

AN ANTECEDENT TO THE USE OF INSTRUCTIONAL TECHNOLOGY: A SOUND INSTRUCTIONAL STRATEGY

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FIVE PHASES OF INSTRUCTION

It is often the case that we become so enamored with the technology of instruction that we fail to attend appropriately to the instructional strategy to be used in developing an overall instructional plan to educate students. Therefore, although this is a conference on instructional technology, I have chosen to address what I consider to be a critical antecedent to the use of instructional technology, that is, a sound instructional strategy. This paper presents a simple but useful five phase strategy for instruction that can be used by faculty members as they prepare instruction. Various forms of instructional technology will be appropriate for the delivery of instruction at each of five phases of the instructional strategy detailed. The instructional strategy presented here can be used in delivering instruction in a classroom/laboratory or over a distance using telecommunications, in lectures or on computers and video disk.

The strategy that I will describe is derived from the work of Rowland S. Blake, a colleague who is now with Digital Equipment Corporation as an instructional developer, and myself. In developing the strategy, we attempted to translate research and theory into practical suggestions for educational practitioners. Both Dr. Blake and I have used the strategy in preparing instruction for various modalities of delivery technology.

The five phases of the strategy are as follows:

1. *An orientation phase.* In this phase the student should learn about the purpose, goals, and benefits of the learning experience. Further, s/he should receive an overview of the lesson.
2. *A presentation phase.* In this phase the student should be exposed to the knowledge or skills to be acquired. S/he should be provided with a range of examples, and points of confusion should be indicated.
3. *A practice phase.* In this phase the student should have the opportunity to practice what has been learned, first with and finally in the absence of assistance. Practice examples should range from easy to hard.
4. *A review phase.* In this phase the student should review what has been practiced. The student should have free access to all prior learning materials.
5. *An evaluation phase.* In this phase the student should demonstrate mastery of the skills of knowledge s/he has been studying. The examples used in the evaluation should be similar to, but not the same as, examples utilized in presentation and practice.

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Although the five phases can occur as distinct segments, there will be times when this is not the case: three follow. First, presentation and practice could merge. For example, in a math lesson, an example solution for a set of simple algebraic equations could be presented and the students could practice a similar example. A more complex example might then be presented and the students could practice a problem of similar complexity. Such presentation-practice iterations could continue throughout a lesson. Second, practice can be at times precede presentation: such is the case in inductive (discovery) learning. In a science lesson, for example, students could be provided with a fulcrum, lever, and weights of varying mass and be asked to develop an equation for calculating placement of the fulcrum to balance weights at the ends of the lever. A presentation on moment arms could then follow. Finally, review could occur after single presentation and practice sessions or after a series of such sessions.

What follows is a description of each phase of the instructional strategy and a citation of some related literature.

Orientation

The student entering a learning experience may have very vague or poorly formed notions about the purpose, rationale, or objectives for learning. The orientation phase should, therefore, seek to provide the student with an explicit set of objectives for the learning experience. This can be done by providing a series of expected outcomes. A series of such expectations can help to focus the students' attention upon the relevant knowledge or skills to be learned (Faw & Waller, 1976; Frase, 1968; Frase, 1970; Rothkopf, 1970). Such statements must be written in terms that are intelligible to the student. Objectives written in educational jargon are of very little use to the student. In addition to expected outcomes, the student could be given an example test. To further focus attention, students could be given an overview of the skills to be learned.

During the orientation, students should be provided with the administrative procedures for the learning exercise. This can promote smooth access to the learning experience and can minimize confusion on the part of students. Finally, the orientation should give the rationale for and benefits of the learning experience. That is, relevance and relationship of the learning experience to students' curriculum of study should also be incorporated into the orientation.

Presentation

The presentation phase should start with directions; when and where answers to questions can be sought, how the instructional materials will be delivered, and the like. This phase is expository in nature, i.e., the student is exposed to the knowledge or skills to be acquired. Three distinct types of learning can occur in the presentation phase: learning verbalizable knowledge, learning intellectual skills, and learning psychomotor skills. Verbalizable knowledge is a fact or proposition which a learner must be able to recall. An intellectual skill is an internal cognitive capability requiring more than simple rote memory and recall. A psychomotor skill is an observable muscular-skeletal capability under the voluntary control of a learner.

When students are expected to acquire verbalizable knowledge, they should be presented the critical information to be learned without extraneous detail. The student should be exposed to the context for the facts, i.e., where specific facts fit within a body of knowledge. For example, students learning vocabulary in an Architectural Drafting Course should be exposed to the place of the vocabulary in the content discipline of architecture.

Students expected to develop intellectual or psychomotor skills should be given rules, procedures, processes to be followed. These can serve as a bridge between rote application of a skill and application to a unique and unencountered problem situation. The presentation should include examples that

illustrate application of the rules, procedures, and processes (Merchner, 1965). Examples should be varied to facilitate transfer to new situations (Tennyson, Steve, & Boutwell, 1976; Tennyson, Wolley & Merrill, 1972). Further, examples should range from easy to hard and should be presented in an order of increasing difficulty. The presentation should include the same type of examples as occur in the practice, review, and evaluation phases. It is not unusual for teachers to evaluate students on skills which have not been presented, practiced, or reviewed.

Finally, during the presentation, students should be exposed to common errors or points of confusion (Huttenlockher, 1962). Doing this can provide insight into pitfalls associated with learning and can alleviate frustration and difficulty for the student.

Practice

Directions are as important for the practice phase as for the orientation and presentation phases; i.e., are practice exercises to be graded, should practice example be completed without peer collaboration, etc. For verbalizable knowledge, the student should complete memory drills and exercises to firmly and establish mastery (Klausmeier & Feldman, 1975; Skinner, 1975). The learning of facts can be very tedious, and any effort to enliven the learning of such can act to facilitate motivation. Keesan (1980) has, for example, utilized crossword puzzles and computer generated word-search puzzles as student practice exercises in the teaching of terminology.

For skill learning, students should apply the rules, processes, and procedures presented to a wide variety of examples. The examples should vary from easy to hard, and the student should be required to actively respond to the examples (Anderson, 1967; Crist, 1966; Stolurow & Walker, 1962). Further, students should receive feedback and knowledge of results (Moore, 1969; Rosenstock, Moore, & Smith, 1965; Sassenrath & Yonge, 1968).

There are two categories or types of practice: assisted and unassisted (see Table 1). They are essentially the same, with one exception. In assisted practice students are given feedback during exercises but in unassisted practice they are given feedback after completion of the exercise. Memory aids, rules of thumb, cues, and prompts should be available during assisted practice (Bower, Clark, Lesgold, & Winzez, 1969; Hartley & Davies, 1976). As practice progresses, however, assistance should be removed until at the end of unassisted practice the learner receives feedback only after an exercise is completed (Anderson & Faust, 1967; Kulhavy, 1977). At the termination of unassisted practice, student responses should reflect mastery.

Review

Many students do not possess adequate review skills, and it is therefore very helpful to provide a series of review strategies. Review can be facilitated by student-generated review questions. In addition, a lesson summary can be presented to the student for his or her use. Such a summary could be supplied for initial lessons. Students could be encouraged or required to generate their own for subsequent lessons. During the review phase the student should have free access to all previous instructional materials and technology.

A review might not occur until after several presentation and practice exercises. This would result in a substantial time delay between initial learning and evaluation. For example, a student might participate in several presentation and practice lessons in physics prior to a review exercise and an evaluation. In such cases, it is especially important to provide for a review phases (Anderson & Carter, 1972; Anderson & Myrow, 1971; Gagne, 1977; Gagne & Briggs, 1974). Finally, the student should now the directions to be followed in the review.