeking input from others about actual teaching issues.

The group seminar offers certain advantages as a consultation format. First, it is an effective forum for the presentation and exchange of information and ideas. For example, the consultant may present material about student development theory. Second, the seminar encourages group problem solving. When confronted with a teaching problem, the resources of the group outweigh those that can be provided by any one individual. Third, the seminar offers the consultant an opportunity to model good teaching techniques such as question asking or leading a small group discussion. Fourth, the seminar constitutes a teaching support system for its participants. Recognizing that others struggle with similar concerns lessens the anxiety accompanying change.

An Example: The Faculty Seminar

Writers who choose to describe instructional improvement models through articles in journals share a common problem; that is, how to transmit the flavor of the interactions between the clients and change agents within a relatively limited amount of space. Lists of steps or pictures of boxes and arrows rarely capture the nature of transactions

| FIGURE 1. Excerpt from a discussion in a typical faculty seminar. |
| Setting: | Six faculty members and a consultant are seated around a large conference table. It is the second meeting of the group. The consultant has distributed a handout. |
| Consultant: | The handout I've given you describes a teaching problem encountered by a political science teacher. Take a few minutes to read it over. When you've finished, list some possible explanations for the differences between the two sections of the course. |
| Tom Wilson is concerned about one section of his introductory political science course, which is now in its fourth week of the semester. Although he is using the same syllabus and text in both sections, he perceives Section 1 to be less effective than Section 2. "Students in Section 1 act disinterested and unmotivated," Wilson complains. "I try to encourage class discussion by asking provocative questions but most of the students stare at the floor or give me confused looks." Wilson enthusiastically states that class discussions from Section 2 are so lively that some students even stay past the end of class. A number of Section 2 students challenge Wilson's interpretation of political events. Not infrequently, they offer alternative interpretations. Wilson also notes that Section 1 students do poorly on homework assignments that require analysis or synthesis of what they've read and heard in class. Typically, students simply paraphrase the text or parts of the lecture. |
| Consultant: | Who would like to begin? |
| Faculty 1: | I agree, John! Sometimes I have a class that just doesn't work. I could give the best lectures, show the best films, everything short of dancing on the tables but nothing helps! |
| Faculty 3: | I think Wilson has a group of low ability students. They simply aren't capable of performing up to his expectations. I'm sure he finds this section a boring one to teach! |
| Consultant: | Some of you have formed opinions about the kinds of students Wilson likes to teach and those he dislikes. |
| Faculty 3: | Absolutely. I think Wilson really dislikes the "wissy washy" dependent ones... he wants students to think for themselves. |
| Faculty 6: | I think he likes students who are able to think like he does! |
| Faculty 1: | I see it more in terms of ability. Wilson likes to work with bright kids and dislikes those who aren't! |
| Consultant: | I'd like to suggest another way to think about students Wilson likes and dislikes teaching. Let's return to the student development theory we discussed briefly last week. Does Perry's work suggest an alternative framework for thinking about students from these two sections? |
| Faculty 1: | Well, it is possible that many of the students in this year's class are at the lower end of the developmental continuum... forgotten the correct label. |

JOURNAL OF INSTRUCTIONAL DEVELOPMENT
Faculty 3: Dualists.
Consultant: Why do you think this might be the case?
Faculty 1: Section 1 students seem uneasy about making judgments. They don’t have much confidence in their opinions.
Faculty 3: Yes, and they behave as if they think the instructor’s word is truth. The description says they never challenge him.
Consultant: Using a developmental framework, how might you characterize students from Section 2, who Wilson finds easy to work with?
Faculty 2: They are more advanced...they are willing to disagree with the authority figure...they believe they have a right to their own opinions and interpretations of events. These students also seem capable of judging their own ideas.
Faculty 1: They appear to be capable of building arguments based on evidence. The students Wilson finds difficult to teach can memorize information but don’t seem to internalize it or act upon it.
Consultant: If Wilson accepts this developmental framework as reasonable, might it have implications for what he does in the classroom?
Faculty 3: Speaking from my own experience, thinking about students developmentally might give me more options. Perhaps I wouldn’t feel “stuck” with a class of slow students.
Consultant: Say more about those options.
Faculty 3: Let’s see...well, for example, if I judge that many of my students are dualists, I might put them in a situation where they must argue a different side of an issue from me.
Consultant: How would you do this?
Faculty 3: Suppose that rather than lecturing, I formed a debate; one half of the class would be instructed to argue the pros of some issue and the other half argue against it.
Consultant: Would you let your own views be known?
Faculty 3: No, I would insist that they formulate their own ideas.
Faculty 2: That method might work in your content area but I’m not sure how to carry it off in my introductory nutrition course.
Consultant: Mary, perhaps before we try to respond, you could tell us more about what you hope to accomplish in that course.

Changes they have made to accommodate students at different developmental levels.

Reference Note

References

Summary
Through individual consultation, classroom observation, and seminars teachers are encouraged to examine their assumptions about students, teaching approaches, and content. Interviews with faculty members indicate they have enriched perspectives about teaching and learning. Many cite specific

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PROJECT TOPIC:
Needs Analysis: Project Data Sheet
Northern Trust Company, Chicago

Background
At the Northern Trust Company in Chicago, six instructional designers are assigned to conduct needs analysis. As a group, the designers freely exchange ideas on the different needs analysis tools and techniques applied by each designer in his or her respective area. One tool recently developed and currently under investigation by the design group is the Project Data Sheet illustrated in Figure 1. The Project Data Sheet has proven effective in extracting information on general expectations of the requester.

The Project Data Sheet is in a questionnaire format. Questions are answered by the person from the client area who requests the study. The Project Data Sheet is completed before the first meeting between the designer and the project requester. Used in this context, it maximizes the availability of essential information before a valid analysis of an area’s needs can begin. Its use also minimizes the frustration created by the appearance of such information later in the project. The Project Data Sheet extracts information from six major categories: Area Documentation, Area Environment, Job Performance, Target Population, The Training Problem (as identified by management), and Support.

FIGURE 1. Project Data Sheet Used by Northern Trust Company.

PROJECT DATA

NAME

TITLE

EXT.

DEPT./DIV.

PART 1: AREA DOCUMENTATION
Given the list below, please mark the status of each document by placing an “A” next to the document if it’s available, “W” if the document is being worked on, “N” if the document is nonexistent:

- Workflow charts
- Up-to-date listing of the area’s open and closed positions
- Career planning charts
- Proposals (equipment/organizational)
- Job descriptions and job grades for each position
- Job procedures
- Listing of those employees taking Bank and/or outside courses
- Weekly/monthly reports written in the last 6 months that deal with a specific production or customer problem
- Current training materials
- Turnover statistics for each position
- Performance ratings for area employees
- Organization charts
- Mission statement
- Volume, quality assurance standards, and reports
- Operating procedures for any area equipment

Please list the area’s equipment below.

List the other areas of the company from which you receive support (e.g., Systems or Records & Communications).

PART 2: AREA ENVIRONMENT
What has caused this recognizable need for training?
Do you plan any equipment or organizational changes within the next 18 months that might affect the content of this design effort?
List the names of other divisions or outside companies currently doing studies in the area.
Would you say the traffic in your area is heavy, medium, or light?
Are there certain times during the year, month, week, or day when it is heavier than other times?
Is there a time in the next 3 months when it will be inconvenient for the designer to be in the area?
PART 3: JOB PERFORMANCE

If the employees being targeted for training are not new, have they done the job correctly in the past?

Give a description of the acceptable job descriptions for each position being targeted for training.

Can you provide me with names of several employees who are performing the job well and several who are performing the job below standard?

PART 4: TARGET POPULATION

What is the educational profile of those employees targeted for training? (Highest level completed)

What are the prerequisite skills and knowledge of those hired for this position?

What type of behavior lends itself to this job? (For example, should the individual enjoy pressure or prefer a low-key environment? Should she or he enjoy working alone or prefer a team approach?)

How many employees do you feel require training?

How have these employees been trained in the past?

How will training of these employees affect other areas of the Bank? (List)

PART 5: THE TRAINING PROBLEM

Please state your view of the training problem.

In your opinion, is the problem due to a lack of knowledge or skill?

What means do you think could best be employed to solve the problem?

What will the consequence be if the problem is not solved?

PART 6: SUPPORT

Will you be able to appoint a subject matter expert who can orient the designer to your area and provide the necessary technical information and approvals (time commitment of several hours per week)? Explain.

Will your employees be able to spend time talking with the designer while he or she is determining the needs of the area and the program content, and, later, when the program is being pretested?

Part 1: Area Documentation

Area documentation can include anything from past training materials to current equipment proposals. It includes factors affecting the management, organization, people, and/ or products of an area. For example, memos written about a specific problem would be valuable documentation for the designer. Part 1 is a checklist that, when completed, presents the status of such documentation.

Part 2: Area Environment

Part 2 extracts information on the area in which the job (or jobs) targeted for training is performed. These data are crucial to the selection of appropriate needs analysis techniques. For example, if the area has substantial traffic the designer will be less likely to select one-on-one interviews as being an appropriate needs analysis technique.

Part 3: Job Performance

Many companies have written job descriptions for every position. Part 3 determines if such job descriptions exist and whether they are up to date. (Very often the lack of accurate and up-to-date job descriptions is the source of the training problem.) Questions in Part 3 also ask the manager to identify several employees who currently do the job well and several who are substandard performers. This enables the designer to observe these individuals to determine whether a pattern emerges in how they perform the job tasks.

Part 4: Target Population

Part 4 offers a concise profile of the employees under study. In addition to determining specific cognitive and psychomotor skills beneficial to the area, the designer elicits information on affective behaviors most appropriate to the job. Occasionally, a performance problem results from improper placement rather than from a lack of a skill. For example, an individual with a high need for affiliation may be inappropriately placed in a position where there is minimal interaction with other employees, or an individual with a low tolerance for pressure is placed in a job that has absolute quality standards accompanied by rigorous deadlines. This profile is later augmented with data from the needs analysis.

Part 5: The Training Problem

Part 5 offers some insight to the problem as viewed by management. As in Part 4, the training problem identified here must be documented by further study.

Part 6: Support

Primarily, the needs analysis stage of a design project is the study of people. A valid study cannot be undertaken without that “people commitment.” In addition to obtaining such commitment, Part 6 encourages the area management to discuss in advance who will be responsible for providing the designer with technical data (subject-matter expertise).

Conclusions

The first stage of a needs analysis is disconcerting if too much time is spent grappling with the unknown. The Project Data Sheet minimizes that time by uncovering a large amount of information in a relatively short period of time. Again, it must be emphasized that the Project Data Sheet is simply a preliminary step in needs analysis and must be followed by additional tools and techniques that will validate and enhance this basic information.

This project was reported by Mary Ita Power, Administration Department, Northern Trust Company (Fifty South LaSalle St., Chicago, IL 60675). Also contributing to the article were Carolyn Thomas, Barbara Beck, Mark Sullivan, Martha Mook, Linda Wedenoja, and Peggy Kenney, all with the Northern Trust Company.

During the past 20 years, the author, Robert Abramson, has served in management consulting and training service to public and governmental projects in East Africa, Pakistan, the West Indies, Nigeria, and Zambia. He has taught at the University of California and the University of Southern California. Also, he has worked as a management consultant instigating comprehensive programs of organization development (OD) and performance improvement. Abramson’s knowledge and past experiences in OD and performance improvement lend credibility to the material presented in this book, which is logically organized into three major parts: “A Revised Concept of OD,” “Illustrative Case Examples of OD Efforts,” and “OD in an East African Community Public Corporation.”

Part I presents current concepts of OD through a survey of writings of current leaders in the field. Abramson builds upon those constructs to present a more comprehensive and integrated model as being nothing more than applied behavioral science. The author suggests that the OD process is a formulation of the applied behavioral sciences “as well as the specific contributions of general (or classical) management theory and management science” (p. 7).

Upon presenting a theory of OD, the author logically links the theory with practice; Part II of the monograph presents 16 case studies of OD efforts that vividly illustrate a variety of OD strategies and approaches. Ten cases represent the private sector and the other eight illustrate the public sector, often omitted from the literature. The reader is made aware “that there is no one correct or standard OD approach or strategy” (p. 35) and that the total OD effort could vary from one day to a few years in duration. The case studies also make clear that the environment determines how an OD effort is started and that at least one strategic person must note a need for change. Even though a variety of cases is presented, basic elements, such as (1) planned change within a total system and (2) a systems approach to the planning of strategic interventions, do exist in each case.

Part III, a major section of the book, illustrates a case study of a long-term organization development (OD) project in the East African Posts and Telecommunications Corporation which (1) describes the sequential steps of an integrated approach and (2) analyzes the outcomes. This case study qualifies as an OD effort that clearly illustrates the dimensions and interrelatedness of those dimensions of the revised concept of OD.
offered by the author as the thesis for this monograph. Factors of the East African project illustrate and qualify the definition of the revised integrated model of OD presented in the first section of the book. This case study embodied a planned effort to bring about change by involving a total organization system. The change agent within the organization undertook a leading role in the process. Goals of the OD project not only "increased effectiveness and health in general but also the achievement of specific performance targets" (p. 54). Other aspects of the East African project that illustrated the modified concept of OD were OD inter-ventions that pervaded both the structure and the processes of the organization and exploitation of the social sciences and other relevant knowledge.

An added bonus of the book is a supplement offering (1) a bibliography, (2) a flow chart that indicates steps for performance improvement, (3) a survey for assessing team effectiveness, and (4) materials and activities for an Organization Development (OD) Performance Improvement Planning (PIP) Workshop.

A strength of this text lies in its examples of OD projects illustrating how the major subsystems (human, technical, and managerial) interact with each other and "with the external environment" (p. 20), and OD intervention strategies. Other features that make this book a valuable addition to OD literature are (1) a timely contribution to OD theory and (2) examples of application of that theory of organization development and project improvement to practice.

This book is especially important for the audience for which it was primarily intended. Individuals working on OD projects, major or minor, in the public sectors (especially those in developing nations) can use this text to draw information based on action research. —Reviewed by Jaquita Cranfill, Coordinator of Curriculum Design and Development, Division of Educational Design and Development System of East Texas State University, Texarkana, TX 75501.

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This paper looks beyond the language of shared decision making and team teaching to provide insight into how the norms of Individually Guided Education are translated into specific adoption outcomes. Its purposes are (a) to explicate the historical context and assumptions about the nature of schooling and the role of the teacher that are implicit in the consideration of IGE as a reform program; (b) to relate these assumptions to the parameters and importance of user system participation in research sites utilizing Rogers and Shoemaker's consonant-dissonant adoption typology; and (c) to consider the implications of the studies of implementation research for the broader area of innovation adoption. Analyses reveal that change models which assume that organizations operate as a unit are inadequate in depicting and predicting the complexities of the change process. Finally, critical attention is focused on the role of participation in the IGE adoption process. The study concludes with an exploration of possibilities for further research.—Microfiche 91c, paper copy $3.75 plus shipping as document ED 188 602.


A systems model was developed and applied to a general psychology course taught at Howard College (MD) in response to a low passing rate and both student and instructor dissatisfaction with the course. The development of this model intended to improve course quality involved nine steps: the enumeration of precise skill objectives which could be applied by students to everyday life; the development of a sequence for objectives from the simple to the complex; the analysis of data to determine such student characteristics as age, educational background, and motivation; an analysis of student performance to determine success factors; the provision of systematic course evaluation to ensure student feedback; the solicitation of ideas and suggestions from fellow instructors; the utilization of the professional literature, e.g., the Skinnerian writings on class attendance; the use of educational psychology to provide optimum student learning; and the application of research concerning the goals of learning. The success of this approach has been demonstrated in improvements in the percentage of students passing the course and in student course/teacher evaluations. The description of the model concludes with some general comments about its development.—Microfiche 91c, paper copy $2.00 plus shipping as document ED 187 388.


Intended to help ABE (Adult Basic Education) teachers learn to design effective learning activities, this handbook provides activity suggestions, informative materials, and sample forms and materials. The first of five sections, Adults As Learners discusses the unique characteristics of this age group and includes an article on teach-
ing strategies and learning styles. Three critical concerns—need, want, ought to have—are emphasized in Deciding What to Teach, and Setting the Climate provides 35 get-acquainted ideas and three articles on nonverbal communication. A five-step instructional model presented in Organizing for Instruction includes diagnosis and assessment, statement and selection of objectives, selection and implementation of strategies, measuring the accomplishment of objectives or rediagnosis, and evaluation. Charts, articles, sample materials and instructions, descriptions of teaching methods, and a teacher self-evaluation are included. The final section on the GED (General Educational Development) Test presents basic data about test content and test taking skills. Appendices include APL (Adult Performance Level) objectives, additional activities, and an evaluation packet.—Microfiche 91c, paper copy $11.90 plus shipping as document ED 185 345.


Making new knowledge meaningful by relating it to prior knowledge is an important aspect of instructional design theory. Six kinds of prior knowledge optimize the acquisition, organization, and retrieval of new knowledge: (a) superordinate, which includes and subsumes the idea to be learned; (b) coordinate, which is closely related to the new knowledge; (c) subordinate, which is an instance or example of a new idea; (d) arbitrary, which has no inherent relationship to the new knowledge; (e) analogic, which is outside the content area of the new knowledge but is similar; and (f) cognitive strategies, which are content-free skills used to facilitate learning and remembering. Instructional strategies for making use of prior knowledge include subsumptive sequencing (superordinate knowledge taught first); synthesizers (which show relationships among concepts, principles, or procedure); mnemonics (arbitrary memory aids provided in, or activated by, the instruction); analogies (which relate new knowledge to highly similar knowledge outside of the content area); and cognitive strategy activators (which embed strategy within instruction or tell the learner to use it).—Microfiche 91c, paper copy $3.65 plus shipping as document ED 195 263.


Recent advances have been made in facilitating implementation of Ausubel’s advance organizer strategy. One reason Ausubel’s approach has not been widely adopted is its lack of specificity about how to relate what is to be learned to what has already been assimilated within the cognitive structure. The use of subsumptive sequencing, coordinate linkages, and the activation of appropriate generic or cognitive skills are three approaches for providing anchorages for the assimilation of new knowledge. Subsumptive sequencing is the arrangement of material to be taught in a hierarchical relationship; coordinate linkage is the arrangement of material in a coordinate relationship; and activating appropriate cognitive skills is accomplished by arranging the material to be taught in an analogic relationship. Instantiation and elaboration are strategies for emphasizing hierarchical relationships, while comparison/contrast and synthesis emphasize coordinate relationships, and the use of analogies and metaphors stresses analogic relationships. Specific procedures for implementation each of these strategies have been developed.—Microfiche 91c, paper copy $3.65 plus shipping as document ED 195 230.


This study tested the hypothesis that high school students can effectively manage their learning needs in a computer-assisted instructional system when provided on-task advisement of their learning achievement in relation to a given criterion. One hundred and thirty-nine male and female high school students from a 12th grade course in psychology were assigned randomly to one of four treatment conditions. The two independent variables of management strategy (adaptive control and learner control) and advisement (with and without) were tested with a pretest-posttest, two-way factorial design that involved the four treatment groups. Advisement information was provided to the students using the Minnesota Adaptive Instruction System. Data analysis indicated that advisement, using either a program control or learner control management strategy, resulted in better posttest performance, less instructional time, and fewer instructional examples than those same management strategies with no advisement.—Microfiche 91c, paper copy $2.00 plus shipping as document ED 195 229.


An examination of task analysis from several perspectives in order to identify some of its purposes and advantages reveals that, as the interest in learning theory has shifted from a predominantly behavioral perspective to a more cognitive orientation, the purpose of task analysis has also shifted. Formerly, the purpose of task analysis was to aid in instructional design by identifying and classifying component behaviors that could accumulate into a terminal performance. However, cognitive and information processing theorists have been interested in the structures of the component behaviors as well as in the cognitive activity that occurs between these behaviors. Thus the emphasis on task analysis has shifted from behavioral outcomes to the analysis of cognitive processes. Three cognitive approaches to task analysis are (a) the optimal content structure approach, (b) the learner-content match approach, and (c) the optimal content presentation approach. Although task analysis has been approached from several perspectives, there is agreement among theorists on at least one point: task analysis, at a minimum, helps the instructor or designer understand the content to be taught—Microfiche 91c, paper copy $2.00 plus shipping as document ED 195 229.