TYPES OF CAPABILITIES AND LEARNING HIERARCHIES IN INSTRUCTIONAL DESIGN

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As I understood my assigned task as a speaker, I was to describe what kinds of skills and competencies should be aimed for in the training of specialists in instructional development, and also to describe how the concept of the learning hierarchy might be used in planning such programs. I realize that I need to speak more generally about capabilities as they might occur in any field of study, not just that of instructional development itself. I hope that my remarks will serve both the narrow and the broad purposes.

The initial thought to be expressed here, it seems to me, is that one has to deal with appropriate levels of generality and specificity. At the more general level, learning hierarchies suggest the techniques of *task analysis* and *classification of program objectives*, both of which are technologies I believe to be of definite relevance to the design of educational programs. Stating this idea in another way, there are some general decisions to be made in the design of a program of training for instructional development specialists. These have to do with, first, the analysis of projected occupational activities to reveal the kinds of *tasks* required of people in this field. Once this has been done, a further step is to analyze the tasks to see what kinds of learnable human capabilities (sometimes called competencies) are involved. These competencies are then *classified*, in order to identify the general nature of conditions needed for instruction. At that point, the technique of *learning hierarchies* may indeed come into play. What this technique is designed to reveal is the prerequisites for learning the kinds of performances required. Specifically, these are the *intellectual skills*—the *enabling skills*, as they are sometimes called—which may be expected to form a major portion of the objectives of a training program.

Task analysis. Let me then say a few more words about these more general approaches to the design of instructional programs for instructional designers. The first job is, as I have said, making an analysis of what instructional development people do, in order to arrive at a basic list of human tasks.

Methods of conducting investigations of job tasks are rather well known, and have been widely employed in recent years. Some good examples exist in the closely related field of "Educational Research and Development." This field is not simply closely related, but in fact contains many overlapping sets of human tasks, since "educational development" and "educational technology" are really not always viewed as distinguishable job areas from "instructional development." For these reasons, I believe that studies of tasks required in Educational R & D are excellent models for the analysis of tasks required in instructional development. Three major efforts have been undertaken in this field. One is by a task force of the American Educational Research Association, reported by Worthen and his associates (1971). A second, directed by Schalock (1972), is titled *The Oregon Studies: Research, Development, Diffusion, Evaluation*. And a third is a project of the Far West Regional Laboratory, under the direction of Paul Hood (1973).

These three studies, independently conducted, drew highly similar conclusions about the tasks involved in jobs having responsibility for educational R & D, including instructional development. One study identified 69 task categories, another 197, and the third 280; of course, these represent different levels of specificity, which can nevertheless be made comparable in terms of their content. I cannot, of course, repeat the substance of these lists here. According to the Far West Laboratory report (Hood, et al, 1973), they tend to fall into the following general categories:

1. Collecting information on development techniques
2. Analyzing alternative development solutions
3. Planning and designing for product development
4. Developing a product
5. Implementing the product
6. Evaluating the development process
7. Communicating the development process.

Analyzing and classifying learning objectives. Once we know what the tasks are that are performed by instructional technologists, the next step is to see what they contain in terms of their learnable capabilities (or "trainable competencies"). A certain amount of psychological sophistication is apparently required at this stage. In particular, one is interested in distinguishing competencies that can be learned in an educational program from several other categories: (1) those that cannot be learned; (2) those that can only be learned over a lengthy period of time; and (3) those that are so simple they can be learned at once without a period of training.

In making this kind of a competency analysis, I believe it is helpful to conceive of competencies in terms of certain broad categories of learning outcomes, which I call *intellectual skills*, *verbal information*, and *attitudes*. For the moment I ignore consideration of the two additional categories—*cognitive strategies* and *motor skills*. A brief definition of these categories—five in all—is shown in Figure 1.

Figure 1. Learned Capabilities

TYPE	*EXAMPLE*
Verbal information	Stating a fact
Intellectual skill	Applying a rule
Cognitive strategy	Originating a novel plan
Attitude	Choosing a preferred activity
Motor skill	Executing a motor performance

The three categories of greatest relevance are, as I have said, intellectual skills, verbal information, and attitudes.

Each of these varieties of competency would seem to be valuable for the instructional developer. Obviously, he or she must possess many intellectual skills, of the sort involved in analyzing human tasks, identifying requirements for instruction, matching characteristics of media, and evaluating the outcomes of new instructional programs. Perhaps not quite as obviously, such a person needs to have considerable knowledge—knowledge about the content of the variety of subjects to be taught, and also about theories which relate such subjects to the changes in human performance which are to be brought about by learning.

I have been interested to note that an article I contributed eight years ago, entitled "Characteristics of instructional technologists" (Gagné, 1969) did not fail to mention the importance of *values* for the instructional developer. (Values are equivalent to attitudes). In particular, I mentioned as a desirable attitude for instructional developers "a belief in empirical evidence as a source of truth and a preferred basis for action." I would therefore reaffirm the idea that appropriate attitudes, along with intellectual skills and verbal knowledge, are valuable for the instructional developer.

I emphasize again that the five categories I have mentioned represent important distinctions primarily because they imply different requirements for the design of instruction. The next four speakers in this symposium will be talking about instructional design strategies, so I will leave that topic to them.

Prerequisites and learning hierarchies. Now if one has arrived at the point of identifying the tasks for which instruction is to be provided, identifying those that can be learned within a reasonable time, and classifying them so as to know what instructional strategies are needed, much of the work of planning the production of instructional developers has been done. Where, then, do learning hierarchies come into the picture?

It is notable that they do *not* enter into the planning process up to this point. A learning hierarchy is not a tool for planning a total curriculum, or even a total course of study. Instead, learning hierarchies are likely to be useful in determining prerequisites for individual tasks, and for the intellectual skills that these involve. For example, suppose that one of the specific tasks involved in the area of *analyzing alternative development solutions* is a task such as "combining cost and benefit factors to obtain weighted averages." Obviously, this is an intellectual skill which requires the learning of some prerequisite skills (computing cost factors, computing benefit factors, using an expression to obtain averages, etc.). Certainly, the development of learning hierarchies to identify prerequisite skills can be of benefit to the planning of instruction, for a task such as I have mentioned, and for many others having similar characteristics.

Notice that I say (Gagné, 1968) that learning hierarchies are only applicable to the learning of intellectual skills, not to verbal knowledge or attitudes. Nevertheless, as I have just previously stated, I believe that these categories of learning outcomes are at least equally important for the instructional developer to acquire.

Learning hierarchies are often considered to be guides to the sequencing of instruction. However, they also have some other implications for the design of instruction. Basically, a learning hierarchy identifies *essential prerequisite skills* for any given intellectual skill. A prerequisite skill is a capability that must be immediately accessible in the learner's memory at the time new learning of the targeted skill is to occur. If it is not immediately accessible, learning may be delayed until the prerequisite skill is learned or recalled. If all the necessary prerequisite skills *are* accessible at the time of new learning, that learning will be very rapid. Evidently, then, this particular set of implications of learning hierarchies for instructional design pertains to the assurance of mastery and ready accessibility of prerequisite intellectual skills.

References

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