DOCUMENT RESUME

ED 028 969 SP 002 285

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Pub Date Feb 69
Note-7p.; Presented to Symposium on Instructional Technologists, American Educational Research Assn. Annual Meeting, Los Angeles, February 1969
EDRS Price MF-$0.25 HC-$0.45
Descriptors-*Instructional Technology, Job Skills, Professional Education, *Qualifications, *Specialists

A thoroughly planned program for instructional technologists--one including selection, education, and on-the-job training--must take into consideration the competencies and characteristics desirable in such technologists. Such requirements fall into three categories: attitudes or values, specialized knowledge, and intellectual skills or methodologies. Since an instructional technologist should be able to choose approaches to instructional design and development that are capable of empirical test and public communication, he should have a set of values that maintains empirical evidence in high regard. He will need to know something about a variety of subject matters in which he wishes to work--whether this be language and communication skills, science, technology, or equipment maintenance and repair--and he will need to know a good deal about the variety of ways in which instruction is done, whether by lecture, group discussion, laboratory, role playing , or whatever. But most important, he needs knowledge of theories about instruction and the human intellectual processes on which these are based. Such knowledge provides a means of testing new ideas and approaches by the criteria of internal logic before they are subjected to empirical test. Intellectual skills required, other than statistical competence and communication skills, are those enabling him to analyze learning outcomes, measure outcomes, and construct empirical tests of learning outcomes. (JS)

Characteristics of Instructional Technologists

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(Presentation to Symposium on Instructional Technologists, AERA Annual Meeting, February 6, 1969)

From the standpoint of broad principles, it can readily be seen that there are three components to the problem of obtaining qualified instructional technologists. These are selection, education, and on-the-job training. These three approaches are most likely to be used in combination--in fact, it is a little difficult to imagine a total approach to the problem which does not partake of all three in some combination. The crux of the problem is one of designing a program which will provide the proper emphasis, or weighting, to each of these factors. Such a program will be reasonably effective, in the sense of producing the desired outcomes (capable instructional technologists) and at the same time reasonably efficient, in the sense that it keeps wastage of time and manpower to a minimum.

How can one plan for a proper balance among the factors of selection, educational program, and on-the-job training? Obviously, this must be a matter of deciding which can do best in achieving the particular outcome one wants to achieve. If being a good instructional technologist were to require some particular physical characteristic, for example, selection would obviously be the best way to achieve this result. If it should require knowing the organizational structure of the U. S. Office of Education, one would scarcely hesitate in assigning a major role to on-the-job training; neither selection nor an educational program could adequately deal with the transitory nature of such knowledge.

Determining a proper balance for these three "personnel procedures" means, then, that one must have some goals in mind. The previous papers in this symposium have given us some valuable concrete examples of what such goals may need to be. I should like here to focus on these goals, considered quite broadly. What do these papers, considered in a general sense, imply as to the nature of the characteristics of instructional technologists? What qualifications do they imply for the incumbents of such jobs?

I should like to consider this question without having answered what many would consider a prior question--which is, what various kinds of jobs are such people going to occupy, anyhow? I simply do not have the information with which to answer such a question. My guess would be that instructional technologists are going to be employed by industry, in designing programs of training; by research and development organizations, in work pertaining to development, evaluation, and dissemination of instructional subsystems; by schools and school systems, in designing and evaluating curricula and instructional methods, as well as in supervising their installation and utilization; and perhaps in a number of other places as well. In the absence of dependable data of this sort, I should like instead to comment upon what seem to me to be the core of qualifications that would presumably underlie all of these jobs and occupational roles.

Emphases on specific qualifications will vary with the job. But what kinds of characteristics constitute the irreducible minimum for the instructional technologist? These appear to me to fall into three categories. The first is attitudes or values. Second, there is some specialized knowledge which is needed. And third, perhaps most obvious of all, there are intellectual skills, which are often called methodologies.

Values

Many of my colleagues would perhaps simply assume the presence of suitable values, going along with an interest in the field of educational technology. Perhaps, therefore, my comments imply a greater tendency than most would exhibit to see bogey-men where none exist. I confess, however, to being rather grossly dissatisfied with a substantial portion of the younger generation and, sadly, to attribute their shortcomings to our formal educational system (rather than to Dr. Spock). I believe it is quite possible for young people to have values which are distinctly undesirable as qualifications for instructional technologists.

Stated in as simple terms as possible, it seems to me that an instructional technologist should be able to choose approaches to instructional design and development that are capable of empirical test and public communication. Instructional techniques need to be describable and communicable--whether or not they are personally or esthetically satisfying. Instruction needs to be subject to empirical validation--whether or not it is intuitively gratifying.

Such characteristics are, I think, properly put in the category of values. If this is what they are, we know from a wealth of evidence that they are changed with much difficulty, and after rather lengthy periods of education. And we are by no means confident about the educational techniques which can be effectively used to bring about changes in values. The simplest and shortest way, then, is by selection. One needs to choose people who believe in empirical evidence as a source of truth and a preferred basis for action.

Knowledge

There are undoubtedly many kinds of specialized knowledge that will be needed by instructional technologists. They will need to know something about

a variety of subject-matters in which they wish to work--whether this be language and communication skills, science, technology, or equipment maintenance and repair. They will need also to know a good deal about the variety of ways in which instruction is done--whether by lecture, group discussion, laboratory, role-playing, or whatever.

But beyond these specific knowledges, it seems to me that this kind of person needs some theoretical knowledge. What kind of theory? I should describe it as theory of instruction--a model, with alternatives, of the causal chain that takes place between the input and the output. Specifically, I mean a theory that connects the events that occur when material to be learned is presented, with the events that convince us that a change in human performance has been effected. Obviously, the kind of theory I am talking about is psychological in nature, since it deals with the operation of what has traditionally been called the human mind. Other than this, does it matter what kind of theory it is? Well, of course, it does--it should be a scientifically respectable theory--one that is tied to empirical reality at both ends. Within such limitations, though, there may well be several alternative theories which serve the same purpose.

What good is theoretical knowledge to a person whose orientation may be primarily to the practical matters of development and validation? I should be inclined to say that theoretical knowledge provides a means of testing new ideas, new approaches, in the light of criteria of internal logic, before they are subjected to empirical test. Theory provides a standard against which novel ideas can be judged without going to the extent of actually trying them out. I do not mean that anyone should use theory to make a final and absolute rejection of a new idea; rather, I am suggesting that the possession of such a standard makes possible an estimate of the likelihood that

such a new idea will eventually pan out--a kind of internal operations analysis, if you will. The number of new ideas publicly proposed in the area of instruction is really quite staggering. Sometimes it seems that any crackpot can get a book published about "how Johnnie can learn," or "how to teach ghetto youngsters intransitive Chinese verbs." There are many fads in this area of education and many faddish ideas. Knowing where one stands theoretically is a very good way of avoiding the trap of succumbing to the appeal of fads.

Intellectual Skills

The kinds of intellectual skills which would appear to be desirable for the instructional technologist are perhaps easiest to describe. Without having heard the preceding presentations in this symposium, I should imagine them to be the least controversial. Of course, there need to be some differences in emphasis in different jobs. The kind of communication skills needed, for example, by an instructional technologist who works for a regional laboratory may not be quite the same as those needed by the individual who works in a school system, or by the individual who works in an industry.

The list of intellectual skills I would propose is as follows:

1. Analyzing learning outcomes. In a number of practical enterprises with which I have been associated, the ability to make good analyses of the outcomes of learning has invariably turned out to be a highly valuable skill. Such analyses start with operational descriptions of human performances. I have known some teachers who have learned to do this, and I wish all of them would. Analysis proceeds by a process of identifying prerequisite learnings. This is not impossibly difficult to learn how to do, so long as one has the determination to remain oriented to what the learner is supposed to be

doing, rather than what the analyzer himself is doing. In one of my previous articles, I estimated that over a period of some five years of work on instructional improvement, no procedure proved to make a greater difference than properly conducted analyses of learning outcomes.

2. Techniques of measurement of outcomes. I should expect an instructional technologist to know how to design situations for measurement of learning outcomes. Such a skill, it seems to me, is mainly concerned with the problem of translating an instructional objective into a measurement situation in a manner which avoids distortion of measurement. I do not think the measurement skills I am talking about are connected in any important way with knowing such concepts as reliability, validity, or item difficulty. I should say they pertain to the ability of constructing veritable measures of defined human performances.

3. Constructing empirical tests of learning outcomes. Besides the ability to define measures of performance, the instructional technologist needs to be able to identify, and probably to design, convincing demonstrations of the effects of instruction. He needs to be able to tell what is needed to show that an instructional program has had an effect on attitudes, on competencies, or on such slippery qualities as creativeness.

4. Statistical competence. Perhaps little needs to be said about this area, since I believe there would be little disagreement about it, except on the specifics. The fundamental ways, and the efficient ways, of demonstrating that findings can be depended upon, can be replicated within certain reasonable probabilities and are not the result of chance, are the kinds of skills that are needed. Nowadays,

of course, such competence definitely includes the use of standard computer programs and the selection of alternative programs, to carry out these kinds of computations.

5. Communication skills. Skills of communication are also important. The needs for oral communication skills will surely vary somewhat with the particular job. When the position is in a school system, communication skills may well partake of persuasiveness; whereas, in more remotely based Research and Development organizations, clarity and precision of expression may be the emphasized characteristics. As for technical writing skill, it would seem to be of high value in many different kinds of jobs.

Perhaps I have not managed to mention all of the intellectual skills which are important possessions of the instructional technologist. I have deliberately avoided those which might be expected at a "higher level," that of the independent researcher. And since the skills I have mentioned have come last in my talk, let me say again that I look upon them as only one of three kinds of qualifications. The other two are knowledge of theories about instruction and the human intellectual processes on which these are based, and a set of values that maintains empirical evidence in high regard. I believe that a thoroughly planned program for the instructional technologist will attend to all three of these, partly by selection, partly by education, and partly by on-the-job training.