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AUTHOR Thiagarajan, Sivasailam
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ABSTRACT

This article summarizes the systematic process of instructional development by breaking down the three major stages of instructional analysis, design, and formative evaluation into the steps of needs analysis, learner analysis, task analysis, concept analysis, specification of instructional requirements, and the statement of instructional objectives; construction of criterion tests, media selection, format selection, and production of prototype; and expert appraisal, developmental testing, and final production. Each step is discussed briefly and illustrated with examples from actual teacher training materials. The article also anticipates and answers various questions from trainer-developers. It provides practical suggestions on mastering and refining instructional development skills, using local personnel and trainees as members of the instructional development team, and scheduling part-time instructional development efforts. (Author)

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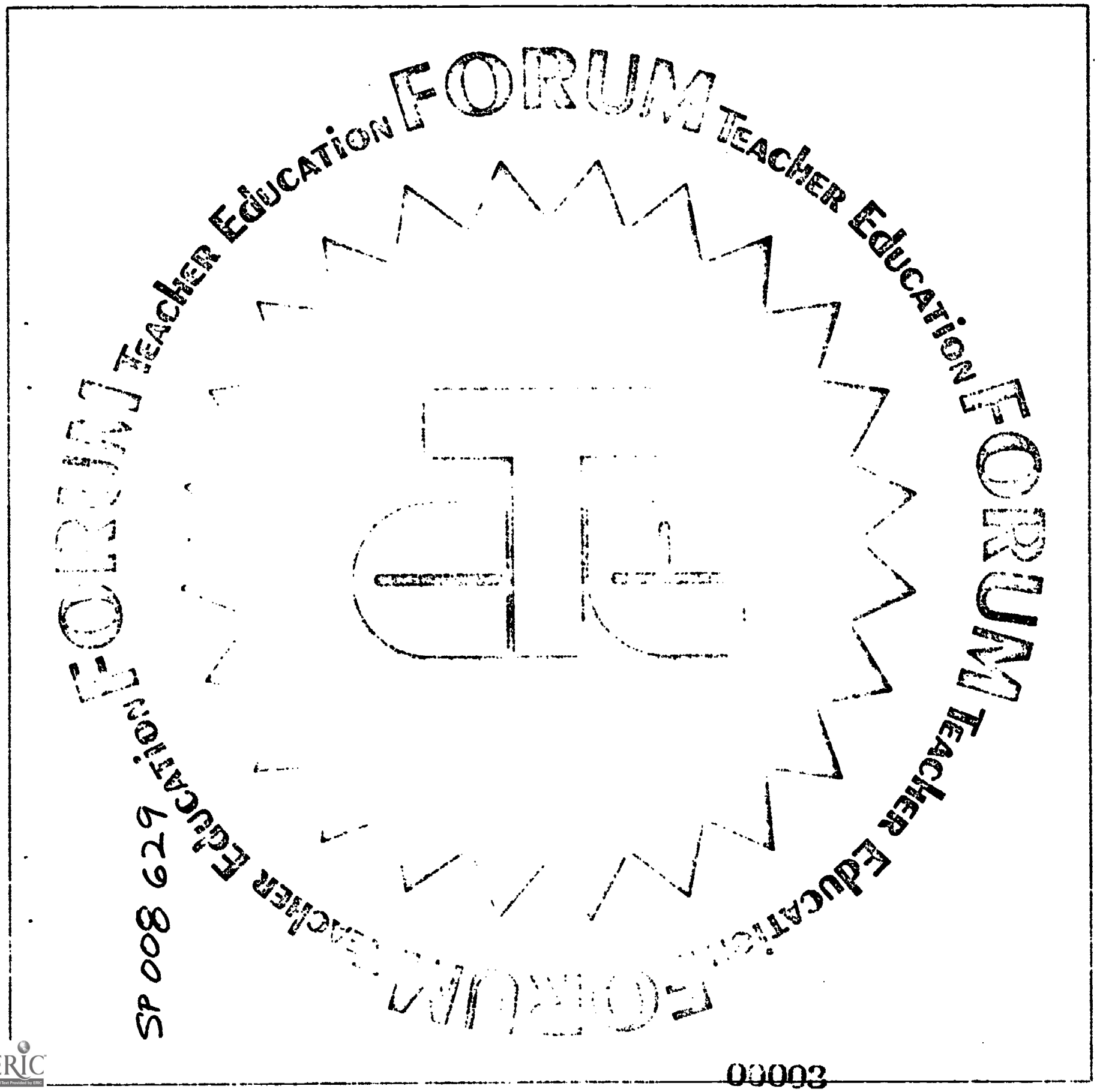

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THE TEACHER TRAINER AS AN INSTRUCTIONAL DEVELOPER

SIVASAILAM THIAGARAJAN

division of teacher education
309 education building
indiana university
bloomington, indiana 47401

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With the growing popularity of competency/performance-based teacher education, teacher trainers find exciting uses for instructional development skills and principles. Through acquiring such developmental competencies, the teacher trainer can design his own modules to accompany a competency-based training program. Further, the discipline of instructional development invariably provides useful insights into the structure of teaching competencies. These insights transfer to the trainer's performance in interactive teaching; teacher trainees generally appreciate witnessing practical applications of what is being preached to them.

This article summarizes the systematic process of instructional development. It also anticipates and answers various questions from potential trainer-developers.

During the past five years, a number of authors have explained different versions of the instructional-development process in bulky books and frightening flowcharts. Although each author describes his own variation, all models of systematic instructional development contain three major components of analysis, design, and formative evaluation. In the analysis stage,

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SIVASAILAM THIAGARAJAN is *assistant professor of education* and *assistant director for instructional development*, Center for Innovation in Teaching the Handicapped, School of Education, Indiana University, Bloomington, Indiana.

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instructional objectives and requirements are defined; instructional materials are produced in the design stage; and in the formative-evaluation stage, ways to modify and improve the materials are identified.

A N A L Y S I S

Each stage of the instructional development process consists of a number of different steps (Fig. 1). The analysis stage, for example, includes the steps of needs analysis, learner analysis, task analysis, concept analysis, specification of instructional requirements, and specification of instructional objectives. Each of these steps is briefly described below:

Needs Analysis:

The development of instructional materials should be a response to a need rather than a self-perpetuating activity. During needs analysis, the symptoms and possible causes of the underlying problem are identified and analyzed to determine the feasibility of an instructional solution. In many cases, more effective management of contingencies and/or re-engineering of the environment is likely to produce satisfactory results. Assuming that an instructional answer is suggested, the next phase of the needs analysis is to survey existing materials to see if unnecessary duplication may be avoided through adopting or adapting them. At the end of this step, the developer has a general idea of the nature of the original problem and the extent to which instructional development activities are called for.

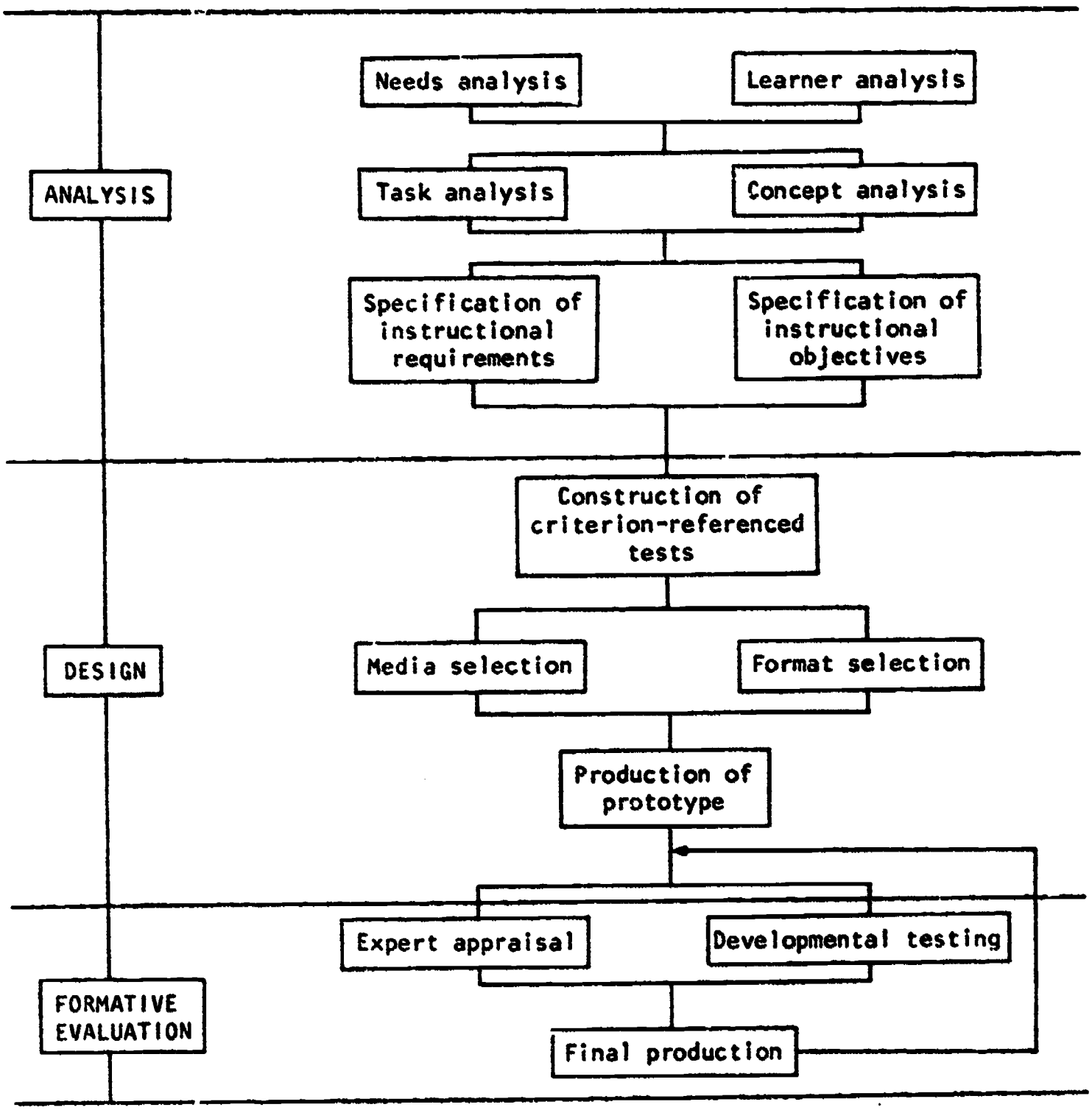

Figure 1. Stages and steps in the systematic development of instructional materials.

Learner Analysis:

The nature of the target population--the trainees for whom instruction is to be designed--determines the nature of the instructional materials. It is obvious that even if the content is the same, it has to be presented in a different form to cater to the differing needs of elementary and high school teachers, teachers in regular classrooms and in special ones, and preservice and inservice teachers. During learner analysis, the developer specifies his target population and identifies those characteristics which are likely to interact with the design of instruction. For example, the entry level of the trainee--how much he already knows--determines the level at which instruction begins. The general attitude of the trainee toward the content dictates the approach taken by the developer. Some of the other factors which determine the final form of the instructional package are trainees' language level, stylistic preference, and media sophistication.

Task Analysis:

The skills and strategies to be taught to the target population are analyzed into component parts; a set of relevant instructional objectives is derived from them. This step of task analysis also provides suitable sequences for instruction and diagnostic testing. The analyst begins with the main task, identifies the necessary and sufficient subtasks which directly contribute to it, and repeats the process with each of the subtasks until the entry level of the target population is reached. Figure 2 shows a sample analysis of the

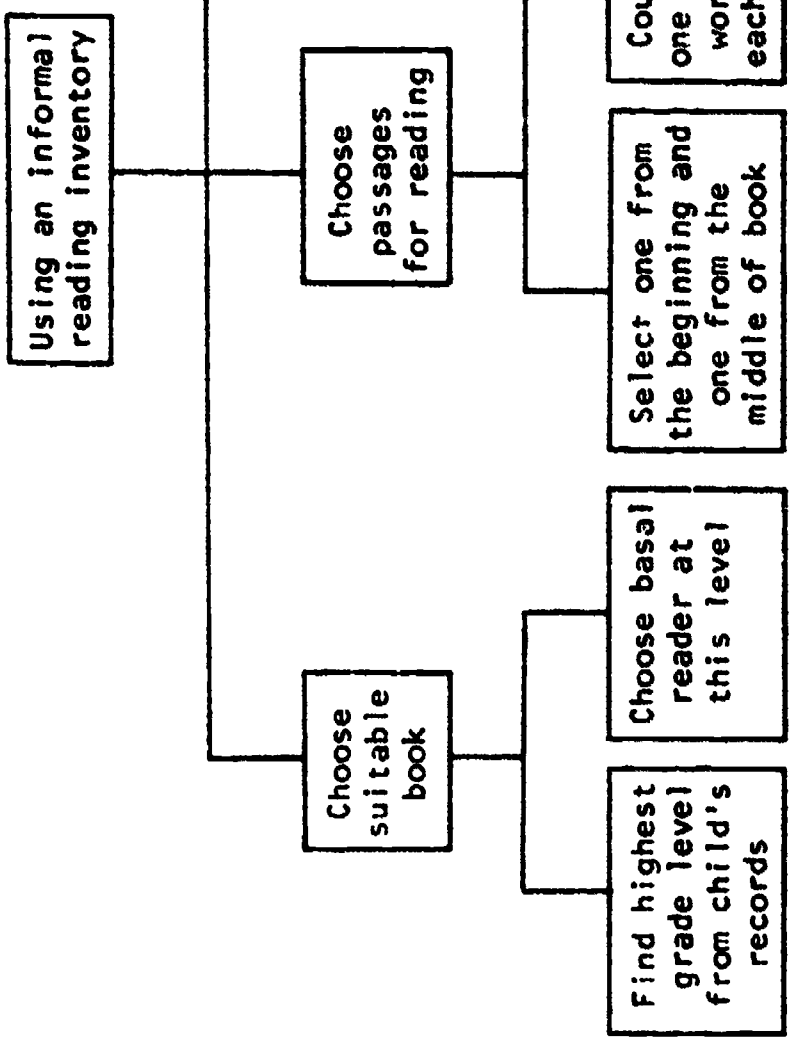

Figure 2. Analysis of the task of informal testing of reading.

teacher-training task of giving an informal reading test.

Concept Analysis:

In addition to skills and strategies, the teacher trainer may be called upon to teach various concepts and principles. Let's assume that he wants to train teachers to keep track of the frequency of physical aggression. This requires a clear specification of the term physical aggression. Concept analysis clarifies the definition by systematically sorting out examples of the concept to identify critical and irrelevant attributes. Especially useful in this analysis are borderline cases--far-out examples and close-in nonexamples--such as physical aggression in defense, aggression under instruction from a teacher, or accidental "aggression." On the basis of this analysis, the developer may decide to limit the term to behaviors which are (a) directed against another person, (b) hostile in intention, and (c) physical in nature. He may also decide that it is irrelevant whether the behavior is self-initiated or provoked or whether the target is a child or an adult. As Figure 3 shows, these critical and irrelevant attributes suggest the nature of examples and nonexamples to be used during instruction.

Specification of Instructional Requirements and Objectives:

Although these analyses are extremely important, they are merely intermediate steps enabling the developer to define the requirements for the training materials he is developing. On the basis of the needs analysis and learner analysis, he is able to determine, for example, the situation in which

Critical attributes of physical aggression	Type of nonexample suggested
Interactional	Child banging his own head against the wall
Physical	Child screaming at his mother
Hostility	Child pushing another accidentally

Irrelevant attributes of physical aggression	Range of examples suggested
Provocation	An unprovoked attack
	A retaliatory fight
Target of aggression	Child fighting with another child
	Child hitting an adult
Form of aggression	Child biting a sibling
	Child throwing a block at mother

Figure 3. Examples and nonexamples suggested by critical and irrelevant attributes of the concept physical aggression.

training is to take place, the desired length of training materials, media and language preferences, and adjunct materials needed. On the basis of the task analysis and concept analysis, he is able to specify a set of behavioral objectives to be attained by the trainee upon the completion of instruction. Figure 4 gives an example of how different analyses are converted into behavioral objectives. These objectives form the base not only for the design of instruction, but also for the construction of criterion-referenced tests.

D E S I G N

The developer enters this second stage of systematic instructional development with clear specifications of instructional requirements and objectives. This stage results in a prototype instructional package obtained by constructing criterion-referenced tests and selecting suitable media and format.

Constructing Criterion-Referenced Tests:

A criterion-referenced test directly measures the attainment of instructional objectives. During the development of the instructional package, this test suggests the appropriate sequence, provides useful feedback on its adequacy, and permits a demonstration of effectiveness. After development, it is used as a pretest to determine whether or not the trainee needs the package, as a progress test to check his pace, and as a posttest for confirming complete mastery or suggesting areas for remedial training.

Construction of the criterion-referenced test bridges the stages of analysis and design. Criterion items, carefully prepared and logically sequenced,

I. A. Choose suitable book. 1. Find child's grade level. 2. Choose basal reader at this level.	1. Given information about a child, the trainee shall choose a suitable book for administering an informal reading test. The book he chooses should be at the highest grade level from the child's records.
B. Choose passages for reading. 1. Select one passage from the beginning and one from the middle of the book. 2. Count off 100 words for each passage.	2. Given a suitable book, the trainee shall choose and mark appropriate passages for use in an informal reading test. The two passages chosen by the trainee should be at the beginning and the middle of the book and should contain 100 words each.
C. Have the child read the passages. 1. Tell child about story. 2. Ask child to read aloud.	3. Given a suitable passage, the trainee shall have the child read it as a part of an informal reading test. In doing this, the trainee should first tell the child something about the story and then clearly ask him to read aloud.
II. A. Identify errors. 1. Count as error if the child says, "I don't know this word."	4. The trainee shall listen to an audiotape recording of a handicapped child reading a given passage and identify and record (with 100% accuracy) the number of times the child indicates that he does not know a specific word.
2. Count as error if the child mispronounces a word.	5. The trainee shall listen to an audiotape recording of a handicapped child reading a given passage and identify and record (with at least 80% accuracy) the number of times the child mispronounces a word.

Figure 4. Conversion of task analysis into behavioral objectives.

become a major component of the finished package. In a number of instructional formats, the developer merely suggests various existing resources to help the trainee master each criterion item. In the design of a more elaborate package, a technique borrowed from programmed instruction uses criterion items to provide an outline. As Figure 5 shows, in this technique the instructional designer first closes the gap between the trainee's entry behavior and the first criterion item. Then the gap between this and the next criterion item, and so on until all criterion items have been systematically covered.

Media Selection:

Selection of suitable media for instruction depends upon two primary considerations--the nature of the task and the characteristics of the target population--and two secondary ones--availability of media resources, and cost. Media commonly used in training packages include print, audiotape, slides, overhead transparencies, videotape, and film. In making a choice among these, the developer has to disregard surface differences and identify underlying attributes. If a videotape is used to present the talking face of a psychologist or a picture of printed words, it is not surprising that the results do not differ from those of conventional instruction. What is needed is a systematic analysis of each instructional objective to find required media attributes such as color, three dimensionality, motion, realism, pace, random access, sensory mode (e.g, visual and auditory), and sign type (e.g., verbal and nonverbal). These are converted into suitable media combinations as shown

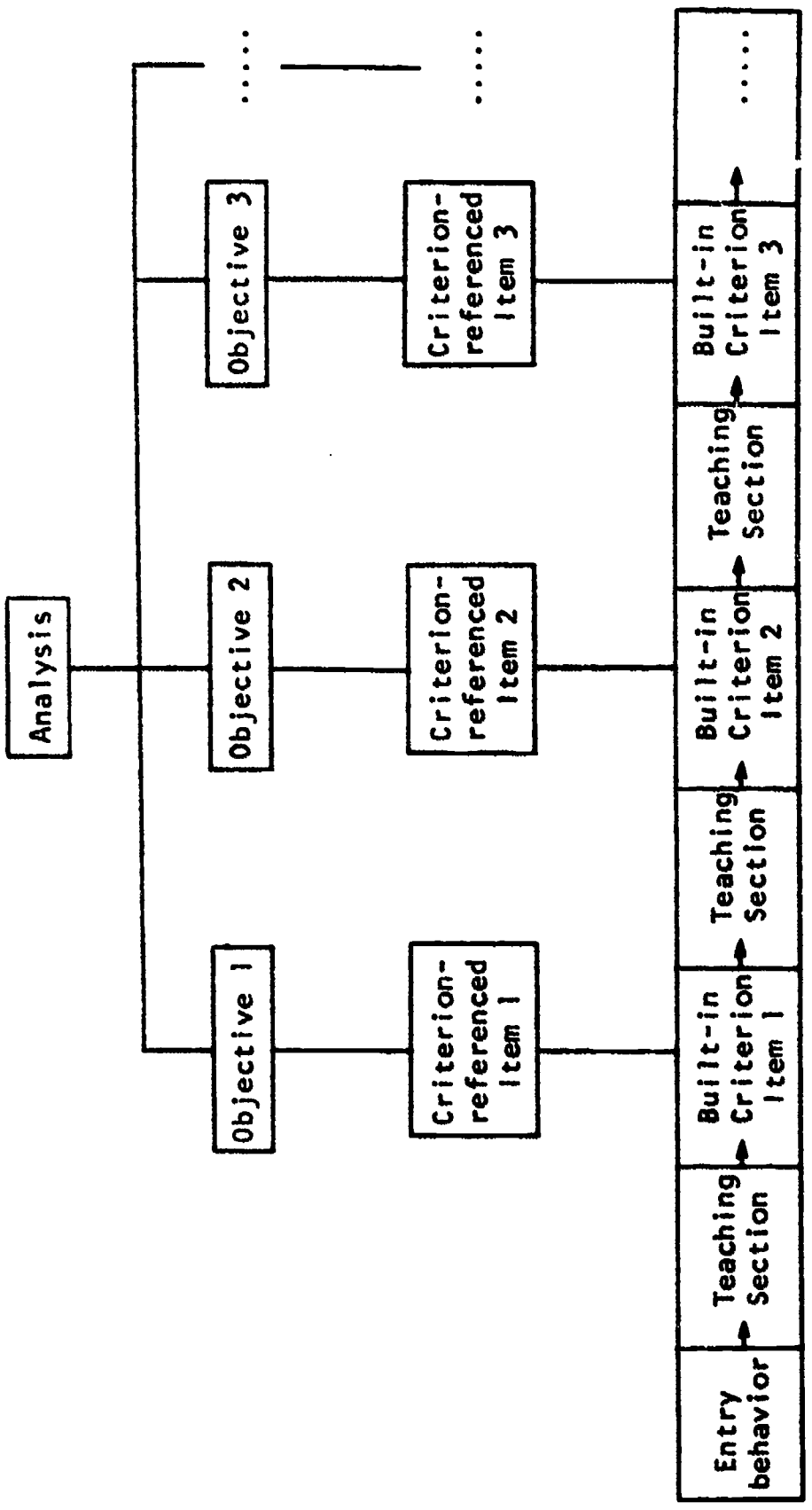

Figure 5. Using criterion-referenced test items to form the outline of an instructional package.

in Figure 6.

Format Selection:

A combination of media, teaching strategies, and utilization techniques form a specific instructional format such as programmed instruction or simulation games. There are six major groups of instructional formats of potential use to the teacher trainer:

Resource-management formats. These instructional formats systematically organize and structure existing instructional resources. A list of behavioral objectives and/or a criterion-referenced test are used as the base and each item is annotated with reference to print (e.g., books, current articles, and pamphlets), nonprint (filmstrips and audiotapes), and human resources.

Mastery-learning formats. These instructional formats are based on the concept of formative evaluation through repeated testing. A criterion-referenced unit test is administered to the trainee any time, and any number of times, he wants to take it. He is also given diagnostic feedback and alternative resources as in the previous format. In practice, there is usually a limit to the number of times a trainee may repeat the same unit test.

Self-instructional print formats. These instructional formats use paper-and-pencil materials in an independent-learning situation. Textbooks, handouts, and conventional programmed instruction are examples of this format.

Self-instructional nonprint formats. In recent years, audiovisual training modules of various types have become increasingly popular for inde-

Instructional task:

Recognize and record the following types of reading errors: Omission of words, omission of word endings, addition of words, and mispronunciations.

Media attributes:

Essential:

Visual mode (to show what the child is reading), auditory mode (the oral reading of the child), and realism (to facilitate transfer).

Desirable:

Random access (to permit selected review and reference), and flexible pacing.

Irrelevant:

Three dimensionality, color, and motion.

Preliminary media decisions:

Because it is essential to show the words the child is reading and reproduce the exact oral responses of the child at the same time, a medium capable of audiovisual presentation is necessary. Film and videotape are appropriate single media; sound filmstrip and audiotape/book are appropriate media combinations.

Secondary considerations:

Film is too expensive and sophisticated for the simple task of turning pages of a book. Sound filmstrip is not portable enough for use in independent study situations. Between the videotape and audiotape/book combination, the latter is more portable and less expensive.

Final media selection:

A combination of print and audiotape. A printed training manual contains basic explanations of error types. It directs the trainee to listen to audiotape excerpts of a child's oral reading. Pages of reading materials are reproduced in the manual.

Figure 6. Sample media selection.

pendent learning. These include programmed instructional materials presented by audiovisual "teaching machines," videotape training segments, and audio-tutorial systems in which an audiotape controls the trainee's learning activities.

Small-group learning formats. In addition to providing the instructional content, these formats structure the interaction among members of a small group so that they learn with and from each other. The trainees act as peer tutors, practice grounds for interpersonal responses, and sources of social reinforcement. Learning games, roleplays, and group discussions are examples of this format.

Large-group learning formats. These formats include large-group lectures, film shows, and multi-screen presentations. Their use usually results in higher cost-effectiveness for informational and inspirational goals.

Each format has its own advantages and disadvantages. If for no other reason than variety, the developer is strongly urged to experiment with different formats.

Producing the Prototype:

Once suitable media and format have been selected, a prototype instructional package is produced. This step involves preparing the content--writing, illustrating, narrating, recording, and shooting--and integrating various learning activities for the trainee. Although production is the beginning and the end of conventional development, it is just another step in the systematic

process being described here. It marks the end of design and the beginning of formative evaluation.

FORMATIVE EVALUATION

The third stage of the systematic instructional development process is the formative evaluation which involves repeated modification of the prototype package to improve its effectiveness and usability. This stage consists of expert appraisal, developmental testing, and final production.

Expert Appraisal:

Although the real test of an instructional package is the actual tryout with trainees, knowledgeable experts can often provide suggestions for the improvement of its conceptual adequacy and technical quality. Such expert opinion is obtained both on instructional and technical aspects of the package. The developer's colleagues may be asked to check the relevance of the objectives, theoretical soundness of the content, adequacy of definitions and explanations, proper use of technical terms, and appropriateness of examples. Experienced trainers can suggest further improvements on the usability of the instructional package, adequacy of packaging, availability of media equipment, appropriateness of scheduling, and flexibility of usage. On the technical side, an experienced editor may check the language for its organization, style, consistency, and integration; a media expert may suggest improvements on the technical quality of production.

Developmental Testing:

This is another type of formative evaluation in which feedback is obtained from tryouts with representative members of the target population. The purpose of this testing is not to grade the trainee but to make the materials instructionally and motivationally more effective. To maximize feedback, a lean prototype version is used. This permits location of the need for additional instruction--a task which is easier than that of identifying redundant or superfluous content. Tryouts are initially conducted individually, with the developer working alongside the trainee who works through the package. Of course, the developer does not teach the trainee but merely observes and records his progress and problems. The most important feedback collected during these initial tryouts relates to the trainee's mastery of the instructional objectives as indicated by his responses to the criterion-referenced items. In addition, the trainee's comments and reactions are also noted. During later phases of developmental testing, more quantitative feedback may be obtained by testing the package on groups of trainees. In addition to achievement testing, various direct and unobtrusive measures of motivational effects of the package are used.

Final Production:

The final version of the instructional package slowly evolves during formative evaluations; final production is carried out in a piecemeal fashion throughout this stage. At the end of each tryout, all necessary modifications

are incorporated into the package before it is tried out again. When the developer consistently obtains satisfactory results, he may terminate the formative-evaluation process and utilize his package in everyday training. But in a larger sense, the instructional package never reaches the final production stage; it is constantly improved and updated on the basis of feedback from trainers and trainees who use it.

PRACTICAL CONSIDERATIONS

These, then, are the steps in the systematic development of teacher-training materials. The reader's immediate reaction to the process, like that of many other busy teacher trainers, is probably one of bewilderment and hesitation. We have given below some of the most frequent questions asked by trainers about the actual implementation of instructional-development efforts along with attempted answers to each:

Can I Do It?

We don't know for sure. But we do know that a number of trainers have undertaken small-scale instructional development projects and come up with successful training materials without any special funding and without extra manpower. Materials developed by these part-time, amateur instructional developers are not only used in their courses, but in many cases are borrowed by other trainers.

How Long Does It Take? How Can I Find Time To Do All These Complicated Things?

The process of systematic instructional development is not as complicated and as time-consuming as it may appear at first sight. As a teacher trainer, you have undoubtedly already undertaken learner, task, and concept analyses even though you may not call them by these fancy names. You know a lot about the characteristics of your trainees and more so about the structure of skills and knowledge you are teaching them. You may even have already designed a number of lesson plans, class assignments, reading lists, and test items. With such a head start, you are in a position to bypass, or at least rapidly complete, the stage of defining your instructional requirements. In the design stage, several simple but effective design formats are available for the part-time instructional designer. One of these is the annotated resource list format. This design merely involves specifying instructional objectives and providing the trainee with a wide variety of textual references, handouts, journal articles, films, and other existing materials. Even if you plan to develop a more ambitious instructional package, you need not do so in a single sitting. During each semester, you may concentrate upon preparing instructional materials for a small unit of the course and gradually accumulate enough materials until you have a self-contained course. You may test your unit with the trainees one semester, spend the next one revising the material on the basis of their feedback, and reserve the semester after that for

beginning the next unit.

How Do I Learn How To Design Training Materials?

All of the skills of instructional development are easily learnable, especially by those with a background like yours. A number of excellent books have recently appeared on the market. On the last page, you will find a set of books on instructional development which we highly recommend. One of these books, Instructional Development for Training Teachers of Exceptional Children: A Sourcebook, expands upon the process briefly described earlier and uses the same approach and the same terminology. It contains additional information and has bibliographies on selected areas of instructional development.

Where Do I Find People To Help Me?

If you have a generous sponsor, you should hire other trainers, writers, illustrators, media producers, editors, test constructors, and evaluators to help you in the project. Without funds, however, you may have to play all these roles yourself. It can be done if you are willing to be patient. You should also try to interest some of your colleagues in undertaking a cooperative venture. It will be a good idea to have them check your content from time to time and comment upon its relevance. Another effective procedure is to involve your trainees in the development of instructional materials. In addition to their helping you, they help themselves tremendously in the process by acquiring insight into the skills and knowledge they need.

Is It Worth Doing?

The process of systematic instructional development requires fairly heavy investments of your time and other resources. It definitely should not be wasted upon worthless content as in an attempt to transform the chapters of a traditional textbook into modules. Make sure that you are not duplicating any material which is already available. For example, there are at least four packages on behavior modification and fifty on how to state behavioral objectives.

Choose a teaching competency which is of fundamental and practical importance to a large number of teachers. The product you obtain will be well worth your developmental efforts.

What About Media? Do I Have To Use Them?

Most trainers are apprehensive about media. They claim that they do not even know how to use a slide projector and they are afraid of having to produce multimedia training packages. Part of this anxiety is due to a misunderstanding of the term. Of the three specific training formats which we discuss in the later modules, two use no more than paper-and-pencil media. For our purposes, the most we will need to tamper with are audiotape, videotape, and photographic slides. In all three cases, equipment designers have simplified everything to the extent that even the most non-technological trainer can master the fundamentals of media production in a matter of a few hours. Also, we always have some trainees eager and ready to help us in our media

production projects.

C O N C L U S I O N

In the final analysis, the best way to acquire instructional-development skills for teacher training is through actual design. In doing this, the trainer may discover that the process is not as smooth nor as linear as our earlier discussion might have suggested. However, if formative evaluation is undertaken early in the developmental process, gradual refinement is bound to occur not only in the materials but also in the skills of the developer.

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